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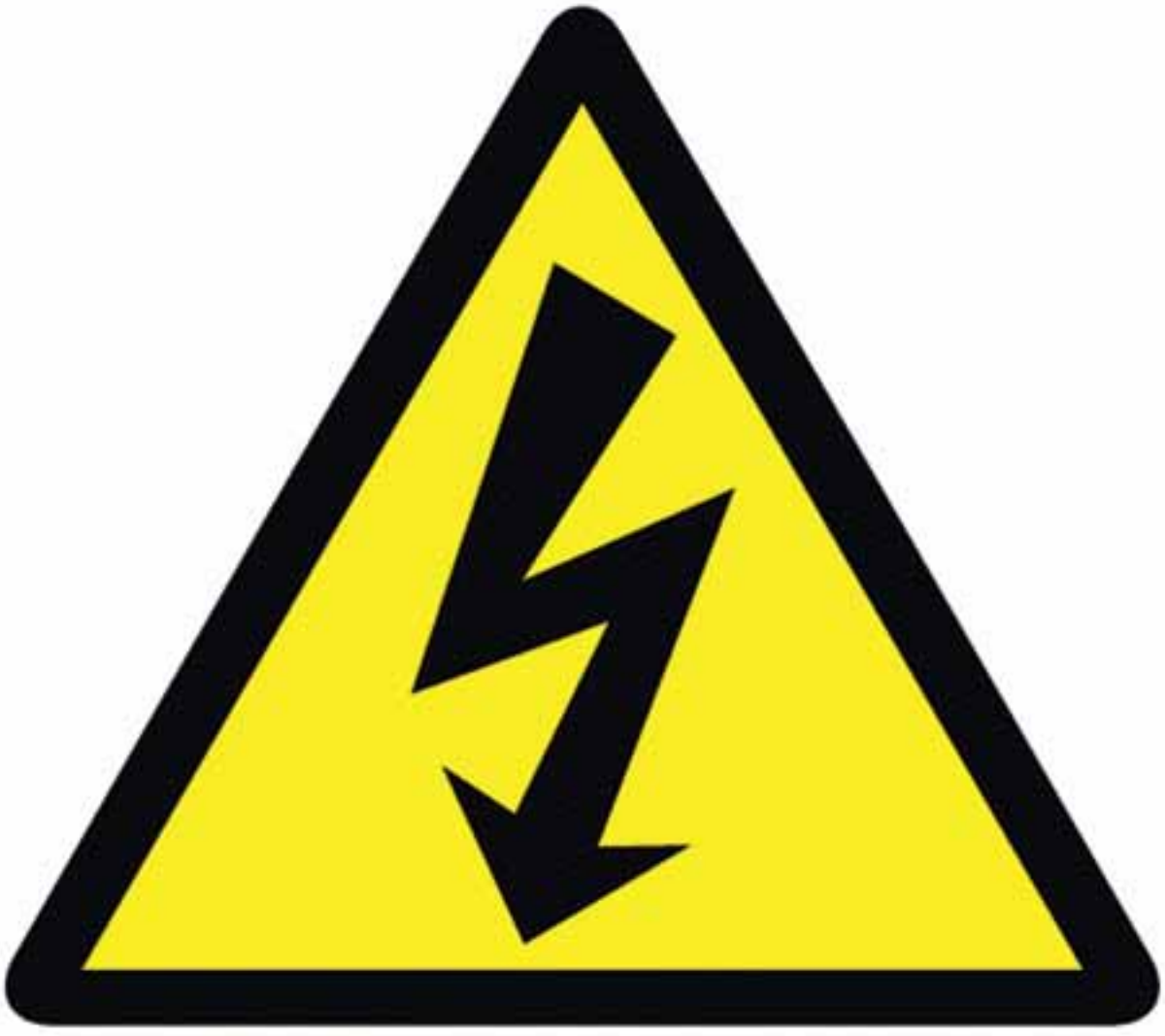

THE ELECTRICAL PROTECTION & SAFETY ISSUE

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RESEARCH & DEVELOPMENT
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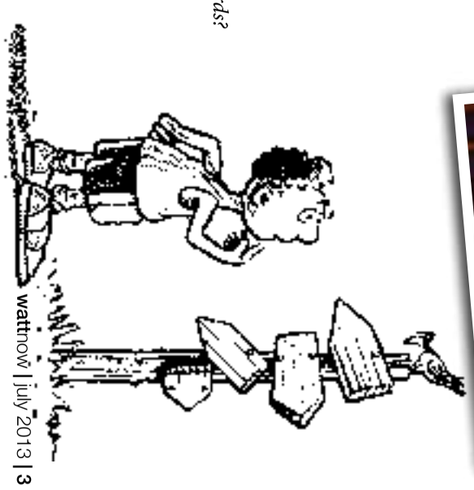

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5905

July brings with it our Electrical Protection and Safety issue and in our feature section we talk about the OSHA 1910.269 regulation that is set to be updated during 2013 and what exactly it will entail. Read more on page 22. The second feature discusses the use of electrical equipment in hazardous locations, which should be identified and classified. Read this article on page 26.

Our Technology section starts on page 32 and sports a case study on a Metal Shredding plant and presents a before and after measurement of a transformer installation. We conclude the riveting article from Felix Bosch on Uranium Technology on page 36.

Our Power section features an article on Electrical Energy Storage and informs us of the characteristics of electricity and why energy storage is inevitable. Read more on page 43.

Bill Calder enlightened us with his tongue-in-cheek view on his days as an apprentice- read more on page 48.

I am proud to introduce you to our new opinion piece, which will be written on a monthly basis by Angela Price (yes... relation to the late Dr Bernard Price). Read her engineering take on communication on page 58.

We are already halfway through the year, and soon we'll start getting ready for the year-end functions.

Our SAIEE Charity Golf Day is taking place at the Randpark Golf Club on the 18th of September. Please contact Gerda Geyer and come and join us on this day. The SAIEE President has chosen The Girl's & Boys Town, a charity close to his heart – who will be recipient of any proceeds taken from the Golf Day. Come and show your support for this worthy cause.

Well, herewith the July issue, enjoy the read!

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

SAIEE MEMBERS

Write a winning Engineering article for **watt**now and win an iPad!

wattnow prizes will be awarded for articles written by SAIEE members that are published in the **watt**now magazine and that are adjudged 'excellent' by a panel of experienced engineers and academics. Articles of between 1500 and 2000 words in the Engineering categories of Communications, Control, Computers & Software and Power as well as General Interest and Science, written by SAIEE members, in good standing, and published in **watt**now will be eligible.

SAIEE members have broad and expert experience and knowledge about many Engineering projects topics in which they have been involved. **watt**now wants to access and record the experience and knowledge of the SAIEE member community and publish this to a wider professional audience.

Write about your (or others') experience and help to spread knowledge, interest in and history of our great engineering capabilities and achievements.

ARTICLES WILL BE JUDGED ON THE FOLLOWING CRITERIA:

- General technical professional interest
- Accuracy and Reliability, Technical Correctness
- Currency and relevance
- Coverage and Objectivity
- Style, language, illustrations, article structure, etc.

Awards will be made at the Annual SAIEE Banquet for the best article in each category, published between September and August of the past year. Note that a prize for each category is available but will only be awarded if articles are judged to be of a sufficient standard. The prizes for 2013 will be Apple iPads. The judging panel will be made up of experienced members of the Engineering fraternity, including academics and industrialists and their decision is final. Detailed rules are available on the SAIEE website - visit www.saiee.org.za

SAIEE
South African Institute of Electrical Engineers

The image of the iPad is not necessarily the model to be awarded.

Greetings to you all. I have had a very busy month which included a visit to the Cape Western Centre. I managed to combine this with a PIESA (Power Institute of Eastern and Southern Africa) at the CTICC (Cape Town International Conference Centre) together with attending the Africa Utility week.

All very stimulating, first of all, the Cape Western Centre meeting took place at the Eskom training centre at Edgemead, ably chaired by the WCC Chairman, Mr Phumelelo Ngxonono.

I am always fascinated by the level of commitment and participation by the SAIEE members in the Centres and my address in Cape Town generated a very interesting debate regarding the benefits of membership of the SAIEE.

The following is an extract from an email that I received after the talk:
'I have found that although the Institute has high numbers of younger members in the age group 20-40, the events are mostly attended by the older members who are often no longer even working in engineering. As such, the networking opportunities at the monthly talks are quite limited. Younger members are hesitant to offer to talk on current projects or new technologies we have encountered as there is little to no benefit.'

That is an interesting revelation, as this is precisely what the SAIEE is trying to achieve. We want young members to participate in the events, and we encourage lively discourse between members.

The networking and interaction between members is what makes the SAIEE unique and shows what Professional behaviour is how it is passed between members. To quote from the book by Malcolm Gladwell, 'The tipping point': *"we are trying to be 'connectors' that create a 'tipping point' to ensure that professionalism is a thread that goes throughout all our dealings with each other at any age."*

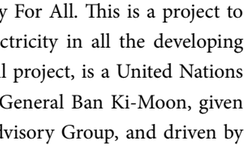
Later in the month, I attended a renewable energy conference organised by the USTDA, and this was followed by a telecommunications conference organised by the Utility Telecommunications' Commission (UTC) also from the United States in collaboration with the European commission (EUTC) based in Belgium.

Due to the rapid development of electrification in Africa, as part of the United Nations Millennium development goals to eradicate poverty, the Global Sustainable Energy Partnership (GSEP) has introduced a programme code named SE4All, an acronym for Sustainable Energy For All. This is a project to provide universal access to electricity in all the developing nations of the world.The SE4All project, is a United Nations initiative, led by the Secretary General Ban Ki-Moon, given direction by the High Level Advisory Group, and driven by SE4ALL Executive committee. By harnessing the collective experience of Global Sustainable Electricity Partnership (GSEP), the intention is to accelerate electrification, with the ultimate objective of establishing 100 million new connections worldwide by 2030.

In Africa, the UN has set a target to provide electricity to 35 million rural homes by 2030. This is an enormously ambitious, but very necessary project to contribute to the alleviation of poverty and upliftment of the community.

The project is intended to commence with the development of an 'Electrification Guideline' document which includes planning for the development of 'Mini Smart grids", and distributed renewable generation.

The PIESA is planning a conference that will be held in Arusha in Tanzania on 23-27 September 2013, with the main theme titled 'The development of Renewable energy based mini grids', where the SE4All project will be launched.
All the best for this month ahead!



Paul van Niekerk Pr. Eng
SAIEE President 2013

SHAW CONTROLS

WORLD CLASS QUALITY AND RELIABILITY

Founded in 1981, Shaw Controls is one of Africa's foremost suppliers within the electrical trade. With a focused approach on quality production processes, the company is a world class manufacturer of motor control centres, distribution boards, control desks, PLC instrumentation control enclosures, portable container substations and various other electrical panels. Products manufactured, range from voltages of 24 Volts up to 1000 Volts and current ratings up to 4000 Amps.

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Gadgets and gizmos for you... go ahead, spoil yourself! You deserve it!

Code: 17735 - Flood Coast Guard - R1 499.95

Code: 17737 - Solar Flood Sentry108 LED - R1 899.95

Powered by the sun

One of the best and most inexpensive means of improving the aesthetic appeal of your home's outdoor areas is to add solar-powered outdoor accent lighting. The Lighting Warehouse's Decorative outdoor solar lighting can instantaneously uplift the visual appeal of your outdoor areas – giving them an elegant and inviting look at night, without adding a cent to your monthly electricity bills. For more info, visit www.lightingwarehouse.co.za

Like Tea Mug

If you consider yourself "in a relationship" with tea or coffee and often get "poked" by the desire for more caffeine, then update your status with the original Like Tea Mug. Price: R125 (incl.)

Da Vinci Catapult

Now for the first time you can build and test out your very own working scale model of a Leonardo Da Vinci Catapult taken from the Codex Atlanticus. Have fun assembling the ingenious design, and then test it by flinging the soft clay balls (included) over an amazing 15 feet. The model is made of wood and when fully assembled measures in at an impressive 41cm x 25cm x 16cm. Price: R250 (incl.)

Veho™ Pebble XT Portable Gadget Charger

Charge your portable device on the move without the need for mains power. The pocket size Pebble portable battery pack will charge all popular mobile phones, including the iPhone, as well as all generation iPods, digital cameras, camcorders, GPS, Nintendo DS, PSP plus many more.

Features:

Powerful 5000mAh potable battery charger (up to 1250 iPhone extra standby hours or 125 hrs extra music playback);

Will charge most popular mobile devices including iPhone, iPod, Blackberry, Samsung, Nokia, Sony, Gaming and USB charged devices.

6 hour charge time will give weeks of portable battery life.

Auto shutoff mode to protect against short circuit, over-current, over-charging and over-discharging.

Stylish pocket sized portable design with included neoprene carry case with pocket for your favourite connectors

Price: R665 (incl.)

RazorPit Teneo Razor Sharpener

Razor blades are not blun, they are just dirty. Five years of research made it possible to clean and sharpen all razor blades. Independent scientific tests has proven that Razorpit removes organic material that accumulates on the edge of the blades.

Razorpit is built on the same technology as the barber strop used by professional barbers for decades. The barber strop removes the organic material that makes a razor knife feel dull. The new RazorPit technology works with all razor blades, even cartridge, disposable and DE blades. Guaranteed to extend the life of your razor blades and give you a sharp, smooth and comfortable shave every day. Price: R200 (incl.)

USB Cup Warmer

With a USB Cup Warmer, you'll never have to put up with drinking cold half-cups of tea or coffee again! The USB Cup Warmer is pretty self-explanatory – it plugs into your computer's USB port and keeps your hot beverage hot for you. What more could you want! The USB powered hot plate keeps your drink hot for up to an extra 30 minutes and can maintain the temperature of your drink at 40 degrees even after an hour.

Easy to use and low voltage, the Cup Warmer will accommodate most ceramic cups and small mugs. Give it a try - you'll soon get used to the luxury of having a hot drink by your side and will wonder how you ever lived without it. Price: R130 (incl.)

Man Bowl

If you know a guy with a beast of an appetite - or indeed the manners of a beast! - this piece of could-be canine crockery makes the ideal tongue-in-cheek gift! From a distance it looks just like a classic dog bowl, but get a little closer and you'll see that this quirky ceramic dish is in fact emblazoned with the word 'MAN' rather than the word 'DOG'! Okay, you might want to draw the line at placing it on the floor come mealtimes, but it makes the perfect receptacle for man-sized portions of pasta or rice, XL puddings and helpings of cereals that'll set you up 'til suppertime! Price: R250 (incl.)

IK Multimedia iKlip Universal Microphone Stand Adaptor for iPad

Now you can take your favorite iPad music apps on stage for live performance. IKlip makes it easy to use your iPad or iPad 2 in any live setting - on stage, in the studio, at school or in the boardroom. With its adjustable multi-angle design, you can securely position your iPad for optimal viewing and accessibility, while all controls, buttons and connection ports remain free from obstruction. IKlip is made in Italy from dense thermoplastic-molded components for extreme durability and a secure hold under the most demanding situations.

Strong yet extremely lightweight, iKlip is the ideal, stable option for most stand types. Guitarists and bassists can use iPad on stage with AmpliTube iRig as your amp and effects unit, with controls accessible in front of you on your mic stand. If you use tablature apps, iKlip puts your iPad within easy viewing range for learning and performing. As a vocalist or instrumentalist, you'll have the perfect companion for performances: from lyrics to chord charts to sheet music, everything you'd use on stage with your iPad is now within your reach. Got a DJ or beat making app? iKlip mounts your iPad on tabletop stands, too, making it the perfect DJ or virtual instrument performance companion. Price: R599 (incl.)

All the products featured on pages 8 & 9 are available online at www.mantality.co.za unless specified differently.

WATTSUP

SAIEE/IEEE RENEW THEIR RELATIONSHIP AGREEMENT

From l-r: Ron Harley, Andre Hoffmann, Tara Wisniewski, Pat Naidoo (Vice President, SAIEE), Peter Staecker (President IEEE), Jacques van Wyk, Gordon Day, Saurabh Sinha, Max Clarke and Stan Bridgens.

Dr Pat Naidoo, Deputy President SAIEE signs the MoU with the President of the IEEE, Mr Peter Staecker.

Mr Jacques van Wyk, immediate Past Chairman, IEEE SA Section and Stan Bridgens, Director SAIEE signs as witnesses.

Max Clarke, Chairperson Historical Section, with Pat Naidoo handing Mr Staecker a copy of "Living amongst the stars".

On Friday 14 June 2013, an IEEE delegation visited the SAIEE headquarters. The renewed Memorandum of Understanding was signed by the Deputy President, Dr Pat Naidoo and Director, Stan Bridgens on behalf of the SAIEE and on behalf of the IEEE, Mr Peter Staecker, President and CEO and the immediate Past Chairman of the IEEE South African Section, Jacques van Wyk.

