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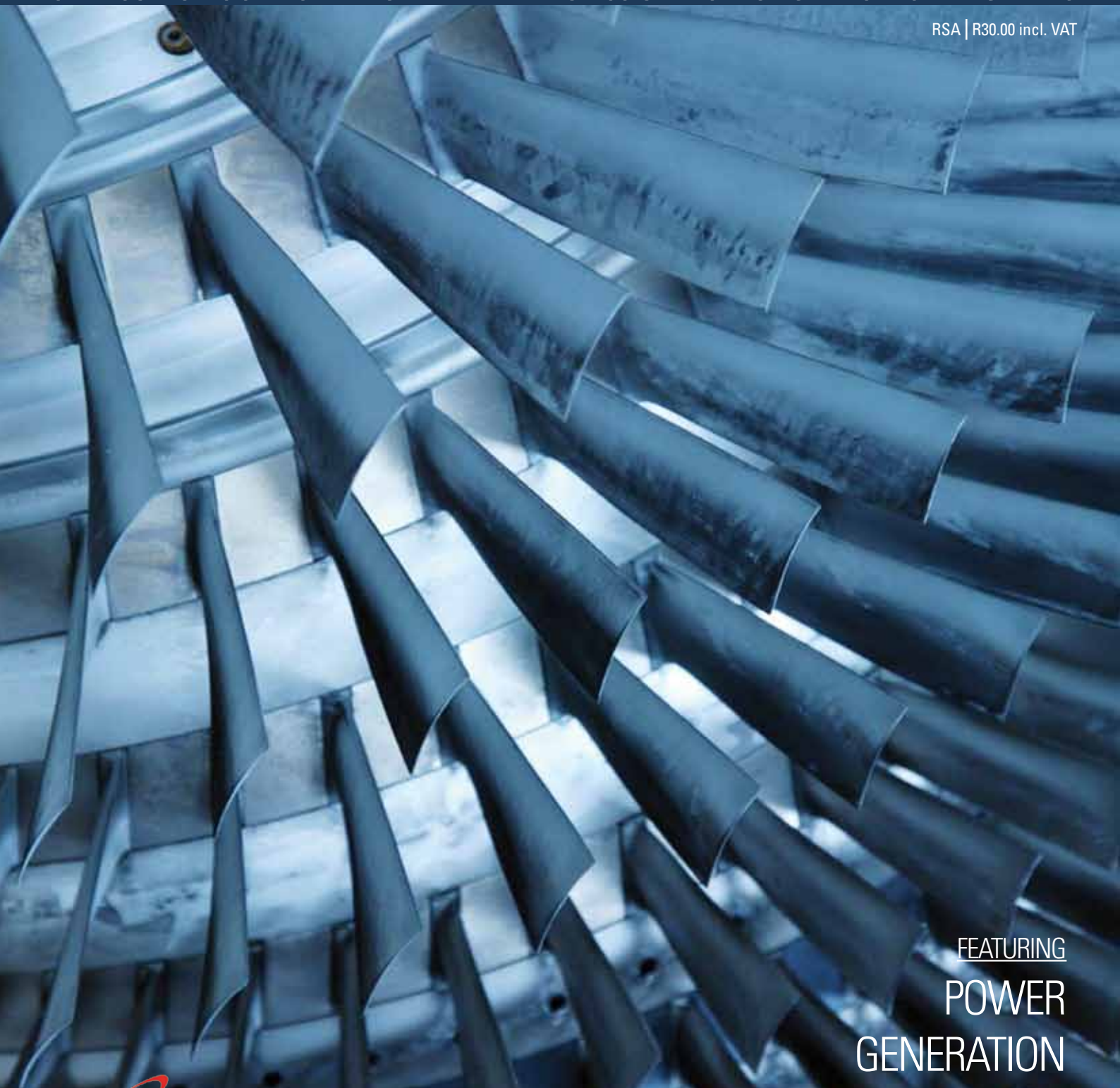

FEATURING

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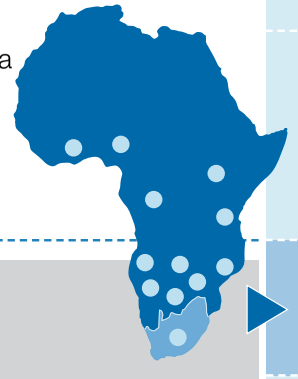

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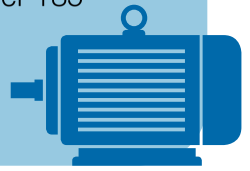

1961	1980	1991	1994	1997	1998	2002	2002	2007	2007	2007	2008	2009	2010	2010	2013	2020
WEG established in Brazil	Zest Electric Motors established in Jhb	Durban branch opens	Cape Town branch opens	Richards Bay branch opens	Trichardt branch opens	Rustenburg branch opens	Port Elizabeth branch opens	Middelburg branch opens	Zest acquires IMS Cape	Zest acquires Shaw Controls (est 1986)	Zest acquires Enl Electrical (est 1984)	Zest acquires Zest Energy (est 2008)	Zest Electric Ghana opens	WEG acquires Zest WEG Group	Zest WEG Group acquires Hawker Siddeley Transformers (est 1956)	And beyond

contents

wattnow magazine

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ISSN: 1991-0452

5905

With March fast approaching, I glanced at my diary and realised we are moving into a jam-packed month filled with events all over South Africa.

Not only is it the long awaited Power-Gen Africa and DistribuTECH Conference and Exhibition taking place in Cape Town in March, but it is also the SAIEE AGM on the 27th in Johannesburg. Please read page 66, for more information on all the exciting events taking place in March.

This issue of **watt**now features articles on Power Generation, which is actually such a broad subject, that I really need so much more than these few pages. The first feature article appears on page 26 and focuses on how a generator creates electricity. For those of us who don't know, you can also learn something on the role of turbines in power generation. This you will find on page 34.

I feature a lovely article written by Dudley Basson, on "Women of Science and Maths" on page 42. This makes for an absolutely fantastic read!

Gerhard Brown, the SAIEE delegate to the 2013 IEC general meeting, reports back from his trip to New Delhi, India, with his article "A young professional's guide to Technical Standards". Read more on page 52.

I've been inundated with article submissions since my request two months ago. Thank you – I promise, I will publish each suitable article I receive – it does take time to edit the content and I might not be able to publish your article/paper in the very next issue of **watt**now, but it WILL BE published. Please continue sending me your dusty old papers/articles – I find it absolutely fascinating.

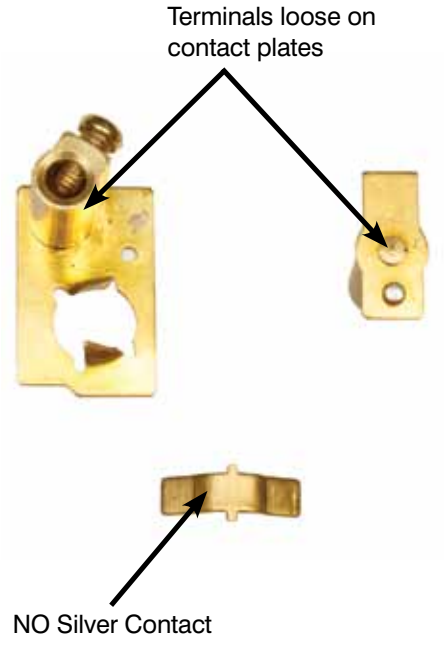
Have a fantastic March – until next month, enjoy the read!

Minx

Earn CPD Credits

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

This product *is unsafe!*



BE AWARE!
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This product is distributed in South Africa under the "Yigni" brand. The design and manufacture of some of the internal components, that are not visible to the buyer or user, can result in arcing, temperature rise and fire.

This product does not pass the following regulatory tests: SANS 164-1 and SANS IEC 60884-1. This instance has been reported to the National Regulator for Compulsory Specifications (NRCS) and the National Consumer Protection Commission.

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There are many sub-standard products and services provided in South Africa, usually at lower prices than their compliant competitors. Beware when purchasing electrical products and services!

The provision of products and services by members of the SAFEhouse Association is your assurance of responsible behaviour: **SAFEhouse members undertake to supply only products and services that comply with regulations and that are safe and fit for purpose.** Ask for products and services supplied by SAFEhouse members.

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Not all Electrobase members have subscrived to the Safehouse code of conduct. For participating members please see the Safehouse website **www.safehousesa.co.za**

As at 10/02/2014

Greetings to you all. I recently returned to Johannesburg from an extended visit to Plettenberg Bay in the Southern Cape where I had an opportunity to visit the Southern Cape centre in George. The centre is doing very well, and it was a great opportunity to catch up with many 'old' friends.

I joined them on a very interesting technical visit to the new George Digital Television Broadcasting Antenna, followed by a well presented, and very informative, technical paper on the conversion project by Sentech (unfortunately, as a power Engineer, a lot of the technical details went over my head).

It did stimulate my thoughts on the complexity of Electrical Engineering, and the need for a close link between the older, more experienced Engineers and new graduates; basically a sort of passing on of knowledge gained from experience.

Back in Johannesburg and everyday reality, I observed that Eskom are still in dire straits, as South Africa's electricity becomes increasingly expensive and blackouts loom ominously.

In Eskom's latest bi-weekly systems status bulletin, they explained that on Monday, January 27, 27% of the required capacity was out of service, which implies that nearly one-third of income producing generation plant was not available. Eskom says that 18% of this was planned and 9% unplanned.

South Africa's 2010 Integrated Resource Plan (IRP) allows for the global norm of 14% of capacity being unavailable due to maintenance requirements. Eskom has followed this standard and assumed 86% power station availability in their fleet. This however is proving to be increasingly difficult due to the aging fleet of Power Stations.

Consequently, the current proposed update to the IRP 2010 now assumes 80% availability capacity, which Eskom has adopted with its 80:10:10 maintenance strategy. The 20% allows for 10% planned and 10% unplanned maintenance and accepts that more unplanned maintenance will be the norm.

My concern is that 10% of Eskom's Fleet equates to nearly 4000MW. So if this planned outage is accompanied by an additional 8% unplanned outage (approximately 7200MW) - this will exceed the capacity of one of the new mega stations, due for commissioning in 2014 and we will be back where we were in 2008 with load shedding.

In order to cater for the ambitious government programme in the Integrated Development Plan (IDP), this trend of increasing unplanned outages must be eliminated.

The recommended solution to the problem is encapsulated in the 1998 Energy White paper which allows for the opening up of the sector to Independent Private Producers (IPPs). This policy has still not been changed. However, beyond a small amount of renewable power, competitive access to the grid is still a long way off.

The country really cannot afford to have heavy industrial customers forced to have shut downs and potential load shedding for large private consumers. Even worse is the decline in power quality due to the lack of capacity of the grid which can result in frequency reduction, and associated decrease in the life of equipment.

The draft update of the IRP has seen the projected reliance on nuclear, coal and wind technologies downgraded while increasing solar photovoltaic (PV) and gas, it will require a more intelligent grid (Smart Grid).

If the grid were smarter it could rely on a greater mix of energy sources and use them more intelligently to provide more precise energy to meet immediate loads. These systems could, in effect, shuffle power to where greater loads are at any given time which makes for far more dynamic management.

While the current draft of the IRP calls for additional solar PV energy this creates a problem as due to its unpredictable nature, this energy supply is not transferable. The same unpredictability argument holds true for wind power. Hence the need for a smart grid and improved communication facilities which will require the introduction of standardised utility telecommunication protocol.

However, that will be the subject of another discussion for another day …

Back home, the SAIEE campus is looking beautiful, we should all be very proud of magnificent buildings and grounds that we have, and be grateful to our predecessors for their forethought and financial management which has given us these facilities with no extra financial burden on our members.

In fact SAIEE annual subscription fees are still the lowest of all the Professional associations, as it is subsidized by ECSA.

In the near future, Innes House will accommodate the museum and some additional SAIEE administration facilities. The Historical Section of the SAIEE, under the watchful eye of Max Clarke, has commenced equipping of the museum to accommodate the carefully restored artefacts that they have been working on for many years. We will soon be having a preview ... watch this space.

Paul van Niekerk | Pr. Eng | FSAIEE
SAIEE President 2013

WATTSHOT

Herewith showcasing some of the latest cool gadgets (and unusual gifts) for men that are now available to buy online. A gadget and gizmo for every one... whether it is a gift or just a self-spoil - go ahead, you deserve it!

Freeloader Globetrotter Kit

Freeloader Classic is an advanced portable charging system that can power any hand held device anywhere, anytime.
Price: R1,199.00 (incl. VAT)

Sun Jar

Leave it in a well lit area during the day. It glows for ± 5 hours throughout the night. No switch - it automatically begins to glow as night falls. Price: R350.00 (incl. VAT)

thumbsUp! Ecocan

This fully bio-degradable re-usable drinks can has a lifespan of ± 10 years and when disposed, breaks down within 180 days. Price: R180.00 (incl. VAT)

Super Plantarium - no water

Aerospace designed nutritive gel. To see how plants grow, right in front of your eyes.
Price: R295.00 (incl. VAT)

Powertraveller®

Recharge your iPad or iPod without plugging it in! Only need sun!
R600.00 (incl. VAT).

Toollogic T1 Series

Lightweight and thin to fit into your wallet, this ingenius business card contains essential items. Price: R249.00 (incl. VAT)

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

Bluetooth Headset with Microphone

Built in mic for voice/skype calls. Built in battery with USB charger means it can be charged anywhere. R499.00 (incl. VAT)

RED-E PowerBanks

Designed to give you charging power while you are on the go. Retail between R299 - R699. For mor info, visit www.omnico.co.za

His & Hers Piggy Bank

Drop a coin in - only to despair as your money tumbles into little miss piggy's bank below! Price: R195.00 (incl. VAT)

Joby® GorillaMobile Yogi

Flexible legs stabalise your iPad on the most uneven surfaces. Price: R599 (incl. VAT)

Stainless Steel Dimple Cufflinks

Make a style statement with these black & stainless steel cufflink set. Price: R195.00 (incl.)

Luminaid Inflatable Light Bag

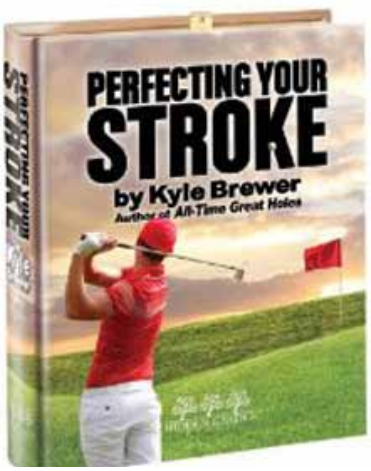
LuminAID will illuminate your life for 8-10 hours on high. Price: R550.00 (incl)

Eton Axis Charger with Radio Weather-Alert & Flashlight

Be "Red-Cross" ready for any emergency! Price: R1,295 (incl. VAT)

iPhone® 4/4S - Calculator Cover

Frustrate wannabe iPhone thieves, they wouldn't want to steal a retro school calculator! Price: R175.00 (incl. VAT)



Perfecting your stroke Kit

The perfect kit to perfect your stroke... when you are using your 10-iron that is. Price: R725.00 (incl. VAT)

WATTSUP

Powertech Transformers small power transformer facility officially opened

L – R: Alex Smith - CFO Altron, Robert Venter - CEO Altron, Charles Kalima - Senior Manager: Commercial, Commodity Sourcing – Eskom, Neil Kayton - CEO – Powertech, Bernard Meyer – CEO Powertech Transformers.

Powertech's new Small Power Transformer facility based in Pretoria West

Powertech Transformers, a company in the Altron Power division of the JSE listed Altron Group is pleased to announce that its small power transformer facility was officially opened on 3 February 2014 by Charles Kalima, Senior Manager: Commercial, Commodity Sourcing, ESKOM and Robert Venter, CEO of Altron.

This facility was specially designed and built to improve the flow of a transformer through the manufacturing process resulting in shorter production lead times.

The transformer sizes that will be manufactured in the facility range from 20 to 60MVA 132kV.

The project which commenced eighteen months ago was carried out in two phases, the first one being the purchasing of new vertical winding machines and upgrading of the existing ones as well as the excavation of the existing factory space and the second phase the installation of additional equipment as well as reorganising the existing fabrication area to enable the tank fabrication to match the assembly area.

The facility which was locally designed and locally manufactured will double the Small Power Transformer (SPT) capacity. The new SPT capacity is 4,400 MVA (previous 2,200 MVA) which equates to 120 transformers per annum (40x20MVA + 60x40MVA + 20x60MVA).

PTT's total revised factory capacity inclusive of Medium Power Transformers (MPT) and Large Power Transformers (LPTs') is 13,680 MVA per annum.

Bernard Meyer, CEO said *"With Powertech Transformers 70th birthday celebration around the corner, we are thrilled with what the future holds in this market sector for both domestic and export supply. This major investment confirms the confidence we have in manufacturing in South Africa."*

He added: *"We have nearly doubled our capacity in this market sector in anticipation of a R250m potential increase in the export market. The new facility is also perfectly timed with new growth opportunities in the renewable energy and rail market sectors. Lastly, and most importantly, we have created additional employment opportunities for many skilled, semi-skilled and professional young talent."*

Powertech Transformers supplies a full range of transformers, from generator step-up to transmission and distribution transformers in its three factories. The range includes three-phase and single-phase units, auto-transformers, arc-furnace, locomotive and traction transformers, miniature sub-stations, NECRT's as well as LNER's and shunt reactors.

An after sales service division offering complete peace of mind for our customers which includes maintenance of their transformers and related equipment for an extended period specific to each and every customer has been added to our range of services.

COMTEST Wins Business Award

The Comtest Group - distributor of Fluke, the leading OEM of electrical test equipment worldwide - offers high-end, quality test instruments to customers in Africa, has been awarded the prestigious 2013 African Electric Test Equipment Customer Service Leadership Award by Frost & Sullivan, global research analysts.

For the past 50 years, Frost & Sullivan has been involved in global research enabling it to monitor more than 250 000 companies worldwide, operating in over 300 industries. Key bench-marking criteria for the Customer Service Leadership Awards included quality and timeliness of service, the impact of service on customer value, as well as the cost of service to their customers.

