

# wattnow

RSA | R30.00 incl. VAT

*The* Power  
issue

SAIIE

THE OFFICIAL MOUTHPIECE OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | FEBRUARY 2012



# contents

## LETTERS

- 6 Letter from the SAIEE President  
- Mr. Andries Tshabalala.
- 46 You said....  
Letters received from our members.

## REGULARS

- 8 WattsHot  
Gadgets and gizmo's - what is new on the market.
- 12 WattsUp  
Social events - were you there?
- 58 Mentorship
- 62 SAIEE Calendar of Events
- 63 Crossword  
Enter now and stand a chance to win R1000!
- 64 SAIEE Council

## FEATURE

- 16 Getting off the Grid  
One is sufficiently motivated to seriously investigate becoming independent and getting totally off the grid!

## POWER

- 22 Dynamic Compensation for AC Arc Furnaces  
AC Arc Furnaces rate among the highest contributors towards power quality issues in any power network.
- 28 General Overview of Harmonics in Power Networks  
Power Factor Correction Capacitors  
It is commonly accepted that utilities generate a near perfect sine wave voltage.

## TECHNOLOGY

- 36 The Duhva Power Station Turbine Failure  
On the 9th of February 2011 an explosion occurred at the 3600MW Duhva coal-fired power station, which destroyed the 600MW turbo alternator set.
- 42 Everything You Wanted To Know About Silica Gel  
Silica Gel was invented/discovered seventy years ago.

## CPD

- 56 CPD Courses - 2012

## MEMBERSHIP

- 48 Member Profile: Rod Harker
- 60 Benefits of being a member of the SAIEE

## SUBSCRIBE

- 67 Not a SAIEE member? Subscribe today!

Energy efficiency, energy management,  
ISO 50 001, tax incentives...



DO YOU JUST WANT TO START  
SAVING ENERGY AND MONEY?

Contact **Energy Cybernetics**

### OUR SERVICES

Energy consulting  
Energy auditing  
Energy management tools  
Energy policies and strategies  
Energy training

### OUR WORKFORCE

26 Engineers  
8 CEMs  
11 CMVPs  
8 Technicians and technologists  
4 Software developers

### OUR CLIENTS

Eskom, Anglo American, Sasol, Exxaro,  
CSIR, Vodacom, Avis, BMW, MTN,  
Netcare, SAB, Samancor, De Beers,  
PPC, Barloworld, World Bank,  
Old Mutual Properties, etc



**ENERGY**  
**CYBERNETICS**

(018) 297 5908 - (012) 369 9880 - info@energycybernetics.com - www.energycybernetics.com





## MANAGING EDITOR

Minx Avrabos | minx@saiee.org.za

## EDITORS

Derek Woodburn  
Mike Crouch  
Jane-Anne Buisson-Street

## CONTRIBUTORS

Viv Crone  
Piet Swart  
Fred Greyling  
Rob Thomson  
Derek Woodburn  
Derek A. Dingwall

## EVENTS

Gerda Geyer | geyerg@saiee.org.za

## PHOTOGRAPHER

Heather McCann | 011 682 3298

## CPD

Sue Moseley | suem@saiee.org.za

## MEMBERSHIP & TECHNOLOGY LEADERSHIP

Ansie Smith | smitha@saiee.org.za



## ADVERTISING

Avenue Advertising  
T 011 463-7940 | F 086 518 9936  
E barbara@avenue.co.za

## PUBLISHER

SAIEE Publications (Pty) Ltd  
P.O. Box 751253 | Gardenview | 2047  
T 011 487 3003 | F 011 487 3002  
E wattnow@saiee.org.za | W www.saiee.org.za



## SAIEE 2011 OFFICE BEARERS

President	Andries Tshabalala
Deputy President	Mike Cary
Senior Vice President	Paul van Niekerk
Junior Vice President	Pat Naidoo
Immediate Past President	Dr. Angus Hay
Honorary Vice President	Graeme Hopewell
Honorary Treasurer	Mike Cary

ISSN: 1991-0452

SAIEE Publications (Pty) Ltd. All material is strictly copyrighted and all rights are reserved. Reproduction without permission is forbidden. The views expressed in this publication are not necessarily those of the publisher or the SAIEE.



*W*

ell, it is February already and the time is passing too quickly. Soon we will be seeing the change of colour in nature, which

brings with it cool autumn days.

This "Power" issue of the wattnow magazine is filled with very interesting articles.

On page 7 we feature a very special offer on two books, "The First Ten Decades" and "Living amongst the Stars".

On page 16, Mr. Viv Crone shares with us the pros and cons for "Getting Off the Grid". We will probably not succeed in this completely, but we definitely should give it a try.

Mr. Rob Thomson shares with us what really happened at the Duhva Power Station on page 36. This explosion has shocked electricity users in South Africa as well as electrical engineers.

On page 42, Mr. Derek Woodburn tells us everything we wanted to know about self-indicating Silica Gel, but were too afraid to ask.

As promised in the last issue, this issue of wattnow features a letters spread, aptly named "You said..." - I've listed here a few of the emails I received and most of them are complimentary. Thank you.

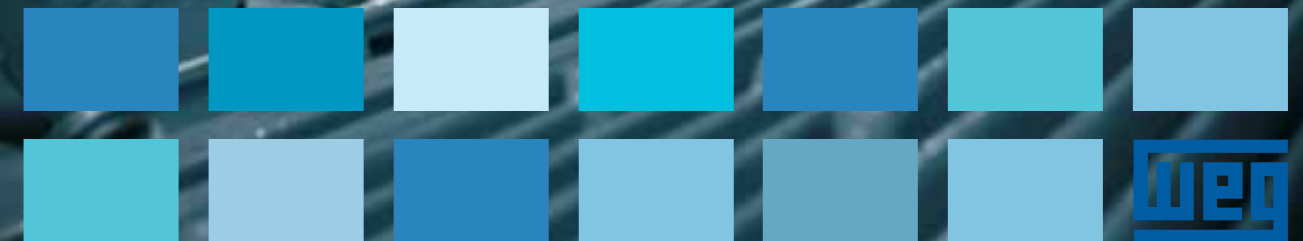
In the January issue of wattnow, I featured an article about the dangers of energy saving light bulbs (pg. 52). It has come to light that parts of this article MAY be a hoax. The article cannot be clearly substantiated as only the content, not the photos, can be found on various websites.

I am currently researching this topic and will publish my findings once everything is confirmed for what it is.

On this note, I would like to wish you a happy read. Herewith, your "Power" issue.

*Minx*

**Earn CPD Credits**  
Visit [www.wattnow.co.za](http://www.wattnow.co.za) to answer the questions related to these articles to earn your CPD points.



Passion Through Our People



# ZEST

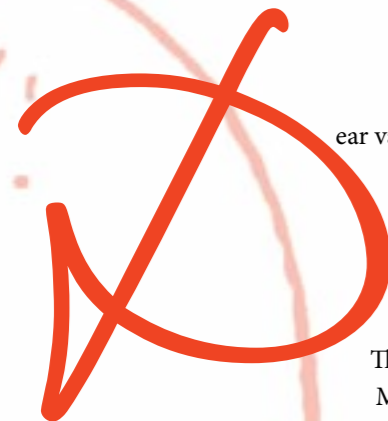
## WEG Group

0861 00 ZEST | [www.zest.co.za](http://www.zest.co.za)

- Electric Motors
- Variable Speed Drives
- Soft Starters
- Transformers
- Low & Medium Voltage Switchgear
- Diesel Generator Sets
- Power Generation & Energy Solutions
- Packaged Switchgear Solutions
- Containerised Substations
- Electrical Instrumentation & Control System Installation
- 24 Hour Back-up & Support
- Training







Dear valued member and advertiser,

We are now well into the 2012 year and looking forward to the Institute's Annual General Meeting (AGM) to be held at the end of March 2012. The SAIEE staff is settling down well in the new SAIEE House offices. We are now looking at the renovation, restoration and future use of Innes House. This will be a new project under the guidance of the newly established Facilities Management Committee. They are currently investigating various options and budget implications for presentation to Council for approval.

All of us were shocked to learn about the passing of our Past President: Mr Ron Leigh in December 2011. In the new year, the passing of Ms. Ester Manne at the end of January 2012 also shocked us. Ester was a long serving and hard working employee of the Institute for more than 15 years. Our condolences go to the family and friends of the departed. May their souls rest in peace.

The National Planning Commission (NPC) has called for submission of comments on the National Development Plan (NDP). Office Bearers took a decision for SAIEE to contribute to a consolidated submission from the wider Engineering fraternity of South Africa, under the auspices of ECSA. Mr. Paul van Niekerk has kindly volunteered to champion the SAIEE contribution to ECSA.

Members are invited to contact Mr. van Niekerk if they have some input to make. The theme of this edition of *wattnow* is 'Power'. This is most relevant at the time when the Eskom generation capacity is under huge pressure. The reserve margin is at an all time low. Hence, we are all requested to use electrical energy most conservatively.

In accordance with Eskom's request, we are all expected to save 10% of our normal demand in order to help keep the lights on. Also, energy is responsible for approximately 40% of global carbon emissions. We are, therefore, expected to play a huge role in the reduction of carbon emissions in order to limit global warming. South Africa successfully hosted the 17th Conference of the Parties (COP17), on climate change in Durban.

Deliberations resulted in an agreement on the way forward, although some major countries have not yet made binding commitments on carbon emissions reduction targets. We are also seeing the distribution network coming under more pressure as demand increases and as the lack of investment over many years begins to result in unreliable performance by the old distribution network.

The editorial team has put together a most informative assembly of contributions on the theme.

Enjoy reading this edition of **wattnow**.

Andries Tehabalala

# GET YOUR OWN COPY

## "Living amongst the stars at the Johannesburg Observatory"

Written by Dirk J Vermeulen, vice-chairman of the Historical Section of the South African Institute of Electrical Engineers (SAIEE), has traced the fascinating evolution of the Johannesburg Observatory from the early 1900s to its current ambitious goal of becoming a dynamic science and education centre.

**Own it now for only R275\***

## "The First Ten Decades - the history of the SAIEE"

Written by Mike Crouch, Past President of the South African Institute of Electrical Engineers (SAIEE), was commissioned by the Centenary Committee to record and celebrate the contributions that electrical engineers and in particular, members of the SAIEE made to the profession and the betterment of society over the past century. **Own it now for only R250\***



**SPECIAL OFFER!**

BUY BOTH BOOKS FOR ONLY

**R450\***

To place your order, please email all your details, i.e. name, surname, postal address, etc. to [wattnow@saiee.org.za](mailto:wattnow@saiee.org.za) or contact 011 487 3003.

\* All prices quoted are inclusive of VAT, but excludes Postage of R30.00 per book.





# WATTS HOT

COOLEST GADGETS FOR 2012

Showcasing a few gadgets you might find interesting!



## Polaroid Z340 instant digital camera

“Shake it like a Polaroid picture” has proved to be one of the more enduring lines from OutKast’s early hit, “Hey Ya!, and as we all know, the name Polaroid is synonymous with instant photographs back in the days when items like digital cameras were virtually unheard of. I guess it is only fitting for a legendary company like Polaroid to roll out the Z340 instant digital camera, bringing a modern take to an old school product, how cool is that?

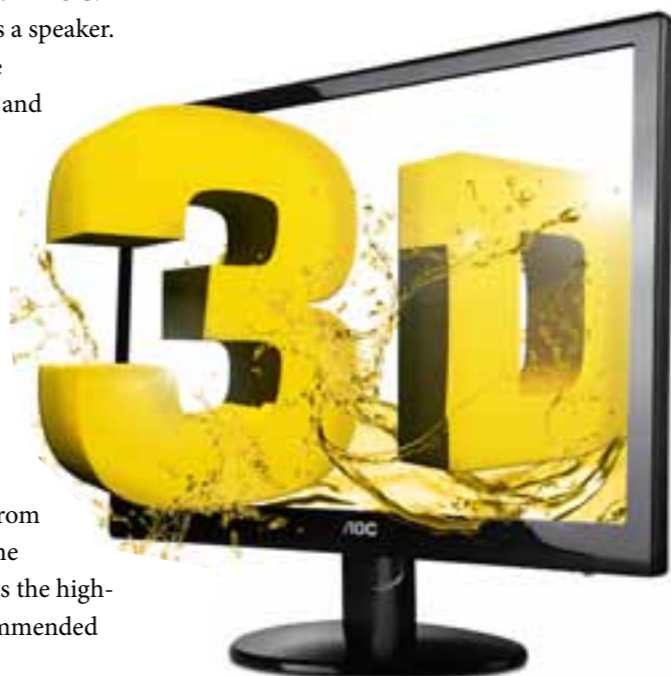
The Polaroid Z340 is said to boast of a full-function 14-megapixel digital camera as well as a built-in ZINK printer, delivering a whole new twist on the instant experience. This camera enables you to customize each individual photo between the snap and share process, turning it into a portable digital photo booth, now how about that? You will be able to deliver such images from a file to print in under a minute. Something tells me that the Polaroid Z340 is going to be very, very popular at weddings in the near future assuming the price is right.

## 3D for the desktop

Platinum Micro has introduced a new 23-inch 3D desktop monitor from AOC. The monitor connects to most computers via HDMI and also includes a speaker.

According to Martin Kruger, product manager at Platinum Micro, the introduction of 3D technology is a leap forward especially for gamers and other performance users who are constantly seeking new horizons in cyber-reality. “With the AOC e2352Phz, 3D comes to the desktop in a 23-inch display which features Flicker Free 3D technology using passive polarised glasses,” he says.

Flicker Free technology means the monitor continuously shows a different image pattern to each eye, without the on-off switching typical of other 3D displays. The result is pleasant, vivid 3D images with a wide viewing angle. The LED backlit panel has a ultra-high dynamic contrast of 20,000,000:1, delivering more depth and detail in darker scenes. Connecting to any PC via its HDMI 1.4a input, the monitor includes a speaker and is ready to play 3D video and sound from the latest consumer electronics devices, including 3D Blu-ray and game consoles. The recommended resolution of 1920x1080p at 60Hz reflects the high-definition expected of a modern display. The e2352Phz carries a recommended retail price of R3,499.



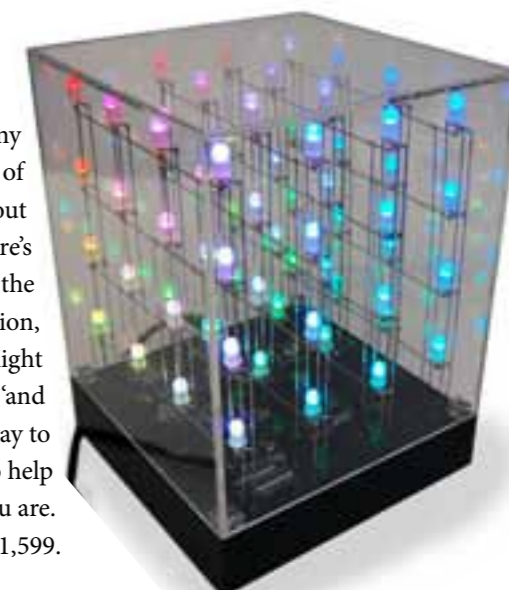
## The Freeloader Battery Charger

The Freeloader Battery Charger is a new device for recharging AA batteries and AAA batteries directly from the USB port of a personal computer, or from a Freeloader Solar Charger. It’s manufacturers claim this is the smallest and lightest AA and AAA battery charger in the world, and it can be used with both NiMH and NiCd rechargeable batteries. The Freeloader Battery Charger (AA/AAA) The Freeloader Battery Charger is supplied with two 1,300mah AA rechargeable batteries. These can be charged up to 75% of full charge within just 1 to 2 hours from the Freeloader Solar Charger and in 3 to 4 hours from a USB connection. If higher capacity rechargeables are used then the charging time is increased. The charger is just 85 x 37 x 19mm in size and weighs in at just 54g including the batteries! The input voltage is 5.5 Volts with a charging current of 150 to 300mAh. Battery charge indicators (LEDs) display the charging status of the Freeloader and the power level of the batteries. Recommended retail price R299.