At this ceremonial occasion the opportunity for Max Clarke to present to the distinguished guests a sound narrative and slide show by Dirk Vermeulen on some of the renowned achievements in electrical engineering in South Africa.

From l-r: Mr Peter Staecker, IEEE President, Mr Gordon Day and Tara Wisniewski, Director, Social Innovations Programs, IEEE.

TIME TO ACCELERATE IMPLEMENTATION OF THE NDP

Recent talks that the National Development Plan (NDP) is fatally flawed and impossible to implement, are worrying and cause for concern when in the State of the Nation Address, Government adopted the NDP as a route map with the aim of eliminating poverty and reducing inequality in our country.

The issues raised in the criticism of the NDP calling it "fatally flawed and pathetic", and doubting its effective implementation are certain to be put to bed as soon as the plan is rolled out.

Consulting Engineers South Africa (CESA) is on record welcoming and supporting the NDP which provides a long term vision for the planned provision of essential infrastructure.

It is important to note that the NDP is a vision outlining long-term deliverables (the 'what') while the implementation process (the 'how') remains open for debate.

Both theory and practice have proven that a long-term focus on infrastructure provision not only benefits society by improving the quality of life for all, but it achieves economic growth by providing a platform of certainty for investment, job creation and business opportunities.

"CESA is extremely disappointed that the long term visionary goals of the NDP appear to have been placed on hold while our members eagerly anticipate the rollout of the programme. Let us see more action rather than talk because these actions will boost business confidence in the country," states CESA CEO Graham Pirie.

Graham Pirie, CEO, CESA

"We need policy certainty from the government," he emphasises. Pirie adds that the unblocking of the construction pipeline will create more jobs which will improve the quality of life of the people in the country.

CESA believes that Government cannot acknowledge that the NDP is a roadmap for tackling the problems of poverty, inequality and unemployment and then remain silent on the matter. This is giving the wrong signal.

"Political will is needed to enforce the plan and yes we can update it along the way, but it is critical that the same resolve and urgency that that the country had in ensuring that 2010 infrastructure was delivered on time, is needed to accelerate the NDP going forward," concludes Pirie.

LIVE CABLE REELS

Denver Technical Products, offer a broad range of cable reels for industrial applications.

Rewind options are: spring, manual crank, electric, hydraulic or air-motor. The reels are equipped with three or four slip-rings capable of carrying 45 A per collector (slip-ring) assembly. Special custom versions are available to carry up to 300A.

Spring and air motor rewind reels are available for constant tension applications, for example; cranes. Four way roller assemblies are available to protect the cable from damage caused by rubbing on the flanges of the reel.

Typical applications include general industrial use, rescue and hazmat operations, agriculture, electric power tools, portable lighting, auxiliary leads for power generation, hoist and crane operations.

For more information, please contact:
Denver Technical Products (Pty) Ltd
Tel: 011 626 2023
E-mail: denvertech@pixie.co.za
Website: www.denvertech.co.za

WATTSUP

SAIEE PRESIDENTIAL VISIT TO WESTERN CAPE CENTRE

Paul van Niekerk, SAIEE President visited the Western Cape Centre recently.

After his inaugural talk, Paul presented awards to the three best third year Electrical Engineering students who graduated in minimum time and enrolled for B-Tech at the Cape Peninsula University of Technology. They are Guillaume Matthys du Toit, Waheba McWhite and Dane Richard Wrigley. This award was donated by Mr Edwin Gobler.

Paul van Niekerk with Richard Wrigley

Paul van Niekerk with Waheba McWhite

Paul van Niekerk with Guilaume Matthys du Toit

SCHNEIDER ELECTRIC RELEASES NEW 4.40 VERSION OF VIJEO HISTORIAN SOFTWARE

With data sets growing larger and more complex, process historian software is an effective means by which industrial businesses can access and study vast amounts of real-time and historical process data to optimise support decisions.

Vijeo Historian 4.40 software is the information management component of the innovative Schneider Electric PlantStruxure process automation system that enables businesses to collect data from various systems and devices in order to run real-time analytics more efficiently and gather intelligence lying within large sets of historical data.

"Included in the software is a robust, easy to use plant historian that offers powerful analytical capability and SCADA system integration, revealing rich data for reporting purposes," says Quintin McCutcheon, industry business marketing and operations general manager at Schneider Electric South Africa.

"This evolution of Vijeo Historian provides customers with reduced engineering time, while offering additional capabilities in the delivery of business-critical data for real time decision-making support. Historian Enquire for Microsoft Excel has an entirely new user interface accompanied by significantly improved reporting and analysis functionality. Users can filter, sort and pivot data in any format for analysis and generation of customised reports."

Automatic configuration allows hierarchical data, including tags, alarms and trends already configured in Vijeo Citect systems, to be duplicated and synchronised in Vijeo Historian 4.40. McCutcheon adds that this eliminates the need to configure and update both systems separately, leading to considerably reduced configuration and ongoing maintenance time.

Vijeo Historian has extended its access to a wider range of data from SCADA to greatly enhance the quality and accuracy of reports. Analysis and troubleshooting on system events and alarms is significantly easier as the time stamp is sourced directly from Vijeo Citect. This means accuracy and consistency throughout the system from device to final reports.

"Quick, accurate and efficient access to real time data means that users at all levels of the organisation can make informed decisions based on comprehensive overviews of their plant," concludes McCutcheon.

IT'S ALL UNDER CONTROL WITH THE RTI KX7 IN-WALL TOUCHPANEL...

Distributed by HFX Systems, the extraordinary RTi KX7 in-wall touchpanel is jam-packed with a wide range of features for complete control of entertainment, environment and security systems in any residential or commercial installation.

The RTi KX7 wall-mounted touchpanel has a slim profile, framing a control interface that can be custom tailored for every installation. Taking the user experience to a new level, the vivid 7" LCD touch screen even allows screen swiping for page navigation. *"Homeowners will love the powerful capabilities at their disposal, such as the built-in infrared communication capability, allowing for direct control of electronics without a control processor.*

In addition, video inputs make it possible to view analog video, while an Ethernet connection enables even more functionality, such as viewing IP security cameras, surfing the web and advanced two- way control," explains Ryno Goosen from HFX Systems.

He says that the KX7 takes touch panel control to new heights with an infrared output for control of devices up to 1000 feet away. When combined with RTI accessory products, the KX7 offers intuitive two-way communication for control and feedback from compatible electronic devices such as music servers, HVAC, lighting, and more.

The sleek and sophisticated design of the KX7 features a beautiful 7" WVGA (800x480) multi-touch capacitive touch screen to display the completely customisable control interface. In addition, composite, S-video and component video inputs provide crystal clear video at up to 576p resolution.

The KX7 is outfitted with both wired and wireless Ethernet, providing convenient access to advanced capabilities, including two-way control of devices, viewing motionJPEG digital video, web browsing and system file updating. The KX7 10/100 Base-T connection even supports PoE

(Power over Ethernet) to reduce cabling requirements and simplify installations.

KEY FEATURES:

- Touch Screen
- High Resolution viewing
- Wireless Ethernet.
- High output IR port
- Powered using power supply, CB8 connecting block or PoE
- Optional Processors
- USB and Ethernet Programming.
- Stylish low-profile faceplate available in black or white.
- Integrated mounting wings

For more info, visit www.hfxsystems

WATTSUP

ALTAAQA GLOBAL INSTALLS 24MW TEMPORARY POWER PLANT IN OMAN

Altaaqa Global CAT Rental Power, a leading global power solutions provider, recently designed and installed a 24MW temporary power plant in the Sultanate of Oman.

To meet electricity demands throughout the summer, the 24MW temporary rental power plant will supply power to the electricity grid at a time when there is a significant increase in the use of temperature control equipment, such as air conditioning and district cooling. Supporting the existing generating capacity of Oman, the interim power plant will ensure peak performance during the hottest months of the year.

Taking just 96 hours to install, Peter den Boogert, Altaaqa Global's General Manager for Business Development, commented on the impressive speed of deployment. *"This reaffirms Altaaqa Global's ability to install, commission and safely generate power within a matter of days. The full turnkey solution offers a complete package of power generators, transformers, fuel tanks, distribution panels, electrical accessories, and 24/7 CAT certified power engineers who will manage the temporary power plant."*

"We are proud to deliver our temporary power solution to the people of Oman," said Steven Meyrick, Managing Director of Altaaqa Global. *"Our highly experienced rental power team coupled with Caterpillar's power dense and fuel efficient rental diesel generators is the perfect combination to provide grid optimization and dependable supplementary power."*

Robert Bagatsing, Altaaqa Global's Marketing Manager, stated, *"We can deliver multi-megawatt rental power projects to any part of the world, from 20MW to 200MW. Catering to a wide spectrum of sectors such as power utility, government services, mining, industrial manufacturing, oil & gas, petrochemicals and construction, Altaaqa Global provides large-scale turnkey power solutions anywhere, anytime."*

ICMEESA – TECHNICAL VISIT STANDARD BANK DATA CENTRE

ICMEESA members recently visited the Standard Bank Data Centre Tier IV in Samrand Road, Midrand.

Risk analysis was clearly taken into account and is clearly visible by the enormous steel gate at the entrance and the re-enforced perimeter wall. As you walk around the property you can feel the sense of "Big Brother", as dozens of cameras gaze down upon you.

The visitors were guided by Mr Neil Smith, the Facilities Manager, who informed them that construction on this project began in 2009 and was completed in 2010.

It has a total floor space of 27 000 square meters and has been designed and built as the largest Tier 4 level Data Centre facility in Africa. The impact to the environment has been taken into consideration in terms of Environmental legislation. With an

impressive air cooled chilled water systems to cool the Data Centres.

RENEWABLE ENERGY CABLING

German cable manufacturer Helukabel is experiencing unprecedented demand for cabling and related products used in the renewable energy industry.

With a multitude of projects underway for wind and solar energy projects (and more on the cards), the company is leading the way with supply contracts for many of the projects. Its speciality range of both solar and wind power station cabling has steadily become the cabling of choice on local projects.

"This owes mainly to the fact that our cables hold all the necessary certifications from worldwide quality and accrediting agencies. This means our cables perform to the required specification for conductivity, strength and durability required on each new project," says Doug Gunnewegh, Managing Director of Helukabel South Africa.

He continues that due to the time urgency required the availability of the right cable at the right time is critical. As a result the company recently moved to even bigger premises in northern Johannesburg, where massive stock holding are being maintained just to keep up with rising demand from the energy, as well as other sectors.

"Clearly Helukabel's investment in the industry in terms of developing the appropriate technology and ensuring the correct stock holding per region has paid off. Worldwide and in SA the company is involved in supplying cable to the biggest and most advanced projects of their type. Our strategy is to supply these projects with a "full basket" of products to ensure that power transmission, control instrumentation, data, security, medium voltage, telecommunications and torsion cables are supplied from the company as a single-source supplier," adds Doug.

Doug Gunnewegh
MD | Helukabel South Africa

GREEN CONSTRUCTION: CRITICAL TO A GREEN ENVIRONMENT

The South African built industry is increasingly recognizing that green construction is imperative if we are to reduce carbon emissions and leave a world that will be habitable for future generations. The move to green is therefore rapidly gaining momentum here, in line with the global focus on ensuring a green, sustainable environment, and the international commitment to reducing energy consumption.

"The worldwide focus on sustainability, rising electricity prices and triple bottom line reporting are forcing companies to become increasingly aware of their carbon footprint," states Jaco Cronje, a Director at EES, an ISO 9001 Professional Engineering and Management company, and a leader in project managing the provision of information technology (IT) solutions to the built environment.

Essential to the construction of a green building is integration of IT and multiple system intelligent infrastructure, and in overseeing this integration EES proactively assists its clients to reduce their carbon footprint and wherever possible curtail any practices which negatively impact on the environment.

"A strong information and communication technology (ICT) platform is essential to ensure the delicate balance between being environmentally responsible and growing a company's African and global presence," continues Cronje.

Bradley Hemphill, Managing Director of EES, stresses that integral to being environmentally responsible is energy efficiency. *"Intelligent infrastructure integrates energy efficient lighting and heating, ventilation and air-conditioning (HVAC) temperature control systems. Through further integration of CCTV security and access control, fire control and*

digital signage it contributes to the efficiency of the overall building.

These efficient resources and systems of course contribute to the well-being of owner/occupiers and tenants of the building.

Hemphill concludes: *"We at EES are proud to be able to contribute to the environmental sustainability initiatives of our clients, to help the built industry reduce its carbon footprint, and to play a role in shaping South Africa's green future."*

WATTSUP

FNB BECOMES THE FIRST BANK TO SUPPORT LOCAL PEERING


Lex van Wyk, CEO Teraco

First National Bank (FNB) has leveraged its telecommunications licenses, skills and internal ISP, FNB Connect to become the first bank in the country to support peering by joining the NAPAfrica platform. *"This is a substantial first for the South African banking industry and we believe that FNB has set a great example not only for the financial services industry but for other ISP's"* says Lex van Wyk, CEO at Teraco Data Environments.

Van Wyk adds that peering will allow FNB Connect several benefits such as access to additional quality online content and the sharing of network capacity with other carriers, internet service providers and content providers both locally and internationally. *"The sharing of network capacity impacts on the price of connectivity, ultimately lowering bandwidth costs directly to the consumer and we are hoping other banks will understand the immense benefits of peering and follow in FNB's footsteps,"* says Van Wyk.

FNB has been announced as the South African bank with the most satisfied customers, following the results of the recent South African Customer Satisfaction Index (SAcsi). *"For us at FNB, customer satisfaction is a priority and open peering fits this drive perfectly. We have used the opportunity for peering not only as a network efficiency measure, but have passed on the savings and benefits directly to our existing clients as a value added service,"* says Farren Roper, Head of FNB Connect ISP. *"One of the benefits is free access to Online Banking and FNB sites that we are able to provide our customers,"* says Roper.

Furthermore, Roper says, *"At FNB Connect, we are also excited about the quality of download speed, made possible through open peering."*

Van Wyk says that since the initial introduction of route servers by NAPAfrica early in 2012 there has been a subsequent overall reduction in ISP operating costs in the South African market through the simplification of the peering process. He says that route servers lower the barrier to entry for African ISPs, such as FNB Connect and with one connection, all NAP members have direct access to the FNB content at no charge. This increases access to key applications such as online banking through the clients' current service provider. There are over 70 peers live at NAPAfrica with access to over 27 local and international carriers.

Teraco offers the choice of both multi-lateral and bi-lateral peering which then helps all members to connect to the exchange based on what is preferable to their business.

Teraco is the most connected data centre facility in Africa already offering connectivity to major international carriers including SAT3/SAFE, Seacom, WACS and EASSy; mobile carriers including Vodacom, MTN and Cell C; local carriers including Telkom, Neotel and Broadband Infraco and fibre infrastructure provider, Dark Fibre Africa and many more.

PREVENTATIVE MAINTENANCE STRATEGY FOR SURGE ARRESTORS TO ACHIEVE OPTIMUM PERFORMANCE FOR SUB-STATIONS

Test Instruments Africa (TIA) is proud to anounce the launch of the SA 30i, a leakage current meter from SCOPE. It's a 'state-of-the-art', on-line test system for Residual Life Assessment of Surge Arresters. The instrument measures and directly displays the values of resistive and total leakage current. The SA 30i can be pre-loaded with the identity (Asset number, make, year, Serial number etc.) and tests conducted on the same ID of the Arresters are saved under its own folder. Trend analysis software, Sadata, picks up this data and files it in a similar fashion on a PC. This analysis software enables the user to take a decision to repair or replace the arresters, while considering safety limits. The SA 30i is designed to work under the hostile electrostatic noise found in live EHV switch yards. Visit www.testinstrumentsafrica.com

PASTERNACK ADDS ALL NEW LINE OF RF COAXIAL TEST CABLES

Pasternack Enterprises, Inc., an industry leading ISO 9001:2008 certified manufacturer and global supplier of RF and microwave products, adds new line of SMA and N-Type Test Cables, ideal for testing applications requiring low insertion loss and operating frequencies up to 26.5 GHz.

Pasternack Enterprises' new RF test cables are specifically designed for environments requiring highly durable test cables, but where expensive ultra-stable cables are not required. New coaxial test cables from Pasternack are available in both in-series and between-series configurations.

These cables use male versions of SMA (26.5 GHz) and N (18 GHz) connectors, and Pasternack's own PE-P141 type coax, a flexible version of 141 semi-rigid coax. Each test cable is constructed with extremely durable, machined, stainless steel connectors and come standard with a double-shielded coax and FEP jacket.

Pasternack's new SMA and N test cables are used for many applications including prototyping in test labs, production line testing, and antenna range testing. These rugged RF cables are a cost effective solution for various types of production testing, eliminating the need to buy more expensive versions. Testing cables from Pasternack are available in standard lengths from 12 to 120 inches and can be ordered in 12-inch increments. Metric lengths can be ordered for each series in 100, 150 and 200 centimeter (cm) lengths.