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Matrix (DSM) - an analytical tool that compares companies' performance relative to each other - allowing their research and consulting teams to objectively analyze each company's performance.

A spokesperson for Frost & Sullivan says, *"Independent analysis of the Test Equipment market clearly shows that Comtest's customer service has made it possible for Fluke to stand out as the leader in many electrical test equipment product segments in Africa. As a reliable source of information on technologies and applications related to electrical test equipment, Comtest helps African customers make the choice of accuracy and safety for their businesses, thus avoiding potentially costly mistakes.The company has also developed a large distribution network for electrical test equipment across Africa, making such instrumentation easily accessible to Africans across the continent. All of these efforts make Comtest the worthy recipient of the 2013 Frost & Sullivan Customer Service Leadership Award in the Electrical Test Equipment Market."*

Southern Cape Centre : Digital Television Presentation

The Southern Cape Centre recently hosted a tour of the Sentech transmitter facilities at the George tower, mainly to see the newly commissioned digital terrestrial television (DTT) transmission equipment.

DTT is set to provide a broad spectrum of existing and new TV channels as well as having to provide a much greater number of services than is possible with the present analogue system, which will eventually be switched off.

Reception of these digital transmissions will require a TV set with built-in digital decoder, or a new set-top box, which is not yet available to the public. Existing domestic receiving antenna systems should be adequate for the digital services.

The input equipment and dual 2000W DTT transmitter are operated on a robust UPS, further backed up by a standby generator. The transmitter has liquid cooled amplifier stages, and is configured with a large measure of redundancy. Remote status monitoring and switching facilities are also provided.

Following the tour of the transmitter station, Marius Venter, Head of Network Planning at Sentech, gave a comprehensive presentation on the DTT project, including the history of the initiative, reasons for digital migration, advantages, global deployment, international standards, site and network planning, satellite linking, technical configuration, and domestic receiving requirements.

The launch of DTT services will represent a very significant step in the history of broadcasting in South Africa.

The newly commissioned digital terrestrial television (DTT) transmission equipment.

Marius Venter
Head of Network Planning at Sentech

R1000 JANUARY 2014 CROSSWORD WINNER:
A DABROWSKI FROM PRETORIA.

WATTSUP

TechRig Technical Solutions Agency orchestrated the opening of the Mandela School of Science and Technology sponsored by Siemens

Siemens made a promise to Nelson Mandela to build a high school in the small rural village of Mvezo, Madiba's birthplace. This was a massive undertaking, but true to their word, Siemens built a state of the art facility, brilliantly executed, a first in the area.

TechRig Technical Solutions Agency was selected by CLA Event & Brand Engineering as the preferred technical supplier for the official opening of the school on 17th January 2014.

The opening was a big event that included guest of honor, President Jacob Zuma, the MEC for the Eastern Cape, other dignitaries, international guests, local chiefs and the community of Mvezo.

As the technical support TechRig supplied all the sound, stage, and lighting equipment needed for the massive event (3000 guests attended) with both indoor and outdoor setup. Due to the size of the event and the remote location of the school this amazing project was not without its challenges.

"Logistics were a challenge, securing sufficient power, audibility and clarity on the multi-camera production was no small feat ensuring all guests felt included in this momentous occasion, then there was the scorching heat and incessant rain" notes TechRig CEO Michael Collyer, *"we had to be ready to handle anything in a remote location. This meant having all necessary backups, including, light, sound, generators, playback to control projectors, LED and microphones."*

Mandela's passion was education *"Education is the most powerful weapon you can use to change the world"* - Nelson Mandela. In honour of Madiba and Siemens legacy to him, TechRig took the opportunity of assisting this phenomenal endeavor, sponsoring R150 000 worth of technical equipment to the school as part of their CSR which included a new PA system and projector installed in the school hall, as well as a screen, playback and projector in the teachers staffroom.

TechRig is South Africa's foremost technical solutions agency delivering the highest level of expertise with professional technical equipment in a global arena.

TechRig is the proud owner of some of the best technology including the world's biggest, brightest projectors. For further information visit www.techrig.com

Pinnacle Africa partners with Logitech to distribute their range of UC products

Pinnacle Africa is very proud to announce that it has been selected by Logitech to launch Logitech's Unified Communications range of products in Africa. *"The rise of the mobile workforce, and the growing costs of business travel make unified communications products like mobile videoconferencing ever-more appealing to business customers,"* says Pinnacle Africa's Managing Director Tim Humphreys-Davies. *"The exclusive distribution partnership with Logitech will allow us to really tap into, and increase our foothold in, this growing market."*

Sustaining Consulting Engineering is Key to Growing the Economy

Consulting Engineers South Africa's (CESA) newly appointed President, Abe Thela, recently presented his presidential message and theme for the year at a function held in Johannesburg. With the theme of 'Sustaining Consulting Engineering is Key to Growing the Economy' Thela stated that the National Development Plan (NDP) was created in order to develop the South Africa's economy. Government through the NDP has identified infrastructure development as key to the socio economic development of the country. Thela believes that the NDP and its objectives will never come to fruition unless there is involvement of consulting engineers at the forefront of this development.

L-R: Lefadi Makibinyane, CESA CEO and Abe Thela, CESA President.

Altium and Nimbic Announce Partnership

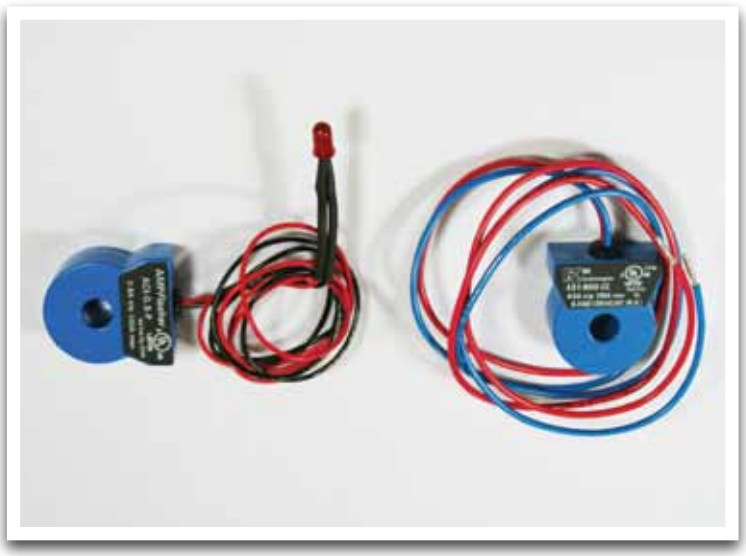
Altium Limited, a global leader in Smart System Design Automation, announce a new development partnership. This will make Nimbic the newest developer partner to join Altium's newly formed Altium Developer program. The agreement consists of a strategic alliance between the two companies and the introduction of a new power integrity solution - Altium PI-DC.

Altium PI-DC gives users the ability to validate DC voltage and current performance in their designs before prototype and production. Now, designers can avoid issues with power delivery and are better able to identify potential failure points. This includes high via currents that could cause fusing, or high resistance neck-down regions resulting in excessive voltage drop.

Built from the ground-up, Altium PI-DC is based on Nimbic's specialized 3D full-wave electromagnetic solver, and is designed to address the requirements of large-scale power integrity problems. Unlike other solutions in the market, the Altium PI-DC delivers fast solution times without compromising on accuracy.

"BGAs have hundreds of power and ground pins with numerous supply rails requiring complex networks of capacitors to manage "pure" power. The sophistication of the PDN (power distribution network) requires engineers to be able to effectively analyze and make corrections early on in the design process," said Daniel Fernsebner, Director of Technical Partnerships for Altium. *"This partnership with Nimbic introduces a robust integrated power integrity solution to our customers."*

AC Current Operated Switches



NK Technologies of San Jose, California have introduced low cost current operated switches designated AS1, which consists of a compact case and a solid state relay. Simply pass the primary conductor through the aperture, the self-powered unit utilizes a solid state relay to provide the opening or closing of the solid state relay once the thresh-hold of 0.5A is exceeded.

Typical applications will include, quick reporting of motor load status, identify open circuit heaters, independent verification that a load is energized, confirmation operation of critical lighting equipment.

In addition to the solid state relay device, NK also offer the Amp Flasher which is also self powered, will give a flashing LED indication of an energized load.

For further information, please visit www.denvertech.co.za

WATTSUP

Fluke's new high-performance power quality recorder launched

The Comtest Group, Fluke's authorised Test and Measurement Distributor for South and southern Africa, has introduced the Fluke 1750 three-phase power recorder, for power quality and monitoring of power quality disturbances.

These power meters automatically record every power quality parameter and event, on every cycle continuously for applications as diverse as:

- Long-term analysis
- Power quality surveys
- Quality of service compliance
- Equipment installation/commissioning benchmark

The 1750 allows for quick and reliable configuration via the ARCHOS 43 Internet Tablet which provides a window into what the instrument is recording, allowing for quick and reliable configuration even in awkward test locations. It provides power quality measurements that comply with IEC61000-4-30 standards for correct evaluation of all measured values, including voltage, current, power, harmonics, etc. It captures every measurement, on every channel with cross-channel and current triggering capture as well as every parameter: voltage and current on three phases, neutral and ground.

With the 1750, the user may apply thresholds after the data is collected with Fluke Power Analyze Software, so that there is no possibility of missed information due to incorrect setups. The feature, "Auto Report" creates either standard reports or customised reports and, with the 'Plug and Play' feature, set-up is easy with self-identifying current probes and single-lead connections.

For more info, visit www.comtest.co.za

Altron subsidiary, Powertech sells its 50% stake in Tridonic

Powertech, a wholly owned subsidiary of the JSE-listed Altron group has sold its 50% stake in Tridonic SA (Pty) Ltd to Tridonic Holding GmbH, Austria. The transaction took effect on 1 February 2014. Tridonic SA had been a joint venture between Powertech and Tridonic Austria since 1993.

Neil Kayton, Group Executive: Altron Power says, "We have had a long and fruitful partnership with Tridonic Austria. As part of our drive for efficiency and customer centricity, Powertech has taken the decision to focus on its core business of power electronics. We decided to sell to our stake in Tridonic SA to our partners and enable them to expand their business in Sub-Saharan Africa and dedicate our focus and funds on other areas of the business

Tridonic SA is an intelligent lighting control and energy-efficiency lighting supplier. The company will remain at its current premises in Jet Park, Johannesburg.

Through its four operating divisions - Cables, Transformers, Batteries, and System Integrators - Powertech comprises of a large number of individual operations specialising in the design, manufacturing and delivery of world class products, services, expertise and solutions to address diverse needs for electrical and power equipment in South Africa and beyond. Powertech is part of the Altron Power division.

Fairview Microwave announces new line of Variable RF Switch Attenuators

Fairview Microwave, Inc. a preeminent supplier of on-demand microwave and RF components, has released a new line of compact hot-switchable variable attenuators. RF attenuators are used to reduce the amplitude of an electronic signature in many common electronic scenarios including lab testing equipment, distributed antenna systems (DAS) and power and signal monitoring systems.

SAIEE joins African Utility Week to provide free, practical workshops for electrical engineers in the energy sector

CONFERENCE AND EXHIBITION
13-14 May 2014
FOCUS DAY
12 May 2014
SITE VISITS
15 May 2014
LOCATION
CTICC, Cape Town, South Africa
WEBSITE
www.clean-power-africa.com
www.african-utility-week.com

African Utility Week and Clean Power Africa have joined forces with the South African Institute of Electrical Engineers (SAIEE) to host two days of free, practical, CPD-accredited technical workshops on the event's expo floor for all electrical engineers, technicians and contractors working in the power and water industry.

The award winning 14th African Utility Week and Clean Power Africa conference and expo is taking place at the CTICC in Cape Town from 13-14 May 2014. It is attended by more than 5000 power and water professionals from more than 30 African countries and 70 worldwide, at what is the largest utility gathering of its kind on the continent. Discussions, workshops, exhibits and site visits will focus on the industry disciplines of metering, clean power, water, large power users, investment and finance, transmission & distribution, smart grids and generation.

The SAIEE has grown to a membership of over 6000 professionals engaged in the full range of electrical engineering and related activities including academic research, manufacturing, electronics, telecommunications, measurement and control, mining, and power infra-structural services.

Is this the future that we want for ourselves? Andre Hoffmann, SAIEE Senior Vice President says: *"South Africa Inc. is at a critical juncture in our development as a country, having achieved much in political emancipation since 1994. However, we remain critically poised on a fine balance that may tip us economically and send us spiraling towards a more unpleasant future."*

He continues: *"the vision of a South Africa that has degenerated into a chaotic state of civil strife precipitated by degrading service delivery infrastructure should be frightening enough to jolt us out of our complacency. Is this the future that we want for ourselves, our children and grandchildren?"*

According to SAIEE's Andre Hoffmann: *"South Africa is not an island. It exists in a globally competitive environment and its infrastructure that supports the economy cannot be left to degenerate without affecting our medium and long term sustainability as a country."*

He explains: *"there is little point in refining and perfecting our specialised disciplines if 'Rome' is burning. Let's fix the problem, let's set a course for a future that we all actually want to live in and then we can go back to business as usual."*

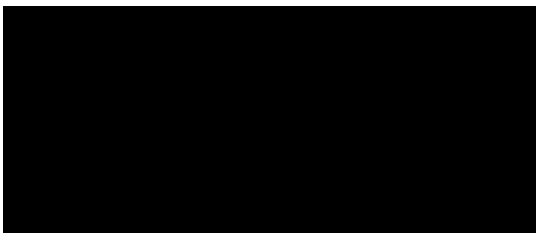
African Utility Week's partnership with the SAIEE is part of a wider strategy to involve professional industry organisations in the conference and technical training workshops to remain a relevant event for and by the industry.

"Technology does not exist in isolation of society, it is developed and implemented to benefit society and it continues to evolve at a rapid pace. Delegates to the African Utility Week need to use the opportunity to build and strengthen their professional networks and appreciation of the new developments in the various technologies available to them" said André.

He adds: *"furthermore I believe that a concerted effort needs to be made in lobbying with government and policy makers to reinforce the role of the trained and competent professional engineer or technologist in capacitating government utilities to run effectively and sustainably over the expected economic life-cycle of the investment."*

The Electrical Engineering Workshops at African Utility Week, hosted by the SAIEE, will include various courses.

For more info on the courses available, visit www.saiee.org.za wn



Africa moves to increase power infrastructure

Africa's power demands are soaring beyond the capacity of an ageing infrastructure to cope, but multiple programmes are being put in place to address the challenges. This is according to Dr Willie de Beer, Chairman of the DistribuTECH Africa Advisory Board.

Pretoria based energy expert De Beer was speaking at DistribuTECH International/Utility Products in San Antonio, Texas, where nearly 10,000 delegates from 67 countries gathered to discuss global power trends and challenges last month.

He said that Africa's total power demand in 2010 was 590 TWh, projected to grow to 3100 TWh by 2040 on the back of an ever-increasing demand for energy. *"The population of Africa is projected to reach 1.9 billion by 2050 and customer expectations are on the increase,"* he said. De Beer said that while there were pockets of power excellence and high levels of stability across the continent, the need for investment and upgrades was clear.

However, South Africa and the continent as a whole, was taking steps to address the challenges.

De Beer noted that Africa is part of the Smart Grid infrastructure investment by 45 emerging market countries – including Brazil, Russia, India, China and South Africa – which over the next decade will reach USD274.9 billion, outpacing investment by developed countries. In addition, Africa and South Africa's investment is particularly focused on reducing electricity theft, improving reliability and incorporating renewable energy into electricity grids, and Africa is a key focus for the US, benefiting from President Barack Obama's grant package worth $7 billion in government funding plus an additional $9 billion in private sector commitments.

De Beer told delegates: *"Eskom, South Africa's national electricity company and DistribuTECH Africa's Host Utility & Networking Sponsor, plans to spend over $150 billion on power infrastructure over the 2010-2030 timeframe, including $11 billion on transmission-sector reliability alone and pilot projects over the next 10 years."*

Africa's plans to address power challenges and meet the future demands of an increasingly industrialised continent will come under in-depth discussion at POWER-GEN Africa and DistribuTECH Africa in Cape Town in March.

These events, co-located for the first time at the Cape Town International Convention Centre from 17 - 19 March 2014, will attract around 3,000 industry experts and power industry professionals from across Africa and abroad.

The event, presented by PennWell Events, will feature the best of the international POWER-GEN and DistribuTECH events, combined with an in-depth focus on Africa's unique challenges and opportunities. The world's leading power engineering vendors will also present solutions designed to address Africa's unique power challenges.

De Beer notes: *"Facilitating economic development, smart grids and the role of emerging technology are just some of the solutions the inaugural DistribuTECH AFRICA event will present to help Africa to achieve successful strategies for long-term, sustainable solutions."*

For more information about attending POWER-GEN Africa conference and exhibition, visit www.powergenafrica.com, or more info on DistribuTECH Africa, visit www.distributechafrica.com.

POWER-GEN AFRICA

DISTRIBUTECH® AFRICA

Conference & Exhibition
17–19 March 2014
Cape Town International Convention Centre
Cape Town, Republic of South Africa

www.powergenafrica.com
www.distributechafrica.com

EQUIPPING AFRICA'S ENERGY FUTURE

INVITATION TO PARTICIPATE

POWER-GEN Africa combines with DistribuTECH Africa for the first time to provide an extensive coverage of the power needs, resources, and issues facing the electricity generation, transmission and distribution industries across sub-Saharan Africa.

Africa's energy requirements continue to expand with the rapid growth and development throughout the continent, driving the need for more widespread and reliable electricity.

Together POWER-GEN Africa and DistribuTECH Africa will bring together world leading power equipment suppliers, operators and developers from government utilities, commercial, manufacturing and consulting sectors as well as officials and ministers tasked with energy policy in this dynamic region of the world.

The three day event will feature multi-track conference sessions and an extensive combined exhibition featuring the leading suppliers from both the International and African power sectors, demonstrating their latest technologies.