## Animated LED Cube Light

This ingenious LED cube is the coolest way to create an atmosphere in any room. Offering over 1000 different colour combinations and a wide range of light patterns – the animated light show runs for over half an hour without repeating itself! – it truly is the Grand Master of mood lighting. But there’s much more to this funky, multicoloured light box than simply looking the business; it’s a great relaxation tool too! If you’re in need of a chill-out session, simply sit back and watch the cube skip through all sorts of hypnotic light patterns – you’ll be transported to a Zen-like place before you can say ‘and relaaaaax’. Smart enough for use in the workplace and a coolly inventive way to brighten up your home, the LED Cube is an all-in-one lightshow ready to help you unwind wherever you are.

List price: R1,599.



## Series 5 Ultrabook for SA

Samsung has introduced the new Samsung Notebook Series 5 ULTRA, representing more than just thin and light, packing ultra performance beyond expectations. Available in 13” and 14”, the Series 5 ULTRA reveals its performance through an Intel Core i5-2467M processor, up to 8GB memory, ExpressCache system by Diskeeper and AMD Radeon™ HD graphics card. As a result, the Series 5 ULTRA is able to fast boot in just 20 seconds, wake up in two seconds, whilst web browsing is twice as fast as the previous generation notebook PCs. Performance alone is insufficient without enough space to store your data. Due to the development of digital image devices and various media platforms, files are getting larger every day, increasing the need for bigger user storage. Despite the recent trend of cloud storage,

local storage is still preferred among users on a daily basis. Not to compromise these needs the Series 5 ULTRA 14” offers up to 1TB ultra storage capacity ensuring that users never need to carry a peripheral storage device with them. The performance has been further enhanced by the extended battery life. The Samsung Series 5 ULTRA delivers up to 6.4 hours of battery life on a single charge, to make sure users enjoy the ultra features throughout the day. The Samsung Battery Life Plus is a true anti-aging battery technology which keeps 80 percent of the cell’s original capacity in a life cycle lasting up to 1,500 charging cycles / three years. This ensures that the battery can last up to five times longer than other notebooks.





# WATTS HOT

GADGETS FOR 2012

## Ibiza LED Binary Watch

If nerdiness is the new rock n roll, then this Binary Watch is as rock n roll as you can get. Yep, emphasise your cool credentials with a watch that no one can decipher except you (and maybe not even you).

Instead of the, oh so last century, analogue or digital watch face, the watch displays the time in futuristic binary. The first column represents hours, the second ten minutes, and the third single minutes. So, if four lights show in the first column, two in the second and two in the third then the time is 4:22. It's easier than it looks and you're brain will quickly get used to telling time in binary.

Reading the date is just as easy. To activate the date setting simply press the function button, then the first column represents months and the second and third represent the day.

But the watch is about so much more than just telling the time. It's cool, innovative and unique, and will make you the talk of the science club common room. Its sleek design and blue led lights will make you look like you've just stepped out of a science fiction film, and let's face it, there is nothing better than knowing something very few other people do.

Retail price R995 (incl.)



## The Epson MG-850HD HD All-in-One Projector is the Perfect Way to Share Videos from Your iOS Device

Have you ever attempted to show a group of friends an awesome video on your iPhone or iPad, and then had to pass your device around so that everyone can watch it back with a decent view? With the Epson MegaPlex MG-850HD, you can project your latest home recording onto any white background so that all of your friends - heck, even your whole street! - can get a good view first time around.

What makes the MegaPlex great for iOS (formerly iPhone OS) users is its built-in dock that features a 30-pin connector compatible with your iPhone,

iPod Touch, or iPad. That means all you have to do is stick your device inside and hit play. But it's not just for iOS devices; it'll also play nicely with your computer, games console, Blu-ray player, and many other smartphones and tablets.

The MegaPlex isn't just an awesome way to show off your videos and movies at 100-inches in 720p, but it's also great for gaming with friends, and sharing slideshows and presentations. Epson promises the device will provide you with a "remarkable" 720p resolution, with "2,800 lumens of color and white light output."

The device also offers built-in stereo speakers, which you can use just for music when you don't want to project, and it'll charge your iOS device when you're using it. However it isn't cheap. This particular model will cost you ± R8,499.99 incl VAT .



## Google reportedly to release Android 5.0 'Jelly Bean' by June 2012

Before Ice Cream Sandwich has managed to reach more than 1% of Android devices, reports are suggesting that its successor, Android 5.0 'Jelly Bean', could launch as soon as June.

The news comes in the form of a Digitimes report, which is known for being hit-and-miss with its accuracy, but cites supply chain sources that state the search giant will seek to release its new Android platform to provide competition to Microsoft's new Windows 8 operating system, which will debut in the third quarter.

With Android 5.0 thought to deliver yet more features for tablet devices, Taiwanese suppliers are already to deliver dual-OS tablets and notebooks, which will be able to instantly switch between Google's and Microsoft's mobile-friendly platforms.



## Galaxy Nexus in SA

The Galaxy Nexus will touching down on home soil early in 2012 - it should also be the first with Ice Cream Sandwich on board in SA, unless the Transformer Prime beats it out the door.

Interestingly, they also mention that Google Earth will be on board...this means local availability of the app as well. Google Earth has been unavailable in SA since its Android launch some time ago.

With NFC on board, Samsung and Google also state that they will be working with local developers to stimulate adoption and understanding of NFC technology in South Africa.

GALAXY Nexus will be available in South Africa from early 2012 at a RRP of between R 6,999 - R7,299.



## go green and save

Electrogreen products save you money and electricity, while saving the environment. They aim to decrease consumption, reduce carbon footprint and extend the life-span of machinery and appliances. Power factor correction systems, occupancy sensors, quality of supply analysers and voltage stabilisation systems are among Electromechanica's "green" products.

### Power factor correction

Installation of a power factor correction system reduces electrical burden on cables and electrical components, power consumption and costs, and increases load capacity.

### Occupancy sensors

Hager occupancy sensors automatically switch lights on when movement is detected depending on the amount of natural light. Lights are turned off after a preset time period.

### Quality of supply analysers

Lovato's DMG range offers measurement accuracy of harmonic voltages and currents, protection from potentially dangerous power, versatility and connectivity. They are easy to install and suitable for LV, MV and HV electric systems.

### Voltage stabilisation systems

PowerSines energy controllers cut energy consumption and stabilise voltage. Easy to install in existing infrastructure, they are available in a wide range of sizes suitable for small to large scale deployments.



Gauteng 011-249-5000  
Cape 021-529-7000  
Kwazulu-Natal 031-569-3500

[www.em.co.za](http://www.em.co.za)

Email: [electrogreen@em.co.za](mailto:electrogreen@em.co.za)





# WATTSUP

## Heritage Trust Visits SAIEE Headquarters



Over 40 members of the Parktown and Westcliff Trust visited Observatory for guided tours of the site and Innes House.

Recently about 50 members and friends of the Parktown and Westcliff Heritage Trust visited the Observatory site to view its buildings and to learn something of its history. Talks were presented on the Herbert Baker Library Building at the top of the ridge, the prefabricated wood-and-iron cottage which was the first astronomer's house and Innes House. Members of the astronomical society were on hand to show and speak about the 26" telescope. On behalf of the SAIEE, Max Clarke, Chairman of the Historical Section, welcomed the visitors and spoke about its history.

Two of the Trust members, who had previewed the site on a previous visit, guided the guests

to the places of interest and dealt with their history. During their visit to Innes House, Dirk Vermeulen, Vice-chairman of the Historical Section, gave a 30 minute talk on the Stars of Electrical Engineering. An appropriate selection of the Institute's museum artefacts were set out to illustrate the work of Dr Hendrik van der Bijl, Dr Basil Schonland, Dr Trevor Wadley and Henry Rubin which were thus available to view and touch.

Considering that the audience was largely non-technical, it was most encouraging to hear and see their enthusiastic response to our presentations. Many expressed a wish to return for a deeper view of our collection and

welcomed our proposed Museum of Electrical Engineering in Innes House. The SAIEE intends reprinting Dirk's book "Living Amongst the Stars" and several visitors placed orders for copies when they become available.

In spite of a sudden downpour requiring umbrellas and some changes to the routes, the visitors enjoyed the afternoon and praised the work being done to preserve the site.

In conclusion light refreshments were provided in the new SAIEE House and visitors were given the opportunity of viewing the new Council Chamber and other parts of the new building.



Mr. Max Clarke, Chairman of SAIEE Historical Section enlightened the visitors on the history of the SAIEE



Mr. Dirk Vermeulen, author of "Living Amongst the Stars" spoke about the work of Hendrik van der Bijl, Trevor Wadley, Basil Schonland and Henri Rubin.

## Recognising Maths And Science Achievements In Rural Schools

Two students from Samkelwe Secondary School in Addo, in the rural parts of Eastern Cape, experienced an opportunity of a lifetime by being chosen to attend the Southern African Energy Efficiency Convention (SAEE2011) in November 2011 at Emperors Palace in Gauteng. Nombuzo Stefaans, a Grade 12 pupil, and Ntombekhaya Matsamko in Grade 11 were rewarded by the Technology Innovation Agency (TIA) for dedication and potential shown in mathematics and science in High School.

Zoleka Ngcete, the Business Development Manager for the Eastern Cape office of TIA, who chaperoned the scholars to Gauteng, said this was an opportunity for the scholars to experience the world of engineering and innovation that subjects like mathematics and science could deliver. Students in rural schools have limited opportunities to identify career and business options that will enable them to choose for their future studies. TIA, the Platinum Sponsor of the SAEE2011 teamed up with the Southern African Association for Energy Efficiency (SAEE), in an effort to tout the opportunities that exist in the energy and innovation industries as a career path where meaningful contributions are desperately required to combat climate change and protect our natural resources.

By attending the SAEE2011, Nombuzo and Ntombekhaya experienced first-hand, the challenges that societies face, and can now start thinking innovatively about the difference they could make within their communities and for the country.



Live interview on SAE's Green Hour radio programme at Kingfisher FM in the Eastern Cape. From the back left Zoleka Ngcete (TIA), Wendy-Lou Johnson (SANParks), Ntombekhaya Matsamko and Nombuzo Stefaans (Samkelwe Secondary School, Addo), and Gareth Burley (Kingfisher FM).



Ntombekhaya Matsamko and Nombuzo Stefaans (Samkelwe Secondary School, Addo) with Zoleka Ngceta (TIA) in the centre, pictured at the Annual Banquet and Awards Ceremony, the opening event of the Southern African Energy Efficiency Convention (SAEE2011) in Gauteng.

## Certified Measurement & Verification Professional (CMVP) – training for tax incentive measurement and verification

South Africa has just under 40 Certified Measurement and Verification Professionals (CMVP®) that are within the process of qualifying to measure and verify energy savings in accordance with the Regulation 12L of the Income Tax Act. SANAS is the authorised body to accredit M&V Bodies for this purpose, and a stipulation is that CMVP® is a requirement for such accreditation. Are you going to be caught waiting for the tax incentive regulation to be passed before embarking on qualifying for this purpose?

CMVP® training carries 2 CPD credits in accordance with ECSA requirements. The 2012 CMVP courses will be held at Emperors Palace in Gauteng on:

- 12 - 14 March 2012
- 23 - 25 May 2012
- 17 - 19 October 2012

Book online at [www.energytrainingfoundation.co.za](http://www.energytrainingfoundation.co.za).





# WATTSUP

## Past President's Luncheon



From left to right; Stan Bridgens, Ian McKechnie, Dr Angus Hay, Mike Crouch, Andries Tshabalala (2012 President), John Gosling, Bill Calder, Bruce Jackson and du Toit Grobler

As per tradition, SAIEE Office Bearers and members of staff had the pleasure of converging with numerous SAIEE Past Presidents at the annual Past President luncheon held at the end of January 2012. The University of Johannesburg welcomed the attendees to enjoy their lunch at the University's Hotel and Tourism campus. The traditional occasion was enjoyed by all, as the Past Presidents took pleasure in sharing fond memories of being a president of the SAIEE.



Mark Wilson, ACTOM's CEO and Chairman

## ACTOM acquires Savcio group

ACTOM (Pty) Ltd, the largest locally controlled manufacturer of electrical equipment in Southern Africa, has acquired Savcio (Pty) Ltd, the well-known South African group devoted mainly to providing maintenance and repair services for rotating equipment and transformers throughout Africa.

The acquisition, following approval by the Competition Tribunal South Africa today (February 13, 2012), boosts ACTOM's annual order intake by 50% to over R7,5-bln and increases the number of its operating units to 40 from the previous total of 33. The group's production, service and repair facilities now number 39 and it has 26 distribution outlets.

In addition, the total staff complement of ACTOM has increased from about 6000 to about 7500 as a result of the deal.

Mark Wilson, ACTOM's CEO and Chairman, says all former Savcio divisions will continue to operate in their existing form, under their present brand names LH Marthinusen, Marthinusen & Coutts, Reid & Mitchell, Transwire and Wilec and with their existing management and staff.

"The acquisition reinforces the group's ongoing strategy of local added value and technology development. This approach is supported by strong partnerships with multinational companies and is targeted at supplying technical solutions specifically but not exclusively tailored to the African market.

## IEEE South African Chapter hosting the Power Africa 2012 Conference, Exposition & Tutorial

" Intelligent Grid Integration of Renewable Energy Resources"

July 9 – 13, 2012

The University of the Witwatersrand, Johannesburg, South Africa



The 20th Century vertically integrated bulk electrical power systems of central power generation, high voltage transmission and power distribution system merges with information technology and communications systems to become the Smart Grid of the 21st Century. The Smart Grid is challenged to deliver on energy savings, on energy conservation from demand side solutions, on energy efficient applications and to accommodate renewable energy resources. Power Africa explores the intelligent grid integration of renewable energy resources and invites paper and poster contributions and your participation in structured tutorials and a supplier exposition.

- Call for Papers, 5 page digest and Proposed Tutorials & Exhibitions - March 30, 2012
- Notification of acceptance of Papers, Tutorials & Exhibitions - April 28, 2012
- Submission of Final Manuscript and Tutorials - May 28, 2012

## Energy Crossword Puzzle Winner

It is with great pleasure that we announce the winner of the Energy Crossword Puzzle. Mr. Tsakani Mthombeni is the recipient of R1000 prize money. Congratulations! If you want to be a winner of R1000, go to page 63 and fill in the Power crossword puzzle and email it to minx@saiee.org.za.

## Energy Crossword Answers:

### ACROSS

1. TAIWAN | 5. THREE | 6. FOUR | 8. METHANE  
9. GREATER | 11. TRILLION

### DOWN

2. COAL | 3. NUCLEAR | 5. TWO | 7. FIFTEEN  
10. ENTERIC | 12. SIXTY

ABB solar inverters for photovoltaic systems. Enabling the power of the sun.



ABB has products and solutions for renewable energy. With the growth in PV (photovoltaic) power systems, ABB offers leading edge solutions such as powerful solar inverters. ABB solar inverters are designed for increased efficiency, reliability and ease of installation to maximize your return on investment. ABB supplies complete solar power plants and associated electrical infrastructure.

Find out more at [www.abb.com/energyefficiency](http://www.abb.com/energyefficiency)

ABB South Africa  
Tel. +27 10 202 5000  
Fax. +27 11 579 8000  
E-mail: info@za.abb.com

Power and productivity for a better world™ **ABB**





# Getting off the Grid

BY I VIV CRONE | PR. ENG. FSAIEE

“Nobody’s perfect!” would be my mother’s words to me often as I was growing up. However, living in the Johannesburg Metropolitan Area, I now know that Mom was wrong and that there are people within the Municipality that are absolutely perfect in their incompetence!