"Our new lines of N-Type and SMA test cables using our PE-P141 coax are a great addition to our growing range of test and measurement products" says Gerry Camacho, VP of Technical Marketing at Pasternack Enterprises, Inc. *"We are pleased to offer our customers lower-cost test cable options without sacrificing performance or degrading the materials used."*

The new selections of test cables from Pasternack are in-stock.

You can browse the available options and detailed specs on Pasternack's website or by visiting www.pasternack.com.

SU Business Launchpad to boost entrepreneurship in South Africa

Student entrepreneurs and aspiring business ventures will soon have a home in the heart in Stellenbosch.

A whole floor of Stellenbosch University's Admin Building, in the centre of the campus, is currently being fitted out to welcome a next generation of innovators, freethinkers and entrepreneurs. The Business Launchpad is an initiative of InnovUS, the University's technology transfer company.

The Business Launchpad, as it is currently known, offers tenants excellent infrastructure and network services, as well as guidance from academic staff and leaders in the business world to help them launch their business ideas. Aptly described as a business accelerator, the Launchpad aims to boost entrepreneurship on campus by providing networking opportunities, mentoring and affordable rental rates in an entrepreneur-friendly environment.

The accelerator will include Stellenbosch University (SU) spin-out companies (formed in conjunction with the University) as well as student-owned enterprises, which function independently of the University, but have access to the services in the business accelerator. In addition, the business accelerator will be open to external start-up companies who would like to benefit from the entrepreneurial services on offer, as well as internal or external service providers who are able to provide mentoring, support or guidance to the accelerator tenants.

The first tenants in the Business Launchpad include two start-ups from SU – Stellenbosch Wind Energy Technologies (SWET) and Praelexis, a software company based on machine learning technology, while established spin-out company SUN MEDIA STELLENBOSCH, will function as a service provider within the accelerator.

"We are also particularly excited to welcome Orientis VC, a venture capital company that will provide mentoring to the other tenants in the accelerator," says Anita Nel, CEO of InnovUS. *"Through pure word of mouth, we have already received tremendous interest from both student ventures, as well as external entrepreneurs to become accelerator tenants. This shows that there is a significant need for entrepreneurial support in the region."*

The business accelerator will also offer a "hot desk" area for students with promising business ideas. *"For a limited period, we're offering this hot desk space free of charge – students will only be expected to cover their own expenses, such as telephone calls and internet usage. In the hot desk area students will benefit from the expertise of those providing mentorship in the accelerator, as well as the opportunity to network with other like-minded individuals,"* says Nel.

The goal is for the accelerator to become the hub of entrepreneurial and innovational activities at Stellenbosch University. *"I would like to invite local businesspeople or academics to become involved with our entrepreneurs in a mentorship capacity. By fostering entrepreneurship on campus we are empowering our students to start their own businesses and create jobs, wealth and knowledge in the process. We really need the support of a strong network of mentors who want to contribute to the growth of entrepreneurship on our campus,"* says Nel.

50 HOURS INTERNSHIP PROGRAMME

The business accelerator will also become the home of the InnovUS 50H (50 hours) internship programme. This programme is aimed at postgraduate students who would like to gain real life experience of a start-up company by assisting with financial modelling, market research and other activities. *"This kind of experience is invaluable on your CV when you enter the job market,"* adds Nel.

At present, the Business Launchpad is funded by the University, but the intention is to develop this interim accelerator into a fully fledged business accelerator, for which external funding is still required. The business accelerator still requires a name of its own, and funding will grant the sponsoring company partial naming rights and significant exposure.

Anita Nel | CEO | InnovUS

"Universities have a responsibility to commercialise the products and services flowing out of their research so that they are available to industry and the public. As a research-based university, Stellenbosch University has an important responsibility in this regard to ensure that entrepreneurs receive the support they need to function as part of the innovation chain," says Professor Leopoldt van Huyssteen, Executive Director: Operations and Finance at SU. *"I believe the Business Launchpad is the beginning of a wave of entrepreneurial activity on campus. Entrepreneurship is vital to economic growth and job creation in South Africa and Stellenbosch University is committed to contributing in this regard."* wn

Zest WEG Group makes robust progress in the SHE Arena

The Zest WEG Group has made robust progress in aligning ISO 9001 standards with the requirements of the Occupational Health and Safety Act and this alignment has elevated the Group's customer focus to a new level.

All activities are being implemented to proactively achieve high levels of health and safety with the main objectives being boosting customer satisfaction and employee motivation as well as contributing to the well-being of the Group's local communities,

So says newly-appointed Group SHE (Safety, Health & Environment) specialist, Jaqui-Lynne de Beer, who occupies this recently created position to co-ordinate all SHE activities within the Zest WEG Group.

"As a major supplier to industry in Africa, it's essential for all our companies to align their SHE undertakings with each other and with the required legislation," says de Beer. *"We're highly focused on raising awareness across the board of all the issues in this arena to improve our processes."*

"All members of the Group's top management team have given their full commitment to the process, granting it top priority by making a major investment necessary to reach our objectives. This is not about paying lip-service to the law — we're truly committed to uplifting our SHE standards across the Zest WEG Group."

Craig Smorenburg, Zest WEG Group's SHEQ and customer services manager, adds that the intention is to extend SHE compliance above and beyond the legal requirements.

"Our health and safety policy confirms our moral and legal duty to ensure the health and safety of our employees, contractors and customers," he says. *"We're striving to ensure that our employees adopt the healthy and safe culture necessary to achieve a risk free environment. We want to provoke such a strong awareness of health and safety issues that our employees take these behaviours well beyond the workplace and make them a natural part of everyday life. This includes identifying and assessing safety, health and environmental hazards in both new and existing operations and managing the associated risk."*

The Zest WEG Group promotes Health and Safety on the company's intranet and through extensive training and monitoring through the Group SHE Specialist and SHE Committees. These practices are intended to encourage ownership of SHE issues by all employees as a crucial element of the Group's day-to-day operations.

Forklift training being conducted as part of the Zest WEG Group's safety requirements.

"To help achieve this, we've initiated a SHE Recognition Programme that identifies and recognises the SHE successes of employees at all levels," comments de Beer. *"The programme aims to motivate employees to actively participate in creating a healthy and safe environment and has been very well accepted by our employee body."*

"Implementing the Zest WEG Group management system is incredibly rewarding, as it offers the opportunity to develop partnerships with all levels of stakeholders. These relationships are crucial in achieving the Group's health and safety goals." wn

Jaqui-Lynne de Beer, Zest WEG Group's SHE (Safety, Health & Environment) specialist, and Craig Smorenburg, Zest WEG Group's SHEQ and customer services manager.

Earn CPD Credits

IMPLEMENT NFPA 70E & NESC ARC FLASH TRAINING CHANGES

Don't get burned

The Occupational Safety and Health Administration (OSHA) hasn't made major changes to the U.S. electrical safety standards since OSHA 1910.269 was created in 1994. That should change in 2013. OSHA's regulatory calendar issued last year announced it will update during 2013, this critical standard and some parts of OSHA 1926 (related to electric utility construction) and 1910.300 series related to general industry electrical work.

BY HUGH HOAGLAND
SR. PARTNER **|** E-HAZARD.COM

Those familiar with these standards know that they are inadequate to build a safety program around without outside help since much of the language is performance-based without clear guidelines on how to comply. Most of industry turns to the national consensus standards such as ANSI/IEEE's National Electric Safety Code (NESC) (ANSI C-2) or NFPA 70E Electrical Safety in the Workplace. These two standards cover electric utility work and other general industry electrical work respectively.

In 2013, the updated OSHA standards are scheduled to make changes which most companies have yet to implement in their electrical safety training. These critical changes help put electrical safety programs in line with the new law coming in 2013.
Start using the term *"arc-rated (AR)"* vs. *"flame resistant (FR)"* clothing.

The NFPA 70E committee, being an end user standard, has sought to end confusion over the misuse of the term *"FR"*. FR is a very generic term which only has meaning in the framework of the hazard. Flash-fire rated clothing should meet a flash fire standard (such as NFPA 2112 or for rainwear use ASTM F2733), electric arc hazard clothing should meet an arc standard (such as ASTM F1506, ASTM F1891 for rainwear or ASTM F2178 for hoods, goggles and faceshields) and firefighter clothing should meet a firefighter standard (such as NFPA 1971 Turnout Gear, NFPA 1975 Fire Station-wear or NFPA 1977 Wildland Firefighting).

The National Fire Protection Association (NFPA) recently provided a clear statement against misusing NFPA 701 in garments.

This standard is not designed for labeling garments and doing so is a misuse of the standard and opens the company labeling garments as flame resistant per NFPA 701 to liability since it is only for *"wall coverings," "curtains," "furniture"* and other building uses but NOT clothing. No credit for using cotton, wool or silk under arc rated clothing in NFPA 70E even if you test them.

The National Electrical Safety Code (NESC) still allows use of non-FR underlayers to be tested and add protection, but most companies are recognizing only the arc rated layers as adding protection. More and more companies are using arc rated t-shirts and layering to reach the desired protective levels without wearing flash suits.

This is most common in utilities or companies employing designated electricians. This more conservative approach has been justified by NFPA 70E due to the variability of non-FR undergarments (no one has tested every undergarment) and the variability of arc exposures (calculating an 8 cal/cm² for a label does not mean you will never have >8 cal/cm² in a real life event).

Preventing non-FR t-shirt ignitions could save several lives per year and reduce injuries in many workers who come in contact with electricity by preventing their clothing from igniting. This can be accomplished by using an arc rated undershirt or ensuring that the outer suit is always at the arc rating required for the work for low voltage work. For layering data, see your garment manufacturer or check out ArcWear.com's public arc rated layer data (ArcWear.com does not sell clothing and provides multilayer system data free on systems tested by end users through our testing service using ASTM F1959).

A phenomenon known as a "tracking arc" provides a compelling reason to use arc rated t-shirts. If electrical contact occurs when working greater than 1000V lines, an arc can track through the clothing or under the clothing and ignite clothing from the inside out.

NON-MELTING ZIPPERS, FINDINGS AND LOGOS

NFPA 70E 130.7(C)(11) states that AR clothing must meet certain performance characteristics beyond those in ASTM (American Society for Testing and Materials) F1506.

Clothing consisting of fabrics, zipper tapes, and findings made from flammable synthetic materials that melt at temperatures below 315°C (600°F), such as acetate, acrylic, nylon, polyester, polyethylene, polypropylene, and spandex, either alone or in blends, shall not be used. *Informational Note: These materials melt as a result of arc flash exposure conditions, form intimate contact with the skin, and aggravate the burn injury."* ASTM F1506.

Flame resistant zipper tapes do exist, but when normal zipper tapes are covered properly they can comply with ASTM F1506. Unfortunately, they now will not

Don't get burned

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comply with NFPA 70E. While we prefer flame resistant zipper tapes in testing, there is a danger in using them without thought. Exposed zipper tapes, like those in a sweatshirt, can break open earlier than the fabric thus making the garment unsafe at exposures below the garment rating. However, due diligence on the part of the manufacturer via testing (using ASTM F2621) or by covering the zipper with adequate protective fabric will prevent ignition.

Arc Tested zippers (zipper tapes are never arc rated but can be evaluated in a garment form) can solve issues of ignition if a zipper is not properly protected in the garment design. Reading the informational note, it could be interpreted that the committee did not intend to eliminate the use of common zipper tapes unless they could make intimate contact with the skin. This has yet to be determined. Currently, that is the interpretation of ASTM F1506 regarding zippers.

Logos are not included in findings because NFPA 70E refers the user to ASTM F1506 which allows non-FR logos as long as their design does not increase the extent of an injury. See NFPA 70E 130.7(C)(13)(d) which points to ASTM F1506 for trim and logos.

NEW ARC RATINGS BASED ON ASTM F1959-06 (OR LATER) WITH TWO LAYER "PRE-ABLATION BURN" MEASUREMENTS

Some clothing systems have been down-rated due to a phenomenon often termed the "double hump". Some clothing systems, specifically heavy layers over lighter layers, will sometimes allow skin burns BEFORE the outer shell begins to "ablate" or open up to allow cooling immediately after the arc. The ASTM committee made a change to the test method in 2005-2006 addressing this, but NFPA 70E pointed to the 1999 version of the standard F1959 which did not address this. Therefore, some system ratings were artificially higher than those tested after 2005. This also applies to hoods and flash suits even though these systems are not inherently unsafe because of this phenomenon.

The principal issue arises when these suits are worn alone (read "naked" under the suit).

A coverall tested over a shirt, however, would potentially exhibit this effect and could allow second degree burns in some unusual cases. New systems should have an ASTM F1506-08 or newer label to meet NFPA 70E-2012 requirements. We have encountered many garments with generic NFPA 70 and ASTM F1506 labels that do not meet the new standard.

Arc flash boundary and limited approach boundary now require energized electrical work permit.

Related terms used throughout the document such as: "flash protection boundary" "flash hazard boundary," "flash boundary" have been modified to the new term "arc flash boundary" and the "arc flash boundary" now clearly requires a written energized work permit [NFPA 130.2 and 130.2(B)(1)]. Previously, this was required at the Prohibited Boundary.

Now, it is required at the arc flash boundary or the limited approach boundary whichever the greater distance is. Practically, many companies have a default boundary for energized permits and PPE donning.

REDEFINED ARC FLASH HOOD ALLOWS FLEXIBILITY.

The definition of arc flash hood no longer requires a specific design or a "bee-keeper's style hood". It now requires 360° protection, and it may be designed without restriction as long as it provides that protection. Newer hoods are now made with hardhats with less fabric and balaclava/goggles are now being used in situations where fabric on top of the hardhat could cause a greater risk of shock. Making the work practice standard less prescriptive and more performance based may allow even more flexibility going forward.

AUDITS

(three different NFPA 70E audits and an NESC audit) Another change in the NFPA 70E standard that should be trained is in regard to auditing. There are four audits required in NFPA 70E and a few implications in NESC which require an audit.

SUPERVISORY WORK PRACTICE INSPECTION

- NFPA 70E 110.2(D)(1)(f);
- NESC 421.A.2 Supervisor routine auditing;
- NESC 410(A)(2&4) employee retraining when not following work rules, implies a supervisory level audit;
- NESC 420(A)(1) work rule knowledge auditing;
- OSHA 1910.269 (d)(2)(v) LOTO auditing. Remember this is law for utilities and recommended for all electrical workers.

1910.269(a)(2)(iii) - The employer shall determine, through regular supervision and through inspections conducted on at least an annual basis, that each employee is complying with the safety-related work practices required by this section.(a)(2)(iv) An employee shall receive additional training (or retraining) under any of the following conditions:(a)(2)(iv)(A)If the supervision and annual inspections required by paragraph (a)(2)(iii) of this section indicate that the employee is not complying with the safety-related work practices required by this section.

ANNUAL WORKSITE AUDIT

Similar to above but focused on the worksite in general. Companies could combine this with the supervisory audit in some situations but the program should be clear and documented. This is electrical specific but could be combined with a safety audit. It should cover electrical safe work practices. The auditor should be knowledgeable of the proper safe work practices in the standards. Many of the audits we have seen focus on NEC wiring issues and little or no audit of work practices. The Annual Worksite Audit is a work-practice procedure audit, not an electrical wiring audit.

3-YEAR PROGRAM AUDIT

[NFPA 70E 110.3(H)(1) & NESC 410.A.1, 420.A.1]

Work rules must be written and up-to-date with the latest OSHA and proper consensus standards so NFPA requires a written electrical safety program audit every three years in the 2012 edition of the standard to ensure that it is in line with the standard. This could be done when any of the applicable standards change but most companies have a requirement to audit the program periodically so that the program is updated on a cyclical basis.

TRAINING FREQUENCY

New to NFPA 70E is a requirement to retrain every three years. Previously the frequency was not defined. Keeping up with these changes in the consensus standards should help companies on compliance with the new OSHA changes in March and make safety programs more comprehensive on a hazard which is one of the top five killers in the workplace. wn

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Using Electrical Equipment in Hazardous locations

Hazardous areas are locations where the potential for explosion or fire exists because of ignitable gases, dust, or easily ignitable fibres or filings being present in the atmosphere.

In most countries, strict regulations apply pertaining to the use of electrical (and mechanical) equipment in these designated hazardous areas, and any such areas have to be formally identified and classified.

In South Africa, Europe and most countries outside of North America, classification of hazardous areas is accomplished by separating the areas into zones. These zones are determined by the frequency of the presence of an explosive gas or vapour and its duration, and are used to define the probability and risk of an explosive atmosphere being present and thereby the level of safety required for equipment installed in these locations.

Protection types denote the level of safety for the device. Groups classify the exact flammable nature of the material. These groups are separated differently than those of the North American Groups. Temperature identifications convey the maximum surface temperature of the apparatus based on an ambient of –20° to +40° C. These temperature codes are selected carefully so as not to exceed the ignition temperature of the specific gas or vapour to be encountered in the application.