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ACSA workshops towards conforming with ISO50 001

The Energy Training Foundation (EnTF) presented its Energy Management System Implementation (EnMSI) training and workshop with members of the Airports Company of South Africa's (ACSA) technical and engineering member team who have all undertaken roles and responsibilities to reduce ACSA's energy consumption through a properly implemented energy management system.

ACSA has already embarked on a number of energy efficiency projects at the various airports under the auspices of Chief Engineer, Dupie du Plessis, who is based at ACSA in Port Elizabeth. Extensive lighting upgrades to LED technology at most runways of the regional airports, as well as other lighting system improvements have already delivered at least 15% of energy savings. *"We are now focussing on ensuring the sustainability of energy saving initiatives which have already been done, as well as any further energy efficiency projects, by following a properly implemented energy management system in accordance with ISO50 001"*, said du Plessis.

The workshop session over 3 days is based on the SABS/ISO50 001 Energy Management System standard. It takes the format of the EnTF's Energy Management System Implementation (EnMSI) training course together with a consulting service delivering not only an understanding of the ISO standard and its requirements, but is coupled with a delivery module which leaves a skeleton roadmap that includes:

- What needs to be done on the site to achieve optimal energy management
- Where energy can be saved
- Estimates of what energy savings could be expected
- Savings options that warrant further investigation for more accurate energy saving targets
- Training needs of staff and upskilling
- What tasks can be done in-house and what would be better outsourced
- Short, medium and long-term investment considerations
- Which technologies and retrofits need to be considered
- Which incentives and rebates can be pursued
- What is required to ensure continuous energy saving

The in-class bill verification process highlighted the importance of understanding tariffs and giving attention to billing received from utilities to ensure energy savings are measured correctly. A downward trend in billing received does not necessarily mean an energy saving if there has been a tariff change downward, the same would apply with upward tariff adjustments where it would not

At the Port Elizabeth International Airport in January 2014, ACSA Energy Management System Implementation workshop and training with the Energy Training Foundation (EnTF).
From left to right (back): Riaan Lombard (ACSA George), Lance Coghlan (ACSA Upington), Roland Timm (ACSA Kimberley), Calvin Gilfillan (ACSA PE), Bradford Kruger (ACSA George), Tshele Monareng (ACSA Bloemfontein) (middle): Simphiwe Mbonambi (ACSA PE), Dupie du Plessis (ACSA PE), Yolanda de Lange (EnTF), Patrick Nkeeane (ACSA Bloemfontein), Dr Braam Dalgleish (EnTF lecturer) Sikhona Mkhwanazi (ACSA Bloemfontein), (front): Siyanda Nxazonke (ACSA East London), Samkelo Luyenge (ACSA East London), Tshele Monareng (ACSA Bloemfontein)

necessarily mean increased energy demand. Du Plessis said, *"These comparisons have prompted us to list bill verification as an opportunity to perform better energy management."*

He continues, *"We have had many ideas of energy improvements that can be made, but the site visit with the EnTF team highlighted even greater opportunities to not only save energy but improve the performance of the equipment we utilise".*

Populating the energy review information, together with the available ACSA energy data, into a plan in line with the standard has given the ACSA team a clearer picture of the energy savings possibilities and how to establish the processes and means to work towards sustainable energy efficiency improvements.

Such on-site training workshops that facilitate the development of an energy policy, action plan and a roadmap to follow allows interaction between team members responsible for the success of any energy efficiency initiatives. It breeds an equal understanding amongst team members on the energy management road ahead, and what is required to achieve the targets set by the team members themselves. wn

PTT supplies a full range of transformers, from generator step-up to transmission and distribution transformers. The range includes three-phase and single-phase units, auto-transformers, arc-furnace, locomotive and traction transformers, miniature sub-stations, NECRT's as well as shunt reactors.

PTT's small power transformer facility which was officially opened in February by Charles Kalima, Senior Manager: Commercial, Commodity Sourcing, ESKOM and Robert Venter, CEO of Altron, was specially designed and built to improve the flow of a transformer through the manufacturing process resulting in shorter production lead times.

The transformer sizes that will be manufactured in the facility range from 20 to 60MVA 132kV and the floor size that has been allocated is 4200m^2. The total size of the factory is 23894m^2.

The facility which was locally designed and locally manufactured will increase the Small Power Transformer (SPT) capacity by 100%. The new SPT capacity is 4,400 MVA (previous 2,200 MVA) which equates to 120 transformers per annum (40x20MVA + 60x40MVA + 20x60MVA).

PTT's total revised factory capacity inclusive of medium power transformers (MPT) and large power transformers (LPTs') is 13,680 MVA per annum.

Powertech Transformers management saw the potential growth of the small power transformer (SPT) market both locally and within Southern and Sub-Saharan Africa and a decision to invest in the facility was taken in order to expand the capacity as regards that range of transformers.

We are a local manufacturer and employ local people. Skills development with the increase of headcount is envisaged as follows:

- 80 Operators / Apprentices / Artisans;
- 10 Technicians;
- 5 Engineers;
- 5 Administrative; and
- 5 Managerial personnel;

This is a total of 105 people.

Company growth and increasing and sustainability of our market share combined with our endeavour to supply more of ESKOM and other customers' requirements regarding the small power transformer market. Other benefits we envisaged was hedging against the exchange rate and saving of foreign exchange for

Energy transformed is power!

Powertech Transformers (PTT) consists of three world class operations involved in the design, manufacture, installation, commissioning and servicing of transformers.

the country which with depressed economic market conditions will hopefully reduce imports of similar type of equipment.

We hope to increase our annual manufacturing capacity. At present we have doubled our manufacturing capacity of small power transformers and hope to fully use the entire capacity within the next 3 – 5 years.

The investment was approximately R90 million.

The project which commenced eighteen months ago was carried out in two phases, the first one being the purchasing of new vertical winding machines and upgrading of the existing ones as well as the excavation of the existing factory space and the second phase the installation of additional equipment as well as reorganising the existing fabrication area to enable the tank fabrication to match the assembly area.

The winding production area consists of three (3) new locally designed and manufactured vertical winding machines, three (3) existing vertical winding machines which were upgraded to a certain degree and three (3) existing horizontal winding machines. The existing winding machines were upgraded to be able to manage the improved throughput time necessary.

The existing 200 ton winding press and the two vacuum/heat drying chambers were repositioned and upgraded. The winding drying ovens are used for drying of completed windings and operates in a heat and vacuum cycle.

The 200 ton winding press which is hydraulically operated and accurately calibrated is used for final dimensioning of completed windings in axial direction. Because of the nature of the completed windings being similar to a coil spring, after manufacture the windings will grow axially and through the application of an axial pressure, the windings are brought back to the desired winding height which is required to ensure correct fitment onto the magnetic core.

Pressures vary for the different coil designs but it is important to note that, for example, if a certain winding requires a pre-calculated pressure of, say, 100 tons, to ensure the required winding height, the 100 tons load on the windings is a distributed axial load over the circumference of the windings in question.

The pressure is applied in single phase formation i.e. each phase on a 3 phase transformer is individually done. The 100 tons considered in this example can be related to the weight of a large diesel electric railway tractor or 1300 adults. The winding production area has been realigned for a more efficient product and is separated from the production area.

A hydraulically operated locally designed and manufactured core stacking table with a maximum capacity of 50 tons which includes floor mounted levelling beams for final measuring of cores prior to moving to the assembly stations for building of transformer active parts was also installed.

Five (5) locally designed and manufactured active part assembly stations each, equipped with their own

Energy transformed is power!

continues from page 21

five (5) ton hoists for coil and tapchanger fitments. Each station has vertical and horizontal adjustable personnel platforms and a unique system of adjustable fingers. The "fingers" that hold the worker ensure he can work safely on the whole active part. Assembly platforms that were installed are state of the art and are designed to give the transformer assembler a 360 degree safe access to the transformer active part.

The new autoclave for vapour phase drying of active parts prior to tanking has the ability of drying multiple amounts of active parts at the same time. A 30% improvement of the drying time of the transformer active part is a major advantage. The auto-clave is a European design but was manufactured locally. The system used to dry out the active parts is a kerosene vapour and vacuum cycle. The drying cycle serves to remove moisture (water) from the insulation material used in the manufacture of transformers. Insulation is a fibrous (paper based) material and is highly hygroscopic i.e. draws moisture from the atmosphere and said moisture needs to be removed to prevent electrical failure of the transformer during high voltage testing and operation of the transformer within an electrical substation. Drawing out an equivalent of 100 litres of water from an active part is not uncommon, this volume relates to the fuel capacity of a large vehicle (filling your vehicle twice over).

Two (2) new locally designed and manufactured fully adjustable assembly stations positioned after the drying cycle for final adjustments to the active parts prior to tanking.

Two (2) new locally designed and manufactured elevators with operations below floor level for final fitting of the active parts into the transformer tanks, oil filling under vacuum and fitment of the HV and LV bushings prior to transporting the transformer to the electrical testing facility.

The tanking elevator which reduces the need to work at heights resulting in a safer work environment and faster turn-around time. This elevator is able to lift approximately 100 tonnes which is an equivalent of 1300 people instead of 10 people which is the maximum in a normal elevator.

Movement of active parts and tanked transformers via remote controlled imported pallet trucks with associated pallets. The existing fabrication area was upgraded to improve the flow of the tank through the area.

The paintshop was enclosed and an additional grit blasting cubicle and painting cubicle were commissioned to assist with the increased anticipated volumes of transformers through the facility. These were all locally designed and manufactured. Tanks and covers are prepared and painted prior to final assembly.

The floors were epoxy coated for ensuring a clean environment and improved working conditions for employees.

The new facility has been designed to initially produce 110 transformers per annum with a planned increase to 130 trans- formers per annum.

Additional information on Powertech Transformers is as follows:
Powertech Transformers is a Level Three Contributor to BBBEE and their rating was re-certified in June 2013.

PTT offers a Transformer Manufacturing and Design training course which has been accredited by the South African Institute of Electrical Engineering (SAIEE). The training course has been awarded 4 (four) Continuous Professional Development points (CPD) and the validity period stretches over a period from July 2012 until June 2015. The course, which includes both practical and classroom training over 5 (five) days, covers various aspects of transformer production, inter alia: design processes (both electrical and mechanical); tank fabrication; insulation; paper-lapping; core-cutting; core stacking, winding manufacture; winding assembly; active part assembly; oil processing; tanking; quality assurance and control; factory testing, protection components, first line maintenance, transport and dispatch of the transformers as well as research and development. Feedback from delegates has been very positive.

We believe in supporting black businesses and do so through preferential procurement and enterprise development and have various iniatives as regards enterprise development. By supporting emerging black businesses in a way that ensures their sustainability over the longer term, providing management advice, guiding them in financial best practice and providing assistance through advantageous payment terms. This not only benefits historically disadvantaged members of society, but also provides us with reliable, alternative procurement sources for many of our products. wn

Further information on our preferential procurement and enterprise development iniatives can be obtained from our Group Supply Chain Manager, Shane Smith.

Powertech

MAKING POWER PERFORM

What the statue of liberty is for the USA, Powertech Transformers is for the transformer market in South Africa and beyond.

It's been over six decades since Powertech Transformers first opened its doors and over that time we've established ourselves as a symbol of trust and hope in the transformer market. We supply a complete range of transformers, from generator step-up to transmission and distribution transformers, three-phase and single-phase units, auto-transformers, arc-furnace, locomotive and traction transformers, miniature sub-stations, NECRT's as well as shunt reactors.

Additional services include after-sales service, a SANAS accredited laboratory and testing facility, preventative maintenance, engineering solutions and field services.

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Powertech Transformers

In search of brilliance . . .

Eskom's Energy Efficient Lighting Design Competition is challenging the finest design engineering talent in the country to merge creative flair and trend-setting artistry with no-nonsense functionality – and come up with beautiful solutions in lighting design that will last a lifetime.

Few design elements are as versatile and wield as much power to define and transfigure a space as does light. Yet, despite its endless possibilities, the power of lighting as a design tool is often underestimated.

Engineers, electrical contractors, DIY-homeowners and other artistic souls are challenged to think beyond convention, and use their intuition and imagination to design (and build) a lamp prototype that not only works, but makes use of energy-efficient technology, such as compact fluorescent lamps (CFLs), light-emitting diodes (LEDs), fibre optic or any energy-efficient lighting system or product suitable for residential application.

The call is to meet the challenge of striking the perfect balance between functionality and creative expression.

PRIZES

The total prize value of R200 000 is awarded as follows:

Category A: Residential Luminaire Design (Students)

Full-time students at all tertiary institutions (universities, colleges, design centres and schools of design) in South Africa are invited to submit a luminaire design using an energy efficient light source, suitable for use in the home.

First prize:	R30 000
Second prize:	R20 000
Third prize:	R10 000
Educational institution prize:	R10 000
Top regional finalists (6):	
Lenovo 7" Android tablet (wifi and 3G enabled)	
Total prize value:	R85 000

Category B: Innovative Energy Efficient Lighting Design (Professional)

In Category B, professional graphic designers, architects, electrical engineers, product designers, researchers and anyone with a passion for design are invited to submit innovative energy efficient designs, systems or products, suitable for residential application.

First prize:	R 40 000
Top regional finalists (6):	R 5 000 each
Total prize money:	R 70 000

Category C: Most Promising Young Designer (Learners)

Promising young designers from secondary schools and FET or independent colleges, between the age of 14 and 20, are invited to submit innovative energy efficient designs, systems or products, suitable for residential application.

Most Promising Designer (Individual):	R 10 000
Top regional finalists (6):	
Lenovo 7" Android tablet (wifi and 3G enabled)	
Educational institution prize money:	R10 000
Total prize value:	R 35 000

Special Discretionary Award:

Most Promising Designer (Individual):	R 10 000
Total prize money:	R 10 000

If you have the ability to achieve that magical mix of artistry and functionality, let your imagination run wild! The closing date for entries is 15 August 2014. For more information on specifications, evaluation criteria and entry forms, visit www.lighting-design.co.za, or send an e-mail to karin@dalajunction.co.za.









Earn CPD Credits

How Does a Generator Create Electricity?

Generators are useful appliances that supply electrical power during a power outage and prevent discontinuity of daily activities or disruption of business operations. Generators are available in different electrical and physical configurations for use in different applications. In the following sections, we will look at how a generator functions, the main components of a generator, and how a generator operates as a secondary source of electrical power in residential and industrial applications.

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An electric generator is a device that converts mechanical energy obtained from an external source into electrical energy as the output.

It is important to understand that a generator does not actually 'create' electrical energy. Instead, it uses the mechanical energy supplied to it to force movement of electric charges present in the wire of its windings through an external electric circuit. This flow of electric charges constitutes the output electric current supplied by the generator. This mechanism can be understood by considering the generator to be analogous to a water pump, which causes the flow of water but does not actually 'create' the water flowing through it.

The modern-day generator works on the principle of electromagnetic induction discovered by Michael Faraday in 1831-32. Faraday discovered that the above flow of electric charges could be induced by moving an electrical conductor, such as a wire that contains electric charges, in a magnetic field. This movement creates a voltage difference between the two ends of the wire or electrical conductor, which in turn causes the electric charges to flow, thus generating electric current.

MAIN COMPONENTS OF A GENERATOR

The main components of an electric generator can be broadly classified as follows (refer to illustration):

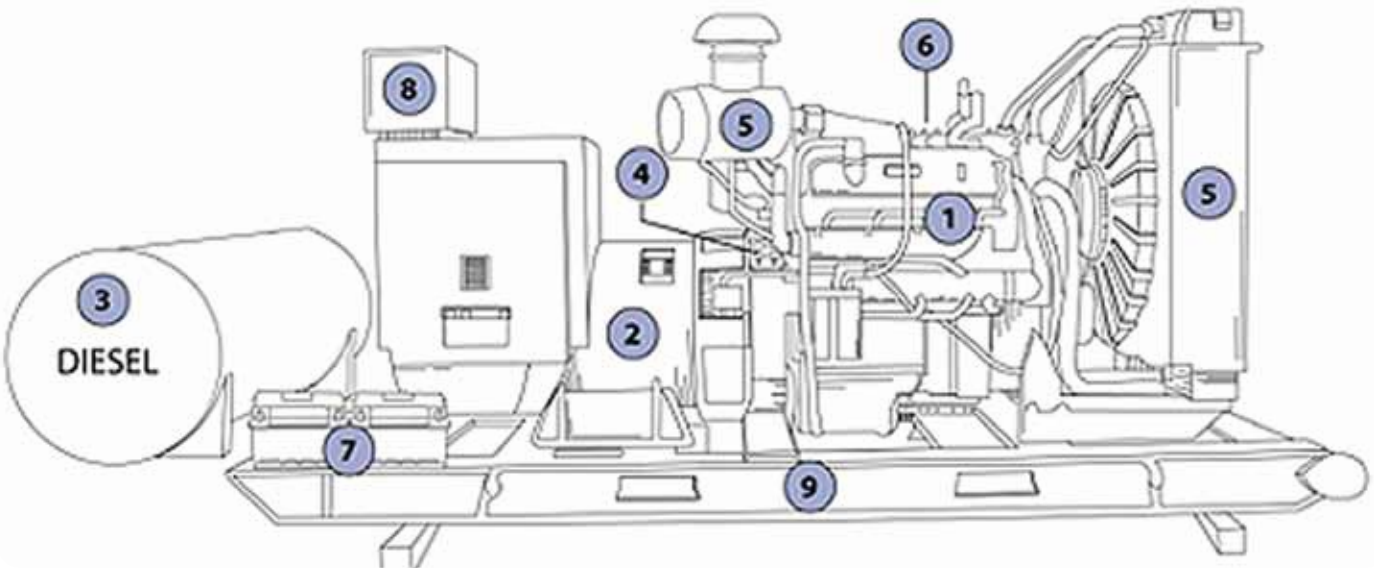
(1) Engine
(2) Alternator
(3) Fuel System
(4) Voltage Regulator
(5) Cooling and Exhaust Systems
(6) Lubrication System
(7) Battery Charger
(8) Control Panel
(9) Main Assembly / Frame

A description of the main components of a generator is given below:

1. Engine

The engine is the source of the input mechanical

MAIN COMPONENTS



1. Engine
2. Alternator
3. Fuel System
4. Voltage Regulator
5. Cooling and Exhaust Systems
6. Lubrication System
7. Battery Charger
8. Control Panel
9. Main Assembly/Frame

How Does a Generator Create Electricity?

continues from page 27

energy to the generator. The size of the engine is directly proportional to the maximum power output the generator can supply. There are several factors that you need to keep in mind while assessing the engine of your generator. The manufacturer of the engine should be consulted to obtain full engine operation specifications and maintenance schedules.

a. Type of Fuel Used – Generator engines operate on a variety of fuels such as diesel, gasoline, propane (in liquefied or gaseous form), or natural gas. Smaller engines usually operate on gasoline while larger engines run on diesel, liquid propane, propane gas, or natural gas. Certain engines can also operate on a dual feed of both diesel and gas in a bi-fuel operation mode.

b. Overhead Valve (OHV) Engines versus non-OHV Engines – OHV engines differ from other engines in that the intake and exhaust valves of the engine are located in the head of the engine's cylinder as opposed to being mounted on the engine block. OHV engines have several advantages over other engines such as:
   - Compact design
   - Simpler operation mechanism
   - Durability
   - User-friendly in operations
   - Low noise during operations
   - Low emission levels

   However, OHV-engines are also more expensive than other engines.

c. Cast Iron Sleeve (CIS) in Engine Cylinder – The CIS is a lining in the cylinder of the engine. It reduces wear and tear, and ensures durability of the engine. Most OHV-engines are equipped with CIS but it is essential to check for this feature in the engine of a generator. The CIS is not an expensive feature but it plays an important role in engine durability especially if you need to use your generator often or for long durations.