Having battled for over 18 months to correct a meter reading error on our electricity bill, by repeated emails, photographs of the meter reading, subsequently ensuring that the meter reader has correctly recorded the meter reading and submission of lengthy reports justifying why we do not owe the Municipality R22,000+, without any intelligent human response, one is sufficiently motivated to seriously investigate becoming independent and getting totally off the grid!

So how feasible is this? Is it possible? Is it viable? The following gives some insights into the goal of Getting off the Grid and becoming independent of “City Hall”.

The municipality contracts with the homeowner to provide a number of services including water, electricity, waste disposal, roads and infrastructure maintenance among them.

## LET’S TACKLE THEM ONE BY ONE.

Electricity is by far the most obvious. The repeated huge price increases which have been implemented by ESKOM plus the equally large unexplained municipal surcharges on top of these increased tariffs have resulted in very substantial energy cost increases to the householder over the last couple of years.



FEATURE



The obvious solution is to reduce one's usage of electrical energy. But before you can do this intelligently, it is important to know where your energy goes. Two of us live in a north-facing, 3 bedroomed house which was replete with all-electrical appliances. Lighting was provided by low voltage down-lighters in all rooms. High efficiency CFL security lights outside complete the picture.

Before starting this exercise our daily consumption was running at an average of between 30 and 45 kWhr per day, depending on the season.

In essence about 1/3 of our Summer energy consumption was lighting, 1/3 our water feature running 10 hours per day and the remainder on cooking, water heating and other usage.

The first area to be tackled to reduce this consumption was water heating. We replaced the standard hot-water cylinder

(geyser in SA parlance) with a thermo-siphoning solar-heated system on the roof. Because we live in an area that experiences black-frosts, we opted for the vacuum tube technology, which indirectly heats water in the manifold above the tubes, instead of the conventional flat-panel collector, with direct water heating. This, so far has proved to be a correct decision as we have experienced black-frost, sub-zero temperatures on a number of occasions without problems.

The next area was that of heating the house. Although north facing, it gets quite chilly in the winter.

Here the most obvious options are oil fired, gas fired or wood burning. Gas proved to be the most expensive per kJ of heat. After examining the options we decided on a wood-burning stove as the cheapest and most attractive means. Wood is the lowest cost heat source of those considered and not directly subject to the vagaries of the

oil price. We fitted a properly designed wood stove pictured. It has a maximum heat output of about 9 kW while also being aesthetically pleasing (and carbon neutral in operation).

A single bakkie-load of wood enables us to have a fire every evening of the winter with an occasional all day fire for the colder weekend days. Tree prunings during the year are retained and also used as heating fuel.

Our house was built in a time when ESKOM was encouraging everyone to use their excess electricity at a very favourable tariff. We have a total of 68 fifty Watt down lighters! Of these, about 32 in the main living areas, are used for between 4 and 5 hours per day.

We decided to replace these with LED downlighters. Initially we obtained samples of various manufacturer LED lamps to try them out. In general there are 3 colour variations; from 2800K to 6500K. We chose 3000K as being the closest to the existing halogen lamps. The 6500K lamps gave a very harsh light not in keeping with a normal home. There are many parameters that describe the light emitted by a lamp. One important one is the CRI or colour-rendering index.

Ranging from 100 downwards, it became apparent that lamps with a CRI of less than 75 significantly changed the appearance of certain colours. Even with a CRI of more than 75, some lamps did not render certain colours accurately. For instance, one particular lamp made a perfectly cooked steak look grey and distinctly unappetising!

Finally a number of decisions were made; as the cost of the LED lamps was of the order of 20 times that of the halogen lamps, only those lights that were most frequently used were replaced. Most of these 50W lamps were replaced with Osram warm white

5.5W LED downlighters. This gave an acceptable light level, although the beam angle was narrower than the halogen lamps and created some darker spots in certain rooms. Passage areas and thoroughfares were replaced with 3W LED lamps, which gave an adequate illumination. The lamps used had a CRI of better than 80 and colours are accurately rendered.

At the time of replacement, the cost of these high quality, European designed lamps was about R180 per lamp. All in all, we replaced 34 halogen lamps with LED units with the result that the normal lighting demand has been reduced from 1700W to less than 200W! With an advertised life of over 25000 hours, we don't expect to have to replace these any time soon.

Finally the electric hob was replaced with a gas unit supplied from an external LPG gas bottle. The dual electric oven has been kept as most of our food preparation is done on the hob.

To take care of longer than usual power outages, we purchased a 5.5KVA petrol generator. This is sufficient to power all essential appliances and provide a comfortable existence when the City Power distribution network or ESKOM power stations fail to keep up. The disadvantage is the cost and noise. Fuel costs alone mean that each kWhr of energy produced costs around R5 at current petrol prices, substantially more than even the current municipal rate.

The reader's notice is drawn to a booklet published by the AMEU in 2008 laying out the guidelines for the safe use of portable generators. Incorrectly wiring a generator into your house wiring can result in disaster, which in turn may result in a claim being repudiated by your insurance company.

At this stage, our average daily consumption of electrical energy is between 15 and 20 kWhr, while running the water feature for 10 hours. If the water feature was turned off, this would reduce the current consumption a further 11 kWhr. As far as water is concerned, the obvious solution is to drill one's own borehole. However as we live on top of a rocky hill, drilling will be expensive and this has been shelved as a possible future project.

Currently our water is supplied by Joburg water from a large reservoir close by. Again as we are high up, the reservoir has to be filled using pumps powered by City Power.

The reliability of supply, however, is spoiled by two potential problems. The first is the inevitable electricity outages and the second is long outages due to pump failures. Five days without any water is not unknown!



Thermo-Siphoning Solar-Heated System



Water feature running an average of 10 hours per day.

**BY MAKING A SIMPLE ARRANGEMENT THAT INCLUDED AN ENERGY METER WE MEASURED THE ENERGY CONSUMPTION OF THE MAJOR APPLIANCES IN OUR HOUSE WITH THE FOLLOWING RESULTS:**

Appliance	Energy Consumption	Remarks
Washing machine	±1 kWhr per load	Average of 3 loads per week
Dryer	±2 kWhr per load	Average of 3 loads per week depending on weather
Refrigerator	±1 kWhr per day	
Freezer	±1 kWhr per day	
Geyser	±6 to 10 kWhr per day	
Lighting (68 downlighters)	3400W max!	Ouch!
Water feature	1.1 kWhr/hour of running. Normally 10 hours giving ±11 kWhr per day.	Obviously it is a decision whether to run this or not!
Space Heating	2.5 kW for an average of 3 to 4 hours. ~10 kWhr	Only in Winter months
Stove and Oven	2.5 kW for an average of 1 to 2 hours per day	





We installed a 2000-litre-JoJo tank.

To counter this we installed a 2000 litre JoJo tank in series with the city supply with an associated booster pump. This has given us at least a week's supply of water (two weeks at a stretch) and improved water pressure in the house. Now we can also have a decent shower!

As far as system resilience is concerned, we can currently survive a couple of weeks without City water and indefinitely without City power (but at a significant increase in electricity cost).

### SO WHAT IS NEXT?

Can we replace the remaining electrical demand using renewables?

As wind is not an option where we are (Johannesburg), we have investigated the use of a solar photovoltaic solution. With current local retail prices running at around R25 per Watt, this is not yet viable, especially when one includes the additional costs of batteries and associated control and power equipment.

### WHAT ABOUT RAINWATER HARVESTING?

This is another area of future work.

### SO WHERE ARE WE?

Currently we have reduced our normal electrical energy consumption by about 1/3. If we chose to do away with the restful sound of running water in the garden by turning off the water feature we could reduce by a further 1/3, resulting in a total reduction of 2/3 from where we started. The winter electric heating is replaced with a lower cost and more environment-friendly heating solution.

This remains an on-going exercise and further work will be done towards becoming independent of the grid. We probably will not succeed completely. However the on-going inability of City of Joburg officials to render effective and reliable services provides continual motivation.

### THE ULTIMATE GOAL?

To use the City and ESKOM as a backup supplier of services! **wn**



We decided on a wood-burning stove as the cheapest and most attractive means in saving electricity.



## Reliable Transformers

Reliable Transformers was founded 30 years ago. Despite the fact that we mainly relied on "word of mouth" advertising in the beginning, our reputation grew and today we are a successful and a serious player in the transformer market.

### WHAT WE OFFER

While many transformer manufacturers are cutting their products to the bone to offer lower prices, we don't sacrifice quality in order to quote lower prices. We are not the largest transformer company and we never aim to be. We would much rather be labeled as the best. We pride ourselves in building solid and robust products that will outlast many of our competitor's offerings.

### OUR CUSTOMERS

From our headquarters in Benoni, 20km from Johannesburg in South Africa, we service a growing network of customers throughout Southern Africa, the SADC region and beyond. We export transformers to the United States, South America, Saudi Arabia and all over the world through our Channel Partners.

### OUR STAFF

Our ever growing staff compliment currently stands at approx 80 people. We have extremely talented and experienced staff. Some of our employees have more than 20 years service resulting in our retention of crucial skills, expertise and in-depth knowledge.

### OUR TECHNOLOGY

Our experienced and qualified designers use state-of-the-art CAD design tools to design all our products. Our quality management system, based on ISO9001:2008, along with our production management systems, are entirely computer controlled allowing us to accurately predict job completion times. We test and manufacture our products strictly according to the applicable SANS and specific customer's standards. We conduct routine tests and inspections throughout our manufacturing processes.

### OUR EXPERTISE

We offer our products in both copper and aluminium.

Some manufacturers have given aluminium a bad name in the past by not being able to produce aluminium wound transformers of similar quality and performance to those made from copper. This has given rise to many myths about aluminium as a winding material.

We are proud to say that we have been producing aluminium wound transformers of equal or better quality and performance to that of copper for more than 10 years. Aluminium allows us to produce lower cost transformers. Lower costs mean savings to our customers without them having to sacrifice quality or performance. A further advantage is the fact that aluminium has significantly lower scrap value to that of copper and resultantly aluminium wound transformers are at much lower risk of being vandalised when compared with copper wound transformers.

### OUR STANDARD RANGES:

We offer Single phase & Three phase Dry-type and Oil-filled Power and Distribution transformers Up to 3.5MVA.

### WE ALSO PRODUCE AND SUPPLY:

- Auto Transformers
- Constant Voltage Transformers
- Furnace Transformers
- Rectifiers
- Precipitator Transformers
- Reactors
- Chokes
- And our own range of 100% duty cycle Plasma Cutting Equipment

### RESEARCH & DEVELOPMENT

Apart from our constant efforts to improve our current ranges, we are currently also involved in the Renewable Energy Sector. Watch this space for more.....

### WE ARE EXPANDING

Our expansion program commenced with the relocation of our Core Cutting and Tank Fabrication divisions into two larger factories during 2011.

The remainder, to be concluded by November 2012, will encompass the following:

- A state-of-the-art assembly workshop with 25 ton lifting capacity.
- Completely new test facilities providing more effective quality control.
- Extended research and development facilities.
- Upgrading of our steel preparation and painting facilities.
- Expanded yard space with overhead truck loading capability and streamlined materials handling capability.
- Upgraded our Oil Storage facilities.
- A modern three storey office block offering a comfortable and spacious work environment for administration staff and management.

For more information  
please contact:  
**Gerhard Duvenhage**  
Sales Manager  
011 421 2333  
083 966 1377  
wattnow@reltrans.co.za  
www.reltrans.co.za





# Dynamic Compensation for AC Arc Furnaces

## THE AC ARC FURNACE POWER QUALITY ISSUE

AC Arc Furnaces rate among the highest contributors towards power quality issues in any power network. Not only are their loads rich in harmonic currents but the very variable nature of the current and current waveform make them one of the most difficult types of loads on which to apply compensation. This article shows that the traditional option of employing Static VAr Compensation on the Medium Voltage Systems to this type of furnace can now be supplanted effectively with Dynamic Compensation at low voltage, directly on the secondary sides of the furnace transformers. Dynamic compensation not only offers all the features of Static VAr, but also offers synchronous switching and eliminates the requirement for additional special harmonic filtering.

The sketch in Figure 1 (pg 24) shows the typical connection configuration of a 6-in line AC Arc furnace. Three separate single phase furnace transformers are used to step down the typical 33kV incoming 3-phase voltage to 1000 V for each of the three electrode sets in the furnace. Other furnace configurations use three electrodes in trefoil in a single bath, and also in the case with three separate furnace transformers.

The delta-connected primaries serve to cancel out the triple-n harmonics, of which the 3rd harmonic current dominates, and that harmonic is injected into the supply network at 33kV. Unfortunately only the balanced 3rd harmonic components are cancelled, and because of the stochastic nature of the loads in the three single phase secondary supplies to the furnaces, cancellation assists in this regard, but is not very effective.

The synchronised recordings of the furnace current and furnace voltage on one phase of a typical submerged arc furnace are shown in Figure 2. For analysis purposes, use was made of several Elspec G4420 Power Quality meters that record all the waveforms of every network cycle at 512 samples per cycle resolution. Hundreds of hours of recorded data was simplified through retrieval of specific types of behaviour by means of using the very flexible and accessible behaviour of the accompanying Elspec Investigator Software.



# Dynamic Compensation for AC Arc Furnaces

continues from pg 23

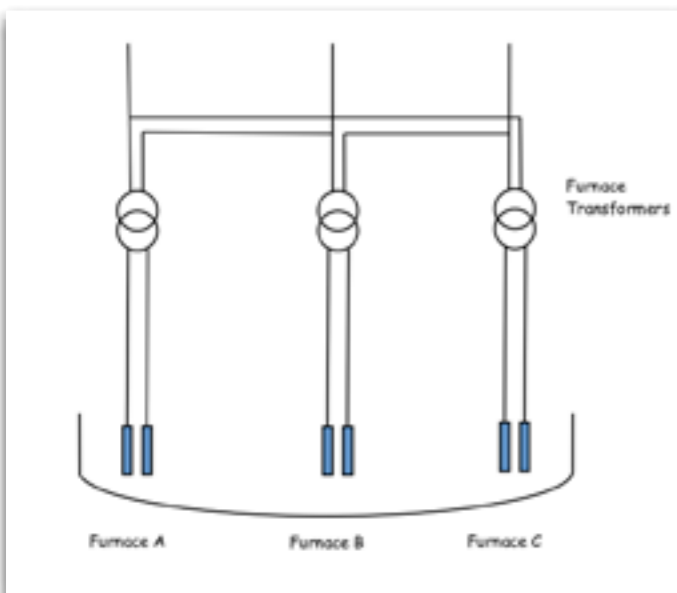


Figure 1 - Typical 6-in line AC Arc Furnace single phase connection topology

## TYPICAL AC SUBMERGED ARC FURNACE CURRENT AND VOLTAGE WAVEFORM

Aside from their stochastic nature, the waveforms shown in Figure 2, the current is dominated by 3rd Harmonic and other higher order harmonics.

## STATIC VAR (SVC) COMPENSATION

AC arc furnace harmonics were traditionally compensated by passive filter banks on the medium voltage side (the 33kV in the present example). Unfortunately passive filtering cannot take care of the sub-harmonic flicker frequency of the furnace currents. Traditionally Static VAr compensation using phase-controlled switching and line commutation was employed for fast power factor control and voltage drop compensation. This is to reduce voltage flicker at intervening high voltage nodes in the power supply system. A simplified single-phase topology of a Static VAr compensator, used for Flicker Reduction on an AC Arc Furnace is shown in Figure 3.