In North America, hazardous areas are separated by classes, divisions, and groups to define the level of safety required for equipment installed in these locations. Classes

Using Electrical Equipment in Hazardous locations

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define the general form of the flammable materials in the atmosphere. Divisions define the probability of the presence of flammable materials. Groups classify the exact flammable nature of the material. North America is actively converting to the international IEC (International Electrotechnical Commission) to align themselves with the rest of the world, but this conversion will take many years.

In South Africa the use of the following mandatory standards, SANS 10108 and ARP 0108 are essential reading for persons wishing to gain a better understanding of hazardous areas and the use of equipment in these areas.

EXPLOSION PROTECTION TECHNIQUES

To enable electrical equipment to be used in hazardous areas, eight commonly recognized explosion-protection techniques have been developed over the years. National and/or international standards and codes of practice govern each technique. In South Africa the International series of standards, IEC-60079 have been adopted and are used in the form SANS (South African National Standard) 60079 documents and define in detail how the equipment should be designed and applied.

National certifying and approvals authorities ensure design compliance and inspectorates vet and usually inspect each installation. In addition, manufacturers of equipment designed to these standards are required to implement strict quality measures which they are regularly audited on.

On top of these requirements, national regulations may also impose further restrictions. Many of these are contained in the ARP 0108 which is "owned" by the regulator, but the user of protected equipment should make sure that he is up to date with all regulatory requirements.

Equipment designed to these standards is marked with the letters "Ex" meaning Explosion Protected. A subsequent letter indicates the type of protection designed into the equipment. (Mandatory equipment marking details is found in ARP 0108). Equipment marketed in the European Union is marked "EEx".

The following protection techniques are covered by these standards:

FLAMEPROOF [EX D] - SANS/ IEC 60079-1

A method of protection where the equipment is contained within an enclosure, which will withstand an internal explosion of a flammable gas or vapour that, may enter it, without suffering damage and without communicating the internal flammation to the external explosive atmosphere through any joints or structural openings in the enclosure.

The enclosure will be designed for a particular gas grouping (I, IIA, IIB or IIC). This design concept is reflected in the equipment marking by the symbol 'Ex d'. Equipment designed to this concept is suitable for use in 'Zone 1' and 'Zone 2' hazardous areas.

INCREASED SAFETY [EX E] - SANS/IEC 60079-7

A method of protection by which additional measures are applied to electrical apparatus to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks during the life of the apparatus.

It applies only to electrical apparatus; no parts of which produce sparks or arcs, or exceeds the limiting temperature of the materials upon which safety depends that are used in its construction. This design concept is reflected in the equipment marking by the symbol 'Ex e'.

Equipment designed to this concept is suitable for use in 'Zone 1' and 'Zone 2' hazardous areas.

PRESSURIZATION [EX P] - SANS/IEC 60079-2

A method of protection using the positive pressure of a protective gas to prevent the ingress of an explosive atmosphere into a space that may contain a source of ignition and, where necessary, by using continuous dilution of an atmosphere within the space that contains a source of emission gas, which may form an explosive atmosphere. This design concept is reflected in the equipment marking by the symbol 'Ex p'. Equipment designed to this concept is suitable for use in 'Zone 1' and 'Zone 2' hazardous areas

ENCAPSULATION [EX M] - SANS/IEC 60079-18

A type of protection in which parts that could ignite an explosive atmosphere by either sparking or heating are enclosed in a compound in such a way that the explosive atmosphere cannot be ignited. The compound provides a barrier between the electrical apparatus and the explosive atmosphere. This design concept is reflected in the equipment marking by the symbol 'Ex m'.

Equipment designed to this concept is suitable for use in 'Zone 1' and 'Zone 2' hazardous areas.

Using Electrical Equipment in Hazardous locations

continues from page 28

POWDER FILLING (SAND FILLING) [EX Q] - SANS/IEC 60079-5

A method of protection where the enclosure of the electrical apparatus is filled with granular material such as fine sand so that if an arc occurs, the arc will be quenched and not be liable to ignite the external explosive atmosphere. This design concept is reflected in the equipment marking by the symbol 'Ex q'.

Equipment designed to this concept is suitable for use in 'Zone 1' and 'Zone 2' hazardous areas.

OIL IMMERSION [EX O] -SANS/IEC 60079-6

A method of protection where the electrical apparatus is made safe by oil immersion whereby the oil presents a barrier between the explosive atmosphere and the electrical apparatus. This design concept is reflected in equipment marking by the symbol 'Ex o'.

Equipment designed to this concept is suitable for use in 'Zone 1' and 'Zone 2' hazardous areas.

INTRINSIC SAFETY - APPARATUS [EX IA] OR [EX IB] OR [EX IC] - SANS/ IEC 60079-11

A protection technique based upon the restriction of electrical energy within the apparatus and in the interconnecting wiring, exposed to an explosive atmosphere, to a level below that which can cause ignition by either sparking or heating effects.

Because of the method by which intrinsic safety is achieved, it is necessary that not only the electrical apparatus exposed to the explosive atmosphere, but also other (associated) electrical apparatus with which it is interconnected, is suitably constructed. The concept is divided into two sub-types which are dependent upon the number of allowable fault conditions. The symbols 'ia' and 'ib' denote the sub-types. This design concept is reflected in the equipment marking by the symbols 'Ex ia' or 'Ex ib'.

Equipment designed to the Ex ia concept is suitable for use in 'Zone 0', 'Zone 1' and 'Zone 2' hazardous areas.

Equipment designed to the Ex ib concept is suitable for use in 'Zone 1' and 'Zone 2' hazardous areas.

Equipment designed to the Ex ic is suitable for 'Zone 2'.

TYPE N PROTECTION (NORMALLY NON-SPARKING OR RESTRICTED BREATHING) [EX N] - SANS/ IEC 60079-15

A type of protection applied to electrical apparatus such that, in normal operation, it is not capable of igniting a surrounding explosive atmosphere, and a fault capable of causing ignition is not likely to occur. This is normally achieved by manufacturing a high quality product that does not generate sparks or heat. This design concept is reflected in the equipment marking by the symbol 'Ex n'.

Equipment designed to this concept is suitable for use in 'Zone 2' hazardous areas.

TD "DUST PROTECTED ENCLOSURES"- SANS/IEC 61421

The enclosure method, where dust is effectively excluded and the external surface temperature defined.

In the product data this is referred to as "dust protected enclosure". This is now standardised as tD with subdivision into Practice A joints and Practice B dust tight. The suffix A and B for the dust protection methods refer to the two practices A and B for the assessment of temperature with and without dust layers. Sub divisions of other protection methods such as iaD and ibD and Ex mD have also been introduced for dust.

Note: The Ex prefix symbol is now used for dust as well.

TYPE S PROTECTION – (SPECIAL PROTECTION) [EX S]

It is possible for a product to be certified that is novel in approach and where this is not fully covered in one or more of the basic "Ex" standards. To have a product certified to this standard, the test laboratory must satisfy itself through whatever test methods it deems fit, that the product is safe in operation in a hazardous area.

DOUBLE PROTECTED EQUIPMENT

From most of the explanations above, it can be noted that only equipment manufactured to Ex ia requirements may be used in a Zone 0 application. This level of safety ensures that even with two separate faults introduced to the equipment, it still remains safe in operation.

To make things a little more flexible, the concept of "double protected" was introduced. This concepts allows for the use of two separate recognized protection techniques to be used together. An example would be a piece of equipment manufactured to the Ex ib standard, and housed in a flameproof enclosure (Ex d). Used on their own, neither the Ex ib or Ex d techniques are suitable for use in Zone 0 areas, but used together, then they are permitted. Each technique remains separate from the other, thus offering "double protection". wn

ANNOUNCING

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The prevalence of sub-standard electrical products that do not comply with South African regulations has prompted the formation of the **SAFEhouse Association.**

The **SAFEhouse Association** is an industry initiative with the following principal objectives:

- To protect users of products
- To expose persistent non-compliance or other features that affect the safety of products
- To enforce its code of conduct
- To co-operate with all entities who have congruent objectives, notably the National Regulator for Compulsory Specifications (NRCS) and the South African Bureau of Standards (SABS)
- To promote environmental protection

The **SAFEhouse Association** requires its members to adhere to its code of conduct which includes the following:

- To sell only products that comply with South African safety regulations and standards
- In the absence of local regulations, to comply with credible international standards
- Compliance with the Consumer Protection Act; and
- In the case of its members' products having safety defects, to:
  - **Inform** customers
  - **Recall** the product
  - **Replace** the product

SAFEhouse membership is suppliers' assurance to customers of responsible behaviour and of customers' safety as a priority in product design and manufacture.

SAFEhouse is primarily a communications organisation that aims to regulate itself and to inform customers of safety requirements and occurrences of non-compliance with such requirements.

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SAFEhouse is an independant organisation established by industry and is committed to communication with customers.

Earn CPD Credits

Metal Shredder Voltage Modulation

Scrap metal shredding is an extremely important process in the disposal and recycling of household and industrial metal products.

COMPILED BY | WAYNE BROMFIELD

A large metal recycling plant near Pittsburgh, PA, uses a 3000hp (2.237MW) metal shredder, similar to that shown in Figure 1, to process thousands of tons of waste metal each year. Although most of the scrap comes from automobiles, the plant also processes refrigerators and similar domestic metal waste, and larger industrial steel waste such as piping and steel drums.

Figure 1: Typical Metal Shredder

Most shredding machines operate at medium voltage (2.4kV to 13.2kV), with motors varying in size from 2000hp to 8000hp (1.5MW to 6MW). Under full load conditions, these machines can operate at 165% of rated power with considerable dynamic load fluctuations. This case study presents before and after measurements of an installation with the 3000hp shredder connected to the network through a dedicated 5MVA 13.2/4.16kV transformer.

An equalizer dynamic power compensation system rated at 4.5MVAr was installed and connected directly to the shredder supply using a 5MVA 600V/4.16kV step- up transformer.

The equalizer, shown in Figure 2, was supplied in two equally rated parts to offer redundancy for annual maintenance and breakdown purposes.

PROBLEM

The shredder idles at approximately 30% of full load; however, power levels increase dramatically with the onset of shredding. Typical load increases are 150% to 200% within three to four cycles (50ms to 67ms). The degree of dynamic load fluctuation is directly proportional to the type of material being processed, i.e., heavier material requires higher power consumption.

Metal Shredder Voltage Modulation

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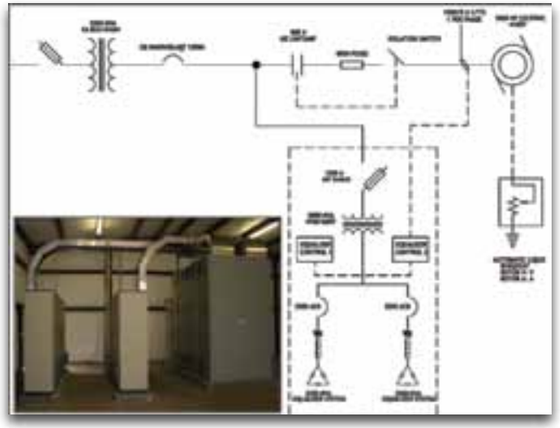


Figure 2: System Installation Diagram

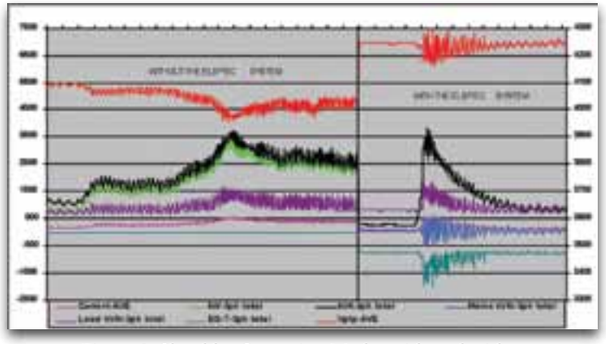


Figure 3: Shredder Operating Modes with and without Power Correction

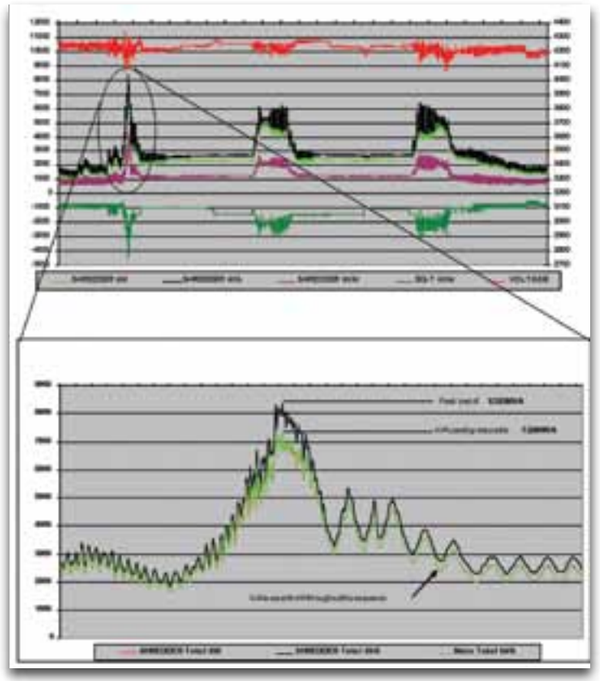


Figure 4: Record Metal Shredder Power Consumption (Bottom Graph is an Enlarged View of this Event)

Reactive power (kVAr) consumption also fluctuates dynamically, varying from 200kVar to 250kVAr in three to four network cycles, even during light loads. When the shredder is operating at a peak load of 9825hp (7.325MW), the reactive power demand peaks at 4.4MVAr, as seen in Figure 4. These power fluctuations result in unacceptable degrees of voltage modulation (flicker or sag) which can be transferred to the local network and affect nearby consumers.

It is not possible to completely eliminate voltage sags without increasing the supply transformer capacity to at least match the peak kVA consumption (8.3MVA) and adding dynamic correction systems.

However, if the reactive power component alone is dynamically removed, then the total consumed power (kVA) will be minimized and the voltage modulation can be limited to an acceptable level.

THE SOLUTION

An equalizer for this application was designed to operate on a load share basis. Each 2.25MVAr powered system is responsible for 50% of the shredder load. This configuration extends the system life and increases overall reliability. Either system can be re-programmed to operate in full load mode in case of breakdown or maintenance shut down. If one system is out of service, the other system is capable of responding to 70% of the shredder's reactive power demand.

Each equalizer system connects or disconnects steps based on sophisticated control algorithms which consider true power factor (PF), all harmonics up to and including the 63rd harmonic order, reactive energy demand and voltage at 4.16kV. The PF and reactive power are monitored and used for reactive correction, while voltage control functions may also be used depending upon utility requirements.

The equalizer system is connected in parallel between the breaker and the shredder. This configuration prevents outages caused by over-current trips of the shredder's 1200A main circuit breaker while meeting power utility voltage requirements.

The current transformers for monitoring the system power for dynamic reactive power control are installed on the power cables feeding the shredder. Information feeds to each of the two system controllers, enabling either combined load share control or independent operation.

Further control functions of each system may be enabled to compensate for the main upstream transformer, further reducing system losses.

PERFORMANCE UNDER VARYING LOAD CONDITIONS

Figure 3 shows a combination of two measurement sequences. The first is a 12s sequence without the equalizer in operation and the second shows a 10s sequence with the equalizer in operation. Each measurement sequence uses a sampling rate of 60 samples per second.

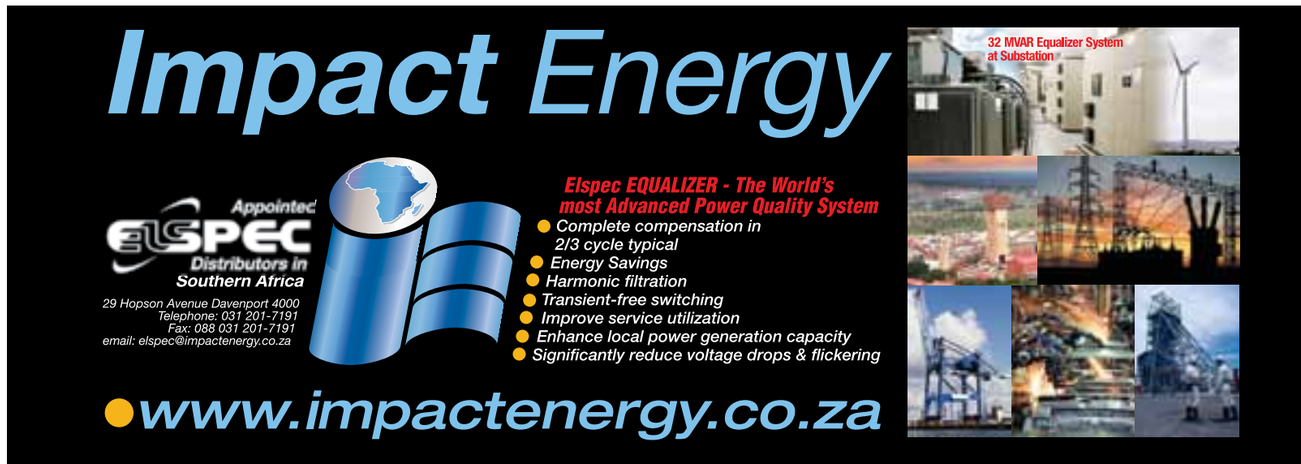
The measurements detail the dynamic nature of a metal shredder load as it moves from idle to shred. The first sequence shows real power consumption (kW) surging by more than 2.6MW in less than 6s. The real power consumption surges even more dramatically in the second sequence, increasing more than 3.5MW in less than 2s. In each case, the real power requirement fluctuates every two to three cycles by ±250kW, while the reactive power consumption fluctuates by ±500kVAr at the same rate.