2. Alternator

The alternator, also known as the 'genhead', is the part of the generator that produces the electrical output from the mechanical input supplied by the engine. It contains an assembly of stationary and moving parts encased in a housing. The components work together to cause relative movement between the magnetic and electric fields, which in turn generates electricity.

a. Stator – This is the stationary component. It contains a set of electrical conductors wound in coils over an iron core.

b. Rotor / Armature – This is the moving component that produces a rotating magnetic field in any one of the following three ways:

i. By induction – These are known as brushless alternators and are usually used in large generators.

ii By permanent magnets – This is common in small alternator units.

iii. By using an exciter – An exciter is a small source of direct current (DC) that energizes the rotor through an assembly of conducting slip rings and brushes.

The rotor generates a moving magnetic field around the stator, which induces a voltage difference between the windings of the stator. This produces the alternating current (AC) output of the generator.

The following are the factors that you need to keep in mind while assessing the alternator of a generator:

a. Metal versus Plastic Housing – An all-metal design ensures durability of the alternator. Plastic housings get deformed with time and cause the moving parts of the alternator to be exposed. This increases wear and tear and more importantly, is hazardous to the user.

b. Ball Bearings versus Needle Bearings – Ball bearings are preferred and last longer.

c. Brushless Design – An alternator that does not use brushes requires less maintenance and also produces cleaner power.

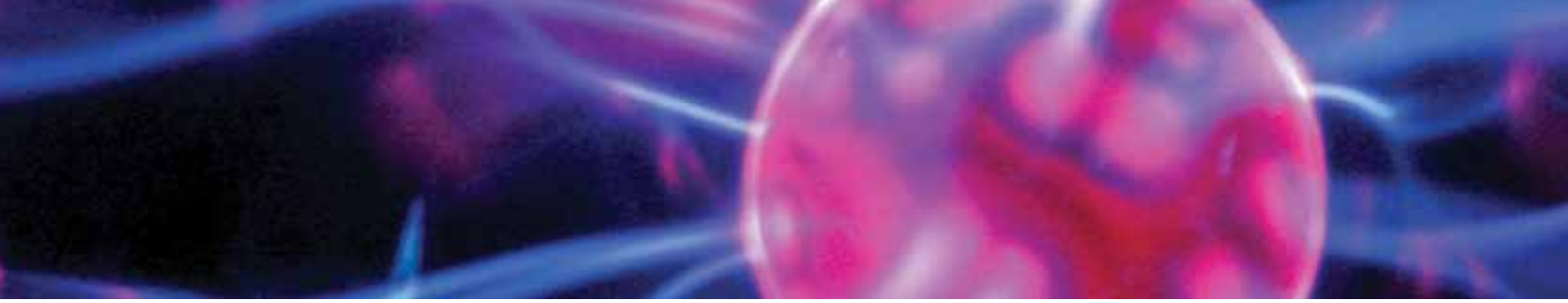
3. Fuel System

The fuel tank usually has sufficient capacity to keep the generator operational for 6 to 8 hours on an average. In the case of small generator units, the fuel tank is a part of the generator's skid base or is mounted on top of the generator frame.

For commercial applications, it may be necessary to erect and install an external fuel tank. All such installations are subject to the approval of the City Planning Division. Click the following link for further details regarding fuel tanks for generators.

Common features of the fuel system include the following:

a. Pipe connection from fuel tank to engine – The supply line directs fuel from the tank to the engine and the return line directs fuel from the engine to the tank.



b. Ventilation pipe for fuel tank – The fuel tank has a ventilation pipe to prevent the build-up of pressure or vacuum during refilling and drainage of the tank.

   When you refill the fuel tank, ensure metal-to-metal contact between the filler nozzle and the fuel tank to avoid sparks.

c. Overflow connection from fuel tank to the drain pipe – This is required so that any overflow during refilling of the tank does not cause spillage of the liquid on the generator set.

d. Fuel pump – This transfers fuel from the main storage tank to the day tank. The fuel pump is typically electrically operated.

e. Fuel Water Separator / Fuel Filter – This separates water and foreign matter from the liquid fuel to protect other components of the generator from corrosion and contamination.

f. Fuel Injector – This atomizes the liquid fuel and sprays the required amount of fuel into the combustion chamber of the engine.

4. Voltage Regulator

As the name implies, this component regulates the output voltage of the generator. The mechanism is described below against each component that plays a part in the cyclical process of voltage regulation.

a. Voltage Regulator: Conversion of AC Voltage to DC Current – The voltage regulator takes up a small portion of the generator's output of AC voltage and converts it into DC current. The voltage regulator then feeds this DC current to a set of secondary windings in the stator, known as exciter windings.

b. Exciter Windings: Conversion of DC Current to AC Current – The exciter windings now function similar to the primary stator windings and generate a small AC current. The exciter windings are connected to units known as rotating rectifiers.

c. Rotating Rectifiers: Conversion of AC Current to DC Current – These rectify the AC current generated by the exciter windings and convert it to DC current. This DC current is fed to the rotor / armature to create an electromagnetic field in addition to the rotating magnetic field of the rotor / armature.

d. Rotor / Armature: Conversion of DC Current to AC Voltage – The rotor / armature now induces a larger AC voltage across the windings of the stator, which the generator now produces as a larger output AC voltage.

This cycle continues till the generator begins to produce output voltage equivalent to its full operating capacity. As the output of the generator increases, the voltage regulator produces less DC current.

Once the generator reaches full operating capacity, the voltage regulator attains a state of equilibrium and produces just enough DC current to maintain the generator's output at full operating level.

When you add a load to a generator, its output voltage dips a little. This prompts the voltage regulator into action and the above cycle begins.

The cycle continues till the generator output ramps up to its original full operating capacity.

How Does a Generator Create Electricity?

continues from page 29

5. Cooling & Exhaust Systems

a. Cooling System

Continuous usage of the generator causes its various components to get heated up. It is essential to have a cooling and ventilation system to withdraw heat produced in the process.

Raw/fresh water is sometimes used as a coolant for generators, but these are mostly limited to specific situations like small generators in city applications or very large units over 2250 kW and above. Hydrogen is sometimes used as a coolant for the stator windings of large generator units since it is more efficient at absorbing heat than other coolants. Hydrogen removes heat from the generator and transfers it through a heat exchanger into a secondary cooling circuit that contains de-mineralized water as a coolant. This is why very large generators and small power plants often have large cooling towers next to them.

For all other common applications, both residential and industrial, a standard radiator and fan is mounted on the generator and works as the primary cooling system. It is essential to check the coolant levels of the generator on a daily basis. The cooling system and raw water pump should be flushed after every 600 hours and the heat exchanger should be cleaned after every 2,400 hours of generator operation.

The generator should be placed in an open and ventilated area that has adequate supply of fresh air. The National Electric Code (NEC) mandates that a minimum space of 3 feet should be allowed on all sides of the generator to ensure free flow of cooling air.

b. Exhaust System

Exhaust fumes emitted by a generator are just like exhaust from any other diesel or gasonline engine and contain highly toxic chemicals that need to be properly managed. Hence, it is essential to install an adequate exhaust system to dispose of the exhaust gases. This point can not be emphasized enough as carbon monoxide poisoning remains one of the most common causes for death in post hurricane affected areas because people tend to not even think about it until it's too late.

Exhaust pipes are usually made of cast iron, wrought iron, or steel. These need to be freestanding and should not be supported by the engine of the generator. Exhaust pipes are usually attached to the engine using flexible connectors to minimize vibrations and prevent damage to the generator's exhaust system. The exhaust pipe terminates outdoors and leads away from doors, windows and other openings to the house or building. You must ensure that the exhaust system of your generator is not connected to that of any other equipment. You should also consult the local city ordinances to determine whether your generator operation will need to obtain an approval from the local authorities to ensure you are conforming to local laws a protect against fines and other penalties.

6. Lubricating System

Since the generator comprises moving parts in its engine, it requires lubrication to ensure durability and smooth operations for a long period of time. The generator's engine is lubricated by oil stored in a pump. You should check the level of lubricating oil every 8 hours of generator operation. You should also check for any leakages of lubricant and change the lubricating oil every 500 hours of generator operation.

7. Battery Charger

The start function of a generator is battery-operated. The battery charger keeps the generator battery charged by supplying it with a precise 'float' voltage. If the float voltage is very low, the battery will remain undercharged. If the float voltage is very high, it will shorten the life of the battery.

Battery chargers are usually made of stainless steel to prevent corrosion. They are also fully automatic and do not require any adjustments to be made or any settings to be changed. The DC output voltage of the battery charger is set at 2.33 Volts per cell, which is the precise float voltage for lead acid batteries. The battery charger has an isolated DC voltage output that does interfere with the normal functioning of the generator.

8. Control Panel

This is the user interface of the generator and contains provisions for electrical outlets and controls. The following article provides further details regarding the generator control panel. Different manufacturers have varied features to offer in the control panels of their units. Some of these are mentioned below.

(a) Electric start and shut-down – Auto start control panels automatically start your generator during a power outage, monitor the generator while in operation, and automatically shut down the unit when no longer required.

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How Does a Generator Create Electricity?

continues from page 30

b. Engine gauges – Different gauges indicate important parameters. Constant measurement and monitoring of these parameters enables built-in shut down of the generator when any of these cross their respective threshold levels.

c. Generator gauges – The control panel also has meters for the measurement of output current and voltage, and operating frequency.

d. Other controls – Phase selector switch, frequency switch, and engine control switch (manual mode, auto mode) among others.

9. Main Assembly / Frame

All generators have customized housings that provide a structural base support. The frame also allows for the generated to be earthed for safety.

USING GENERATORS TO POWER RESIDENTIAL & INDUSTRIAL APPLICATIONS

While the underlying principle of operation to generate electricity remains more or less the same in all kinds of generators, the mechanism of powering up your application using the generator's electrical output varies a little from one system to the other.

PORTABLE GENERATORS

These are usually used for residential purposes to power a few domestic appliances during an outage or at construction sites that have no source of electrical power required to operate tools like drills, saws and paint sprayers.

You would usually require systems that generate at least 4 kilowatts (kW) of power.

Use of Extension Cords

One of the most economical ways to ensure power supply during an outage is to use extension cords to directly connect a portable generator to power the chosen appliances in your home.

Use of Power Transfer Switch

A safer way to use a portable generator is to have a power transfer switch installed and connected to the main electrical panel of your house. Manual switches are operated through direct manipulation or by using a remotely wired control device. During a power outage, the transfer switch isolates the electrical panel from utility supply and connects it to the generator.

The generator can then be connected to the power transfer switch through an extension cord. Electrical output from the generator can then be fed into circuits through the main circuit breaker and used to power the required circuits. Critical and non-critical circuits of the panel can be grouped individually and separately wired such that the portable generator powers only the critical section as required. Isolating the utility lines from the generator source also eliminates the risk of 'back feed'. Back feed is the flow of electrical power from the generator into the utility lines, which can be fatal to electricians working on utility lines during an outage.

RESIDENTIAL STANDBY GENERATORS

A portable generator is limited in utility since it can power only a few appliances. An emergency residential standby system can be used to deliver power for the entire household and can even keep air conditioners operational during a power outage. You can also choose smaller standby units to power only a few circuits to keep essential appliances like refrigerators, lights and fans running during an outage. These units typically range in power generation capacity from 6 kW to 40 kW.

USE OF AUTOMATIC TRANSFER SWITCH

Standby generators are usually installed outside the home and are connected to the main electrical panel through an automatic transfer switch. The system automatically restores power to the household within about 20 seconds of a power failure without any manual intervention.

COMMERCIAL STANDBY / INDUSTRIAL GENERATORS

Industrial generators are used in commercial facilities such as corporate offices, manufacturing plants, mining operations, nursing homes, data centers, hospitals and so forth that simply cannot afford the risk of discontinuity in business operations during a power failure. These are often stationary units that produce anywhere from 50 kW up to 2000 kW of power. Most smaller and residential generators are single-phase (120 Volts), but commercial generators are almost always three-phase (120, 240 or 480 Volts).

USE OF AUTOMATIC TRANSFER SWITCH

Similar to residential standby systems, commercial standby / industrial generators are wired to the main electrical panel of the building through an automatic transfer switch and are fired automatically during a power outage. These are specially designed such that switching between the primary and secondary sources of power takes only about a fraction of a second and practically allows for seamless supply of power. wn

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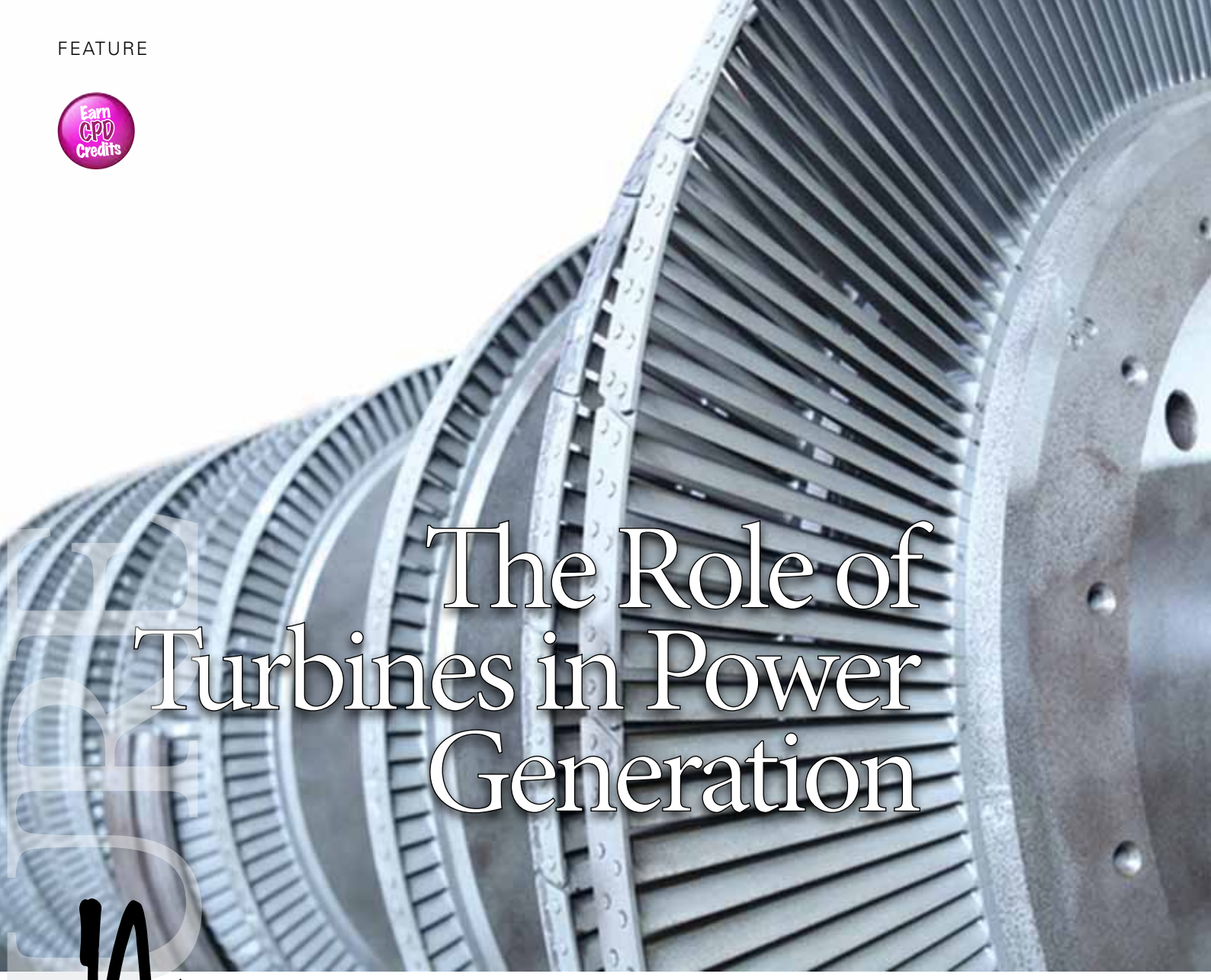

The Role of Turbines in Power Generation

Nearly all of the world's power that is supplied to a major grid is produced by turbines. From steam turbines used at coal-burning electricity plants to liquid water turbines used at hydro-electric plants, turbines are versatile and can be used in a number of applications. There are also gas turbines that combust natural gas or diesel fuel for use in remote locations or where a large backup power supply is required.