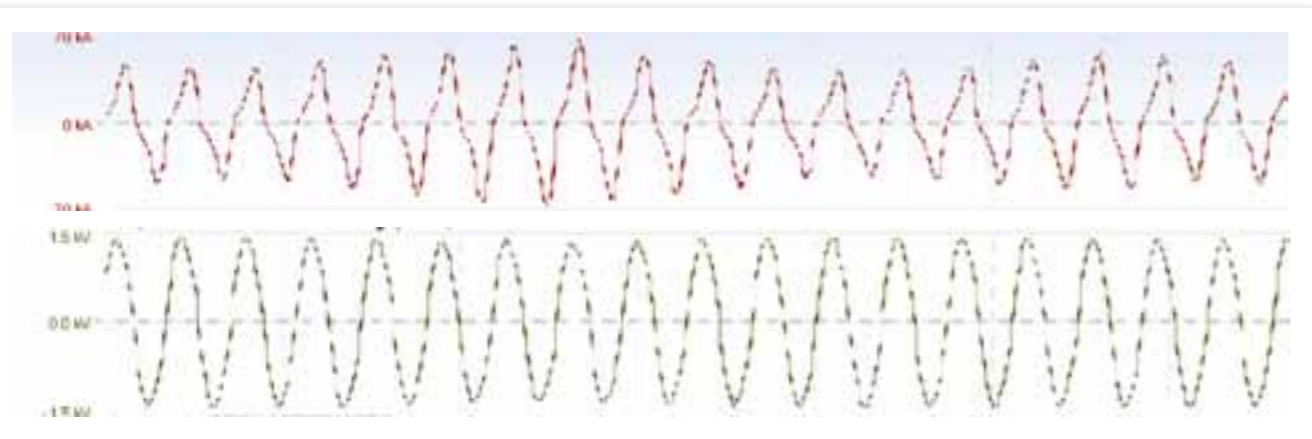


Figure 2 – Typical AC Submerged Arc Furnace current and voltage waveform

## STATIC VAR COMPENSATOR USED FOR AC FURNACE FLICKER MITIGATION

The static VAr Compensator employs a multiple set of series connected (referred to as a valve) of SCRs that are connected in anti-parallel in each phase leg. Its operation is roughly as follows: The shunt capacitor bank in Figure 1 remains connected, and injects a fixed level of leading reactive power into the circuit. By triggering the thyristors for conduction earlier and later in each cycle, the shunt inductor is respectively switched in over longer- or shorter duty cycles in each cycle. This furnishes a variable amount of lagging reactive power that cancels out the leading reactive power injected

into the circuit by the capacitor banks. By controlling the firing angle of the SVC the shunt reactive power drawn by it can be continuously varied. This, in turn will control the reactive voltage drop in the supply system, and through it fast per-cycle voltage stabilisation can be obtained to reduce voltage flicker<sup>2</sup>.

## DYNAMIC SECONDARY POWER FACTOR CORRECTION WITH FLICKER COMPENSATION

Static VAr compensation of the type discussed above produces harmonics of its own into the system because of the variable asynchronous switching it employs and the current waveform distortion it introduces. That requires separate harmonic filtering. Also, because of the high levels of power that must be handled, it is more economical to install SVCs on the primary sides of the Furnace Transformers where the voltage level is higher. That means that all the benefits of power factor correction are lost on the furnace transformers.

Because of their high capital cost, the furnace transformers usually present bottle-necks for power handling capacity in AC arc furnace installations. AC arc furnaces must be operated at low power factor to satisfy optimal power throughput and arc stability criteria. The furnace power factor can be as low as 85%<sup>[1]</sup>. That means that the active power handling capability of the furnace transformer is reduced compared with a higher power factor load drawn by the furnace. In addition, because of the high levels of especially 3rd harmonic current injected into each single-phase transformer, de-rating of the transformers is necessary. The amount of de-rating depends on the construction of the transformers. By improving both the power factor as well as reducing the harmonic content in the furnace transformer secondaries, both MVA-release and harmonics-release can be furnished and existing furnace transformers become able to increase their loading. In new designs, considerable reduction in furnace transformer capital cost can be achieved.

Dynamic VAr Compensation by means of Thyristor Switched Capacitor Systems on the furnace-sides of AC Arc Furnace Installations simultaneously addresses the three main issues in power quality improvement. The way that it can be done is illustrated in Figure 4.

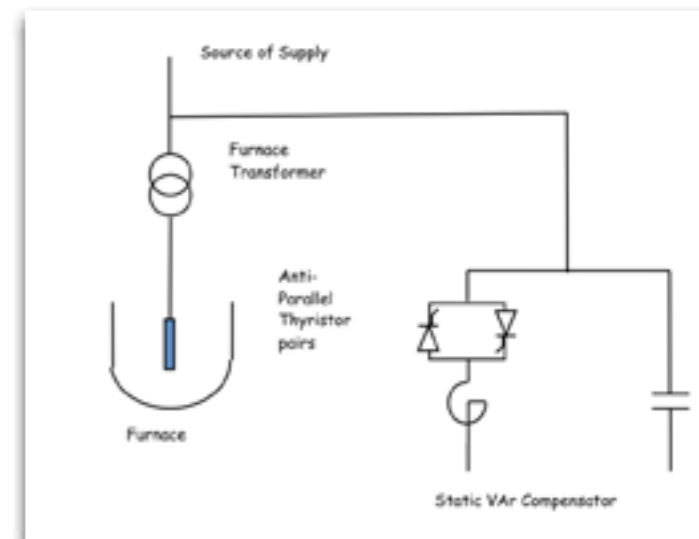


Figure 3 – Static VAr Compensator used for AC Furnace Flicker Mitigation

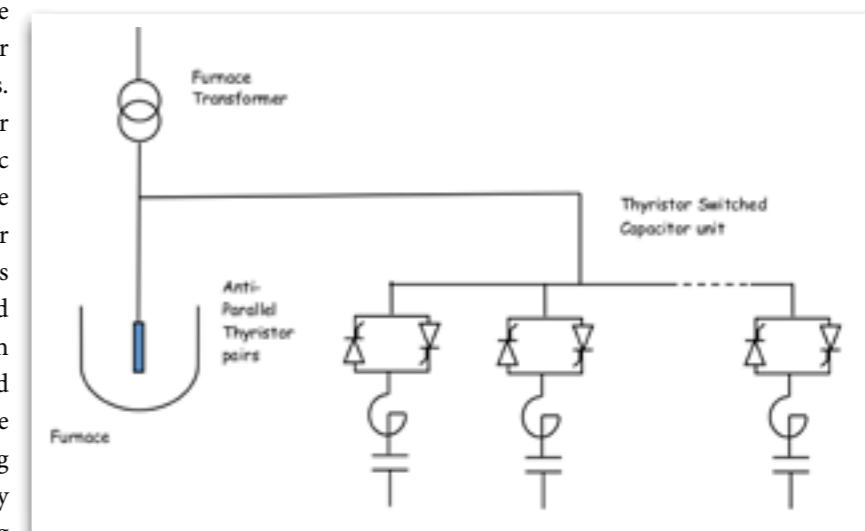


Figure 4 – The Essence of Dynamic Secondary Power Factor Correction and 3rd Harmonic Filtering



# Dynamic Compensation for AC Arc Furnaces

continues from pg 25

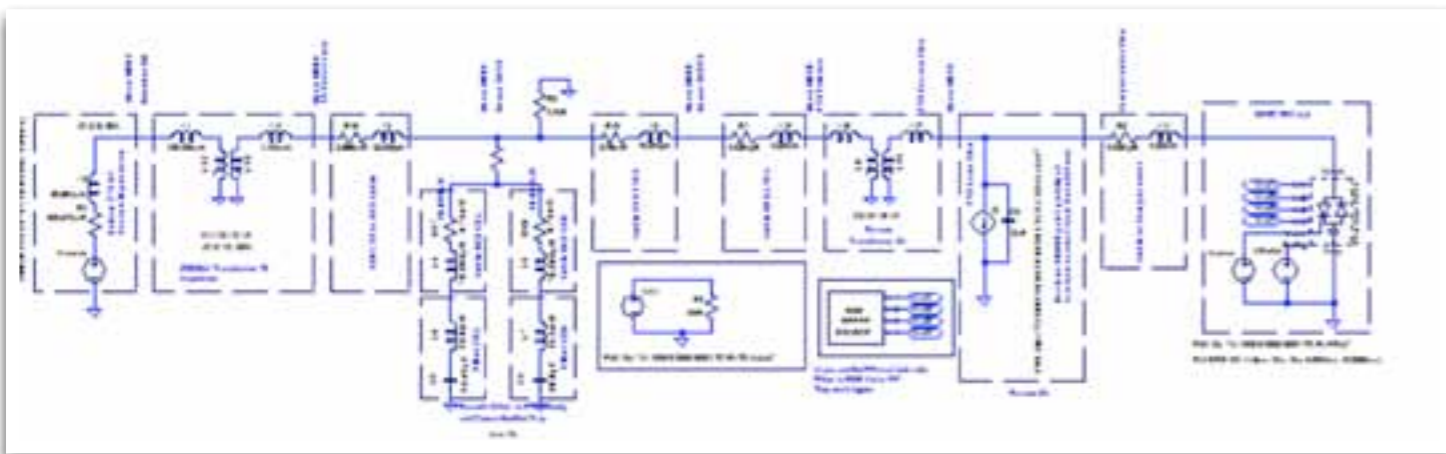


Figure 5 – Complete Single-phase model of the Furnace 3 Power Supply System

## THE ESSENCE OF DYNAMIC SECONDARY POWER FACTOR CORRECTION AND 3RD HARMONIC FILTERING

The simplified diagram in Figure 4 shows one phase of a three phase AC arc furnace in which a set of Thyristor Switched 3rd harmonic filters are connected on the furnace side. Each of the filters are controlled by a set of anti-parallel thyristors that are only switched in and out when the voltages across each respective capacitor bank is of the same magnitude as the supply voltage.

That means that there will be negligible current transients both during switch-in and switch-out of each bank, and only sinusoidal current waveforms will prevail. In addition, the capacitor banks will not be subjected to the traditional stresses that are so characteristic of asynchronous hard-switching.

Because there are virtually no switching losses or transients, successive filter banks can be switched in and out on a per-cycle basis to compensate for power factor, secondary transformer voltage regulation or any other parameter that needs to be compensated.

The main advantages that are gained from a Dynamic Secondary Power Factor Correction scheme such as that illustrated in Figure 4:

- Harmonic-free switching;
- Harmonic current filtering, which could include for 2nd, 3rd, 5th and others;
- Voltage regulation on a per-cycle basis;
- Phase balancing on a per cycle basis in the presence of furnace unbalance;
- Per cycle power factor correction;
- Stiffening of the supply network, enabling more power to be drawn from the utility;
- A reduction in the Maximum Power Demand without compromising on the average power drawn by the furnace;
- Higher production throughput through the furnace at the same incoming power level;
- Increased Arc stability;
- Reduced Voltage flicker;
- Drastic reduction in harmonics through the furnace transformer;

## HOW IT IS DONE

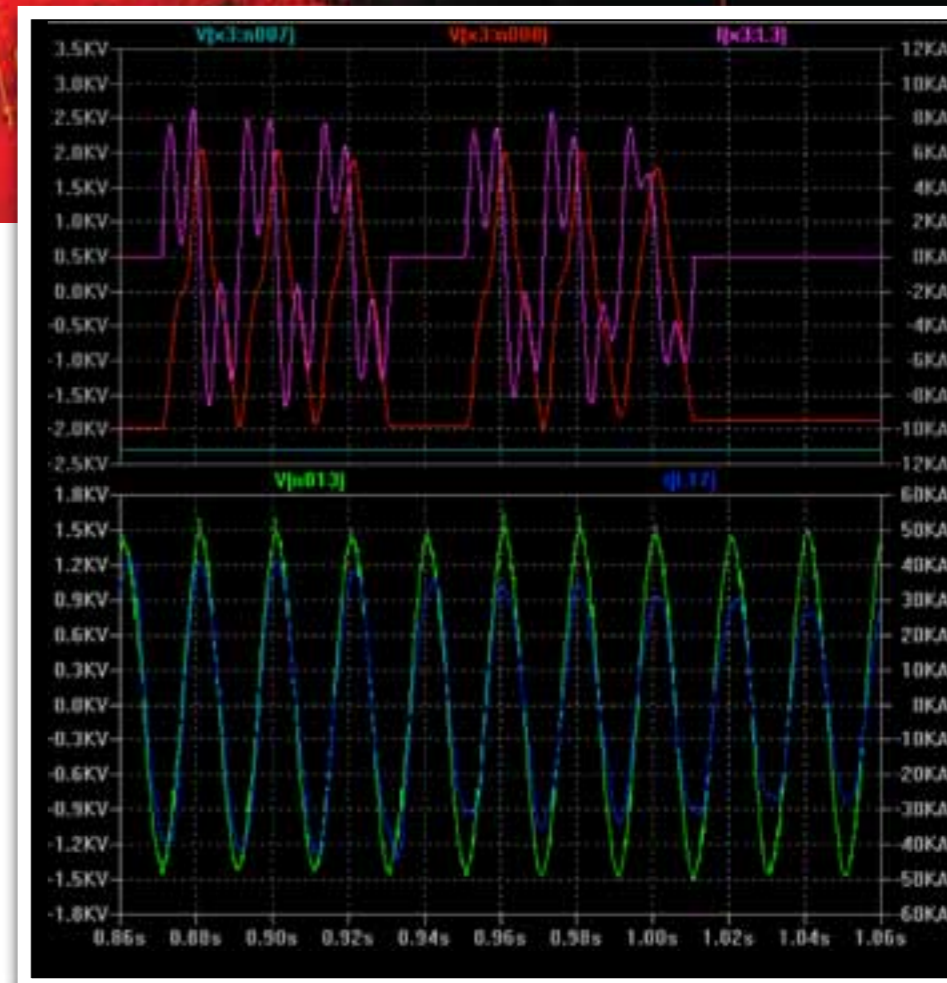
The diagram in Figure 5 shows the schematic capture from a Single Phase Simulation by means of an LT Spice Simulator Package<sup>3</sup>.

## COMPLETE SINGLE-PHASE MODEL OF THE FURNACE 3 POWER SUPPLY SYSTEM

The complete power system is modelled starting at the Thevenin Equivalent source on the left and ending with the Dynamic Compensator on the right. The operation of the Dynamic Compensator (through Thyristor Switched Capacitor Implementation) is illustrated in Figure 6.

Additional filter banks are switched in or out by control. The filter currents are distorted and rich in 3rd harmonic currents, sinking the furnace dominant 3rd harmonic current and keeping it out of the furnace transformer. Note how the capacitor voltage smoothly runs for one or more cycles while the bank is switched in and returns to negative maximum voltage in anticipation of another switching cycle. The filter current always begins at zero and makes a full cycle or more depending on the control demand and ends at zero. The currents also exhibit the dominance of a 3rd harmonic component. Note how the total load current (on the furnace transformer primary side) reduces and the load voltage there increases when more capacitance is switched in on the secondary

Figure 6 – Example of the operation of a TSC system showing the Furnace Transformer Primary current and voltage waveforms in bottom trace and the Filter current and voltage for one of the capacitor banks in the top trace



side in parallel with the furnace load. Also note the virtually unity power factor at the furnace transformer primary side and the low distortion of both voltage and current. (Compare the typical load current of the furnace as shown in Figure 2).

## CONCLUSIONS

Dynamic Secondary Power Factor Correction for AC Arc Furnaces are able to be combined with harmonic filtering

and accomplishes several highly valuable functions in power conditioning on the secondary furnace transformer sides. The same is not possible by compensating on the furnace transformer primary sides.