The dynamic load increases negatively affect the supply voltage. The no-load voltage at the shredder averages approximately 4.25kV. The first sequence starts with the shredder lightly loaded and quickly ramps up to a relatively high load (3.5MW), at which time the voltage at the shredder sags to 3.96kV (overall voltage sag of 290V, or 7%). Although the overall real power and reactive power consumption is slightly higher during the second sequence, the voltage sag is significantly reduced to only 80V (2% below no-load voltage).

Figure 4 depicts a 2min sequence during which the record highest shredder load occured after the equalizer installation. Demand peaked at 7.325MW during this event, 325% of the rated power of the motor.

Although apparent power consumption at the motor peaked at 8.3MVA, the power utility saw over 1.0MVA less demand due to the equalizer systems. Furthermore, even though power consumption peaked at more than three times the motor rating, voltage sags were still limited to less than 3% of 4160V, the motor's nominal operating voltage. The bottom graph in Figure 4 shows the effectiveness and extremely accurate operation of the equalizer systems. The utility apparent power demand is reduced to equal the real power consumption of the shredder motor, effectively reducing average reactive power demand to zero and maintaining the average PF at unity. wn

Article courtesy of Impact Energy.



PART 2: SOUTH AFRICA'S ENRICHMENT SUCCESS (1962-66)

Uranium Technology

On the 20 July 1970, the then Prime Minister, Mr B J Vorster announced in Parliament: *"South African scientists have succeeded in developing a new process for enriching uranium, including the associated technology, and are at present constructing a small-scale plant for enriching uranium based on this process. South African scientists have thus once again won fame for south africa. In the past they have made unforgettable contributions to science but what i announce today is probably unparalleled in the history of the country."*

BY | FELIX BOSCH | NED | AM(SA) | MECH E (RTD) | SM(SA) IEE (RTD) | MDP (UNISA) | AEP (UNISA)
(FORMERLY: HEAD OF TECHNICAL INFORMATION, URANIUM ENRICHMENT CORPORATION OF SA)

This narrative article is the story of one of the greatest scientific and technical achievements in the history of South Africa. It tells of the success of a small team of South Africans who under the leadership of the late Dr WL Grant designed, developed and optimised a unique process for isotope separation and consequently uranium enrichment. In content and complexity this achievement eclipses all others, including heart transplants.

This team of dedicated pioneers, with a very limited budget at their disposal, nevertheless in a very short time, succeeded in achieving what at that stage had only been done by the major powers; Russia, China, America, England France and Germany. Those countries had large teams of engineers and scientists, unlimited budgets, and all the necessary equipment and facilities.

In this article covering the period from 1962 to 1966, the human, scientific, technical, political and economic aspects are inseparably entwined. The aim is mainly to give an honest reflection of some of the day-to-day activities of the team on their way to achieving the ultimate goal in November 1965, and consequently, the above 'press release'.

As a result of a lack of knowledge, and comprehension of the nature, and complexity of the achievement, the press and general public hardly took any notice of this breakthrough. Almost everyone knew about heart-transplants and had a basic idea what they involved. On the other hand there were very few people who knew about the complexity and tremendous problems of enriching uranium by means of isotope separation.

THE GAS COOLING PROJECT

In October 1962, while employed at the Atomic Energy Board as Head of the Design Drawing Office, the then Acting Director, the Late Dr WL Grant confronted me with a proposal; I could remain in the Main Design Drawing Office, or opt to be seconded to a 'Top Secret' specialist group, to establish a project Design Drawing office. With no hesitation I accepted the latter. The mission of the project, code-named 'the GAS COOLING PROJECT' was to research, develop, design and optimise a unique isotope-separation technique. The possibility of making nuclear weapons was only casually mentioned. It was general knowledge that for reactor fuel 3 – 7% enriched uranium is used, but for weapons more than 95% enrichment is necessary.

The requirement for total secrecy was absolutely necessary, as any hint that the project had to do with isotope-separation would have resulted in hefty reaction from politicians locally and abroad. The 'Gas Cooling' name was to give the impression that it had to do with the cooling medium for a 'power reactor concept'.

The team members were all selected for the required expertise they could bring to the project. Everyone associated with the project first had to pass the most stringent security clearance in the Country and, take the 'oath of secrecy' As a result of the nature of the project most of the team members' involvement in the project was never revealed. The families and friends of the team members had no idea what their loved ones were doing. Fathers like me had to tell white lies when my children asked; *"Dad what do you do at work, teacher wants to know?"* My reply was; *"I'm an assistant wheel-tappers mate."*

The project had its origin in premises that were previously a motor spares shop in Du Toit Street, Pretoria, known as 'Northern Tyres and Accessories. All the advertisements against the walls were left in place as an effective disguise. The front part of the premises was a workshop with high-accuracy lathes and milling machines, where several specialist instrument-makers manufactured the experimental and test equipment. The storeroom was converted into a highly-classified laboratory, and only a few staff members with the special security clearance were allowed to enter.

ACCOMMODATION IN SHAMROCK BUILDING

In October 1963, it was decided to rent the top two floors of Shamrock Building in Skinner Street from the City Council of Pretoria, this building was earmarked for demolition in three years to make way for the Skinner Street throughway. The laboratory was moved from Du Toit

Uranium Technology

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Street and established on the first floor. The second floor was mainly offices and a small kitchen. There were no name board at the entrance to indicate who hired the building. Every person working in the building was provided with a key. The members of the GCP were provided with special keys to access the highly-classified GCP laboratory. The Design Drawing Office that I established was in the high-security area.

LIGHT- GAS TEST BENCHES

The initial testing and development work on the separative element was conducted on light gases such as argon, krypton, neon and xenon. These gases are non-reactive and can be easily handled. The two main parameters that were being investigated in the various designs and configurations of elements were; separation factor and separative energy. A light-gas test assembly consisted mainly of; the separative element, a compressor, pressure gauges, rotameter-flowmeters and a mass-spectrometer to determine isotope concentrations. These components were all built into the test bench and connected with metal and plastic tubing.

MATERIAL- TESTING CELL

My first task in the Drawing Office was to design a material-test cell for the project metallurgist. The purpose was to investigate the affect of exposure to UF_6 of a range of material samples; The samples were carefully prepared polished and chemically cleaned, and then exposed to UF_6 at temperatures of up to 130 °C and controlled pressure. The samples were regularly examined and weighed. The first samples were steel, stainless steel, pure aluminium various aluminium alloys, beryllium copper, monel (copper nickel alloy) nickel, and aluminium-nickel-bronze.

DESIGN OF A PRESSURE GAUGE FOR UF_6

My attempt at designing and building a pressure gauge for UF_6 was not a great success. The available gauges were not suitable for UF_6 and I had to use stainless steel. I decided on a helical Bourdon type design. A 350 mm length of 8 mm internal diameter stainless steel tube was filled with Cerromatrix (an alloy with a melting point of 80° C) and turned in a precision lathe to a wall-thickness of 0,25 mm.

The Cerromatrix was removed with boiling water, and a stainless steel strip 0,5 mm thick was inserted into the tube. The tube was now rolled flat and the stainless steel strip removed. The helical Bourdon-tube was formed by coiling the tube, and after heat-treatment and annealing, welded into an existing gauge frame. The gauge worked but had very serious hysteresis deviation. While pondering the problem we heard of a supplier in France that had Monel (copper-nickel alloy) pressure gauges available that would be ideal for UF_6.

It was however very difficult to obtain any equipment that could be remotely connected to arms production due to the UN embargo.

VALVES FOR USE WITH UF_6

Special valves for use with UF_6 had to be designed; they had to be absolutely leak-tight to the atmosphere. Many designs were tested and considered before a suitable one was decided on, namely a stainless steel ball-type. The operating-shaft was welded to an imported stainless steel convoluted bellows, and to the operating mechanism, thereby achieving helium-vacuum tightness. These valves were provided with PTFE sealing-faces making them suitable for pressure and vacuum applications. These valves were manufactured by a local firm, Heat Exchangers Africa, and known as the HEA valves, they played an important part in all future enrichment activities.

MEETINGS OF THE GAS COOLING PROJECT COMMITTEE

An important aspect of the project was the weekly meetings held in Dr Grant's office on Fridays. The committee with Dr Grant as chairman consisted of; the metallurgist, a scientist, a laboratory technician, administrative and purchasing officer, Design office head, foreman instrument maker, engineer from compressor development. When necessary other members such as chemists and metallurgists were included. The Chairman opened the meeting with a review of the past week's achievements and problems as well as progress with the separation tests and other important, related information.

Each group leader then reported on the week's activities. Matters such as work-loading, equipment, material shortages or unavailability were discussed. No agendas were provided before these meetings, or minutes thereafter. Dr Grant did however record the proceedings carefully in an A5-size notebook. The record of the GCP was therefore recorded in a series of these notebooks. In the latter stage of the project reports were compiled, classified; 'TOP SECRET' and distributed on a need-to-know basis.

THE TESTS WITH UF_6 COMMENCE

Because of the aggressive and toxic, nature of UF_6, *(refer to the explanation, Part 1)* all components had to be Helium vacuum-tight; a condition that is very difficult to achieve. Theoretical studies indicated that the isotope-separative ability of the element would be higher if the UF_6 , was diluted with a low-mass carrier-gas, such as hydrogen or helium.

The first attempts with UF_6/H_2 gas mixtures were disastrous. The gas reacted with the compressor components and contaminated them – in the process the gas combined with the contamination products and formed HF. A further complication was that the gas-mixture etched the glass tubes of the rotameter type flow meters rendering them opaque. It was therefore evident that for tests with UF_6 the laboratory would have to be provided with suitable equipment.

BUILDING THE UF_6 TEST BENCHES

The most important component of the test bench was the compressor; it firstly had to be oil-free, and secondly leak-tight.

This type of compressor was not freely available locally, although the chemical industry imported compressors, for use with corrosive gases and food products. The GCP was able to obtain a Corblin diaphragm-type compressor with a stainless steel head and a monel diaphragm. This compressor oscillated at a low-speed and therefore caused a thumping noise, and shocks like hammer-blows.It was therefore installed on its own concrete pedestal and not on the building floor. This machine had inherent problems; firstly the metal diaphragm had a limited life due to metal fatigue, and when the diaphragm ruptured it contaminated the entire test-assembly, requiring thorough decontamination.It was also a time-consuming task to replace a diaphragm that wasted valuable laboratory time.

The experimental work required that the molecular masses of the component streams of the UF_6/H_2 gas-stream, had to be accurately determined. At this stage no instrument was available for determining these parameters. Dr Grant had a brilliant idea after listening to a treadle-organ in the church. He realised that the frequency of the notes were a characteristic of the air in the organ pipes. If the individual frequencies of vibration, of the components of the gas mixture could be determined, this would give the relationship of component molecules. This effect is observed when a person fills his lungs with helium and talks like Donald Duck, because the vocal cords vibrate at different frequencies in helium and air. This principle was successfully applied, and in later enrichment plants hundreds of these 'fluitjiesmeters' (English=whistle-meter) were used.

The tests with UF_6 could now proceed in all earnest. The method was as follows; elements were designed by the scientists, after this the Design Office prepared working drawings with all the necessary dimensions and parameters for the instrument makers. Fabricating the separative elements must not be under-estimated. Only carefully selected and highly-skilled instrument-makers could perform this task. This was still before the era of computers and calculation of angles and lengths had in most cases to be performed with logarithmic and trigonometric tables. After the element was tested by the technicians, the results were carefully analysed. Dr Grant's inputs to the design office were sketches showing the anticipated flows of the various gas streams, these were drawn in colour with ball-point pens. These flow patterns resembled butterflies and consequently the elements became known as 'VLINDERS'.
This name was not a word in some sinister secret language as reported in an article, and was used in all documentation.

COMPRESSOR DEVELOPMENT

The first prototype was basically a standard compressor of the type used by garages for pumping tyres. The machine was fitted with an additional sleeve and crosshead.

The shaft was sealed-off by means of a bellows fabricated by welding a series of stainless steel rings to form a bellows. It worked but only for a few hours before the convolutions succumbed to fatigue. To investigate oil-free working the cast-iron piston rings were replaced by a material with a low shear-stress. This material was 'TEFLON' marketed by Imperial Chemical Industries (England). As a newly released material very little technical information was available for designers. We did however know it had very good electrical and thermal insulating properties, and was successfully used for oil-free bushes.

The cylinder was honed with emery paper, the idea being that one-or-two oscillations of the cylinder would cause some of the Teflon to be transferred to the cylinder-wall, and then it would be Teflon-on-Teflon, and this would be very good. The local agents could only provide Teflon sheet 6,35 mm thick. We cut a strip the width of the ring-groove, bent it over a former to form a ring. The ends of the ring were halved on the centre-line to give a butt-joint with a 3 mm gap. The compressor worked well, but only for about ten seconds before seizing.

Our suspicion, was confirmed; the linear co-efficient of expansion of Teflon was much greater than we had assumed, and on account of the low thermal-conduction the ring expanded much more than we anticipated. A larger gap solved the problem and the machine could run continuously. A quantity of Teflon powder was obtained

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and mixed with 20% (by volume) of bronze powder that was pressed into a mould under high-pressure to form a strip. The volume ratio involved was 9:1. The addition of the bronze powder improved the thermal conductivity of the piston-ring appreciably. This type of piston ring was used extensively with great success. Screw compressors were also investigated but rejected in favour of piston compressors.

THE TESTS WITH UF_6 CONTINUE

The separation-tests required gas samples be taken for analysis to determine the isotope concentrations by means of a mass-spectrometer. With the light-gases it was relatively simple; Glass sample-tubes with glass valves were used for drawing the samples for analysis. An assembly was constructed by the technicians; it consisted of a double valve with two pipes that were welded into a small cylindrical tank. Two pipes from the other connecting points of the valves were connected to the test bench by means of couplings. To draw a sample the gas had to flow through the pipes and the tank. The tank was then immersed into a flask with liquid nitrogen to freeze and solidify the sample. The valves were now closed, the couplings loosened and the sample taken to the mass-spectrometer for analysis.

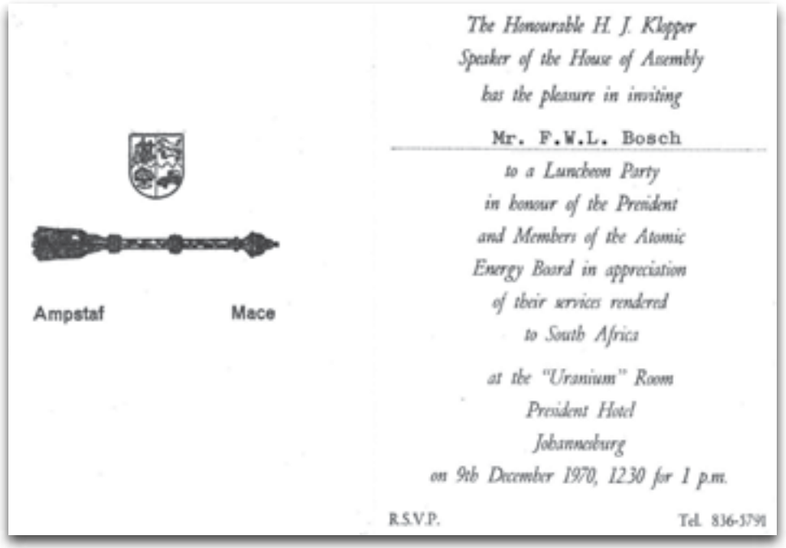
For the analysis the assembly was connected to the MS, the tank heated by means of heating tape to gasify the sample, and the analysis conducted. This method initially worked well – until a disastrous accident occurred; the tank of the sample assembly burst on the welding prep releasing UF6 into the atmosphere, and the technicians that were close by, had to have hospital treatment. The problem was solved by simply replacing the tank with a metal 'U'-tube of sufficient volume.