A turbine is a simple device with few parts that uses flowing fluids (liquids or gases) to produce electrical energy. Fluid is forced across blades mounted on a shaft, which causes the shaft to turn. The energy produced from the shaft rotation is collected by a generator which converts the motion to electrical energy using a magnetic field.

Most power plants use turbines to produce energy by burning coal or natural gas. The heat produced from combustion is used to heat water in boiler. The liquid water is converted to steam upon heating and is exhausted through a pipe which feeds the steam to the turbine. The pressurized steam flow imparts energy on the blades and shaft of the turbine causing it to rotate. The rotational mechanical energy is then converted to electrical energy using a generator.

A good analogy would be the common practice of heating water in a kettle. When the water is heated to boiling point steam is produced increasing the pressure inside of the kettle. The increased pressure causes the steam to exhaust through the spout at a high rate.

After the steam exits the turbine it is fed to a cooling tower where the steam cools and reverts back to water. You can see this occurring when driving past a power plant and noticing the white plumes of smoke being emitted from large towers. This is not smoke, but rather a product of the hot pipes heating water vapor in the cooler air and generating steam.

Large scale electrical energy production largely depends on the use of turbines.

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A similar turbine design is used to produce hydro-electric power at dams. When water is released from the lake side of the dam to the river side, it is fed across a series of turbines. The high rate of flowing water causes the turbines to turn rapidly where this energy captured and converted to electricity. Energy produced by hydro electric means has the added benefit of not using emission producing fossil fuels which will pollute the air. However, hydro-electric dams do affect the environment in other ways as they can disrupt vulnerable ecosystems that rely on the environment where the dam is built.

There are also other forms of large scale electricity generation, like nuclear and geothermal; however they are still very similar in that they still use turbines to produce the electricity but the water is just heated by an alternative source. Some added risks are involved when using nuclear reactors to produce heat thus limiting their widespread use.

Other smaller scale types of turbines exist to produce power in remote locations or to generate power in areas of the world where a power grid has yet to be established. The advantage of this type of turbine is its high efficiency rating. If the waste heat is recovered by heat exchanger and used to power another generator, in a combined cycle configuration, the efficiency can be as high as 60%. In a cogeneration configuration where the waste heat is recovered and used to for space and water heating, the efficiency can be as high as 90%.

There are numerous other benefits to using a turbine to produce electrical power. Gas turbines produce a large amount of power in a small package. They can be turned on and off on demand and it costs a lot less money and takes a lot less time to build a turbine than it does to build a coal or natural gas burning power plant.

They are also ideal for situations where high demand exists on a power grid for short periods of time, like hot days in the summer, and a turbine is in place to carry the extra load.

Large electrical companies like Siemens and GE manufacture and custom build turbines from 10MW to over 400MW depending on the customer's demands. There are also used dealers and distributors around the world that may have a new surplus or used turbine immediately available that fits your specifications.

The simplistic design, versatility, and efficiency of turbines allow for its widespread use in electrical power generation. When deciding on your power supply, be sure to investigate the use of a turbine if the electrical demand is large enough. wn

Earn CPD Credits

Africa's first aerotropolis in Ekurhuleni: will it foster economic growth?

In September it was announced that a global consulting engineering-led consortium had won the contract to develop the Ekurhuleni OR Tambo Aerotropolis in Gauteng, South Africa.

The aerotropolis concept is now mainstream in aviation planning, and there is little doubt that it has brought substantial economic and social benefits to airport owners as well as local businesses and communities. However, this experience has largely been gained in the airports of Europe and North America. The Ekurhuleni Aerotropolis offers a unique opportunity to apply the lessons learnt at these other airports to develop a truly African solution.

The Aurecon Consortium brings together the best global expertise in the development and implementation of the aerotropolis solution, with an unrivalled understanding of the challenges and opportunities of implementing such a project in South Africa and in Gauteng.

WHAT IS AN AEROTROPOLIS?

Air travel is ubiquitous in modern life not only for passenger travel, but to satisfy our growing need for the just-in-time provision of goods and services. The consequences of this is a dramatic increase in the number and scale of airports, their growth as sources of employment and increase in the consumer base at those airports, together with the growth of the airport as a destination. In modern cities, airports have therefore become major drivers of urban form, economic activity and city competitiveness. The aerotropolis aims to take advantage of these changes and optimise the positive effects the airport can have on the economy and on communities.

Essentially, the aerotropolis is an economic development strategy designed to increase competitiveness in global markets, leveraging the access that air travel and air freight provides to global clients.

Critically, an aerotropolis doesn't involve simply building additional retail stores in an airport terminal or more light industrial parks on the land surrounding an airport. It is about taking advantage of all the economic opportunities an airport offers, reflected at times by new physical infrastructure, but also by alternative retail, entertainment, employment and commercial land uses – and these can stretch out in a radius 30km or more from the airport itself.

THE AEROTROPOLIS IN EMERGING ECONOMIES

With aviation only starting to boom, and routes, passenger numbers and business investment still comparatively low in many emerging countries, is it too early to consider the aerotropolis approach for growing economies?

Airports traditionally develop in a piece-meal fashion. Many of the world's current major airports started as small landing strips in the 1920s and have grown incrementally over time, although not always in a perfectly logical manner. There is extensive evidence to show that a large portion of the cost and development inefficiencies inherent in further developing existing airport cities come from a lack of strategic planning at an early stage. Emerging economies tend to have an advantage here as many of the new airports are taking place as greenfield developments, with relatively modest current infrastructure. Where the opportunity for economic growth exists, early planning will therefore enable that growth to be strategically developed, made more attractive and maximised.

THE AEROTROPOLIS PLANNING PROCESS

Aerotropolis development embraces urban and regional planning, but with a strong focus on how these can be used to enable strategic economic development.

The ultimate goal is to maximise the economic competitiveness, attractiveness and growth of the city and its surrounding region through the identification of the optimal mix of land uses and infrastructure investments. The nature of these investments, how they are financed, where they are made, their timing, how they relate to the broader economy and their alignment with economic and social sustainability, are all key outcomes of the planning process.

The planning process for the aerotropolis in Ekurhuleni will follow a process of information gathering, analysis, scenario planning, evaluation and selection. What matters most is the 'who', 'what' and 'how' included in this process.

WHO

An aerotropolis development plan requires an integrated breadth of input across urban and transport planners, economists, financial and logistics experts, environmental managers, market researchers and strategists.

Africa's first aerotropolis in Ekurhuleni

continues from page 37

Aurecon, a global consulting engineering firm, will lead the multi-disciplinary consortium with the added advantage of extensive experience working on planning and infrastructure projects in the Ekurhuleni locality. This local knowledge is blended with international aerotropolis specialist expertise in research and strategic planning from MXD, and urban planning and branding from RTKL.

Two of Imperial Logistics' subsidiaries are also involved and will lead the integration of logistics and freight studies into the project. Turner and Townsend will contribute specialist PPP and financial advice and the Council for Scientific and Industrial Research, South Africa (CSIR) will provide additional traffic modelling experts.

"What makes this consortium a strong candidate to successfully collaborate on this project beyond the extensive technical expertise, is the collaborative culture and absolute focus on excellence. Aurecon's proprietary tool to be used on this project, HUB-id, is all about recognising the inter-relationship between transport, land-use and economics. When examined together, there is potential to deliver social, economic and environmental benefits. This is at the heart of the aerotropolis solution," says Danie Wium, Aurecon Government Industry Leader.

WHAT AND HOW?

By analysing the trends in demographics and economics, and comparing those with land use and air and surface transportation infrastructure in the project area, the team will need to define so-called economic clusters and distinguish between those clusters that are best served by the current systems (be they infrastructure, economic or cultural); those likely to improve with the already planned regional developments; and those where new or substantial infrastructure is required to make them viable for further development.

One of the challenges of an aerotropolis study is in gathering and analysing a large amount of data and then building a complete picture of the aerotropolis and its current evolutionary path.

The team will make use of a number of high-level tools, such as spatial data analysis systems, sophisticated economic analysis tools and transport modelling and planning systems, to deliver the necessary innovation a project of this magnitude demands. The breadth of information and the sophistication with which it is analysed and integrated will be critical to ensuring that all opportunities are captured and optimised.

CATALYTIC DRIVERS AND OPTIMISING DEVELOPMENT

Inevitably some of the identified economic clusters will have the potential to grow faster than others, while some will further have the potential to facilitate growth across the whole region. These are considered catalytic developments.

By identifying the supplying and supporting industries for economic clusters in the region, and taking into account current realities from the information gathering stage, the team will identify such catalytic clusters.

The team will also need to consider how to maximise the positive impacts of these clusters on the regional economy through leveraging upstream, downstream and cross-over industry activities. By considering how other aerotropoli evolve and how particular economic clusters are supported by those developments, the team will determine which of the region's niche economic clusters could benefit particularly from airport supported economic activities.

Further, by analysing the characteristics of recommended target economic clusters and their supporting industries, the team will then assess how to maximise the effect of these industries. These industries will form the consideration of a Sector Support Plan with investment prioritisations. The team will also look for opportunities to enhance economic and social potential through intensification, adaptive re-use or re-development of strategic land sites as well as the potential for transit-orientated development to create positive momentum for long term community enhancement.

In examining these economic clusters, the specific nature and structure of the Gauteng economy, including the informal sector, will be taken into consideration.

FITTING THE OPTIONS TO THE OBJECTIVES OF EKURHULENI

Ekurhuleni is confronted with certain realities that influence how economic development can best benefit its social objectives. The municipality is home to three of South Africa's seven poorest townships and the hub of South Africa's ailing manufacturing sector. Equally, however, it also hosts the largest airport in Africa, effectively forming the gateway to the continent.

As part of the planning process, a series of development scenarios will be developed and each evaluated to maximise potential benefits, according to the following criteria:

- Demographics – will the planned development adequately address the poverty, skills development and unemployment objectives of the city?
- Proposed land-use – will this be efficient and create an attractive environment?
- Forecasted demand transport facilities– will this ensure the maximum efficiency of movement of people and freight in the region, and within each facility?
- Economic growth – will this ensure the economic wellbeing of Gauteng and Ekurhuleni's businesses and community – from the smallest informal trader to the largest multi-national corporation?
- Predicted CO_2 emissions – how much of an impact on the environment will it have?

TYING IT ALL TOGETHER

Like most planning processes, the aerotropolis study is not a completely linear process and a number of tasks run either parallel or through an iterative cycle throughout the life of the project.

In addition, there are many other activities outside the aerotropolis study, such as logistic and supply projects, financing arrangements and marketing of the development to various stakeholders, that run alongside the very technical aspects of analysis and planning. These are in fact just as important to the project's overall success and it's very much a case of not having any weak links.

"It's a challenging prospect, and a great responsibility, to deliver a project as comprehensive as this.

However, with the amazing team we have assembled, we are confident we can deliver the innovative yet implementable aerotrpolis project that Ekurhuleni deserves, and we're committed to assisting not only the municipality but also the country realise its economic and social potential," says Matt Coetzee, Aurecon Urbanisation Competency Leader.

Please visit www.aurecongroup.com for further information.

Clever technology reduces electricity costs for businesses

Electricity consumption is at the forefront of debate in South Africa as the country's main public utility company, Eskom, struggles to balance the needs of its customers against the maintenance requirements of the system and problems with overall capacity.

The renewed threat of planned rolling blackouts, has made the need to reduce energy usage an even higher priority. As requests are made of businesses to reduce their electricity consumption innovative intelligent technology may hold the key to energy stability; the Powerstar voltage optimisation system is one such technology.

As a market leading voltage optimisation solution, Powerstar allows businesses to reduce their energy consumption without impacting on normal business operations. By lowering the voltage from the varied levels supplied through the national system, sometimes as high as 250V, to the 220V required by electrical equipment, Powerstar reduces energy consumption, cuts carbon emissions and saves businesses money. In addition, this proven and reliable system can protect appliances from dangerous transients, or power spikes of up to 25,000V, and also reduce harmonics.

To achieve the optimum results for each customer, as no two buildings have the same voltage profile or electrical load characteristics Powerstar is available in a range of LV and HV variations, all of which are engineered to match the requirements of each individual site.

The Powerstar team's engineering approach is renowned globally. A full unobtrusive evaluation and site survey, at no cost to the business, will allow a team of Powerstar voltage optimisation engineers to provide a full feasibility evaluation to indicate guaranteed savings, which can be substantial.

Voltage optimisation systems are typically LV solutions, and will be either a fixed or electronic-dynamic (sometimes referred to as variable) solution. A fixed voltage system, such as the original Powerstar, is required for a building that has a stable voltage supply. The Powerstar system reduces the voltage and matches the incoming voltage profile of the site, albeit dropped by a set amount.

Powerstar MAX, An electronic-dynamic, or variable system supplies voltage at a constant level regardless of input instability, a vital feature for sites with critical equipment, high night loads and greater security requirements such as hospitals, data centres, hotels and education facilities.

Sites with their own transformers can benefit further by utilising Powerstar HV MAX an HV voltage optimisation system, enabling optimisation of a building's voltage supply at source before it is distributed into the building.

Powerstar HV MAX combines a super low loss amorphous core transformer with the electronic-dynamic Powerstar MAX voltage optimisation technology, allowing clients to replace their existing high loss transformer, Powerstar HV MAX also negates the needed for a separate voltage optimisation system at the LV side.

Powerstar voltage optimisation systems provide average savings of 12%-15%, and payback periods are typically under 5 years. All savings are 100% guaranteed, reducing any risk of investment and Powerstar is back by a clear and transparent 10 year warranty periods.

Powerstar is a global market leader in voltage optimisation, with a track record or dependency; and demonstrated results from over a decade of installations in which Powerstar has been installed into thousands of sites including landmark installations at Palace of Westminster in London and the Western Australia Parliament building. wn

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Women of Science and Maths

Women have been fascinated by science and mathematics since ancient times.

BY | DUDLEY BASSON

Theano, possibly the wife of Pythagoras, was a pupil and tutor of the Pythagorean School and is said to have run the school after the death of Pythagoras. She not only wrote on astronomy and mathematics, she also worked in areas of physics, medicine and child psychology. Her work *"Life of Pythagoras"* has been lost. She also worked on the theorem of the *"Golden Mean"* and theory of numbers.

Since the Golden Age of Greece, women aspiring to higher learning have been sternly frowned upon and this male chauvinism has persisted until quite recent times. Girls were expected to busy themselves with accomplishments such as cooking, needlework, music, art, letter writing, and of course, child care. This has all changed. Currently it is estimated that 9,2% of all professors are women. Girls are given every encouragement to pursue careers in science, engineering and mathematics as well as in all other academic faculties. When the word *"scientist"* was coined, as opposed to *"man of science"*, it referred to a Scottish lass, Mary Somerville. The girls can do it.

We take a look at a few selected cases of women who succeeded brilliantly in their chosen fields, despite in some cases, severe opposition and rejection.

ÉMILIE DU CHÂTELET (1706-1749)

Gabrielle Émilie le Tonnelier de Breteuil received extensive training and tuition as a child. She was accomplished in horse riding, gymnastics and fencing and by the age of twelve was fluent, in addition to French, in Latin, Italian, Greek and German. She also received tuition in mathematics, literature and science. She must have seemed a formidable target to suitors who had a mind to woo her. She could also play the harpsichord, sing operatic arias and took part in amateur acting. Émilie's father, recognizing her brilliance, arranged for Fontenelle, secretary of the *Académie des Sciences*, to give her tuition in astronomy while only ten years old. As a teenager she was frisky and flirtatious and would use her mathematical skills to make money at gambling, which she spent on books. Once, when she suffered a huge loss at the table, she devised a clever scheme of derivatives to settle the debt. Aged nineteen, she married the Marquis Florent-Claude de Chastellet. This arranged marriage conferred on her the title Marquise du Chastellet. Later she would change her name, on the suggestion of philosopher Voltaire, to Châtelet.

In 1733 she resumed her mathematical studies under the tutorship of renowned mathematicians Moreau de Maupertius and later Alexis Clairaut. Maupertius and Euler were both students of Johann Bernoulli. Émilie and the Marquis had three children, one of whom died as a toddler. Émilie invited philosopher Voltaire to live in her country house at Cirey-sur-

Blaise, where he became her long-time companion under the eyes of her tolerant husband. At the time, it was acceptable for ladies of social standing to have lovers without interference from their husbands.

Émilie clarified the concept of kinetic energy, showing that it was proportional to the square of velocity, which was not adequately dealt with by Newton. Lord Kelvin later coined the English term, 'kinetic energy'. In 1737 she published a paper titled *"Dissertation sur la nature et la propagation du feu"* which deals with light and infrared radiation. She entered this work in a competition arranged by the *Académie des Sciences* but the prize went to Euler. She also published several other dissertations and the book *"Institutions de Physique"*, but her major work was the monumental translation of Newton's Principia.

Not only did Newton write it in Latin (as was customary for academic work), he also used a cryptic style to discourage 'dabblers' from reading his work. The frontispiece of her translation shows Émilie as a muse, holding a mirror, reflecting Newton's heavenly insights down to Voltaire seated at his desk. Émilie's translation and introduction remains to this day the standard French translation of Newton. During her lifetime, she was probably the only woman of great intellectual stature in all of France.

In May 1748, Émilie began an affair with poet Jean François de Saint-Lambert that resulted in a pregnancy. Her son strongly disapproved of the pregnancy. Émilie had a fateful premonition that she would not survive another childbirth and made a special effort to complete the scientific work with which she was busy. She died aged 42 from a pulmonary embolism resulting from childbirth complications. Present at her death were her husband Florent-Claude, lover Voltaire and the child's father, de Saint-Lambert. This scene must have had the extreme emotional tension of a Greek tragedy.

CAROLINE HERSCHEL (1750-1848)

Caroline Lucretia Herschel and her brother, astronomer, Sir William Herschel were two of eight children born to Isaac and Anna Herschel living in Hannover. At the age of ten, Caroline was struck with typhus, which stunted her growth so that she remained permanently of unusually short stature. Her mother despaired of her ever marrying and thought that she should prepare for a life as a housemaid. Her father however gave her direct tuition and included her in her brother's lessons so that she would eventually be able to properly support herself. After her father's death, Caroline accompanied her brother to his house in Bath, Somerset, England, where she would assist him with his musical career and also learn to sing.