## BIBLIOGRAPHY

- Erwin Plockinger and Otto Etterich, "Electric Furnace Steel Production", Wiley and Sons, 1955, pp 145.
- Carlos Maffrand, Juan Dixon and Louis Moran, Binary Controlled Static VAR Compensator, Based on Electronically Switched Capacitors, Power Electronics Specialists Conference, 29th Annual IEEE PESC Conference, 1998.
- Excellent Time Domain Simulation Software Available for Download on the Internet from Linear Technologies at [www.linear.com/designtools/software/](http://www.linear.com/designtools/software/)

*Thyristor Switched Capacitor Systems are commercially available through Impact Energy Pty Ltd ([www.impactenergy.co.za](http://www.impactenergy.co.za)).*

# Impact Energy

**Appointed**  
**ELSPEC**  
**Distributors in**  
**Southern Africa**

29 Hopson Avenue Davenport 4000  
Telephone: 031 201-7191  
Fax: 088 031 201-7191  
email: [elspec@impactenergy.co.za](mailto:elspec@impactenergy.co.za)

**Elspes EQUALIZER - The World's most Advanced Power Quality System**

- Complete compensation in 2/3 cycle typical
- Energy Savings
- Harmonic filtration
- Transient-free switching
- Improve service utilization
- Enhance local power generation capacity
- Significantly reduce voltage drops & flickering

**32 MVAR Equalizer System at Substation**

[www.impactenergy.co.za](http://www.impactenergy.co.za)



GENERAL OVERVIEW OF HARMONICS IN

# Power Networks *with* Power Factor Correction Capacitors

It is commonly accepted that utilities generate a near perfect sine wave voltage. In most areas, the voltage found on transmission systems has very low distortion. However, as we move closer to the load, the distortion increases.

BY EPHRAIM KADEC | VICE PRESIDENT | ELSPEC LTD.

The utility that is represented at the customer end by the power distribution transformer is the most common power source in industry. This type of power source is voltage source and its main objective is to maintain stable voltage across its secondary windings. The load's impedance should be much higher than its internal windings' impedance. Ideally, the internal windings' impedance should be zero. In practice it is commonly 5%-7% of the full load impedance due to windings' reactance and parasitic resistance.

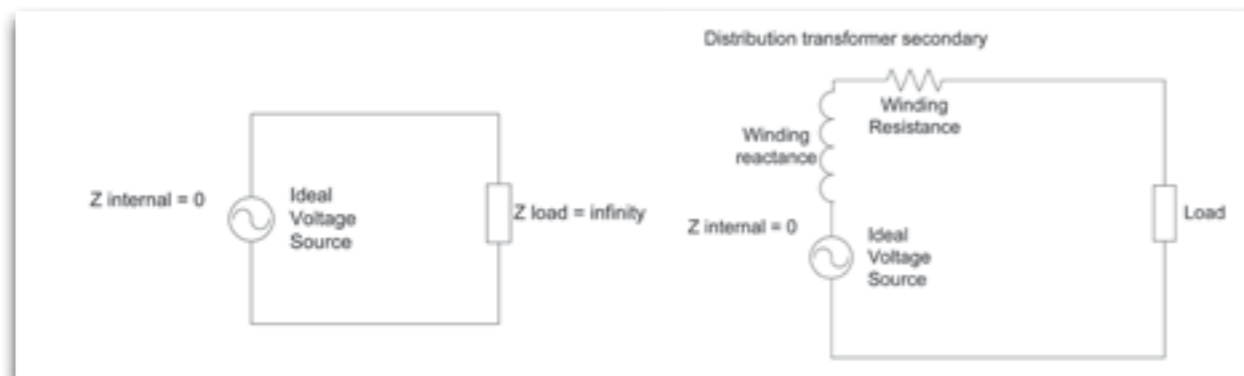


figure 1 – Ideal voltage source vs a practical voltage source



The quality of the voltage sine wave on an unloaded distribution transformer depends on the quality of power generation and interferences from other distribution branches.

Let's analyze a theoretical case, where the power is generated exclusively for one distribution transformer and the voltage is a pure sine wave. In this case, any load connected to the transformers secondary will "see" a pure sine wave voltage and will draw current, according to the load's impedance. When the load's impedance is linear (does not change within a network period), the current waveform will follow the voltage's wave shape very accurately. If the load's impedance is changing

periodically due to chopping, or any other nonlinear operation, the current waveform may differ considerably from the voltage sine wave.

The distorted, non-sinusoidal current wave can be expressed as a sum of pure sine waves, in which the first component is the fundamental frequency and the others are integer multiples of that basic frequency. Each multiple is called a harmonic of the fundamental. All the components (including the fundamental frequency) are simply referred to as harmonics.

Harmonics are current waves created by nonlinear loads. Their frequencies (harmonic order) and magnitudes are

determined by the nature of the load's operation. For example, most DC drives have 6-pulse rectifiers, which generate harmonics, mostly 5th and 7th orders.

The 5th harmonic has a frequency 5 times faster than the basic (fundamental) frequency and the 7th is 7 times faster.

Each harmonic is actually a power source at a higher frequency. Since the harmonics are created in current they are current sources.

### IDEAL CURRENT SOURCE

Unlike voltage source, an ideal current source has infinity internal impedance and prefers zero load impedance, to maintain stable current.



# Power Networks with Power Factor Correction Capacitors

*continues from pg 29*

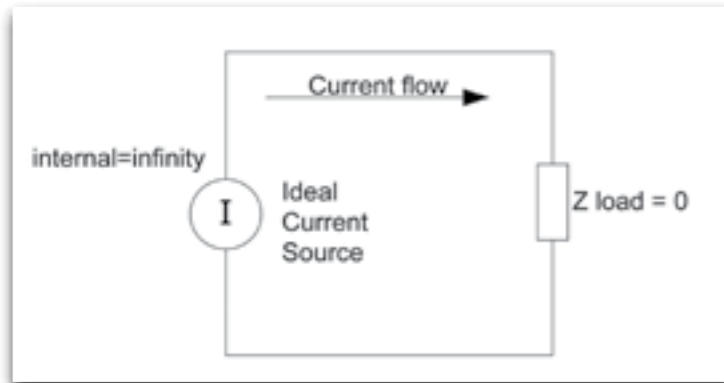


figure 2 – Ideal current source

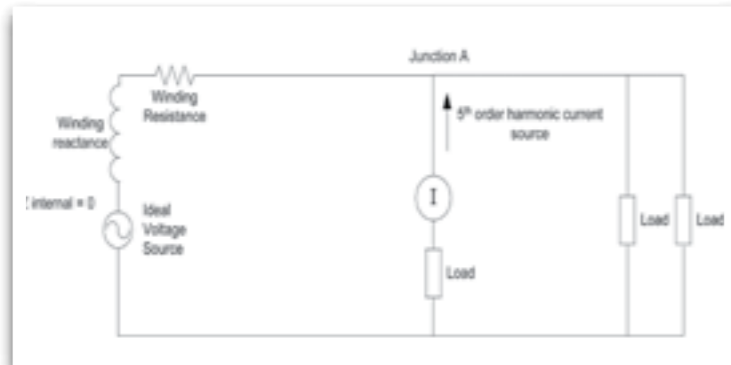


figure 3 - A network diagram of a plant which one of its loads generate 5th harmonic

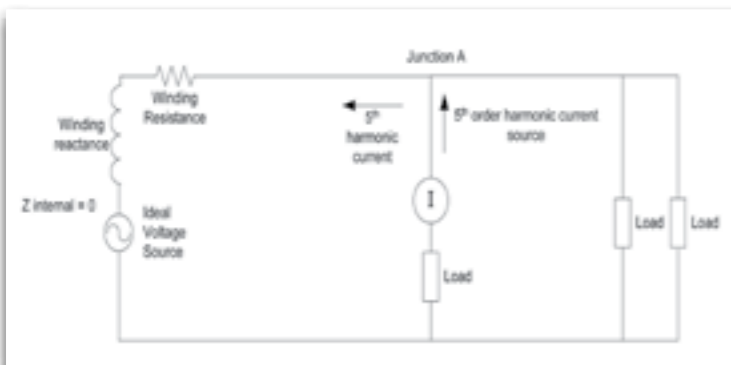


figure 4 – the 5th harmonic current path

The nonlinear load can be expressed as a linear load part and a high frequency current source(s) part. For simplicity, consider a situation where only one of the connected loads is nonlinear and generates only 5th order harmonic current.

### A NETWORK DIAGRAM OF A PLANT WHICH ONE OF ITS LOADS GENERATE 5TH HARMONIC

The 5th harmonic current is represented by a current source, which is a part of the load's operation elements. This harmonic current is being pushed to the network through junction A. At junction A the current will choose the lowest impedance path to flow. The impedance to the left is composed of the internal impedance of the distribution transformer and the line impedance. The total impedance on the left side is much lower than the impedance of the loads on the right side. Thus most of the harmonic current will flow towards the power transformer.

### THE 5TH HARMONIC CURRENT PATH

This current, flowing through the line and transformer's impedances, generates fluctuations, within the same frequency order over the voltage sine wave. These are the voltage harmonics. Additionally, this current, flowing through the transformer's secondary, will induce harmonics over to its primary side, towards the utility. Still, these fluctuations are relatively small.

Now assume that our plant requires power factor correction due to low power factor at the fundamental frequency. A power factor correction capacitor has been added to correct this situation.

### ADDING A PFC CAPACITOR

The harmonic current coming to junction B finds a capacitor and a branch that includes a resistance and a reactance, parallel to it. The resistance part is negligible in most cases, so basically the above can be expressed as a parallel resonance circuit, on the path of the 5th harmonic current. In a case where  $X_L$  will equal  $X_C$ , parallel resonance will take place.

The parallel resonance raises the circuit's impedance dramatically, to infinity values. The current is circulating between the capacitor and the inductance, without being passed to the grounded terminal.

At parallel resonance, or even near resonance condition, the path of the Power Factor Correction (PFC) capacitor and the

*The PFC capacitors will most likely not be able to withstand the high harmonic current, circulating between the capacitors and the distribution transformer.*

distribution transformer introduces very high impedance at the harmonic current frequency. That path is no longer the lowest impedance path, for the harmonic current, starting at junction A. At parallel resonance condition, the harmonic current is forced to go to the load part of the plant.

### PARALLEL RESONANCE

Since the path's impedance is increased dramatically, the harmonic voltage is increased dramatically too. The parallel resonance between the PFC capacitor and the distribution transformer's windings is an extremely dangerous situation for the entire electrical system. This situation may cause very significant damage to the electrical infrastructure. Normally the weakest part, which is the PFC capacitors, will be the first to fail. The PFC capacitors will most likely not be able to withstand the high harmonic current, circulating between the capacitors and the distribution transformer. In few cases where the capacitors withstand the high harmonic current more costly consequences may happen. In this situation, the power distribution transformer or some of the loads may be badly damaged.

The PFC capacitor itself has linear impedance. It does not generate harmonics. However, it always changes the network's frequency response. Regardless to parallel resonance it can either increase or filter harmonics in the network, generated by nonlinear load(s). Resonance condition is determined by the overall capacity (and overall  $X_C$ ), influenced by the number of capacitors connected, and the network's inductive impedance. It is enough for a little harmonic source to generate noticeable voltage distortion and potentially cause damage to the electrical network.

In order to prevent parallel resonance, Elspec and some other PFC systems manufacturers strongly recommend using "Detuned" system configuration, as a standard for any PFC application.

We will now demonstrate this solution on a power network of a plant, with the following characteristics:

1. Transformer: 1000kVA with 7% impedance.
2. Capacitor system: 6 steps of 100kVAr at 400V, 50Hz.
3. The utility generates power exclusively for the plant's transformer.

In case where no capacitors are connected, the network impedance behavior matches the pure inductance frequency response.

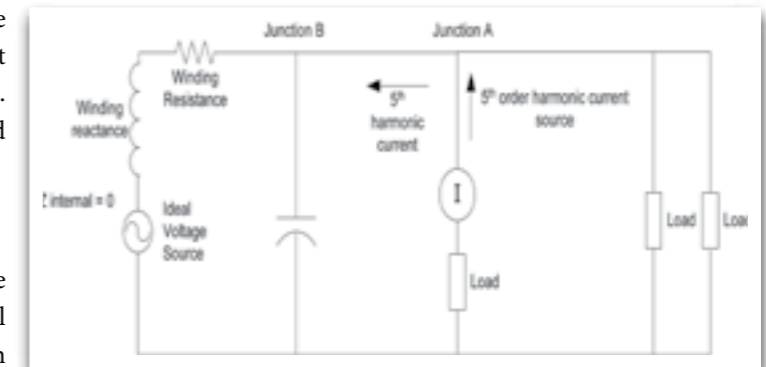


figure 5 – adding a PFC capacitor

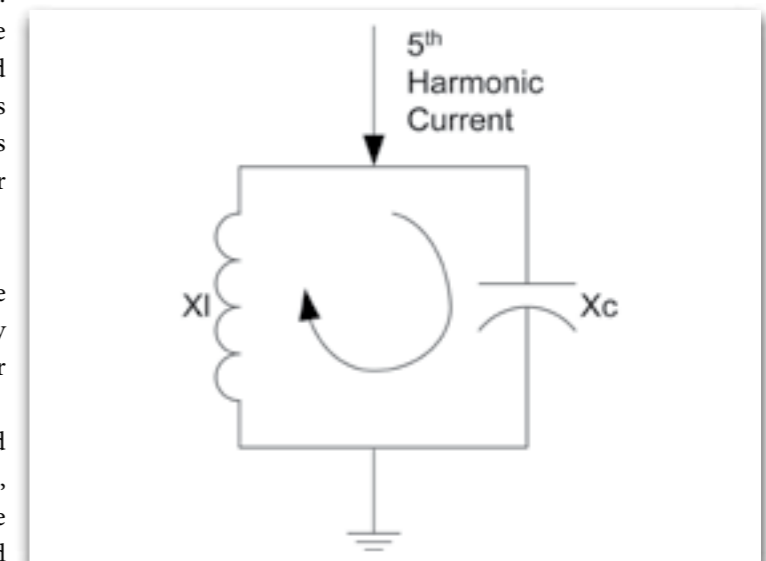


figure 6 – parallel resonance



# Power Networks with Power Factor Correction Capacitors

continues from pg 31

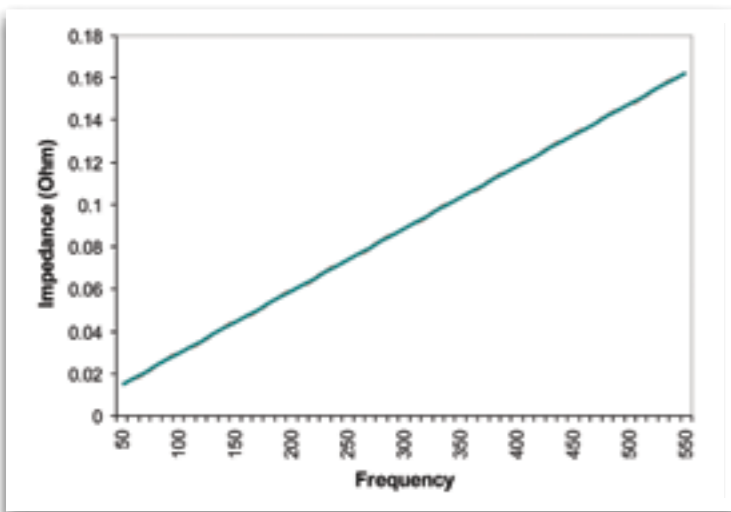


figure 7 – pure inductive impedance of a network without capacitors

## PURE INDUCTIVE IMPEDANCE OF A NETWORK WITHOUT CAPACITORS

The network impedance, from the harmonic source point of view, is linear. It starts somewhere at 0.02Ω for 50Hz and goes up linearly to 0.16Ω at 550Hz (H11).

Please note: the values are valid for this specific case only.