THE BREAKTHROUGH AND SUCCESS

A visit to the GCP by the then Prime Minister Dr HF Verwoerd was planned for November 1965. The date of this visit, that was scheduled months previously, was also the target date for confirming successful separation of U^{235} and U^{238} isotopes by means of the 'VLINDER'.

A week before the Prime Minister's visit a measure of separation had been achieved, but insufficient to claim success. For the next week the project team literally worked day and night. Only a day before the visit – the breakthrough occurred – the moment of truth – 'THE GREAT SEPARATION'. It was now irrefutably demonstrated that the Vlinder could separate U^{235} and U^{238} isotopes in a UF_6/He mixture.

The visit proceeded as planned; Dr Verwoerd was first informed of the progress of the team, then a visit to the laboratories, and finally being introduced to the team members. This was a great moment in history, and for me a career highlight.



RECOGNITION

Five years after the breakthrough certain members of the team were recognised by the then Speaker of Parliament, the Honourable HJ Klopper, at a Luncheon held in the Uranium Room of the President Hotel on 9 December 1970. Present at this function were; The Hon. HJ Klopper (Host), Dr AJA Roux, Dr WL Grant, Dr JWL de Villiers, Dr C Johannes, Dr JJ Wannenburg, Dr JJ Human, Dr RS Loubser, B von M Louw, J Reyneke, WW Grant, FWL Bosch, and R Sinclair. Other invited guests were; Mr Brand Fourie (Department of Foreignl Affairs), and Dr JG Loubser (General Manager, SA Railways) I am proud to have had the privilege of being a member of the GCP, and having had the experience of working under the leadership of a Scientist of World-class in the person of the late Dr WL Grant. wn

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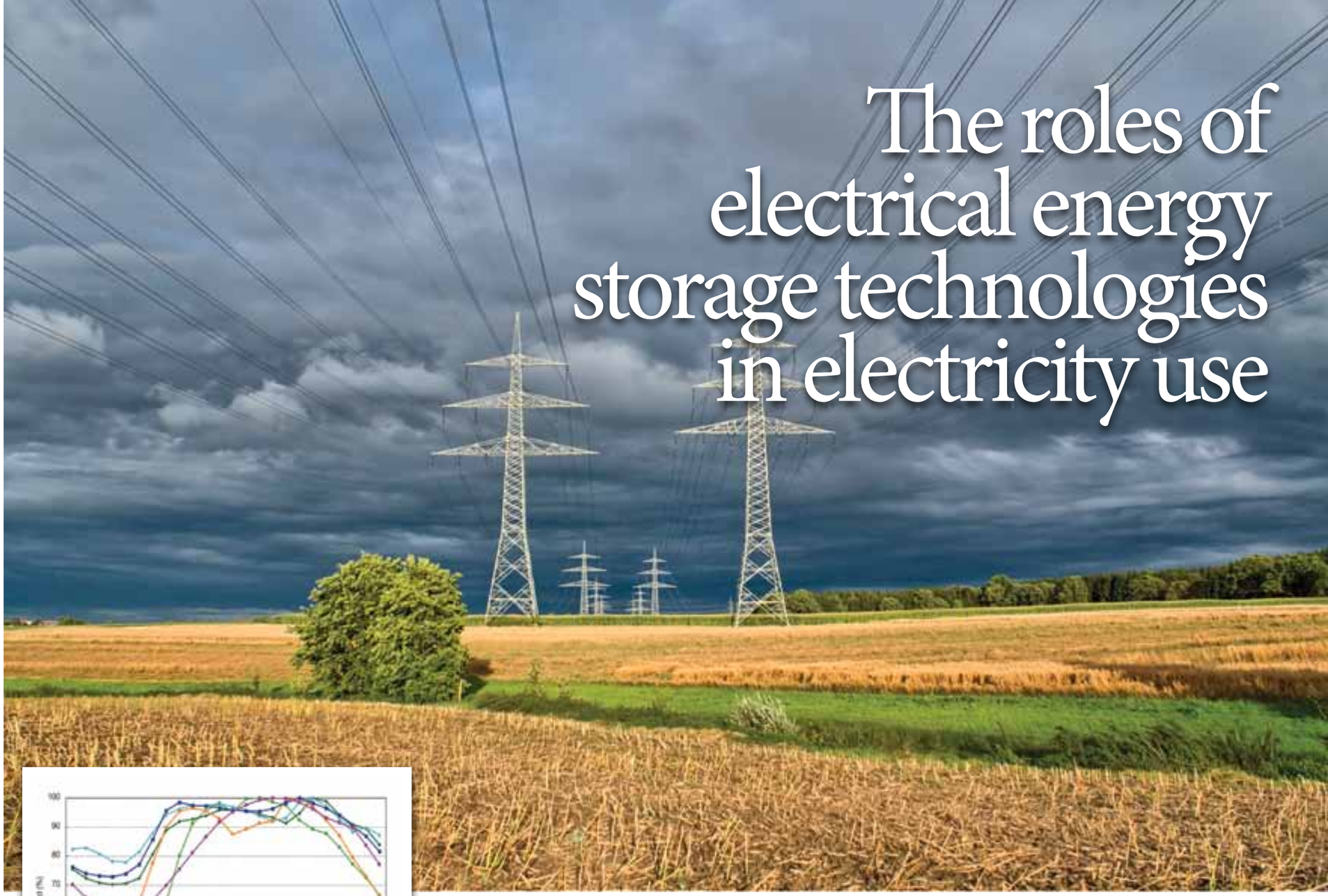

The roles of electrical energy storage technologies in electricity use

Two characteristics of electricity lead to issues in its use, and by the same token generate the market needs for EES. First, electricity is consumed at the same time as it is generated. The proper amount of electricity must always be provided to meet the varying demand. An imbalance between supply and demand will damage the stability and quality (voltage and frequency) of the power supply even when it does not lead to totally unsatisfied demand.

COMPILED BY | MINX AVRABOS

The second characteristic is that the places where electricity is generated are usually located far from the locations where it is consumed[1]. Generators and consumers are connected through power grids and form a power system. In function of the locations and the quantities of power supply and demand, much power flow may happen to be concentrated into a specific transmission line and this may cause congestion. Since power lines are always needed, if a failure on a line occurs (because of congestion or any other reason) the supply of electricity will be interrupted; also because lines are always needed, supplying electricity to mobile applications is difficult. The following sections outline the issues caused by these characteristics and the consequent roles of Electrical Energy Storage (EES).

ELECTRICITY AND THE ROLES OF EES

High generation cost during peak- demand periods

Power demand varies from time to time (Figure 1), and the price of electricity changes accordingly. The price for electricity at peak-demand periods is higher and at off-peak periods lower. This is caused by differences in the cost of generation in each period.

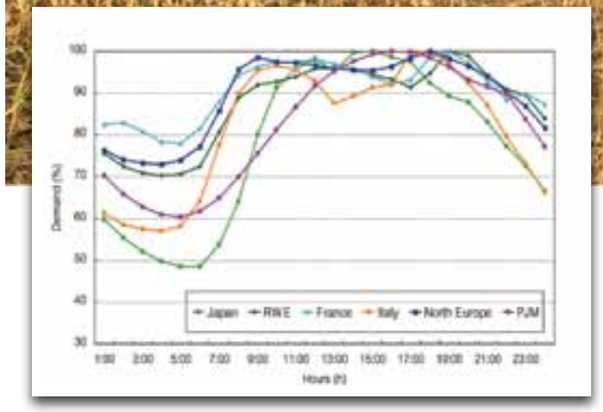

Figure 1 – Comparison of daily load curves

During peak periods when electricity consumption is higher than average, power suppliers must complement the base-load power plants (such as coal-fired and nuclear) with less cost-effective but more flexible forms of generation, such as oil and gas-fired generators. During the off-peak period when less electricity is consumed, costly types of generation can be stopped. This is a chance for owners of EES systems to benefit financially. From the utilities' viewpoint there is a huge potential to reduce total generation costs by eliminating the costlier methods, through storage of electricity generated by low-cost power plants during the night being reinserted into the power grid during peak periods.

With high PV and wind penetration in some regions, cost-free surplus energy is sometimes available. This surplus can be stored in EES and used to reduce generation costs.

Conversely, from the consumers' point of view, EES can lower electricity costs since it can store electricity bought at low off-peak prices and they can use it during peak periods in the place of expensive power. Consumers who charge batteries during

The roles of electrical energy storage technologies in electricity use

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off-peak hours may also sell the electricity to utilities or to other consumers during peak hours.

Need for continuous and flexible supply

A fundamental characteristic of electricity leads to the utilities' second issue, maintaining a continuous and flexible power supply for consumers. If the proper amount of electricity cannot be provided at the time when consumers need it, the power quality will deteriorate and at worst this may lead to a service interruption. To meet changing power consumption appropriate amounts of electricity should be generated continuously, relying on an accurate forecast of the variations in demand.

Power generators therefore need two essential functions in addition to the basic generating function. First, generating plants are required to be equipped with a "kilowatt function", to generate sufficient power (kW) when necessary. Secondly, some generating facilities must possess a frequency control function, fine-tuning the output so as to follow minute-by-minute and second-by-second fluctuations in demand, using the extra power from the "kilowatt function" if necessary. Renewable energy facilities such as solar and wind do not possess both a kW function and a frequency control function unless they are suitably modified. Such a modification may be a negative power margin (i.e. decreasing power) or a phase shift inverter[2].

EES is expected to be able to compensate for such difficulties with a kW function and a frequency control function. Pumped hydro has been widely used to provide a large amount of power when generated electricity is in short supply. Stationary batteries have also been utilized to support renewable energy output with their quick response capability.

Long distance between generation and consumption

Consumers' locations are often far from power generating facilities, and this sometimes leads to higher chances of an interruption in the power supply. Network failures due to natural disasters (e.g. lightning, hurricanes) and artificial causes (e.g. overload, operational accidents) stop electricity supply and potentially influence wide areas.

EES will help users when power network failures occur by continuing to supply power to consumers. One of the representative industries utilizing EES is semi-conductor and LCD manufacturing, where a voltage sag lasting for even a few milliseconds impacts the quality of the products. A UPS system, built on EES and located at a customer's site, can keep supplying electricity to critical loads even when voltage sag occurs due to, for example, a direct lightning strike on distribution lines. A portable battery may also serve as an emergency resource to provide power to electrical appliances.

Congestion in power grids

This issue is a consequence of the previous problem, a long distance between generation and consumption. The power flow in transmission grids is determined by the supply and demand of electricity.

In the process of balancing supply and demand power congestion can occur. Utility companies try to predict future congestion and avoid overloads, for example by dispatching generators' outputs or ultimately by building new transmission routes. EES established at appropriate sites such as substations at the ends of heavily-loaded lines can mitigate congestion, by storing electricity while transmission lines maintain enough capacity and by using it when lines are not available due to congestion. This approach also helps utilities to postpone or suspend the reinforcement of power networks.

Transmission by cable

Electricity always needs cables for transmission, and supplying electricity to mobile applications and to isolated areas presents difficulties. EES systems such as batteries can solve this problem with their mobile and charge/discharge capabilities. In remote places without a power grid connection recharging an electric vehicle may present a challenge, but EES can help realize an environmentally friendly transport system without using conventional combustion engines.

EMERGING NEEDS FOR EES

There are two major emerging market needs for EES as a key technology: to utilize more renewable energy and less fossil fuel, and the future Smart Grid.

More renewable energy, less fossil fuel

On-grid areas

In on-grid areas, the increased ratio of renewable generation may cause several issues in the power grid (Figure 2). First, in power grid operation, the fluctuation in the output of renewable generation makes system frequency control difficult, and if the frequency deviation becomes too wide system operation can deteriorate. Conventionally, frequency control is mostly managed by the output change capability of thermal generators. When used for this purpose thermal generators are not operated at full capacity, but with some positive and negative output margin (i.e. increases and decreases in output) which is used to adjust frequency, and this implies inefficient operation. With greater penetration of renewable generation this output margin needs to be increased, which decreases the efficiency of thermal generation even more. Renewable generation units themselves in most cases only supply a negative margin 3. If EES can mitigate the output fluctuation, the margins of thermal generators can be reduced and they can be operated at a higher efficiency.

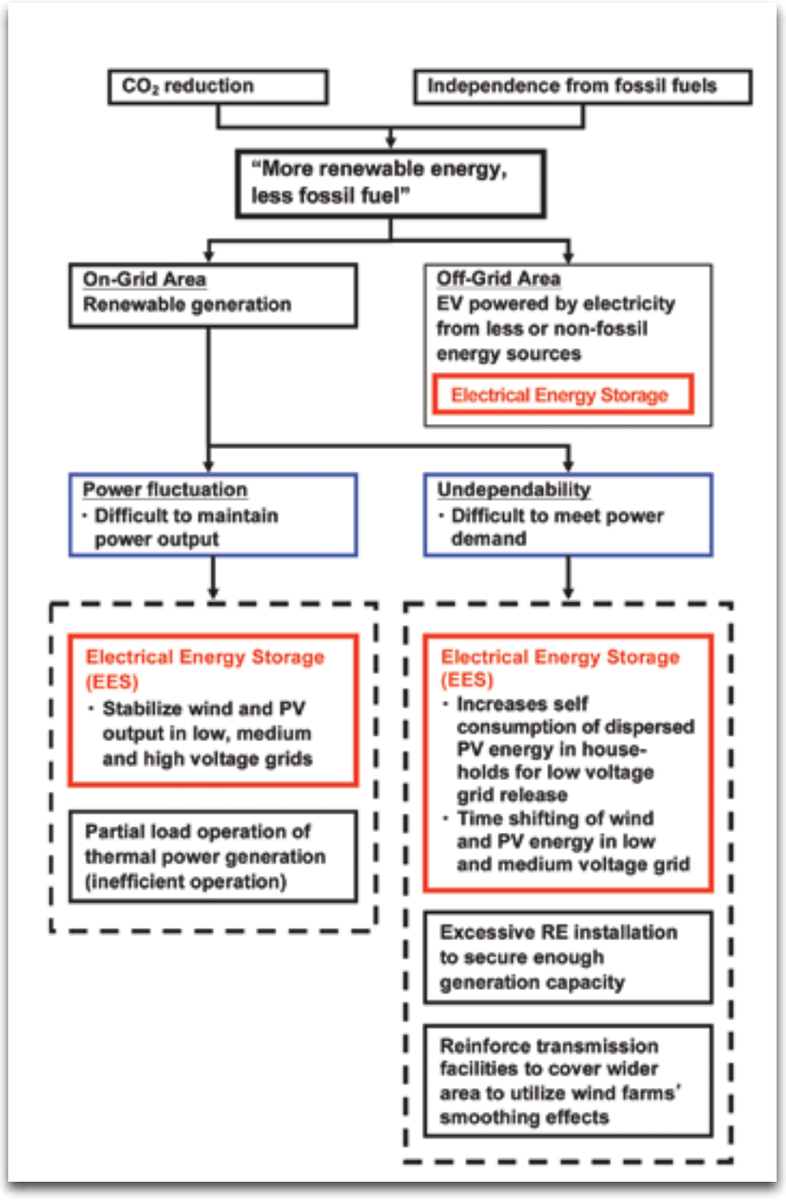

Figure 2 – Problems in renewable energy installation and possible solutions

Secondly, renewable energy output is undependable since it is affected by weather conditions. Some measures are available to cope with this. One is to increase the amount of renewable generation installed, i.e. provide overcapacity, so that even with undependability enough power can be secured. Another is to spread the installations of renewable generators over a wide area, to take advantage of weather conditions changing from place to place and of smoothing effects expected from the complementarity of wind and solar generators. These measures are possible only with large numbers of installations and extension of transmission networks. Considering the cost of extra renewable generation and the difficulty of constructing new transmission facilities, EES is a promising alternative measure.

Off-grid areas

In off-grid areas where a considerable amount of energy is consumed, particularly

The roles of electrical energy storage technologies in electricity use

continues from page 45

in the transport sector, fossil energy should be replaced with less or non-fossil energy in such products as plug- in hybrid electric vehicles (PHEVs) or electric vehicles (EVs) (see Figure 2). More precisely, fossil fuels should be replaced by low-carbon electricity produced mainly by renewable generation. The most promising solution is to replace petrol or diesel-driven cars by electric ones with batteries. In spite of remaining issues (short driving distance and long charging time) EES is the key technology for electric vehicles.

Smart Grid uses

EES is expected to play an essential role in the future Smart Grid. Some relevant applications of EES are described below.

First, EES installed in customer-side substations can control power flow and mitigate congestion, or maintain voltage in the appropriate range.

Secondly, EES can support the electrification of existing equipment so as to integrate it into the Smart Grid. Electric vehicles (EVs) are a good example since they have been deployed in several regions, and some argue for the potential of EVs as a mobile, distributed energy resource to provide a load- shifting function in a smart grid. EVs are expected to be not only a new load for electricity but also a possible storage medium that could supply power to utilities when the electricity price is high.