William had established himself as an organist and music teacher. He was also the choirmaster of the Octagon Chapel. Caroline became principal singer at William's oratorio concerts. When William's interest turned to astronomy, Caroline continued to assist him and became herself a significant astronomer. When William married a wealthy widow in 1788, Caroline became more independent, working on her own astronomical projects. Caroline became skilled at polishing mirrors and mounting telescopes and also acquired the ability and precision to record, reduce and organize her brother's astronomical observations. Caroline discovered several comets, including the Encke comet and also a companion galaxy to the Andromeda galaxy. She was delighted to receive an annual salary of £50, as her brother's assistant, granted by George III.

William discovered that an object, which had, several times before been recorded as a star or comet, was in fact a planet, and named it Georgium Sidus, in honour of King George III. This name was not popular outside Britain and the planet became known by the name Uranus, proposed by astronomer Bode.

Caroline was awarded a Gold Medal from the Astronomical Society of London for her reduction of the 2 500 nebulae discovered by her illustrious brother. This was considered *"unparalled in importance and magnitude in the annals of astronomical labour"*. The Royal Astronomical Society elected her an Honorary Member in 1835, along with Mary Somerville – the first women members. Caroline was also elected as an Honorary Member of the Royal Irish Academy in Dublin. Aged 96, she was awarded a Gold Medal for Science by the King of Prussia.

The listed Georgian Herschel house in Bath stands to this day and is now the Herschel Museum of Astronomy.

SOPHIE GERMAIN (1776-1831)

Sophie's interest in mathematics started when she was thirteen years old. The Bastille had fallen and she had to remain indoors

Women of Science and Maths

continues from page 43

to avoid the revolutionary activities in the streets of Paris. She turned to her father's library and was intrigued by Montucla's *L'Histoire des Mathematiques* and the death of Archimedes, who could not be disturbed from his maths, even when threatened by a Roman soldier. She pored over all the maths books in her father's library and even taught herself Latin and Greek to be able to read the major works.

Her parents were horrified at these activities, and tried to prevent her from studying by putting out the fire in her room at night and taking away her clothes. Sophie had candles hidden away and wrapped herself in the bedclothes to study by candle light. When her parents found her asleep at her desk one morning, ink frozen and her slate covered in calculations, they relented. When Sophie was 18, the *École Polytechnique* opened. As young woman she was barred from attending but the lecture notes were available to all who asked. Students were also required to submit written observations. Sophie obtained the lecture notes and sent her work to faculty member, the famous mathematician Lagrange. She used the name of a dropped out student M Antoine-August Le Blanc. When Lagrange saw the quality of her work, he requested a meeting, which forced her to reveal her identity. Lagrange did not mind at all and became her mentor.

In 1798, Sophie became interested in number theory when she read an essay by mathematician Legendre. She continued with her number theory reading the monumental work *Disquisitiones Arithmeticae* by Gauss. Gauss, one of the greatest mathematicians of all time, thought highly of Sophie's work. To Gauss's astonishment, he learned from General Pernety, that Sophie had played a key role in saving his life during the Napoleonic invasion of Prussia. Gauss did not even know who Sophie was as he only knew her as Monsieur le Blanc. He had nearly suffered the same fate as Archimedes.

Sophie took an interest in a competition sponsored by the *Académie des Sciences* to find a mathematical theory of the vibration of an elastic surface. Sophie began work in 1809 and submitted her paper in 1811, which unfortunately did not win the prize. The contest was extended by two years but her attempt was again unsuccessful. The contest was again extended and Sophie submitted her third paper, *"Recherches sur la théorie des surfaces élastiques"* on 8 January 1816, and became the first woman to win a prize at the Académie des Sciences. Her final differential equation was as follows:

$$N^2\left(\frac{\partial^4 z}{\partial x^4}+\frac{\partial^4 z}{\partial x^2 \partial y^2}+\frac{\partial^4 z}{\partial y^4}\right)+\frac{\partial^2 z}{\partial t^2}=0$$

Even after winning the contest she was not able to attend the sessions as the only women allowed were the wives of members. Seven years later this tradition was broken when she made friends with mathematician Joseph Fourier (of 'Fourier series' fame), a secretary of the Academy, who obtained tickets for her.

Sophie continued with her work on number theory and made a considerable contribution to the proof of Fermat's Last Theorem. Euler had managed to prove Fermat's theorem for the case n=3, but Sophie managed to prove the theorem for a class of numbers which became known as Germain primes. Dirichlet and Legendre managed to prove the theorem for the case n=5 and Lamé made ingenious additions to Sophie's method to prove the case for n=7. Sophie's remarkable proof is considered to be her greatest achievement. Fermat's theorem would have to wait 358 years for the final proof by Andrew Wiles. Sophie also studied philosophy and psychology. Her philosophy was highly praised by Auguste Comte.

MARY SOMERVILLE (1780-1872)

Mary Fairfax was the daughter of a naval officer who would become Vice-Admiral Sir William George Fairfax, and his second wife Margaret Charters. Mary was born near Jedburgh where her mother broke her journey on her way to the family home in Burntisland, County Fife, Scotland. Mary's brothers were given a good education but there seemed no need to educate the daughter, who was taught to read by her mother, but no need to teach her how to write. When she was ten years old and her father returned from sea, he was appalled by her lack of education and sent her to a boarding school in Musselburgh, along the Firth of Forth, not far from Edinburgh, for a year. This was less than successful and Mary remarked on leaving: *"I felt like a wild animal escaped out of a cage"*. Mary began to read every book that she could find in her home but her family disapproved of

this unladylike occupation. She was sent to a school in Burntisland where she was taught needlework. When Mary, visiting Jedburgh, told her uncle that she was teaching herself Latin, he encouraged her and the two would read Latin together before breakfast. Mary also learned to play the piano and was given lessons in painting by artist Alexander Nasmyth. When Mary heard Nasmyth explain to another pupil that Euclid's Elements formed the basis for understanding perspective, as well as astronomy this started her off to study Euclid with the help of her younger brother's tutor. She also became interested in algebra and became so engrossed in mathematics that her parents feared that it would '*injure the tender female frame*'. Social life was strongly encouraged, where Mary enjoyed parties, visits, balls, theatres and innocent flirtations.

Aged 24, Mary married Samuel Greig in 1804, an officer in the Russian Navy who was distantly related to her mother. He died three years later after Mary had given birth to two sons, one of who died young. She returned to Scotland with her surviving son and had a circle of friends who strongly encouraged her interest in mathematics and science. Mary entered into a correspondence with William Wallace, professor of mathematics at the Royal Military College at Great Marlow. They discussed problems set in the *Mathematical Repository* and Mary received a silver medal for her solution to one of these. Mary read Newton's *Principia* and Laplace's *Mécanique Céleste* and many other texts.

In 1812 Mary married William Somerville, an inspector of hospitals, who was supportive of her interest in science and her desire to study. They had four children. She read the most advanced French texts of the day, studied botany, mineralogy and improved her knowledge of Greek. Mary's husband was elected to the Royal Society and when they moved to London they moved in the leading scientific circles of the day. Their friends included George Airy (Astronomer Royal), John Herschel, William Herschel, George Peacock and Charles Babbage. They frequently went to Babbage taking an interest in his marvellous calculating machines. Mary helped and encouraged the daughter of family friend Lady Byron, Ada Lovelace, with mathematics and her work with the Babbage calculating machine.

Mary was invited by the Society for the Diffusion of Useful Knowledge to translate Laplace's *Mécanique Céleste*. The result was a triumph. Titled '*The Mechanism of the Heavens*' it explained in detail the mathematics of Laplace, which was not well understood in England at that time. Laplace remarked that Mary and Caroline Herschel were the only women who ever understood his work. She went to Paris in 1832 where she renewed old friendships with the mathematicians there. In another book, her discussion of a hypothetical planet perturbing Uranus, led to the eventual discovery of Neptune.

Mary was elected to the Royal Astronomical Society in 1835, together with Caroline Herschel, also to the Royal Irish Academy and granted an honorary membership of the *Societé de Physique et d'Histoire Naturelle de Genève* in 1834. She was awarded a civil pension of £200, which was increased by Prime Minister Lord Melbourne to £300. Mary spent her last years in Italy where she wrote many more works, some of which influenced Maxwell. Her most successful book 'Physical Geography' would be widely used by schools and universities for half a century.

ADA LOVELACE (1815-1852)

Augusta Ada Byron was the daughter of poet Lord Byron and Anne Isabella (Annabella) Milbanke – their tempestuous marriage ended soon after Ada's birth. Annabella fled with her child fearing for her husband's sanity and her own safety. Ada was the only legitimate child of the poet. Byron had a notorious affair with Lady Caroline Lamb (née Ponsonby), wife of British Prime Minister, Lord Melbourne. Annabella tried to shield Ada from knowing about the depraved lifestyle of the father that she never knew. Ada later suspected and eventually confirmed that her father was also the father of her cousin Medora Leigh. Ada was frequently in poor health as a child. Annabella had a notion that learning mathematics might reduce the risk of Ada inheriting any insanity from her father.

Women of Science and Maths

continues from page 45

William Frend, William King and also friend of Annabella, the renowned researcher and scientific author, Mary Somerville, privately schooled Ada in mathematics and science. Ada and her tutor Mary became close friends and corresponded for many years. Other acquaintances included: Andrew Crosse, David Brewster, Charles Wheatstone, Charles Dickens and Michael Faraday. Mary introduced Ada to Charles Babbage in 1833, which marked a turning point in her life. Babbage invited Ada to see the prototype of the Difference Engine. Ada became fascinated with the machine and used her relationship with Mary to visit Babbage as often as she could. Mary and Ada were fascinated by the possibilities of the Babbage Analytical Engine. Babbage saw his machine as a means of quickly performing complex and time consuming computations but Ada had a vision of a capability beyond number crunching. The first task envisioned for the machine was the computation of Bernoulli numbers. Ada prepared an algorithm for performing this complex task becoming the first computer programmer.

Babbage required large numbers of precision parts for his machine, which he obtained from Engineer and philanthropist Sir Joseph Whitworth, who claimed that he could measure to one millionth of an inch. He developed the three-plate method of obtaining perfectly flat surfaces. Gears had to be made in mating pairs as interchangeable parts were not possible at the time. Joseph Whitworth is renowned for his development of the Whitworth Sharpshooter Rifle (with hexagonal bore) and the well-designed BSW (British Standard Whitworth) screw thread, which came into widespread use in many countries. Even metric engineering drawings in Germany would sometimes specify BSW bolts.

Babbage joined the influential and advanced literary circle of Harriet Martineau, which included: Charles Darwin, George Eliot, Florence Nightingale, Charles Dickens, Thomas Carlyle, Thomas Malthus, William Wordsworth and Charlotte Brontë.

Using a computer processor consisting of a mechanical gearbox may now seem bizarre, but it must be remembered that in the first half of the 20th century, mechanical calculators were ubiquitous in countries worldwide. They were used in every branch of science and engineering and countless other applications such as land surveying, astronomy, accounting – the list is endless. The use of logarithmic tables for multiplication and division as well as exponential calculations was widespread and there were also trigonometric and log-trigonometric tables available. For calculations where three or four significant digits were adequate, the slide rule was commonly used. These had log scales for multiplication and division and the more elaborate models also had trigonometric scales, and log-log scales for exponential calculations. Small circular slide rules were also available which looked like fob watches – the first pocket calculators.

The Babbage Analytical Engine was never completed. His earlier machine, the Difference Engine, was completed posthumously in 2002. Babbage died in 1871. The basic architecture of the machines was similar to a modern computer. The data and program memory were separated, operation was instruction based, the control unit could make conditional jumps, and the machine had a separate I/O unit. Ada had made copious notes of how the machines would function and also of the difference between the Analytical Engine and the original Difference Engine. Babbage was impressed by Ada's intellect and analytic skills, calling her *"The Enchantress of Numbers"*. She was also skilled in differential equations. In 1844 she commented to Mary Somerville's son, barrister Woronzow Greig, about her desire to create a mathematical model for how the brain gives rise to thoughts and nerves to feelings.

Ada married William King in 1835 becoming Baroness King. When her husband became Earl of Lovelace in 1838 she was then styled *"The Right Honourable the Countess of Lovelace"*. Annabella , her mother, became Baroness Wentworth in her own right in 1856.

LISE MEITNER (1878-1968)

It is astonishing that a shy Austrian girl would become the originator of epoch making discoveries that would influence the future of science and the course of human history.

Meitner's parents placed great value on education and gave her a private tutor as secondary schooling for girls was not fashionable at the time in Vienna. She entered Vienna University in 1901 where she could study her two passions, mathematics and physics, under the famous and inspiring (albeit tragic) professor Ludwig Boltzmann.

She received her doctorate in 1907. When Lise went to work at the Kaiser Wilhelm Institute in Berlin she had to initially work in a basement room as women were not permitted to set foot in the Institute. The Kaiser Wilhelm Institute would later be renamed the Max Planck Institute.

Meitner worked with Otto Hahn for thirty years until political rumblings, that would eventually engulf the world in war, worsened. Lise became a target for anti-Jewish discrimination, and Hahn shamefully claimed credit for her achievements. As a matter of political expediency, Hahn requested Meitner's dismissal from the institute. In order to avoid arrest, Lise had to leave Germany quickly without travel documents.

She was spirited away by train, assisted by Dirk Kostner, to Holland using a lightly travelled route. Wolfgang Pauli remarked: "*You have made yourself as famous for the abduction of Lise Meitner as for the discovery of hafnium*". Hahn could not continue without Meitner's assistance and continued to seek her advice after she had fled to Stockholm in 1938.

In December of 1939, Lise and her physicist nephew Robert Otto Frisch explained and named '*nuclear fission*' using Bohr's '*liquid drop*' model of the atomic nucleus. When Frisch rushed to Copenhagen to tell Bohr of his aunt's discovery, Bohr exclaimed: *"Oh! What idiots we have all been! Oh, but this is wonderful!"* Frisch and Bohr proved Meitner's ideas experimentally in Copenhagen after which Frisch and Meitner published a paper explaining 'fission'. These results were immediately confirmed around the world.

Meitner was invited to join the Manhattan Project but declined saying that she would have nothing to do with developing a bomb. One of the modest Meitner's famous remarks: *"I am not important: why is everybody making such a fuss over me?"*

Meitner and her nephew Frisch were both pianists of modest accomplishment and would on occasion play piano duets together. They had a standing joke that *"allegro ma non tanto"* meant "fast, but not auntie".

Meitner became a visiting professor at the Catholic University in Washington DC and also lectured at the Bryn Mawr (Welsh – big hill) women's college near Philadelphia.

After her retirement she moved to a cottage in Cambridge, England where she remained until her death in 1968. Her gravestone bears an inscription composed by her nephew Frisch that reads: "*Meitner – a physicist who never lost her humanity*".

Meitner never married but possibly a great comfort during her life was the constant friendship of such great people as Niels Bohr and his wife Margarethe, Max Born, Max Planck, Wolfgang Pauli, James Chadwick and Albert Einstein. The great loves in her life were music and walking in the Austrian mountains.

GRACE HOPPER (1906-1992)

Grace Brewster Murray had a remarkable curiosity to know how things worked. Aged seven she dismantled seven alarm clocks to see the inner workings. She had a distinguished academic career: in 1928 a bachelor's degree in mathematics and physics at Vassar, a master's degree at Yale in 1930 and a PhD in mathematics from Yale in 1934. She was promoted to associate professor at Vassar in 1941.

Grace married New York University professor Vincent Foster Hopper in 1930. Grace had a distinguished career in the US Navy, rising to the ranks of Captain in 1973, Commodore in 1983 and Rear Admiral in 1985. The US Navy destroyer USS Hopper is named after her. She also received a glittering list of military awards and medals.

Programming early computers was notoriously difficult, as they had to be programmed with elementary machine instructions. Hopper believed that computers could be programmed in

Leadership

(or lessons from the battlefield)

General George Patton was once asked how he managed to win so many battles. He replied, "I'm a General, I plan battles, corporals win them"

BY I ISCOR APPIE – GEOFF CARTER

The profundity of that statement is probably lost on most of us unless you really think about it very carefully.

Well, you might ask, what does it have to do with me and what I do in this industry?

It is a fact that some of us are generals, some of us are corporals and some of us are troopers. Not everybody can be a general. That should be a position reserved for the real leaders among us. Some of us think we can be generals.

In my opinion, there are three dimensions to being a manager. A manager needs to be in the first instance a leader, then a strategist, and finally an administrator.

A senior manager is required to deal with a very abstract environment. His information system depends on stimuli from a very wide perspective such as the market place and the world trade environment, to name but two. He needs to be able to interpret the information and then to decide how best to steer his company. In other words, he decides if there is going to be a battle, where and how that battle will be fought, and Oh Yes! Who will fight the battle and how best to motivate them to win.

The lower to middle management levels deal with a much more structured information environment. The lower down you go, the less you get the opportunity to take big decisions. At the very lowest level you are simply following orders.

Our general, having formulated his plan, now gives it to his staff to fill in the detail and brief the troops. He sends a very inspirational message to everybody and sends them off to die while he retires to his bunker at the local golf club to await news of the victory... right?

"No!" you scream, throwing your hands in the air in horror.

I would love to say that your horror is misplaced. Unfortunately I have to report that in my experience some "generals", are not generals at all.

I have had the privilege of working for some of the top leaders of men. Two such men were household names in a time when we were a lot younger and some of us were running around in uniform.

I have also had the pleasure of working under a number of excellent leaders in the engineering industry. I know what the genuine item looks like...

Sometimes, a moment of self introspection and reflection on the part of some of those in management positions might show them into which one of the following categories they fall.

- Manager
- Administrator
- Bully and Coward

The best managers are the best strategists and leaders of men.
Anybody can administer. We need three things to administer, a time line, a budget and a cupboard full of stationery. As long as we are operating within the budget and timeline, our project/company is working. Maybe.