Now, we will connect the capacitors:

## IMPEDANCE OF A NETWORK WITH CAPACITORS

The network impedance has been changed dramatically. A few pure parallel resonance points are observed, depending on the number of capacitor groups engaged.

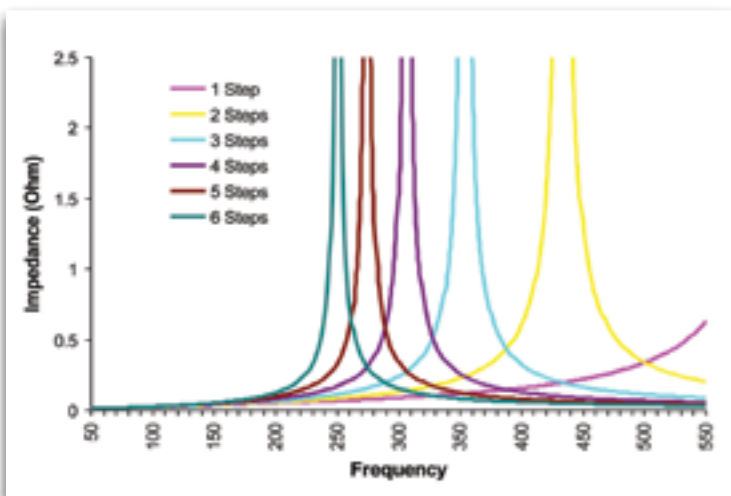


figure 8 – impedance of a network with capacitors

For example, there is a pure resonance condition at 250Hz (H5) when all 6 groups of 100kVAr are connected. The skirts of the resonance graph are not very steep so even at points out of the pure resonance area the network impedance is significantly increased. When only 5 capacitor groups are engaged at that frequency (H5) major disturbance to the network will occur as well since the network impedance is increased from 0.06Ω to 0.4Ω (almost 7 times higher)!

In order to create major disturbance, it is enough to have a parallel resonance condition somewhere in the area of harmonic source frequency.

Whenever capacitors are used for Power Factor (PF) correction, there is a frequency where the network will resonate (parallel resonance). The only way to prevent parallel resonance from occurring is to ensure that the resonance frequency is located in an area (frequency) where there are no harmonic injection sources. It can be accomplished by adding inductors in series to the PFC capacitors. This is the main idea behind the “Detuned” system configuration.

## ADDING A DETUNE INDUCTOR

The tuning frequency is the frequency of the serial resonance between the “Detune” inductor (Xl1) and the capacitor (Xc). That frequency is always higher than the parallel resonance frequency. The most popular “Detune” solution is the 7% inductors in series with the capacitors. 7% means that the inductor’s impedance at

fundamental frequency (50Hz in our case) is 7% of the capacitor’s impedance at the same frequency. The 7% inductors will meet serial resonance condition at 189Hz, which means zero impedance in the inductor-capacitor branch, at that frequency. From this frequency and up, the inductor becomes more dominant and the branch’s impedance increases, following the shape of the inductor frequency response.

## IMPEDANCE OF A NETWORK WITH CAPACITORS AND 7% INDUCTORS

The parallel resonance condition cannot be avoided. It is just moved downstream along the frequency. The frequency of the parallel resonance still depends on the number of engaged capacitor groups, but now it must be lower than the serial resonance point (189Hz). The tuning frequency is normally chosen to be lower than any dangerous harmonic source frequency. The only potential harmonic sources below 189Hz are H2 and H3. H2 (100Hz) normally doesn’t exist, since it has an even harmonic order. Even harmonics are created by non-symmetrical sources only. Most of the electric power applications are symmetrical, so H2, as much as H4, H6 ... are usually not present in industry.

H3, which falls directly in the parallel resonance frequency, in our case, is special too.

The frequency of H3 is three times faster than the fundamental frequency (50Hz). When H3 exist on phase to neutral voltage and current, the phase-phase representation will be as follows:

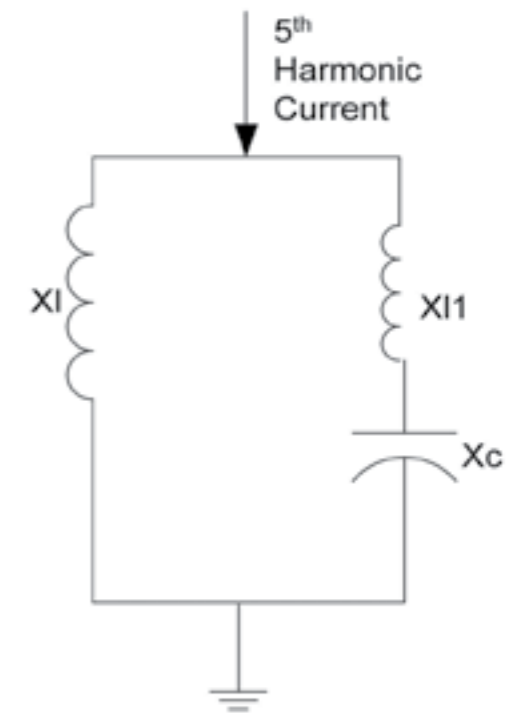
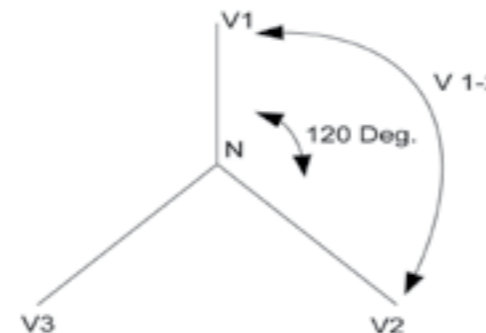


figure 9 – adding a Detune inductor

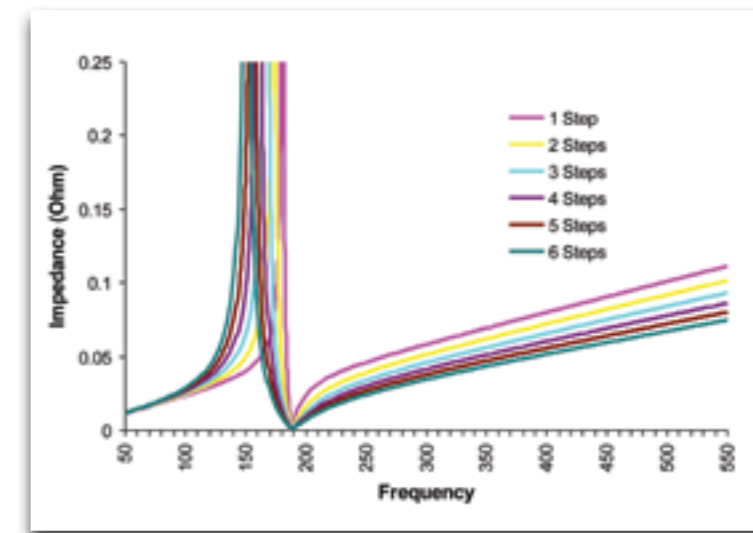


figure 10 – impedance of a network with capacitors and 7% inductors

$$V_{1(H3)} = A_1 \times \sin(3 \times \omega \times t + 3 \times 0)$$

$$V_{2(H3)} = A_2 \times \sin(3 \times \omega \times t + 3 \times 120)$$

$$V_{1-2(H3)} = A_1 \times \sin(3 \times \omega \times t + 3 \times 0) - A_2 \sin(3 \times \omega \times t + 3 \times 120)$$

Since the  $3 \times 120 = 360$  degrees which equals 0 degrees, in cases where  $A_1=A_2$ :  $V_{1-2} = 0$  !!!!



# Power Networks with Power Factor Correction Capacitors

*continues from pg 33*

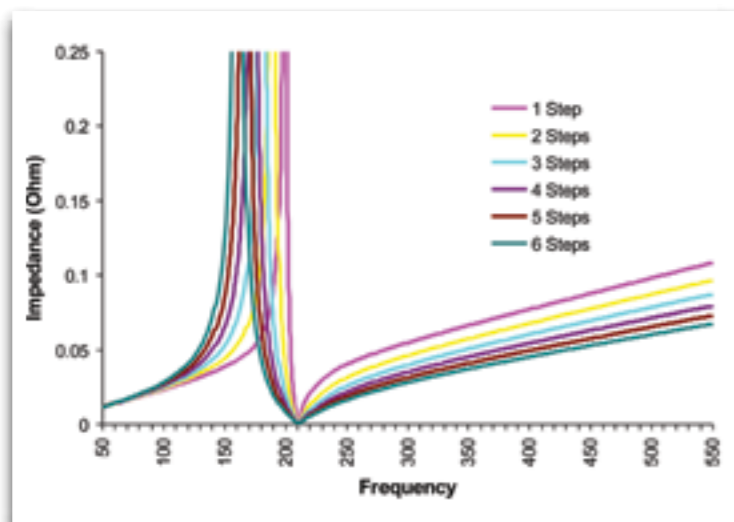


figure 11 – impedance of a network with capacitors and 5.67% inductors, tuned to 210Hz.



The meaning is that when H3 is balanced (similar magnitudes:  $A1=A2=A3$ ) and the capacitors are connected in Delta, H3 is canceled by itself across the load's terminals. The same behavior applies to all triple order harmonics H3, H6, H9 ...

In most cases H3 is balanced and capacitors' configuration is Delta, so H3 is invisible to the capacitors and cannot create parallel resonance condition.

6%-7% detuning inductors are the most popular "off the shelf" solution for Delta connected capacitors. For single-phase capacitor systems and for cases where H3 is not balanced out, the tuning frequency should be set below 150Hz.

Setting the capacitor-inductor serial resonance frequency can be used for harmonic filtering. The low impedance path at the harmonic current can absorb most of the harmonic distortion. This is actually the basic idea of the passive harmonic filtering in "Tuned" systems. It is categorically not recommended to tune the harmonic source frequency exactly as the capacitors can be easily overloaded. Tuning to 220-240Hz is normally adequate for making an efficient H5 filter.

The filter application demands a thorough study of the network and load conditions, prior to the installation, in order to avoid overloading.

Another popular solution is to tune the frequency to 210Hz (5.67% inductors), which is not close enough to serve as a filter, but can help reduce the overall network impedance at H5 frequency and absorb some significant part of H5 current. This type of system is still considered as a "Detuned" system.

### IMPEDANCE OF A NETWORK WITH CAPACITORS AND 5.67% INDUCTORS, TUNED TO 210HZ.

Power factor correction capacitors always change the network impedance for all harmonic sources. The final impedance depends directly on the number of activate capacitor groups (steps) and the inductors' tuning point.

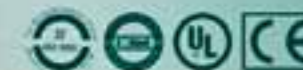
Setting the right impedance curve is the key to avoid harmonic problems, mainly, parallel resonance. **WNI**

## ACTIVAR

Fast compensation (1 second typical, 3-4 seconds maximum), unlimited number of transient-free operations.

Low-cost state-of-the-art alternative for replacing electro-mechanical power factor solutions

- Transient-Free switching
- Prevents damage to sensitive electronic equipment
- Saves energy
- Harmonic filtration
- Accurate power factor control, even with harmonics present
- Extremely long life expectancy
- Considerably low temperature rise, due to unique SCAN mode
- Integral power quality analyzer
- Unique self-testing and comprehensive reporting feature
- Easy upgrade to the Equalizer





HOW COULD IT HAPPEN?

# The Duhva Power Station Turbine Failure

BY I.R.G.W. THOMSON

PR ENG | FSAIEE | FIEE (UK) | SEN. MEM IEEE (USA) | BSC ELEC ENG | MBA | MSC ELEC ENG.

On the 9th of February 2011 an explosion occurred at the 3600MW Duhva coal-fired power station, which destroyed the 600MW turbo alternator set. The cost and time to repair are estimated at R3 billion and up to two years respectively. This occurrence has shocked users of electricity in South Africa as well as electrical engineers. Turbines and generators of that size are not purchased “off-the-shelf”; the queue is long and we will join it after some other national power authorities.

The explosion was apparently caused by a maintenance activity during which the over-speed protection system was tested by forcing the turbine to run at a rotational speed greater than the operating value of 3000 RPM. The turbine and alternator are protected by a combination of electronic, electrical, mechanical and human inter-related actions jointly described as a “Protection Scheme”.

Typically a protection scheme must give warning of an impending hazard or, when time is critical, automatically activate protection devices to reduce the probability of failure or simply shut down the plant in an as controlled as possible manner so as to minimize resultant damage. It should be borne in mind that given the size and mass (and hence the moment of inertia) of a turbo-generator set instant stop or start is impossible and the quicker the stop the higher the probability of further damage becomes.

Manufacturers of turbo alternators prescribe test procedures based on their years of experience in the specific field of design. Such tests are intended to verify the performance of the turbo-generator and the protection equipment surrounding it. Such protection equipment and its design philosophy constitute the “Protection Scheme”.

The protection scheme is intended to maintain safe operation of the equipment and provide a reliable and safe supply of electricity to the users.

Typically a turbo-generator protection scheme would include measurement and automated safety actions for at least the quantities shown in Table 1 below. The author is not a power systems engineer and others could easily provide a better list.

Main bearing oil pressure
Main bearing oil temperature
Vibration
Generator coolant gas temperature
Generator coolant gas flow-rate
Generator stator temperature
Generator rotor temperature
Generator stator current
Generator rotor current
Skilled and experienced personnel

Table 1: Basic Measurements for a Generator Protection Scheme

For the turbo-alternator to fail a certain minimum amount of protection equipment would have to fail and it is possible to guess the probability of

that happening. In some engineering designs, when a quantity or variable is mission or safety critical it is monitored twice and two alarm conditions warrant action. However the anomalous condition could arise when the two monitors give different readings; in that case the solution would be to introduce a third monitor and arrange a voting system.

Evidently the test on the 9th of February 2011 involved a manual override at one location in the power station of some part of the speed control mechanism, with manual monitoring of some variables at another location; communication between the two being presumed to be sufficient to prevent a hazardous situation from arising. It would be of great interest to many members of the SAIEE to receive more information on the nature of such tests and how they are supervised and what information is sought.

The question immediately arises: “What is a hazardous situation”. The answer is presented for the aircraft industry in Table 1, which is general enough to cover the situation at Duhva. As a means of focusing on a well-known



Figure 1: The Damaged Turbine



Figure 2: A Section of the Main Shaft Approximately 360mm Diameter



# The Duhva Power Station Turbine Failure

continues from pg 37



Figure 3: The Roof of the Duhva Turbine Hall



failure, consider the effect of the failure of any part of the steering or braking sub-systems of your motorcar. In a parking ground these would probably be only minor but at high speed on a motorway probably catastrophic. Generally when passenger aircraft are involved the design goal is to reduce the probability of catastrophic failure to  $10^{-9}$  or less (to put that in perspective, bear in mind that the probability of winning the South African LOTTO is about 1 in 14 million =  $7.14 \times 10^{-8}$ ). Failures of lesser severity can be arranged in a Failure Criticality Matrix as recommended in MIL-STD 1629A and MIL STD 1388. The definitions of various hazards are shown below.

Category	Severity	Description
1	Catastrophic	A failure which may cause death or system loss
2	Critical	A failure which may cause severe injury, or major property damage, system damage, mission loss
3	Marginal	A failure which may cause minor injury, minor system damage which will result in delay or loss of availability or mission degradation
4	Minor	A failure not serious enough to cause injury, property damage but which will result in unscheduled maintenance or repair.

TABLE 1: MIL STD 1388-2B-Safety Hazard And Severity Code

Because no one was killed or severely injured the failure can be judged as being “Critical” according to table 1.