A third role expected for EES is as the energy storage medium for Energy Management Systems (EMS) in homes and buildings. With a Home Energy Management System, for example, residential customers will become actively involved in modifying their energy spending patterns by monitoring their actual consumption in real time. EMSs in general will need EES, for example to store electricity from local generation when it is not needed and discharge it when necessary, thus allowing the EMS to function optimally with less power needed from the grid.

THE ROLES OF ELECTRICAL ENERGY STORAGE TECHNOLOGIES

Generally the roles for on-grid EES systems can be described by the number of uses (cycles) and the duration of the operation, as shown in Figure 3. For the maintenance of voltage quality (e.g. compensation of reactive power), EES with high cycle stability and short duration at high power output is required; for time shifting on the other hand longer storage duration and fewer cycles are needed. The following sections describe the roles in detail.

The roles from the viewpoint of a utility

Time shifting

Utilities constantly need to prepare supply capacity and transmission/distribution lines to cope with annually increasing peak demand, and consequently develop generation stations that produce electricity from primary energy. For some utilities generation cost can be reduced by storing electricity at off-peak times, for example at night, and discharging it at peak times. If the gap in demand between peak and off-peak is large, the benefit of storing electricity becomes even larger. Using storage to decrease the gap between daytime and night-time may allow generation output to become flatter, which leads to an improvement in operating efficiency and cost reduction in fuel. For these reasons many utilities have constructed pumped hydro, and have recently begun installing large-scale batteries at substations.

Power quality

A basic service that must be provided by power utilities is to keep supply power voltage and frequency within tolerance, which they can do by adjusting supply to changing demand. Frequency is controlled by adjusting the output of power generators; EES can provide frequency control functions. Voltage is generally controlled by taps of transformers, and reactive power with phase modifiers. EES located at the end of a heavily loaded line may improve voltage drops by discharging electricity and reduce voltage rises by charging electricity.

Making more efficient use of the network

In a power network, congestion may occur when transmission/distribution lines cannot be reinforced in time to meet increasing power demand. In this case, large-scale batteries installed at appropriate substations may mitigate the congestion and thus help utilities to postpone or suspend the reinforcement of the network.

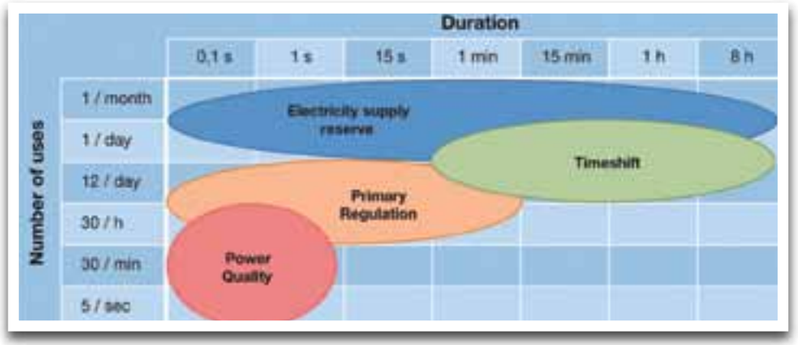

Figure 3 – Different uses of electrical energy storage in grids, depending on the frequency and duration of use

Isolated grids

Where a utility company supplies electricity within a small, isolated power network, for example on an island, the power output from small-capacity generators such as diesel and renewable energy must match the power demand. By installing EES the utility can supply stable power to consumers.

Emergency power supply for protection and control equipment

A reliable power supply for protection and control is very important in power utilities. Many batteries are used as an emergency power supply in case of outage.

THE ROLES FROM THE VIEWPOINT OF CONSUMERS

Time shifting/cost savings

Power utilities may set time-varying electricity prices, a lower price at night and a higher one during the day, to give consumers an incentive to flatten electricity load. Consumers may then reduce their electricity costs by using EES to reduce peak power needed from the grid during the day and to buy the needed electricity at off- peak times.

Emergency power supply

Consumers may possess appliances needing continuity of supply, such as fire sprinklers and security equipment. EES is sometimes installed as a substitute for emergency generators to operate during an outage. Semiconductor and liquid-crystal manufacturers are greatly affected by even a momentary outage (e.g. due to lightning) in maintaining the quality of their products. In these cases, EES technology such as large-scale batteries, double-layer capacitors and SMES can be installed to avoid the effects of a momentary outage by instantly switching the load off the network to the EES supply. A portable battery may also serve in an emergency to provide power to electrical appliances.

Electric vehicles and mobile appliances

Electric vehicles (EVs) are being promoted for CO_2 reduction. High-performance batteries such as nickel cadmium, nickel metal hydride and lithium ion batteries are mounted on EVs and used as power sources. EV batteries are also expected to be used to power in-house appliances in combination with solar power and fuel cells; at the same time, studies are being carried out to see whether they can usefully be connected to power networks. These possibilities are often abbreviated as "V2H" (vehicle to home) and "V2G" (vehicle to grid).

THE ROLES FROM THE VIEWPOINT OF GENERATORS OF RENEWABLE ENERGY

Time shifting

Renewable energy such as solar and wind power is subject to weather, and any surplus power may be thrown away when not needed on the demand side. Therefore valuable energy can be effectively used by storing surplus electricity in EES and using it when necessary; it can also be sold when the price is high.

Effective connection to grid

The output of solar and wind power generation varies greatly depending on the weather and wind speeds, which can make connecting them to the grid difficult. EES used for time shift can absorb this fluctuation more cost-effectively than other, single-purpose mitigation measures (e.g. a phase shifter).

REFRENCES

1. However, in the future there will be an increase in distributed generation (as mentioned for example in sections 3.1 and 3.2), where consumption and generation are typically close together.
2. In Germany such a modification, called "system services", must be implemented in large wind power generators.
3. With extra investment in advanced control schemes and regulation they can also be made to provide a positive margin. wn

Article courtesy of IEC - Electrical Energy Storage, Dec 2011

Further Apprentice Adventures

Shortly after completing my Cape Matric in rather auspicious fashion, I decided that Electrical Engineering was my future and set off to Darkest Africa, the City of Johannesburg. Here I was able to sign on as an apprentice electrician with a company based in Knights. This company was linked to two large UK based companies, Metropolitan Vickers and British Thompson Houston.

BY | BILL CALDER **|** FSAIEE

I was duly given my training schedule which included attendance at Smit Street Trade School, as my Cape Matric was woefully inadequate in such subjects as electrical regulations, drawing and Electricians I and II, all of which were around Standard Eight in the parlance of that time.

My confidence was shattered when I stepped into my class and observed the "Bloubaarde" – all final year apprentices who had spent the happiest five years of their lives in the same class! Texan cigarettes and discussions about their "ironies" (British motor cycles) which were de rigueur for the day! These were the MMWRC – the "Main Manne Wot Really Counted"! Sheer terror inspired me to complete NTC I and II in one year.

Thence to the Witwatersrand Technical College, Eloff Street, where we were greeted by the redoubtable Mr I R G Stephen, a past President of the SAIEE and Head of the Division of Electrical Engineering and Mathematics. Surveying the motley crew from Smit Street, he said *"Gentlemen – and I give you the benefit of the doubt in using that term – this is an Engineering College and in future you will come dressed in jacket and tie so that you will at least look like potential engineering students.*

Photo taken in 1992 at the Wits Technical College 30-Something Reunion (left to right):
Hermann Broschk, Fellow and Council Member of SAIEE and General Manager of AEG Power Distribution Division;
Jan Reynders, Fellow and Past President of SAIEE and Dean of the Department of Electrical Engineering, University of the Witwatersrand;
Ian Stephen, Fellow and Past President of SAIEE and Head of the Division of Electrical Engineering and Mathematics at the Witwatersrand Technical College. Ian Stephen was instrumental as Mentor of the above final year students and his successful completion of the National Technical Diploma and the Graduate examinations of the South African Institute of Electrical Engineers;
Bill Calder, Fellow of SAIEE and Managing Director of CHI Controls, and
Mario Barbolini, Fellow and Council Member of SAIEE and Managing Director of Transformer Manufacturers (Pty) Ltd.

Further Apprentice Adventures

continues from page 49

Secondly, as a gesture of your sincerity, I will expect you to sign on as student members of the SAIEE!".

In his first lecture he announced that he was accustomed to a 100% pass rate, with at least 25% achieving distinctions in one or more subjects. He invited those who were not willing to aspire to these levels to leave his class and find a less demanding lecturer, or have their fees refunded, as the WTC was a voluntary attendance college.

None left, but one individual fell behind in his work and was invited to leave! Needless to say, he was back in within a few months begging to be readmitted. He was gruffly informed that he could do so, but that none of the marks that he had achieved prior to his departure would be credited to him and he would therefore have to achieve full marks for the months remaining! Nevertheless he achieved this, such was the incredible teaching ability of I R G Stephen and his staff. An example was the enthusiastic Mr Hennie Pedder, Head of Electrical Laboratories, where an incredible collection of motors, switchgear and transformers had been donated by mines and local manufacturers.

One irritation was a certain student called Hermann Broschk, whose lab reports were always done in exquisite Teutonic handwriting – accompanied by impressive multi-coloured graphs!

Four future SAIEE Council Members, two of whom became Presidents, namely Ian Reynders, myself, Mario Barbolini and Herman Broschk, were products of these years. Many years later I R G Stephens was persuaded to post for a photograph with us at Innes House. After inspecting the photo, I R G Stephen commented, with a twinkle in his eye, that it must have been a vintage year!

Having passed my trade test, Wireman's Licence and my precious Engineering Diploma, I was advised that the SAIEE would require further study for me to be admitted as a Graduate Member.

I applied to my company for a work/study scholarship as a Graduate Apprentice at the Manchester Works of the then Metropolitan Vickers (later AEI/GEC).

After an anxious few months spent as an artisan in the Knights factory's test departments, permission was granted and with my newly acquired bride, set sail for the UK *"unto the land of the POM, to teach them the South African way!".*

Upon arrival my CV was perused by my Personnel Department Supervisor, an ex-Royal Navy Commander, who looked down his nose and said, *"I see that you do not have a university degree",* in that snooty tone that the British upper class have taken centuries to perfect.

Resisting the temptation to tell him that I was actually a graduate of Hillbrow University, majoring in Humour and Hubcaps – I was told that I would have to follow the standard UK Graduate Apprentice Course and found myself in Power and Light Department. Here all light fittings, plug points, distribution boards, etc. were installed for the Works.

Foolishly, I returned to my Supervisor and requested that as I was already qualified in these skills, would it be possible for me to go to a test department? I found myself transferred to a department where I counted drill bits and tested them for sharpness!

During my lunchtime I noticed that I was next door to Large Industrial Machines (LIM) Test Department and nervously strolled over and asked the nearest test artisan if there was any chance of my training in the department, explaining that I had some experience.

A quick interview with the LIM Superintendent followed and I was informally transferred. Three months went by and I was overjoyed to be able to work with all kinds of machines, my apprenticeship satisfying the Union Shop Stewards that I was acceptable!

Retribution was swift to follow as Personnel Department discovered that I had disappeared. Unfortunately, by the simple expedient of tracing my pay packet, all was uncovered!

Intervention by the Superintendent of LIM Department saved me from deportation back to the Colonies and I was given a second chance, which enabled me to continue my evening studies at the Royal College of Advanced Technology in Salford.

Here I had net some of the lecturers, who worked at Metvick/AEI and I was able to transfer to Switchgear Design and Development. However, the final prize was to get into High Voltage Test Department where SF6 and vacuum equipment was in prototype form up 300 kV. This department was excluded for the normal university graduate but, to my surprise, I found that the Superintendent was an ex-South African.

With the aid of my switchgear colleagues I was able to "accidentally" meet him in the car park and said, *"Baas, ek soek werk".* Somewhat amused he listened to my story and to my joy he agreed to accept me, much to the chagrin to the Personnel Department.

Thence to nearly nine months in Works Engineers' Department under the leadership of Mr Anthony Hugh Lumsden-Carrol, who surprised me with his heavy Polish accent and his ability to read my schematic diagrams upside down from his side of the desk! Pointing with a pencil at an offending circuit, I would be confronted with the question, *"Vy?",* then leaving me to sort out what I had done wrong.

A further six months was spent in Northumberland commissioning the new Blythe Power Station and thence returning to South Africa with my wife and two little British subjects, I pondered on the astute marketing tactics of the UK companies.

Having been trained on their equipment it was only natural to become a potential customer!

Without the assistance and guidance of the SAIEE, I would never have achieved my subsequent career. It is my sincere wish that the SAIEE brings their considerable resourcs to bear in restoring our desperately needed apprenticeship system, combining this with an upgrade of our Technical Colleges and Technikons. wn

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Briefly to Infinity *continued*

So, how can you add up such a sequence as proposed last time?

BY | BILL BRADING | CENG UK | FSAIEE | FIET

Well, you could just do the sum the old way, which does not seem so impossible with modern technology. In fact my notebook computer did it to one million terms and working to 50 decimal places in 107 seconds. Or one could use Abel's Theorem of Limits. (ABEL, Niels Henrik. Norwegian mathematician 1802-1829).

Given a convergent series $\sum a_n$ the power series $\sum f(x) = \sum a_n x^n$ converges at least for $-1 < x \leq 1$. Obviously if x = 1 the original series is unchanged. This simply says that the terms of a convergent series to be summed may be used as coefficients of a power series in x. The resultant power series will also converge provided x is constrained within certain limits. This affords us a very powerful way to sum such a series and is best shown by my proposed example, which, incidentally, was chosen to be quite difficult, giving a spectacular answer. In effect one sums the power series and then puts x =1 in the result.

Find the sum to infinity of the sequence: $\frac{1}{1\cdot3\cdot5}+\frac{1}{6\cdot8\cdot10}+\frac{1}{11\cdot13\cdot15}+.....$

Step 1. Find the general term $a_n = \frac{1}{(5n+1)(5n+3)(5n+5)} \quad n = 0,1,2,3.....$

Step 2. Expand into partial fractions $a_n = \frac{1}{8(5n+1)} - \frac{1}{4(5n+3)} + \frac{1}{8(5n+5)}$

(You will probably have to go back to your early maths notes to do this part, as I did!)

Step 3. Form the power series using Abel's theorem $\sum_{n=0}^{\infty} f(x)_n = \frac{1}{8}\sum\frac{x^{5n+1}}{5n+1} - \frac{1}{4}\sum\frac{x^{5n+3}}{5n+3} + \frac{1}{8}\sum\frac{x^{5n+5}}{5n+5}$

Step 4. Expand term by term. (By using n = 0,1,2…) For the first term: - $\sum\frac{x^{5n+1}}{5n+1} = x + \frac{x^6}{6} + \frac{x^{11}}{11} + ...$

Step 5. Differentiate with respect to x: $\frac{d}{dx} f(x) = 1 + x^5 + x^{10} + ... = \frac{1}{1-x^5}$ *since this is a geometric series.*

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continues from page 52

Briefly to Infinity *continued*

Similarly for the second term:

$$\sum \frac{x^{5n+3}}{5n+3} = \frac{x^3}{3} + \frac{x^8}{8} + \frac{x^{13}}{13} + \ldots\ldots$$ which has the corresponding derived series:

$$x^2 + x^7 + x^{12} + \ldots\ldots = x^2(1 + x^5 + x^{10}\ldots\ldots) = \frac{x^2}{(1-x^5)}$$

And for the third term similarly:

$$\sum \frac{x^{5n+5}}{5n+5} \textit{ leads to the derived series } \frac{x^4}{(1-x^5)}$$

Step 6. Group the terms together including their partial fraction multipliers (from step 2) and integrate back from 0 to 1. See note 1 and this is the hard part.

$$\int_0^1 \frac{1-2x^2+x^4}{8(1-x^5)}\,dx =$$

$$\frac{1}{160}\left((3\sqrt{5}-5)\ln(\sqrt{5}+1) - (3\sqrt{5}+5)\ln(\sqrt{5}-1)\right) - \frac{\ln(5/4)}{32} + \frac{\pi\sqrt{125-10\sqrt{5}}}{400} \qquad (1)$$

Believe it or not this expression is the sum required. Its numerical value to 50 decimal places is:

0.06962542834268350816580980387299726632116697751918 3

An actual summation of the series to one million terms and to 50 decimal digit precision gave the result:

0.06962542834268346816581860387161326650420695611441 7

The last agreeing digit is underlined and convergence beyond this is extremely slow.

The result (1) involving radicals, logarithms, powers of the golden ratio and π is no doubt elegant, interesting and exact but serves no useful purpose in giving a numerical value for the "sum to infinity", which will always elude us because evaluating it to any number of digits will never give an exact answer. It does, however, illustrate the power of the purely mathematical method.