It is when things start to go a little pear shaped that we see the other qualities being displayed.

Women of Science and Maths

continues from page 47

easily readable format by the use of *"compilers"* which could translate high level programming instructions into machine code. The first language developed for the Univac was called FLOW-MATIC. This would be developed into COBOL (Common Business Oriented Language). Another high level language developed was called FORTRAN (Formula Translation), which looked very similar to mathematical notation and could be easily read. Even programming in machine code was facilitated by the use of *"assemblers"* which allowed programming by easily remembered mnemonics which represented elementary machine instructions. The ability to automatically incorporate standard portions of code (macros) greatly facilitated programming.

COBOL was a beautifully designed programming language. The computer instructions were ordinary English words making it easy to read and document. It had excellent file handling and file layout features and key parts of the data layouts and other parts of the programs could be specified to be copied from a copy-library for system wide standardization. For more specialized work, FORTRAN subroutines could be called for mathematical work of any complexity.

Assembly language subroutines could be called for specialized text validation, encryption etc., and for specialized typesetting for advanced laser printing. Subroutines could also be used for accessing databases and network applications. COBOL was for decades a major programming language around the globe.

Some twenty-five years ago an article appeared in a computer journal titled: *"Dad's Army of COBOL programmers marches to oblivion"*. This was indeed the writing on the wall for COBOL. Since then computer science and technology have changed and advanced more spectacularly than any other endeavour in human history.

Grace was interred with full military honours in the Arlington National Cemetery. wn

Leadership

continues from page 48

The bully is easy to identify. He runs around shouting at the top of his voice blaming the situation on anybody and everybody he possibly can. Usually his frustration and anger are directed at those working under him.

His emails are carefully copied to all the managers more senior to him when he issues warnings and instructions to those under him. He is usually surrounded by "yes-men" In other words he practices the old principle of CYA to perfection. And while doing this, he does one other thing to perfection……he de-motivates his staff. They fear him...

The administrator is a little more difficult to identify. However, he can be found running around frantically pointing out the problem repeatedly to everybody and expecting somebody else to solve it. He is benign as far as his staff members are concerned and they don't usually view him as being a threat until it is too late. He is usually an appeaser and will do so both upwards and downwards until pressure is brought to bear on him from above. He then strikes like the proverbial puff adder. He does not motivate staff... they don't respect him.

The manager is very easy to identify. He leads from the front. When he enters a room, his presence is felt. When he speaks to you, you feel as if you are the most important person in the room.

If you are asked to perform a task, you would rather die than have to go back and tell him that you are going to fail, simply because he asked you so nicely.

I have always found that these people are very effective communicators. They will go to great lengths to give you all the information you require to do what it is they require. They will set the goals for you and then leave you to perform. The parting words are words of encouragement.

Should you fail, they will have no hesitation in discussing your genetic heritage with you, discussing your problem with you, setting you right and leaving you again with words of encouragement. It is rare that somebody does not respond positively to this type of treatment. They recognise when an employee is doing his best and reward it. People do not only work for money. A sincere word of thanks and a "Well Done" will very often suffice and serve to motivate people. He motivates staff and they love him.

In today's world of financially driven business models, it is becoming easier and easier to ignore the human element. It is also becoming increasingly clear that to do so spells disaster for an organisation. The leaner and meaner an organisation is the more they seem to survive on hyperbole and cliché.

Let there be no doubt that money is the prime mover of business and one cannot get away from that. If you aren't making enough, you will have a group of financially embarrassed staff members hugging each other as they pass in the corridors.

Nobody in his right mind wants to be treated well by a bankrupt company. But it is a lot of fun working for a successful manager in a company that works well and is financially secure. When you go on annual leave you don't have to leave while wondering if your job will still be there when you get back.

When I deal with an organisation where members of staff tell me they have 20 years of service and wouldn't think of leaving, the company is usually a happy one. When I walk into companies where the drivers and motivators are only financial ones, the company is an unhappy one where most staff have less than five years service.

The true colour of a man is displayed in his reaction to a crisis. The successful companies all tuck up under the communal shield like a Roman Legion in phalanx formation attacking a fortification and just shove push and heave their way through the crisis. This behaviour is largely dependent on the behaviour of the leader.

Will your company tuck up under the shield and attack, or will they jump ship and leave you attacking on your own supported only by a few sycophants clinging to your coat tails? wn

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Working in a fast paced project environment where senior engineers have very little time to explain the details of the work, questions are usually answered with this brief statement: "refer to the standard if you are unclear". So many young engineers therefore begin their careers by following a collection of ideas that were approved by group of "wise old men" and documented in the form of a company, national or international technical standard. These standards become a big part of every engineer's professional career and, as with most other standards; many people don't bother to understand the reasoning behind them.

As part of a search for more insight into technical standards, I was recently awarded the opportunity to attend the 2013 IEC general meeting hosted in New Delhi, India. This was as a delegate of the South African National Committee of the IEC, takeing part in the IEC Young Professionals Programme. This programme was established by the IEC to familiarise young professionals with the world of electro-technical standard, with the aim of developing a new younger generation of standardisation experts.

Through a series of workshops, presentations and participation in Technical Committee meetings, I not only learned about the processes and activities of the IEC, I but also started realising some fundamental truths about standards and standardisation. I realised what a vital role standards play in our everyday lives, and why it is important to develop and maintain these standards for civilisation to prosper. To explain these truths I will discuss a few of them through some everyday examples.

WHAT IS A STANDARD?

A standard is defined as "A principle or example or measure used for comparison. "Technical standards are therefore considered by a lot of people as a "cookbook" providing a specific recipe for working effectively with technology and to measure the work accordingly. For me a better understanding of standards comes from one of the very first standards we learn as babies – our language.

When you compare standards to a language (or visa-versa) a lot of relationships can be drawn between the two. The origin of language came from a need for humans to communicate ideas, warnings and instructions in the form of "words" to interact with other humans. Over many years many people (considered to be experts) started agreeing on specific words and the structuring of these words until

A Young Professional's guide to Technical Standards

As a young professional starting my new electrical engineering career on one of the biggest projects in South Africa's history, I found myself thrown into the deep end of the engineering world with many other young professionals.

BY I GERHARD BROWN
SOUTH AFRICAN DELEGATE AT THE IEC YOUNG PROFESSIONALS PROGRAMME 2013

they became accepted as a language. This concept is similar for technical standards, the only difference being that the "words" used are the ideas, warnings and instructions relating to technology, which experts deem necessary to share with the world.

STANDARDS ARE A CHOICE

A common misperception is that technical standards contain rules or laws that have to be followed when working with a specific technology. Just as there are between 6000 and 7000 languages spoken in the world that the speakers can choose to speak at any time, there are technical standards available that are developed by many standardisation bodies. Technical standards are usually written in a way that leaves room for interpretation and therefore allows more freedom when they are applied in practice.

Even though some institutes or countries can prescribe standards as part of their rules or laws, the implementation of standards are always considered voluntary by the experts who develop them. Just as no one is forced to speak a certain language at any time, and speaking a language everyone understands is more effective than speaking one no one understands (or one you made up yourself), technical standards are voluntary tools users should use to allow them to work better.

STANDARDS KEEP US SAFE

One of our core human survival instincts is to warn others of potential threats we observe. It is due to this instinct that we surround ourselves today with hundreds of warning signs, alarms and signals, to help us survive in a modern world with all its risks. Although many risks are obvious, complex things such as technology have many complex hidden risks that are not so obvious to the average observer. We therefore rely on experts to identify these risks for us and to warn us and protect us from them.

Technical standards play a vital role in our protection from these threats. If a power cable does not comply with the safety standards that were

A Young Professional's guide to Technical Standards

continues from page 53

specified by power cable experts, the risk of electrical shock or even fire would be something that every person would have to prevent themselves or live with every day. Thanks to the many safety standards, that have become laws in many countries, we can live with peace of mind that we will be safe when we turn on the toaster in the morning.

STANDARDS GIVE US VALUE FOR OUR MONEY

I am sure that many of us have, at some point in our lives, bought something for a real bargain price, only to find it failed after a short while. Quality standards make sure we don't have to sit with that awful feeling of being ripped off. In simple terms, a product which conforms to a quality standard will do what it is supposed to do, at least for a reasonable amount of time before it fails. Experts determine these quality aspects though tests and studies, and quality assurance teams verify whether products meet these standards, by putting them through similar tests.

Unfortunately quality comes at a price. Quality tests cost money and conformance testing by independent institutes (such as the SABS) can be very expensive. Products that have passed these quality checks are therefore often more expensive than their cheaper untested counterparts.

STANDARDS HELP US TO WORK TOGETHER

Any good self-appointed handyman has, at some point in is his life removed the electrical wires from a battery charger, or a similar device, and rewired them into another plug (or directly onto the battery terminals) because the charger plug didn't fit into a device.

Just as a person cannot live a normal live without interacting with other people, many technology products are designed to be used in systems with others. A problem arises when these products' interfaces do not "speak the same language". This often leads to re-engineering of the product which compromises its safety and quality.

Inter-operability standards ensure that products which can be used together in systems will have common interfaces. Most of these interface standards apply to physical components such as plugs or terminals.

However more complex software interface standards are being developed as the world moves towards implementing computers in their products. This fact has greatly increased the demand for experts in both hardware and software systems to become involved in standards development.

STANDARDS MEAN BUSINESS

One of the things many people don't realise about standards is the potential they have to make money. As a great example of this fact we need only consider our annual holiday season. From early December (and is some cases as early as August) stores and shopping malls start decorating their windows and aisles with all sorts of lights, reindeer and guys in red suits.

Everybody then suddenly rushes to these stores to buy expensive gifts, fake trees and vast amounts of food and sweets they usually never eat at any other time of the year. Christmas has become a holiday where hundreds of little voluntary standard practices have become the norm, and businesses are making millions out if these "Christmas Spirit Standards".

In a similar manner companies around the world are working hard to get their technology products and practices approved as standards, and to keep their technical standards as the industry norm. When a technology standard gets accepted, more people will spend money on implementing this standard. This will mean more business for companies that develop the standardised technology, and less for the ones that don't.

Whenever similar technologies enter the market, such as the Betamax and VHS video tape formats did in 70's, investors have to decide which technology horse they will back for the race. In this case VHS became an accepted standard, and that caused the companies which had supported Betamax to change. and lose a lot of money in the process.

VHS developers, such as JVC, in turn made big profits from having their technology as a standard. It is for this reason that so many companies and countries invest and contend to have their experts as representatives in standardisation bodies which determine national and international standards.

STANDARDS MUST EVOLVE

One of the big problems that come with implementing a technical standard, especially as a "recipe" for working with technology, is that the users of that standard can start following the standard blindly without any regard of the purpose or motivation behind the standard.

In a world where technology advances on a daily basis, this problem can lead to redundant standards being implemented at great cost to the companies that implement them.

As a great example of this, just ask yourself how many times you have used the Scroll Lockbutton on your keyboard lately.

Another problem that is the topic of many debates is the concern that technology standards hamper innovation. An issue that has become very evident in large corporations which force their engineers to solve problems, by implementing technical standards in an effort to increase production, instead of using their own creative ideas.

International standards organisations such as the IEC have recognised these concerns and are addressing them by making the evolution of standards part of their standardisation processes. In doing this, these organisations invite engineers and experts from industry who are using these standards in practice to apply their ingenuity when looking at existing standards to identify discrepancies or redundancies.

They can then propose updates to these standards when required. Experts working on, and approving these standards, are also required to revisit their approved standards on a regular basis to insure that they are up to date with the advances in technology.

STANDARDISATION NEEDS YOU!

When the words technical standards or standardisation are used, most people associate them with long boring documents that have to be studied and followed in order to complete a task.

In my experience technical standards are more than just a tool used to perform a task. Technical standards are a language used by specialists and experts in a specific technology to work together more effectively. Any person that who considers himself/herself a professional, should not only learn and understand the technical standards relating to their field, but should also work to improve the standards, by involving themselves in standardisation activities.

The most important goals of standardisation is to simplify and optimise the way we work. By learning to speak the standardisation language, we can all contribute to a better world. wn

SAIEE members and other technical experts wishing to become involved in the technical committee work of the South African National Committee of the IEC, should contact the National Secretary: email paul.johnson@sabs.co.za

BY I DU TOIT GROBLER
INTPI(SA)(EE), PRING(EE), PRDIPLING(EM), BSC(ING) (ELEK)(PRET), FSAIEE, SMICMEESA

"Decades of Engineering Excellence" is a 216 page hardcover prestige coffee table publication of the Engineering Council of South Africa.

"Decades of Engineering Excellence"

South Africa has a three tier system education starting with primary school, followed by high school and tertiary education in the form of (academic / traditional) universities, universities of technology and colleges for further education and training (FET).

All South Africans have the right to a basic education, including adult basic education and further education. According to the Bill of Rights of the country's Constitution, the state has an obligation, through reasonable measures, to progressively make this education available and accessible. South Africa has one of the highest

rates of public investment in education in the world. At about 7% of gross domestic product and 20% of total state expenditure, the government spends more on education than on any other sector.

THREE BANDS OF EDUCATION

The National Qualifications Framework (NQF) recognises three broad bands of education: General Education and Training, Further Education and Training, and Higher Education and Training.

School life spans 13 years or grades, from grade 0, otherwise known as grade R (reception year), through to grade 12 (matric). General Education and Training runs from grade 0 to grade 9.

Under the South African Schools Act, 1996, education is compulsory for all South Africans from the age of seven (grade 1) to age 15, or the completion of grade 9.

General Education and Training also includes Adult Basic Education and Training, which is available to adults who want to finish their basic education.

NQF LEVELS – SKILLS PORTAL

The objectives of the NQF framework are to:

- Create an integrated national framework for learning achievements
- Facilitate access to, and mobility and progression within education, training and career paths
- Enhance the quality of education and training
- Accelerate the redress of past unfair discrimination in education, training and employment opportunities
- Contribute to the full personal development to each learner and the social and economic development of the nation at large.

The NQF levels run from Adult Basic Education and Training all the way to doctoral Degrees.

Levels of education in South Africa			
Band	School grade	NQF level	Qualifications
Higher Education and Training Certificate (HETC)			
Higher		10	Doctoral Degree
		9	Masters Degree
		8	Professional qualification Honours degree
		7	National 1st Degree Advanced / Postgraduate Diploma Government Certificate of Competency
		6	National Higher certificate Diploma
		5	National certificate Occupational Award
Further Education and Training Certificate (FETC)			
Further	12	4	National Senior certificates Occupational Awards
	11	3	Certificate
	10	2	Certificate
General Education And Training Certificate (GETC)			
General	9	1	Grade 9 Adult Basic Education and Training (ABET) level 4
	8		
	7		
	6		
	5		
	4		
	3		
	2		
	1		
	R		

Table 1: Levels of Education in South Africa

Further Education and Training takes place from grades 10 to 12, and also includes career-oriented education and training offered in other Further Education and Training institutions – technical colleges, community colleges and private colleges. Diplomas and certificates are qualifications recognised at this level.

STRUCTURE & RESPONSIBILITIES

Since 2009, the national Department of Education has been split into two ministries: Basic, and Higher Education and Training. Each ministry is responsible for its level of education across the country, while each of the nine provinces has its own education department.

Decades of Engineering Excellence

continues from page 57

The Ministry of Basic Education focuses on primary and secondary education, as well as early childhood development centres.
The Ministry of Higher Education and Training is responsible for tertiary education up to doctorate level, technical and vocational training, as well as adult basic education and training.

It also oversees public and private FET colleges, which cater for out-of-school youth and adults. The government aims to have 1-million students enrolled at colleges by 2014.

The split also saw the sector education and training authorities (Setas) move from the Department of Labour to the Higher Education, aiming to foster a more co-operative approach to skills development.

The central government provides a national framework for school policy, but administrative responsibility lies with the provinces. Power is further devolved to grassroots level via elected school governing bodies, which have a significant say in the running of their schools.

Private schools and higher education institutions have a fair amount of autonomy, but are expected to fall in line with certain government non-negotiables – no child may be excluded from a school on grounds of race or religion, for example.

The Umalusi Council, appointed by the minister of Higher Education, sets and monitors standards for general and further education and training, while the Council of Higher Education keeps an eye on higher education and training, including accreditation and quality assurance.

SCHOOL STATISTICS

South Africa relies on the matric pass rate as a significant marker of what's going on in its schools. The matric pass rate, which was as low as 40% in the late 1990s, has improved considerably. A total of 496 090 candidates sat the matriculation exams in 2011, 70,2% of whom passed. Of those who wrote exams, 24.3% qualified for university study. The latest available statistics from the Department of Basic Education show that in 2010 South Africa had 12 644 208 pupils and students ("learners"), enrolled in all sectors of the education system, attending 30 586 educational institutions and served by 439 394 teachers and lecturers ("educators").

The breakdown of schools includes 25 850 ordinary schools and 4 736 other education institutions – namely, early childhood development (ECD) centres and special schools. Of the total enrolled learners, 11 810 224 (93,4%) were in public schools and 449 875 (3,6%) were in independent schools. Of the learners in other institutions, 279 476 (2,2%) were in ECD centres, and 104 633 (0,8%) were in special schools.

The total of 25 850 ordinary schools comprised:

- 14 456 primary schools, with 5 992 863 learners and 187 520 teachers;
- 6 231 secondary schools, with 3 831 937 learners and 142 181 teachers; and
- 5 163 combined and intermediate schools, with 2 445 473 learners and 88 408 teachers.

Other educational facilities include:

- 50 FET institutions with 263 campuses (with about 320 000 students), 4 800 ECD centres and 23 HE institutions;
- 16 250 early childhood centres (ECD), which catered for 719 194 children, of which more than 400 000 were subsidised by the government.
- 23 higher-education institutions.

In South Africa, the average ratio of learners to teachers is 29,3 to one, with public schools generally having larger classes, while independent schools' average around 17,5.

HIGHER EDUCATION AND TRAINING

Higher education and training (tertiary education), includes undergraduate and postgraduate degrees, certificates and diplomas, up to the level of the doctoral degree.