A similar failure involving the loss of a turbo-alternator took place in 1925, 87 years ago at Vereeniging on the Vaal River. Two similar failures in 87 years imply a Mean Time Between Failures (MTBF) of 43.5 years. MIL Handbook 217 F uses the concept of a “Part Failure Rate”,  $\lambda_P$ .  $\lambda_P$  is expressed as the number of failures per million operating hours, which is convenient in this case because a turbo-alternator operates almost continuously.

$$\text{If } \lambda_p = \frac{n}{10^6}, \text{ then } MTBF = \frac{10^6}{n} = 43.5 \times 8760 = 381\,060 \text{ hours}$$

This implies that “n”, the number of failures of the turbo-alternator together with all its control and protection equipment per 106 hours is 2,62, a probability of failure of  $2,62 \cdot 10^{-6}$ . That is not bad. A modern military radio has a MTBF of only 5000 hours. It should be noted that the radio probably has far more components than the turbo-alternator together with all its control and protection equipment.

If the number of the turbo-alternator failures per 43 years stays the same there is no particular need for concern. If however another failure occurs within the next ten years, the implication is that the part failure rate would have increased from 2,62 to 3,53 per million operating hours, an increase of 34,7%. How good or bad is the situation? Table 2 below shows the definition of failure probability based on information in ARP4761.

Quantitative Probability	Description
$10^{-3} < P < 1$	Frequent
$10^{-5} < P < 10^{-3}$	Reasonably Probable
$10^{-7} < P < 10^{-5}$	Remote
$10^{-9} < P < 10^{-7}$	Extremely Remote
$P < 10^{-9}$	Extremely Improbable

Table 2: Definitions of Failure Probability

	Minor	Major	Hazardous	Catastrophic
Frequent	Significant Risk	High Risk	High Risk	High Risk
Reasonably Probable	Significant Risk	Significant Risk	High Risk	High Risk
Remote	Moderate Risk	Moderate Risk	High Risk	High Risk
Extremely Remote	Low Risk	Moderate Risk	Significant Risk	High Risk
Extremely Improbable	Low Risk	Moderate Risk	Significant Risk	Significant Risk

Table 3: Failure Severity Matrix

Combining this information with that of Table 1 result in Table 3 from MIL STD 1629A.

From Table 1, the Safety Hazard And Severity Code for the failure is “Critical”. From table 2 the Failure Probability is “Remote”. Combining these in Table 3 it is found that the Severity of the situation is one of High Risk. It is probably inappropriate to use aircraft safety analysis to analyze a turbo-alternator system but in the absence of any other information the answers appear to be reasonable.

## THE INCIDENT AT VEREENIGING DECEMBER 1925

The author was not alive at the time and so has made extensive use of quotations from the book by R. Conradie and L.M. Messerschmidt; “A symphony of Power.” The incident described involved a 10MW turbo generator part of the then 43 MW Vereeniging Power Station. This event was described with morbid glee by various lecturers at the universities I attended in the 1960’s and was dismissed by cynical students as being merely apocryphal.

A quotation from the book:  
*“During a stormy night early in December 1925, the plant’s 10 MW generators were running as usual. Without warning, no. 2 generator suffered a mechanical failure that effectively removed the resistance against which the rotating part of the generator spun. Steam from the boilers continued to spin the machinery, but without proper resistance it spun faster and faster until the centrifugal force was great enough to rip the generator apart.”*

It is useful to compare the damage shown in Figure 4 with that shown in Figure 3. It also interesting that the damage was caused by over-speed, again implying a failure of the protection scheme. R. Conradie and L.M. Messerschmidt go on to report: “Pieces of metal flew over nearby houses. One piece broke through the branch of a tree and another settled inside someone’s house.”



Figure 4: The Outer Wall of the Vereeniging Power Station 1925



# The Duhva Power Station Turbine Failure

continues from pg 39



Figure 5: The Rotor of the Alternator after the explosion



Figure 6: Another Photograph of the Rotor

As the power station shuddered, one worker was splashed in the face with hot oil, and a flying brick hit a pump attendant. The turbine driver, Mr. W. J. Ball, had been standing only a few yards from the generator, but miraculously escaped unharmed. He lived to become a mayor of Vereeniging. “

As the Star Newspaper reported at the time: “the men who were in the station at the time of the smash, account it nothing short of marvelous that they escaped with their lives, to say nothing of serious injury”.

Again the incident was not catastrophic as defined in MIL SPEC 1388.

R. Conradie and L.M. Messerschmidt: “ The core of the revolving machinery, weighing roughly two tons, ripped through the roof leaving a hole several yards wide. The core flew through the sky, crossing the Vaal River and landing in the Free State, where it was later found embedded in the earth.

The rotating part tore through the frame of the machine, which scattered in pieces in all directions. Large pieces of metal debris were launched throughout the station, penetrating the walls and roof with some pieces landing kilometers away. The other three generators were damaged and one quarter of the station building was destroyed, with not a single window in the building left intact.”

After the shift engineer had frantically checked for injuries among the workers and only minor injuries were found, the panic died down. It is said that he then phoned Central Control to say, “Sir, I wish to report that the generator is now in the Free State”.

## REFERENCES

- R. Conradie and L.M. Messerschmidt; “A symphony of Power.”
- “Military Handbook: Reliability Prediction Of Electronic Equipment, MIL HDBK 217F, published by the US Department Of Defence, Washington DC 20301”.
- The Engineering Society for Advancing Mobility Land Sea and Space “Aerospace Recommended practice”; ARP 4761, December 1996
- MIL STD 1388-2B. 28 March 1991-DOD Requirements for a Logistic Support Analysis Record-United States Department of Defense.

## ABOUT THE AUTHOR

Rob Thomson has been in practice as an electronics engineer since 1967. He obtained his BSc Elec Eng from Pretoria, his MSc Elec Eng from Cape Town and his MBA from Unisa. He is a FIEE, FSAIEE and a Senior MIEEE and is a CEng in the UK. Rob worked for Telcom, Plessey UK, the CSIR where he became the Programme Manager Weapons at the National Institute for Aeronautical Systems Technology (NIASST), and is currently retired. Rob is a Captain in the South African Navy (Reserve). Rob has been designing valve radios, transmitters and audio amplifiers since his schooldays and is a keen amateur artist. **wn**

# What is this ?



A cold bottle of water

## Allow me to capture your product

I do all kinds of photography including:

- Events
- Family
- Boudoir
- Products
- Pets
- Travel
- Commercial
- Nature
- Wildlife

heather m'cann  
PHOTOGRAPHY

Tel: (011) 682 3298  
Cell: 082 579 6953  
heather@mccannphotography.co.za  
www.mccannphotography.co.za





# Everything You Wanted To Know About Self Indicating Silica Gel, But Were Afraid To Ask

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

BY DEREK WOODBURN | FSAIEE

Manufactured in the form of blue granules or beads, which turn pink when they absorb moisture and become saturated, silica gel can absorb up to 40% of its own mass in water. The colour-change component cobalt chloride forms less than 1% of the material mass impregnated in the silica gel. With careful handling the product can be safely re-cycled up to six times before it needs to be disposed of. Over time the fumes from the transformer oil tend to contaminate the silica gel by blocking the microscopic pores, thus limiting the number of possible re-generation cycles.

## HOW DOES SILICA GEL WORK AS A DRYING AGENT?

Under a microscope the material looks like a jumbled pile of tiny silicon straws, such as a children's game of Chinese pick-up-sticks. Water vapour does not chemically combine with the inert silica gel, but is drawn into the minute tubes by capillary attraction. The crystals look as if they are solid, but the material is a hard porous substance.



# Everything You Wanted To Know About Self Indicating Silica Gel, But Were Afraid To Ask

continues from pg 43

## HOW DO THE SELF-INDICATING PROPERTIES WORK?

Forming less than 1% of the material, the self indicating cobalt chloride is impregnated in the silica gel during manufacture. Normally a deep blue colour when dry, the cobalt chloride becomes an almost transparent pinkish colour when it absorbs moisture. The colour change occurs when the absorption of water modifies the optical characteristics of the minute silica gel tubes.

## HOW IS SILICA GEL REGENERATED?

In a breather fitted to a transformer, when the colour change from blue to pink has spread to about a third of the height up from the oil bath seal, servicing of the silica gel by re-generation is recommended. This is done by removing the volume of silica gel which has turned pink, spreading it onto a tray, and gently heating the material at a temperature of about 100°C until the crystals or beads have all turned blue again.

When short-cut or time constraints result in too intense a heat being applied to the crystals, the trapped water boils off inside the tubes and causes the

tiny straw-like tubes to crack. The capacity of the cracked silica gel to absorb water by capillary attraction is then destroyed, becoming a useless, dirty brown coloured product.

The cracking of the straw-like tubes forms powdery particles of dust. Herein lies the

danger of the cobalt chloride component being inhaled, with its possible cancer-forming properties, together with the silica gel dust.

## WHY IS SILICA GEL REQUIRED IN THE ELECTRICAL INDUSTRY AND IN OTHER ACTIVITIES?

The volume of oil in oil-insulated transformers expands and shrinks as its temperature rises and falls. As the conservator air space “breathes” through an oil bath seal with the changing oil volume, it expels or draws in fresh atmospheric air which could be saturated with moisture. Transformer oil is very hygroscopic, and without a silica gel breather, absorbed moisture would be drawn from the air into the insulation through the oil circulation.

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

A less expensive form of clear silica gel absorbs moisture in exactly the same way as the self-indicating type. It is widely used in small sachets to keep photographic and electronic equipment dry and free from moisture damage in transit, storage, and between the factory and the end user. It is also used for packaging shoes, handbags, clothing, the export of motor vehicles, and in rapidly drying flowers to retain their natural colours. The disadvantage of the clear form is that one cannot easily check whether the crystals are dry or saturated.



## IS SILICA GEL HAZARDOUS?

The product is very absorbent and may have a drying effect on skin and eyes. Silica gel itself is not toxic. The colour indicator cobalt chloride has been identified by the IARC (International Agency for Research on Cancer) as possibly carcinogenic to humans. There is limited evidence of cobalt chloride as a cancer causing factor in experimental rats and rabbits. Cobalt chloride is very toxic to aquatic organisms and may cause long term adverse effects on the environment.

Persons handling blue silica gel are recommended to wear a dust mask, protective gloves, goggles or safety glasses, and a covering overall. Protective gear is more important when the blue silica gel has been re-generated, forming dust particles. It is important to note that the use of the blue self-indicating silica gel has not been banned in any country. As yet there is no proof that cobalt chloride could cause cancer in humans.

## HOW SHOULD SILICA GEL BE HANDLED & DISPOSED?

Disposal of blue silica gel is classified as hazardous waste under EEC Directive 91/689, which applies to the European Community. Although not regarded as dangerous for transportation, it is regarded as hazardous waste and must not be allowed to contaminate soil and water. It is considered that general industrial hygiene and housekeeping standards should be observed when handling the material.

## WHAT PRACTICAL PRECAUTIONS SHOULD BE TAKEN TO REDUCE PROBLEMS ENCOUNTERED ON SILICA GEL BREATHERS IN THE FIELD?

Silica gel breathers being maintained in the field tend to be treated roughly, often with heavy handed torque being applied to large diameter breather cylinders connected to small diameter brass threads. Such handling can easily damage the units and spill the silica gel.

## WHAT ABOUT ALTERNATIVES?

New “environmentally friendly” versions of self-indicating silica gel have been developed in a bewildering range of colour changes, and at significantly higher prices.

Some of the recently available silica gel colour changes are:

Orange (dry), which changes to green (damp).

Orange (dry), which changes to colourless (damp).

Green (dry), which changes to purple (damp).

Purple (dry), which changes to pink (damp).

ESKOM has taken a decision not to introduce any of the above new products at this stage, because it could be very confusing when identifying the state of the gel. ESKOM and many Utilities will retain the existing old established Cobalt Blue (dry), which changes to pink (damp) Silica Gel in the transformer breathers for keeping the conservator tank oil dry.

Large world (and South African) stocks of the standard product, and the bewildering range of colour changes in the new products available (at a significantly higher prices) is considered to be a major determining factor at present for retaining the existing product. **wn**







Dear Minx,

Firstly a word of appreciation on the new look wattnow magazine. I enjoy the layout and the variety of articles, innovations, events, photos, and adverts. The quality of the magazine and binding is professional.

I must say did also enjoy the previous style of wattnow magazine with it's eye-catching article titles on the front cover. Others in my family ended up reading it too.

Secondly an observation on the light bulb safety alert article on pages 52 and 53 of the January edition. You may already have received some feedback on this from others.

This story has been circulating in emails for about a year or more, and a quick check on websites such as [hoax-slayer.com](http://hoax-slayer.com) suggests that this is an inaccurate article for several reasons. Apparently the injuries depicted are unlikely to be consistent with mercury exposure but rather some other severe infection such as "necrotizing fasciitis" (sounds bad). The article also contains a few grammar and spelling errors suggesting it may not have passed a proofread check. Probably just a passing gremlin...

All in all you folks are doing a great job in promoting the interests of the electrical engineering profession. I look forward to receiving each issue in the post from South Africa. Well done!

Regards,  
Patrick Byrne (FSAIEE)  
Western Australia

*ED- Thank you for your letter Mr. Byrne. It has come to light that parts of the content can't be clearly substantiated as some of it appears on the Australian Electrical Engineering site and the same on the Environmental Protection Agency's site. It is currently under investigation and I will publish my findings in the wattnow magazine. Thank you for your support and comments.*

Hi

I am member of the Institute.

I was so excited when I read the January 2012 issue and saw the reference on page 37. It was referring to the article on "Geysers-How to evaluate different energy-saving strategies".

Somehow I lost that specific publication – February 2010.

I thought that it was excellent and because of that I was able to advise a few people already regarding the issue.

Is there any chance that I could perhaps obtain that specific article again? It is always better for an argument to have something on paper. I am willing to pay for it if need be.

I will really appreciate any help in this regard.

Regards  
Danie Lombard

*ED- Thank you for your letter Mr. Lombard, the February 2010 issue is on it's way to you.*

The Managing Editor,

Congratulations on a very good first 'new look' edition. It definitely is not easy to step into publishing a technical journal and you and your team have done extremely well! I also have some comments, as invited to do so by Viv Crone.

In an electrical publication it is important to know that power has the units Watt (W), more often in the multiples 1000x, i.e. kW, also Megawatt (MW), Gigawatt (GW) etc. Energy has the unit Joule, but we electrical engineers prefer the equivalent Watt.hour (Wh), with multiples kWh etc.

I mention this with regard to the article in the middle of page 29, third line, "... which can generate one kilowatt of power in an hour ..." The 'in an hour' does not belong here.

A much more serious matter is the training, or rather the lack thereof, of technicians and technologists. This was touched upon in the excellent article by Geoff Carter "I've never been ashamed to tell everybody that I was a ISCOR 'appie'".

The figures really are alarming: According to Shaun Day, MD of Kelly Industrial, in 1975 there were 35,000 registered apprentices, but in 2005 there were only 1,440.

This is the outcome of changing from the tried and tested 'Olifantsfontein' trade test system to the Sectoral Education & Training Authority (SETA).

However, it gets worse: In the January 2012 issue of "Sparks", page 9, Hannes Baard writes: "The electrical industry [recognition of training], in its entirety, was moved to the construction CETA ... and the ESETA was merged into the Water SETA. The ESETA and Construction CETA are both under administration."

(As a Consulting Engineer, and member of CESA, I am acutely aware of the never- and non-functioning of CETA, the abbreviation for the Construction SETA.)

Hannes Baard points out that as a result the trained electrical person, now without a certificate for the trade test and without a unit Standard Certificate (both to be issued by the ESETA or Construction SETA) cannot go to the Department of Labour for registration as a 'registered person'.

Why am I writing to you about this? Being semi-retired, I am "out of the loop" as it were, but I still can attempt to inform all parties who could or should be interested, about what is happening in and with our cadre of engineers, technologists, technicians and tradesmen, all of whom are necessary in our industry. We all know about the shortage of engineers, especially in our cities, but the shortage of qualified tradesmen, technicians and technologists is, if anything, even more serious.