Note 1. At this point one might ask "why integrate from 0 to1?" The alternative would be to form the indefinite integral but then we would need to find the integration constant. To do this we would have to find the value of the integral with the variable set to zero, which comes to the same thing. wn

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JULY

From Latin Julius (mensis) '(month) of July,' named after Julius Caesar.

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1 July

1847 Adhesive stamps go on sale in the USA for the first time.

1916 Coca-Cola's distinctive bottle is launched today

2 July

1900 Count Ferdinand von Zeppelin flew his first airship, the Zeppelin, in Germany. He began construction of this in 1897. It is not a new design but Zeppelin's ship is the largest to be built to date (136m). The LZ.1 flew for a 1 ¼ hours over Lake Constance driven by two 16 hp Daimler engines and reached a speed of 32 kph.

1973 Hollywood star and American GI pin-up Betty Gable died today. She was never at a loss for words and reached the peak of her career in the 1940s with movies such as Tin Pan Alley (1941) and Coney Island (1943). The bouncy blonde's legs were considered as her best feature, so like any sensible young woman taking care of her assets, Miss Gable had them insured for $200 000,00!

3 July

1879 In his address to the Michigan Military Academy, General William Sherman stated: *"I am sick and tired of war. Its glory is all moonshine…War is hell."*

1976 At the age of 20, Swedish tennis player, Bjorn Borg, became Wimbledon's youngest ever men's singles winner today after beating Romania's Ilie Nastase 6-4, 6-2, 9-7.

1979 Jim Morrison, The Doors' lead singer, dies of a heart attack in Paris.

4 July

1853 – "Suffragette appears in trousers". Amelia Jenks Bloomer, the controversial and outspoken suffragette, shocked her audience in Connecticut today by wearing trousers while she delivered a speech denouncing the requirement that women should cover her legs. Mrs Bloomer has been seen wearing this attire (a knee length skirt combined with loose trousers that are bound at the ankle and dubbed "bloomers") since 1849 as a form of protest.

6 July

1925 Birthday of Bill Haley, the American musician who had the first hit rock and roll record with "Rock Around The Clock".

1971 Louis Armstrong, jazz trumpeter, died today at the age of 70. *"Musicians don't retire; they stop when there's no more music in them."*

7 July

1950 The world's air show is held at Farnborough in Surrey, UK.

1985 17 year old Boris Becker today became Wimbledon's youngest ever men's singles titleholder by defeating Kevin Curren.

12 July

1920 The Panama Canal, the world's largest engineering project, was officially opened today by President Woodrow Wilson. Construction began in 1881 but was stopped due to the financial collapse of the main contractor, the French company de Lesseps. President Wilson took up the project and construction began again in 1904; the first ship sailed through on the 7th January 1914.

15 July

1954 Boeing 707 makes maiden flight. Boeing today launched itself into the world of jet age aviation. The new aircraft has four engines hung on pods underneath the wings; the design is based on Boeing's expertise in jet bomber design.

1790 Thomas Saint of London patents the first sewing machine.

18 July

1877 Thomas Edison records the human voice for the first time.

1918 Birthday of Nelson Mandela, South African politician and outstanding leader.

1955 Disneyland opened near Anaheim, California today. This is the creation of film producer Walt Disney and aims to involve children and adults in a non-stop fantasy world.

20 July

1976 The American spacecraft Viking lands on Mars and starts sending back television pictures to earth.

21 July

1969 The Eagle Lands. US Armstrong and Edwin Aldrin manoeuvred their lunar module, Eagle, onto the surface of the moon. Six and a half hours later Armstrong began the first human moon walk while being watched by hundreds of millions television viewers around the world. Michael Collins remained in the command-service part of the spacecraft, Columbia.

22 July

1946 Today Britons faced their first day of bread rationing, more than a year after the end of World War 2. This is due to a poor harvest, droughts, and shortages in war transport and fertilisers.

25 July

1814 Killingworth is the latest colliery to experiment with locomotives for moving coal out of the mines. George Stephenson, their chief mechanic, built an engine that can draw eight loaded carriages bearing 30 tons of coal at a speed of 6,4 kph.

1985 Film star Rock Hudson is admitted to hospital suffering from the killer disease AIDS.

26 July

1978 Louise Brown, the world's first test-tube baby was born by Caesarean Section in Oldham General Hospital last night. The expertise of Dr Robert Edwards and Patrick Steptoe made the birth possible; together they succeeded in fertilising an egg from Lesley (the mother) with her husband's sperm outside the human body.

27 July

1986 Gregory James LeMond (American) became the first non-European to win the Tour de France.

28 July

1586 A new type of plant has been introduced into Ireland by some explorers associated with Sir Walter Raleigh. Called *Solanum Tuberosum* or the potato, it is a perennial herb thought to have originated from the Andes region of South America.

On the light…(er..) side

Recently, I found myself pondering the question 'Are Engineers performing better in the work arena due to the advancements in communications – or not?'

BY I ANGELA PRICE

Engineers are notorious for their poor communication skills, something my mother warned me about when I decided to marry one (she also told me engineers are never rich ….it was then that I truly got cold feet).

This lead me to wonder if the various methods of modern technology which we now have at our disposal (wi-fi, 3G, email, sms's, whatzapp, etc) make communication any easier for those who are 'communicationally' challenged. After all, where once one was forced to pick up the phone and have a conversation with another individual to resolve a query/ issue, now a brief email will now suffice…. infact the briefer, the better.

In the quest to fit as much information into a sms/twitter/facebook character window as is (in)humanly possible, everything that can be abbreviated these days are mind boggling. One hopes that these abbreviations will remain confined to the social media environment. After all, a simple WTF thoughtlessly flung into a work email regarding Wireless Telecommunications Facilities could be termed 'career limiting' by some.

Of course there are the obvious pitfalls to the wonders of modern communications technology. Many of us have found ourselves frantically pounding the 'recall' button in a futile attempt to recall a mis-sent email (usually with little, to no success… after all who doesn't curiously read the email that you see someone has desperatly tried to recall). All to often the lack of direct conversation leads to misunderstanding when interacting with others via electronic means. In (what seems like) a different lifetime I had a director named Mark Marshall, who headed up the I.T department. In a picture perfect illustration of the above point, one of the 'silver-backed' buyers in the company stormed up to said director at a conference and demanded to know from him '…why he was 'rejecting' all his (the buyers) emails! 'Turns out his emails were being returned by the (e)Mail Marshall….. easily confused with Mark Marshall….. now that was career limiting!

I also wondered why it is that engineers have traditionally been labled as poor communicators – what is it about their intellectual make up that makes them better at understanding and relating to inate objects vs. another individual (in my experience and their defence, this is not true of all engineers). Ironically I have my husband's cell phone number cryptically saved on my phone as ICE for that (just) In Case of an Emergency situation (you know….. the one some email circular has warned you about...). Truth be told, my hubby is likely the last person I would call in an emergency. Modern communication technology has done nothing to ressurect his reputation as a poor communicator. If anything it has made it worse. Where once he may have answered his work phone and told me he was a little busy, I now call his cell only to get a swift, automated cell phone response (that his cell phone manufacturers have oh-so-kindly thought to equip his phone with), sent via sms, which informs me bluntly 'I'm in a meeting'. And the wonders of modern technology don't stop there… if I happened to have called from the land line and he sent off the automated sms response, Telkom are thoughtful enough to have a service which phones me on my land line and delivers a voice automated sms message.. 'I'm in meeting' (to be read with a mechanical, american sounding voice)!!

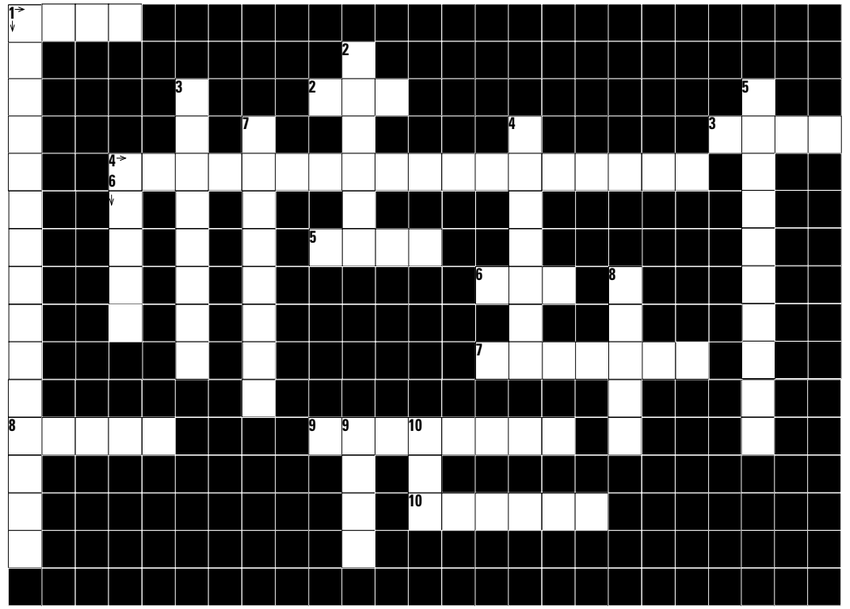
Honestly, ***WTF***! ……

(relax… you know I meant ***Wireless Telecommunications Facilities****)*

Have some fun and stand a chance to win R1000.
Complete the July issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, July 2013 Crossword Puzzle, P.O. Box 751253, Gardenview, 2047* or email it to *minx@saiee.org.za*. The completed crossword puzzle should reach us by no later than **31 July 2013**. The winner of R1000 will be announced in the September 2013 issue of the **watt**now magazine.

R1000 win

BERGMAN FISHER ASSOCIATES, DESIGNERS OF A SAFER GREENER ENERGY EFFICIENT FUTURE, ARE THE PROUD SPONSOR OF OUR CROSSWORD PUZZLE.



ACROSS

1. What can you win in the wattnow article competition? (4)
2. Who will be the 2014 SAIEE President? (3,6)
3. National Electrical Safety Code (abbr.)
4. Disturbance Monitoring Devices include 3 recorders, name them. (7,11)
5. What is happening on the SAIEE Calendar on the 18th of September 2013? (4)
6. See 5 across. (3)
7. See 5 across. (7)
8. See 4 across. (5)
9. One of the Technical Editors of the wattnow magazine. (8)
10. See 4 across. (6)

DOWN

1. A type of protection technique for safe operation of electrical equipment in hazardous areas by limiting the energy available for ignition. (9,6)
2. See 2 across.
3. How many issues of the wattnow magazine have been published since November 2011? (8)
4. What is the light and heat produced from an electric arc supplied with sufficient electrical energy to cause substantial damage or harm? (8)
5. Who wrote the two part series on Uranium Techology, which was published in the wattnow? (5,5)
6. See 9 across. (5)
7. The term used for the maximum amount of electrical current a conductor or device can carry before sustaining immediate or progressive deterioration. (8)
8. In this issue, what is the surnamr of the aithor who write "Angela's Opinion"? (5)
9. Ocupational Safety and Health Administration (abbr.)
10. See 4 across (6

May issue winner:
Helmut Kaufholz | Kempton Park

May issue answers:

ACROSS
1 Paul van Niekerk **2** Sello Raphadu **3** Mike Cary **4** TC Madikane **5** Veer **6** BFA **7** Avrabos **8** 1909

DOWN
1 Andre Hoffmann **2** Sarel Schoombie **3** Phumelelo **4** SAIEE **5** Dawid Bester **6** Ramnarian **7** Ngxonono **8** Crone

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 31 July 2013. 8. The winner will be announced in the September 2013 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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SAIEE Membership Benefits

Members of the SAIEE now enjoy the following a wide array of benefits:

You simply cannot afford not to be a member!

- A discount of up to R1110 on their ECSA registration fee, which is due in April every year, provided that they join the SAIEE before the end of March that same year.
- Upon joining the SAIEE there is a standard entrance fee of R700, an annual membership fee of R923 for Members, and between R1129 and R1223 for Senior members depending on age. Most of this will be recovered through the ECSA discount.
- SAIEE members receive 11 issues of the wattnow magazine valued at R330.
- The SAIEE Africa Research Journal (ARJ) our peer reviewed research publication (which incorporates the SAIEE Transactions) is also available to SAIEE member's quarterly upon request.
- The real rewards of being a member can be realized through attending monthly lectures, debates, tours and site visits organized by the SAIEE. These are mostly free of charge and provide refreshments at no extra cost. Members are awarded valuable CPD credits for attending these events.
- Membership has significant career benefits, as membership holds prestige and recognized status in the profession. SAIEE gatherings provide excellent opportunities for members to interact with normally inaccessible captains of industry.
- SAIEE letters after your name indicate your membership grade and are a useful measure of your 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 to gain professional status through the Institutes large database of mentors.
- SAIEE members are awarded 1 CPD credit (Category3) for being a member of the SAIEE.
- Members are able to serve on organizing committees and gain valuable experience and professional networking in doing so.
- Use the electrical engineering library at SAIEE House.

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 latest CV;
- The completed application form;
- Proof of payment for the application and membership fee which are required upfront. ***Please use surname and initials as payment reference.***

Copies of the required documentation should accompany the application forms but unfortunately we still find application forms are sent in without it.

A number of applicants do not complete the application forms adequately, ***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!!

2013 Membership fees

Rates as from 1st January 2013

Grade of Membership	Annual Subscriptions paid by 28 February 2013		Annual Subscriptions paid after 28 February 2013		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	**117**	82	130	92	130	92
After 6 yrs study	**752**	526	835	593	835	593
Associate	**752**	526	835	593	835	593
Member	**831**	582	923	648	923	648
after 6 years	**972**	680	1,079	765	n/a	n/a
after 10 years	**1,016**	711	1,129	801	n/a	n/a
Senior Member	**1,016**	711	1,129	801	1,129	801
after 6yrs/age 40	**1,102**	771	1,223	868	1,223	868
Fellow	**1,102**	771	1,223	868	1,223	868
Retired Member (By-law B3.7.1)	**465**	326	515	365	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 R700 (except Students which is free)
2. Transfer fee to a higher grade is R400.00 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 2013 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 in the amount of his subscription.

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 be exempt from the payment of further subscriptions." Members who comply with the requirements of By-Law B3.7.3 may make written application to Council for exemption form paying 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 June of each year will be struck-off the SAIEE membership role - subject to Council decree.

Members in good standing and no longer in substantive employment and do not receive payment or salary for work done may apply to Council for a reduction in their annual subscriptions.

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

Calendar of events

If you want to see your function or event listed here, please send the details to Minx Avrabos at minx@saiee.org.za

JULY 2013

23-26	KZN Industrial Technology Exhibition 2013	Durban Exhibition Centre, Durban	www.kznindustrial.co.za
16-19	2013 IEEE Transportation Electrification Conference and Expo	Metro Detroit MI , USA	www.itec-conf.com
23-26	2013 IEEE 14th Workshop on COMPEL	Salt Lake City UT , USA	www.ece.utah.edu/compel13
25	Visit to Eskom Control Centre	Germiston, JHB	geyerg@saiee.org.za
26	SAIEE **watt**now Breakfast (By invitation only)	SAIEE House, Jhb	minx@saiee.org.za
29 - 1	ASME 2013 Power Conference	Boston, Massachusetts, USA	www.asmeconferences.org

AUGUST 2013

6-7	The Digital Revolution in Africa	Hilton, Sandton, JHB	www.tmforum.org.za
13-15	M-Tech Congress	CSIR Conference Centre, Pretoria	www.m-tech.co.za
27-30	9th IEEE International Symposium on Diagnostics for Electric Machines, Power Electronics and Drives - (SDEMPED 2013)		
		VALENCIA , Spain	www.ta.ieee.org
29	SAIEE Bernard Price Memorial Lecture	Johannesburg	geyerg@saiee.org.za
30	SAIEE Bernard Price Memorial Lecture	Cape Town	geyerg@saiee.org.za

SEPTEMBER 2013

3	SAIEE Bernard Price Memorial Lecture	Eastern Cape	geyerg@saiee.org.za
4	SAIEE Bernard Price Memorial Lecture	Southern Cape	geyerg@saiee.org.za
5	SAIEE Bernard Price Memorial Lecture	Kwa-Zulu Natal	geyerg@saiee.org.za
18	SAIEE Charity Golf Day	Rand Park Golf Course	geyerg@saiee.org.za
25-28	Eskom Expo for Young Scientists	Birchwood Hotel, Boksburg	geyerg@saiee.org.za

13-15 AUGUST 2013
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www.m-tech.co.za

M-TECH CONGRESS

International speakers include prof Basim Al-Najjar of the University of Växjo in Sweden, dr Ali Zuashkiani of the Center for Maintenance Optimization and Reliability Engineering of Canada, and prof Wolfgang Breymann of the Zurich University of Applied Sciences. Local speakers include prof Stephan Heyns of the University of Pretoria, Johan Jansen van Rensburg, Factory Manager of Illovo Sugar's Sezela mill, and Karlwim Heese, Business Improvement Manager at Saldanha Steel.

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