A matric endorsement is required for the study at universities, with a minimum of three subjects passed at the higher grade, although some universities set additional academic requirements. A standard school-leaving senior certificate is sufficient for technical qualifications and diplomas.

South Africa has a vibrant higher education sector, with 23 state-funded tertiary institutions: 11 universities, six universities of technology, and six comprehensive institutions. There are also new institutes of higher education, the Northern Cape National Institute for Higher Education, and the Mpumalanga National Institute for Higher Education.

According to figures from the Council of Higher Education, 892 936 students (726 882 undergraduates and 138 610 postgraduates) were enrolled in South Africa's public higher-education

institutions in 2010. Staff employed by these institutions numbered 127 969, with 46 579 of those academic staff.

In 2010, the public higher education institutions produced 153 741 qualifications at all levels, with 74 612 qualifications in the human and social sciences; 41 724 in business and commerce; and 37 405 qualifications in science and technology.

Higher education is also offered at private institutions, of which there are 88 registered and 27 provisionally registered with the Department of Higher Education to confer specific degrees and diplomas. Many of South Africa's universities are world-class academic institutions, at the cutting edge of research in certain spheres. Although subsidised by the state, the universities are autonomous, reporting to their own councils.

The National Student Financial Aid Scheme was established in 1999 to make higher education possible for financially disadvantaged students through loans and concessions.

SPENDING AND CHALLENGES

Compared with most other countries, education gets the largest slice of the public pie – around 20% of total state expenditure. Although the government is working to rectify the imbalances in education, the apartheid legacy remains. Illiteracy rates currently stand at around 18% of adults over 15 years old (about 9-million adults are not functionally literate), teachers in township schools are poorly trained.

Despite the challenges, much has been achieved since apartheid legislation was scrapped. For example, in 1993 nearly half of all students in higher education institutions were white, 40% were black, 6% were coloured, and 7% were Indian. By 2005, white students had fallen to 25% and the blacks had grown to 61%. South Africa's student participation rate – that is, the proportion of 18- to 24-year olds in higher education is almost 20%.

But equity has yet to be achieved: almost 57% of whites and around 45% of Indians enter higher education. The rate for coloureds is 14,8% and blacks 13,3%. The reason for this is generally understood as poor quality primary and secondary schooling, which is a priority for the current government.

The greatest challenges for schooling lie in the rural provinces such as the Eastern Cape and KwaZulu-Natal. Schools are generally better resourced in the more affluent provinces such as Gauteng and the Western Cape.

ACTION PLAN TO 2014

The government's newest strategy for turning education around is known as "Action Plan to 2014: Towards the Realisation of Schooling 2025", which aims to improve learning and the work of teachers.

The new curriculum focuses on literacy and numeracy. Known as the national Curriculum and Assessment Policy Statement, this curriculum provides very specific guidelines to streamline what is taught with the aim to close the divide between well-resourced and poor schools. Curriculum implementation is supported through the national educational portal, Thutong ("place of learning").

Other measures include the introduction of standardised assessments of grade three, six and nine to better track progress; an emphasis on early child development and universal access to Grade R; ensuring learners have access to good quality textbooks; and improving school infrastructure and strengthening school management.

Teacher education and development programmes have also been strengthened, including funding for bursaries for trainee teachers. The education of the poorest of the poor remains a priority, and includes two notable programmes. One is no-fee schools, institutions that receive all their required funding from the state and so do not have to charge school fees. These have been carefully identified in the country's most poverty-stricken areas.

The other is the National Schools Nutrition Programme, which gives more than 7-million schoolchildren a cooked meal five days a week.

PUBLIC UNIVERSITIES

Public universities are divided into three types: traditional universities, which offer theoretically-oriented / traditional university degrees; universities of technology (previously "Technikons"), which offer vocational oriented diplomas and degrees; and comprehensive universities, which offer a combination of both types of qualification.

NEXT MONTH

Synopsis of Chapter 4: ENGINEERING PROFESSION IN SOUTH AFRICA.

CONTACT DETAILS

If you are interested in obtaining a copy of the book, contact du Toit on 083 666 6855 or du.toit.grobler@gmail.com wn

2013 BURSARY REPORT

The SAIEE has for many years provided bursaries for suitable candidates to study for a diploma or degree in Electrical, Electronic or Computer Engineering. The bursaries are for prospective students as well as for students who have completed there 1st, 2nd, or 3rd year at a recognized South African tertiary institution.

BY I HERMANN BROSCHK
FSAIEE I CHAIRMAN OF BURSARY COMMITTEE

The SAIEE has for many years provided bursaries for suitable candidates to study for a diploma or degree in Electrical, Electronic or Computer Engineering. The bursaries are for prospective students as well as for students who have completed their 1st, 2nd, or 3rd year at a recognized South African tertiary institution.

We had 10 bursars who received bursaries for 2013. They completed their year as follows:

- 4th year at University of Kwa-Zulu Natal;
- 3rd year at Stellenbosch University;
- 2nd year at Stellenbosch University;
- 2nd year at Potchefstroom University;
- 3rd year at Mangosuthu University of Technology, Durban;
- 1st year at Stellenbosch University;
- 1st year at University of Pretoria.

Two of our bursars received excellent results from the Stellenbosch University.

Three Bursars need to repeat their year of study, one in 1st year, one in 2nd year and one in 3rd year. Should these students be successful, then the SAIEE will reinstate their bursary for 2015, subject to funds being available.

Of the 6 bursars who passed, 5 will continue to receive their bursary funding for 2014. Unfortunately one of our *"star students"* has accepted another bursary.

We have once again increased the number of bursaries for 2014. This was due to a sponsorship received from the Professional Provident Society (PPS), which enables us to award an additional bursary for 2014. We will thus have a total of 11 bursaries for 2014.

Our Bursary Administration Service, which caters for companies who do not have the facilities to administer bursaries, are not being utilised.

We urge members to encourage their companies who are involved in offering bursaries, or who intend offering bursaries, to make use of this service.

The new bursars for 2014 are:

- Mzomhlophe Zakwe, B.Tech, at Durban University of Technology.
- Wayne Dyamond, BSc (Eng), 1st Year, Stellenbosch University.
- Samuel de Bruyn, BSc (Eng), 1st year, University of Pretoria.
- Connor Collocott, BSc (Eng), 1st year, University of Cape Town.
- Siphesihle Mmusane, BSc (Eng) 2nd year, University of Witwatersrand.
- Levashen Kuppan, BSc (Eng) 1st year, University of Kwa-Zulu Natal.

ARE YOU AWARE

The dependants of SAIEE Members who want to study electrical engineering will receive preference when bursary applications are adjudicated. We hope to see more applications from our members' dependants for 2015. wn

For more information regarding the SAIEE bursary scheme as well as sponsorship and loans please contact:
The Secretary
Bursary Administrator
Dudu Madondo
Tel: 011 487 3003/9045
Email: dudum@saiee.org.za

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March

COMPILED BY | JANE BUISSON-STREET
SMSAIEE | PMIITPSA

The name of March comes from Latin *Martius*, the first month of the earliest Roman calendar. It was named for Mars, the Roman god of war who was also regarded as a guardian of agriculture and an ancestor of the Roman people through his sons Romulus and Remus.

1 March

1555 Nostradamus's "Book of Centuries" was published in France. It consists of 900 four-lined verses that are prophecies about future events. To date the predictions include London's great fire in 1666 and global war erupting twice in the 1900s.

1954 The US exploded the most powerful bomb ever on Bikini Island.

2 March

1791 The semaphore machine was unveiled in Paris forever changing communications.

1882 Electric trams operate for the first time from Leytonstone, East London, England.

6 March

1899 Aspirin was patented, the world's first universally available, inexpensive pain-killer.

7 March

1876 A revolutionary new device was patented today - the electric voice telegraph or telephone.

10 March

1974 *"A Japanese soldier was today found in hiding on Lubang Island in the Philippines"*. He was under the impression that World War II was still happening and was waiting in anticipation to be relieved by Japanese forces.

13 March

1894 The first professional striptease takes place at the Davan Fayoneau Music Hall in Paris.

15 March

1900 US President McKinley's offer to mediate in the Boer War was rejected by British Prime Minister Lord Salisbury.

16 March

1926 Robert Goddard, an American physicist, successfully launched a liquid fueled rocket. This new fuel meant greater payloads could be carried.

18 March

1891 The London-Paris telephone link was opened.

21 March

1955 Antarctic Ice Melting - It was believed possible that the icy Antarctica could melt at a faster rate than most people would think. If this were possible, ocean levels would rise 90 to 150 feet. An Antarctic ice survey and corresponding studies were expected to be completed between now and some time shortly after 1957.

1963 The first of a new generation of trains that drive themselves not needing a driver but controlled by computers which are controlled by picking up signals from coded electrical impulses from the rails and signalling areas and give them the intelligence to start, accelerate, coast or slow down automatically are to be used on London Underground. An operator will still be on-duty aboard the train in the drivers cabin to survey opening and closing doors and to take charge of the train if any of the electrics fail during a journey.

1980 Dallas aired its "A House Divided" episode that led to 8 months of international intrigue regarding Who shot J.R.?

23 March

1957 The U.S. Army sold the last of its homing pigeons.

1966 For the first time in more than four centuries, heads of the Roman Catholic and Anglican churches met in Vatican City.

1983 Dr Barney B. Clark, the recipient of the world's first permanent artificial heart, died 112 days after the plastic and aluminium device was implanted in his chest.

1989 A 1,000-foot diameter asteroid missed Earth by 500,000 miles.

25 March

0421 According to legend, at 12:00 the city of Venice was founded.

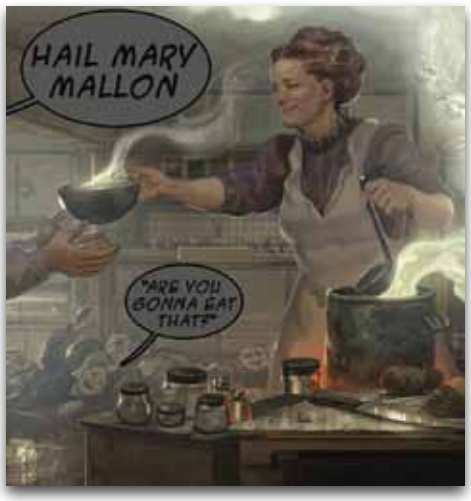
1901 The Mercedes was introduced by Daimler at the five-day *"Week of Nice"* in Nice, France.

1902 Irving W. Colburn patented the sheet glass drawing machine.

1939 Billboard Magazine introduced the (country music) Hillbilly Music Chart. The term country music did not begin to be used until the 1940's when the earlier term hillbilly music was deemed as degrading to the style of music.

27 March

1871 The first international rugby football match, when Scotland defeats England in Edinburgh takes place at Raeburn Place.



1915 Typhoid Mary, the first healthy carrier of disease ever identified in the United States, is put in quarantine, where she would remain for the rest of her life (11 November 1938).

1998 The Food and Drug Administration approves Viagra for use as a treatment for male impotence, the first pill to be approved for this condition in the United States.

2001 California regulators approved electricity rate hikes of up to 46 percent following the partially deregulated California energy system

29 March

1886 A new fizzy drink wen on sale at a pharmacy in Atlanta, Georgia. Coca-Cola, an *"Esteemed Brain Tonic and Intellectual Beverage"*, will cure anything from hysteria to the common cold claims its inventor, Dr John Pemberton.

1981 The first London Marathon organised by Chris Brasher is run with 7,590 taking part including a number of celebrities raising money for charity. The London Marathon is now a yearly event attracting 30,000 runners from around the world, including some of the world's greatest athletes and tens of thousands of others who complete the marathon raising many millions for charities along the way and many wearing fancy dress costumes.

31 March

1889 Paris received its tallest and brashest tourist attraction yet when French Premier Tirard opened the new Eiffel Tower. The soaring skeleton of exposed wrought-iron latticework was by far the tallest man-made structure in the world standing at almost one fifth of a mile. wn

The Wheel Turns

From the top of the economic 'food chain' to the bottom, power conservation and generation is at the top of most people's priority list. More and more home-owners are seeking ways to reduce their costly dependence on power providers.

BY | ANGELA PRICE

Interestingly, foreign investors looking to sink funds into South Africa's mining sector, list the countries power supply (and not mining labour unrest) as their biggest concern.

Since the start of The Industrial Revolution and the generation of electricity in the late 1820s/early 1830s, we have purposefully and deliberately moved further and further away from using man-power in our desire to electrify and motorise everything. Whilst the results have been liberating they have also enslaved us to power generating masters like Eskom.

Tired of being powerless, people are now investigating alternative methods for powering homes and electrical devices. The incentives are many: dwindling resources, environmentalism, a desire to be self-sufficient, conserving energy and saving on electricity costs - to name but a few.

In the drive towards energy independence and liberation, generating your own electricity is obviously one of the best things you can do.

Last month I proposed doing a home energy audit to establish where our home was 'leaking' and how to go about tightening up on our power and water efficiency. I call the exercise Project Power House. You may be wondering how we are faring. A quick progress report revealed:

- some of the leaking taps are fixed;
- he pool pump timer is now functioning correctly;
- and the solar powered geyser is 'a work in progress'.

Ok, so clearly it's not a very progressive progress report. When questioning why this project was not moving very fast I took a hard look at my main resources: time, budget and the labour force. These were my findings:

- Time - I am the chief culprit here as I often book social events on the weekend and then wonder why we never get anything done at home.
- Budget - since one LED globe costs R 130 we are pacing ourselves.
- Labour force/my husband - here I discovered the 'spanner in the works', the real reason for the lack of progress on Project Power House. Closer inspection revealed the lone labourer has plenty of momentum; it's just not directed at the project.

You see, my hubby has a hobby. This particularly contagious hobby (many of my friends' spouses have fallen prey to it) involves: bikes, mud, riding the spruit and pitching oneself against younger men in races which only the certifiably insane would classify as 'fun'. Try as I might I have not succeeded in prying him away from his bike. I hear you saying, "If you can't beat them, join them." Believe me, I would if I could but I lack two key requisites – a bike and a babysitter.

Recently, whilst watching him spinning away on the stationary bike, preparing for a race, I found myself thinking, *'We should harness that energy!'*

In a flash I had it – we need to move from motor to man-power – starting with the sweating hubby on the bike.

A quick Google search offered up a solution which looked something like this:

Watching my unsuspecting minion pedalling away furiously, it occurred to me that we may be coming full circle since the Industrial Revolution. Where we once cast aside the development of man-powered tools with wild abandonment in pursuit of electrification – it now seems that the high cost of our desertion is driving us back towards man-powered solutions.

Let's hope that after decades of idleness it is not too late…..so what are you waiting for, start peddling!

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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

MARCH 2014

4-5	Renewable Energy Forum South Africa	Norton Rose Fulbright, Sandton, Johannesburg	www.refsaconference.com
11-12	Power and Electricity World Africa	Sandton Convention Centre, Johannesburg	www.terrapinn.com
11-12	Shale Gas World Africa	Sandton Convention Centre, Johannesburg	www.terrapinn.com
17-19	PowerGen Africa 2014	Cape Town Convention Centre, Cape Town	www.powergenafrica.com
17-19	Distributech Africa 2014	Cape Town Convention Centre, Cape Town	www.distributechafrica.com
27	SAIEE AGM	Military Museum, Johannesburg	geyerg@saiee.org.za
27-29	2014 Africa PVSEC Conference	Durban ICC, Durban	www.africapvsec.info

APRIL 2014

6-8	Civilution Congress 2014	Emperor's Palace, Johannesburg	www.saice-congress.co.za
8-9	CSP Today South Africa 2014	Southern Sun Cape Sun Hotel, Cape Town	www.csptoday.com
8-10	2014 IET 7th PEMD	Manchester, United Kingdom	www.theiet.org.com

MAY 2014

8-10	2014 IET 7th PEMD	Manchester, United Kingdom	www.theiet.org.com
13-14	Africa Utility Week	Cape Town Convention Centre, Cape Town	www.african-utility-week.com

JUNE 2014

21-22	3rd Intl Conf Economics & Social Sciences	Durban University of Technology, Durban	www.ifrnd.org

Renewable Energy Training

The South African Renewable Energy Training Centre (SARETEC) at CPUT will be a national facility for the training of technicians for South Africa's growing renewable energy sector.

CPUT, in collaboration with foreign investors and the South African government are embarking on one of the most exciting initiatives to hit our shores for some time to come. Focused on training wind turbine and photovoltaic technicians to begin with, this new centre will open the door to a variety of careers in renewable energy.

Until then, we invite the industry to make use of our interim training programmes, which are German accredited to international standards.

To find out more about this new initiative, please contact:
Dieter Sommer | sommerd@cput.ac.za
Howard Fawkes | fawkesh@cput.ac.za

Cape Peninsula University of Technology

www.cput.ac.za

Creating futures

Explore

creative ideas for efficient lighting!

Local designers are invited to meet the real-world challenge of the 2014 Eskom Energy Efficient Lighting Design Competition with homegrown flair.

The 2014 Eskom Energy Efficient Lighting Design Competition will once again showcase local lighting designs that exude individuality and challenge convention. The search is on for talented South Africans with creative flair and design savvy, for the kind of artistic intuition that sparks new trends. And above all: that special gift that has the ability to turn pure science into pure art ...

Few design elements are as versatile and wield as much power to define and transfigure a space as does light. Yet, despite its endless possibilities, the power of lighting as a design tool is often underestimated. This is therefore a call for all designers (students, professionals and high school learners) to meet the challenge of striking the perfect balance between functionality and creative expression.

Engineers and designers – whether 'professional' or not – are invited to design a luminaire (light fitting) that makes use of energy-efficient technology, such as compact fluorescent lamps (CFLs), light-emitting diodes (LEDs), fibre optic or any energy efficient lighting system or product suitable for residential application.

If you are a creative South African who possesses the kind of artistic intuition that will spark new trends, we are looking for you. The closing date for entries is **15 August 2014**, and the total prize value is **R200 000**. Entrants may participate in any of three categories, namely a student, professional or high school learner category. For more information on specifications, evaluation criteria and entry forms, visit www.lighting-design.co.za, or send an e-mail to karin@dalajunction.co.za.