Thank you for your kind attention.  
Wolf Weidemann PrEng

*ED- Thank you for your letter Mr. Weidemann, I applaud your comments. I invite you to please write an article to wattnow magazine about this very serious subject.*

Dear Minx,

My sincere congratulations to you on the superb quality of the last two issues of WattNow.

I always thought that Paddie did a fine job on the magazine, but these two were excellent! Well done, we are proud of you.

Les Stuart  
SAIEE Southern Cape Centre

*ED - Thank you so much for your beautiful compliment, Les. It is greatly appreciated.*

*Keep your news/content rolling in, maybe the other SAIEE centres will catch on and start sending their news and events to me. **wn***

At Nynas, we're passionate about everything to do with power.

Need to talk to a transformer oil supplier who understands your business? One who's local enough to be near you, yet global enough to have the expertise you need. Get in touch. [www.nynas.com](http://www.nynas.com)

Nynas South Africa (Pty) Ltd  
T: +27 10 590 1052 / +27 82 496 2730  
E: [alistair.meyer@nynas.com](mailto:alistair.meyer@nynas.com)  
[www.nynas.com](http://www.nynas.com)

NYNAS



# Roderick Arthur Harker

Mr. Rod Harker, who is a Fellow of the South African Institute of Electrical Engineers (SAIEE), was recently awarded the IEEE EAB Meritorious Achievement Award in Accreditation Activities "for accreditation activities in South African education and impacting accreditation activities worldwide".

I had a brief opportunity to interview Mr Harker to get his views on receiving this accolade.

BY I MINX AVRABOS

Roderick (Rod) Arthur Harker received his BSc. Eng. degree (1967) from the University of Natal, Durban; his MSc. Eng. (1971) from the University of Natal, Durban and his Master of Business Leadership (MBL, 1987) degree from the University of South Africa (UNISA, 1987), Pretoria.

Rod spent his career with the South Africa Post Office (SAPO), and then Telkom, progressing to Senior General Manager on the Management Board of Telkom, before retiring in September 1999. He worked in all sections of telecommunications including design, research, planning, installation, maintenance, finance, strategic planning, laboratory and public relations.

Some major personal highlights are: establishing the major portion of the microwave communication network in SA; developing lightning protection for PCM systems; design and development of DIGINET, one of the most advanced digital data networks in the world at that time; establishment of the Metrology Laboratories in Cape Town and Pretoria and Telkom's National Network Management Centre. He has also participated in 21 international study visits, and presented over 28 technical papers at various conferences and seminars.

Rod Harker has been very active in the profession and has served as a Council Member of the Engineering Council of South Africa (ECSA); chaired and served on numerous ECSA committees on education, standards, registration and accreditation. Rod is a Fellow of the South African Institute of Electrical Engineers and a past President, a Fellow of the IET, London and membership advisor in SA and a Senior Member of the IEEE. He has served on numerous national committees, councils of SA universities, boards of numerous companies and has received several awards.

Mr Harker's involvement with the accreditation of engineering qualifications and registration of engineering professionals began in 1985. He has been an assessor, team leader and visit leader to all the universities and universities of technology in South Africa. He has conducted numerous accreditation-training programs. Rod is Chair of the ECSA Engineer Qualification Committee and Deputy-Chair of the ECSA Accreditation Committee. He has visited numerous universities in the UK and USA on study tours. Rod has also been active in the Washington



(L-R) Mr. Tariq S. Durrani, Vice President of IEEE; Mr. Rod Harker, recipient of the Meritorious Achievement Award; Mr. Moshe Kam, 2011 IEEE President & CEO and Dr. S.K. Ramesh, Chairman of the EAB Awards & Recognition Committee.

Accord and international accreditations, and has assisted in Korea, Malaysia, Mozambique, Namibia, Turkey and India. He was recently leader of the team to undertake provisional accreditation of two universities in Namibia.

The Meritorious Achievement Award in Continuing Education was established in 1984 by the Educational Activities Board of the IEEE to provide recognition for dedicated contributions to the design, delivery and support of continuing education courses and programs in the field of interest to IEEE Members.

The award is given to IEEE Members, Senior Members and Fellows who distinguish themselves as unselfish in their support of continuing education and successful in the delivery of courses as evidenced by their quality, quantity and creativity.

The award consists of a brass and walnut plaque, and \$1,000.

wattnow magazine met with Mr. Harker and asked him a few questions:

**Mr. Harker, how are you associated with IEEE and what have you been doing with or for them to be acknowledged in this way?** I am a Senior Member of the IEEE (Institute of Electrical and Electronic Engineers). It is the largest Voluntary association in the world and they have more than 400 000 members.

**What is the relationship between SAIEE and IEEE?** We have a MoA with the IEEE and work with them on events and have joint student chapters at several universities

**What does IEEE do in the way of training young engineers?** The IEEE has made a commitment to assist other countries that do not have an accreditation system to archive international standards. I have assisted them in mentoring a University in China towards achieving this goal.

**Can you briefly describe the IEEE as an Engineering Association and where do they fit in the global engineering scene?** The IEEE has many publications and it is a valuable source of research information and is very popular with Academics.

**Please give us your take on the needs and work being done in South Africa to address the skills shortage?** The biggest problem with skills shortage in SA is the very limited number of school leavers who have the required schooling in maths and physics to study engineering and technology. We need to desperately improve the school education system.

**You must be very proud of this award - what does it mean to you and where to from here?** Yes - I have been working for ECSA as a volunteer for many years and it is wonderful to be acknowledged for my efforts in ensuring that we maintain a high standard in engineering education in SA and the world. I look forward to many more years of being able to make a similar contribution.

The SAIEE and wattnow magazine salutes Mr. Rod Harker for achieving this accolade. Well done! **Win**

Information on IEEE courtesy of 2011 IEEE Educational Activities Board.



# PNEUDRIVE

## Challenge picked their winners!

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

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

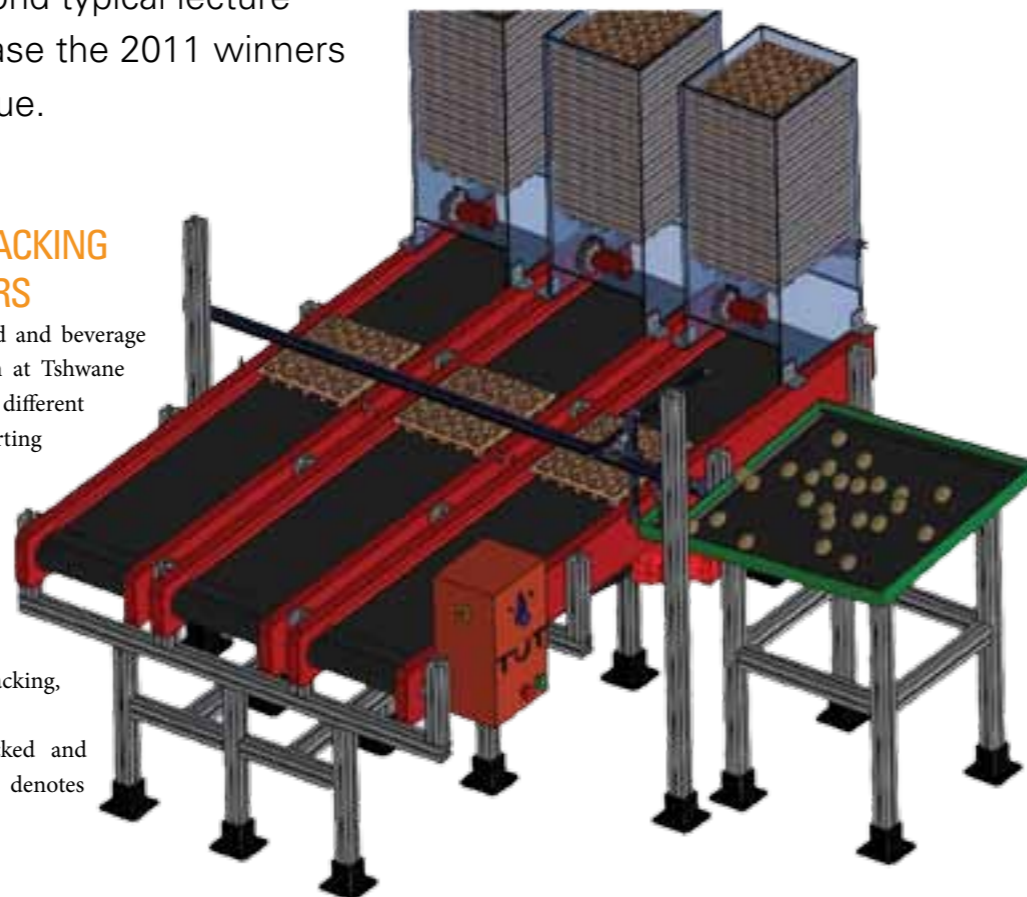
BY I PADDY HARTDEGEN

### AUTOMATIC EGG SORTING AND PACKING MACHINE FOR EMERGING FARMERS

When faced with designing something for the food and beverage sector for the 2011 PneuDrive Challenge the team at Tshwane University of Technology (TUT) considered many different applications before deciding on an automatic egg sorting machine for emerging poultry farms.

The four students, Greta van der Walt, Charl Strydom, N. Nkongolo and S. F. Baloyi chose this project for a number of reasons:

- Emerging farmers are not supported by the large retailers as they can't comply with the packing, merchandising and cleaning requirements;
- Producers must ensure eggs are properly packed and displayed and the term 'promotion' in stores denotes discount prices that will attract buyers;



- Emerging farmers find it extremely difficult to enter the major retail supply chain, as retailers will only deal with producers who can guarantee to meet their demand at an acceptable price and quality.

As a result emerging farmers are forced to sell their eggs to spaza shops, butchers, hawkers and convenience shops or corner cafes.

Moreover, many emerging farmers find it difficult to stick to the grading requirement as outlined in stringent legislation controlling egg production. For these small-scale farmers to penetrate other markets they need to adhere to the regulations and training in grading and packaging may open many new markets for them.

The students suggested that if this could be done for them then they might be able to resolve some of the barriers to entry in terms of the conventional retailing market.

The students researched the poultry market and found:

- Egg consumption increased by 17% in just over 10 years, climbing from an average of 113 eggs per person per year in 1999 to 132 eggs per person in 2010;
- South Africans consume 450 000 tons of eggs annually and egg producers employ 6 400 people in the formal sector;
- Total egg production amounted to 18,5-million cases in 2010 rising to 19-million cases this year.
- Gross turnover at the producer level is almost R6,7-billion, making it the fourth-largest animal product in agriculture. Almost 554,3-million dozen-egg-trays were sold in 2010.
- The distribution chain comprises wholesalers (14%), large retailers such as Pick 'n Pay, Shoprite, Woolworths and Spar (59%), small retailers such as butchers, cafes and convenience stores (19,4%) and cash sales from farms (6,9%).

What emerged from this research is that emerging farmers were being excluded from the retail egg distribution chain and a primary reason for this is that there is no way for these

small producers to consistently and effectively grade, sort and package their eggs in a way that would meet the demands of the major sales outlets.

Thus, an affordable, automatic, sorting, grading and packaging system for these emerging farmers could solve that problem. And that's precisely what the students set about designing. Automatic egg sorting machines are available in South Africa from Dynamic Automation and MOBA but the problem is these machines are sophisticated and cost upwards of R600 000 each, pushing them way out of reach for emerging farmers.

So the TUT students set about designing a machine that would cost about a third of the price, could easily be assembled, would require minimal maintenance, could be operated by one person and would work reliably for sustained periods under tough conditions.

They set about designing an automatic egg sorting and packing machine capable of grading eggs into three sizes:

- Large – more than 59 grams
- Medium – more than 51 grams
- Small – more than 43 grams.

Once graded, the machine had to pack the eggs in trays with 30 dozen eggs in each case.

The machines design has few moving parts making it easy to maintain and its configuration can be scaled to fit the needs of each producer. It also is able to accurately weigh the eggs before sorting and packing.

Most importantly, an extremely gentle method of handling the eggs has to be incorporated to minimise any damage to the shells. The design comprises:

- Gentle accumulation of the eggs, ready for grading, sorting and packing using a feeder system that allows eggs to roll on a soft bed and accumulate in an area where they can be graded, sorted and packed.
- Weighing and sorting the eggs according to their weight
- Picking up the egg with a fin-gripper and softly placing it in a tray without cracking the shell.

The total cost of the machine, programmed and ready for use is R220 502,40 excluding value added tax, making it considerably less expensive than anything else available on the market today.

The TUT students believe that this machine is a key to providing a reliable way for emerging poultry farmers in South Africa to get their products into the formal sector retail distribution supply chain and start reaping the benefits of regional and national sales on a much larger scale.

The profits they make from efficient egg production, sorting, grading and packing can then be used to improve their farms and increase their own production in an affordable way.

Their design won them second place in the 2011 PneuDrive Challenge.

### FORGET WIMPY OR RAVE BURGERS – TRY A BLITZBURGER

University students all over the world often rely on hamburgers, hot dogs or other junk foods and energy drinks when they start preparing for their final exams. This is probably the reason why the University of Johannesburg's decided to design an automated hamburger machine.

The UJ team, comprising Jason Berry, Warrick Kin, Isak Coetzee and David de Ponte - who used the pseudonym BeKiCoDe or beh-ki-code - designed the BlitzBurger: a machine that has commercial possibilities in the fast-food sector or can be used for promotional purposes by companies such as SEW Eurodrive and Festo.

The BeKiCoDe team comprises third-year students who have not yet completed courses in control systems, electronics, mechatronics or project management and as a result, the students say, the final report might not be as refined as some of the other entries.

Once the design was completed, it was sent to Klapwijk Engineering, an engineering company based in Pretoria, for design ratification and an accurate quote for its manufacture.



## PNEUDRIVE Challenge picked their winners!

continues from page 49

The BlitzBurger operates using a rotating central arm, around which there are seven food containers or hoppers that contain the essential ingredients to assemble a hamburger: a bun, patty, cheese, tomato, lettuce and sauce. Any of these ingredients can be supplemented so, for instance, the patty can be made from chicken, beef, lamb or soya.

Once the burger has been assembled it is autonomously packaged before being dispensed to the customer, ready for reheating (if necessary) or immediate consumption. The burger is assembled inside a cylinder, which comprises two halves adjacent to each other.

They are attached to an arm that rotates within the machine, stopping at various containers where a measured portion of the specific ingredient (contained in a hopper) is dropped into the cylinder by a separator.

Each separator plate has a drainage facility achieved by drilling tiny holes into the separator plate so that oil from the patties, juice from tomatoes or any other moisture can fall through the holes into a removable drainage trough for easy cleaning.

The sauce dispenser is similar to a soap dispenser but the one used for the BlitzBurger was reverse-engineered and changed so that it would dispense between 8ml and 10ml of sauce for each serving. It uses a DNCI actuator.

Once all the ingredients have been placed within the cylinder holding the assembled burger the cylinder moves away from the hoppers to stop above a conveyor. Each half of the cylinder swings open, allowing the burger to fall a small way onto a piece of waxed paper positioned on the conveyor using a second linear actuator.

The first stage of the wrapper folds the wax paper over the burger, forming a slit. The conveyor moves – using an SEW Movigear – to the next position simultaneously enclosing the top and bottom of the burger. The sides are folded using two poles that push the wax paper

down on either side of the burger to completely enclose it. These poles rotate parallel to the conveyor on either side of the burger. Further along the conveyor, two blades fold the sides under the burger using a fast rotating motion. The burger is now properly packaged, contains the right amount of each ingredient and is ready to be dispensed to the waiting customer.

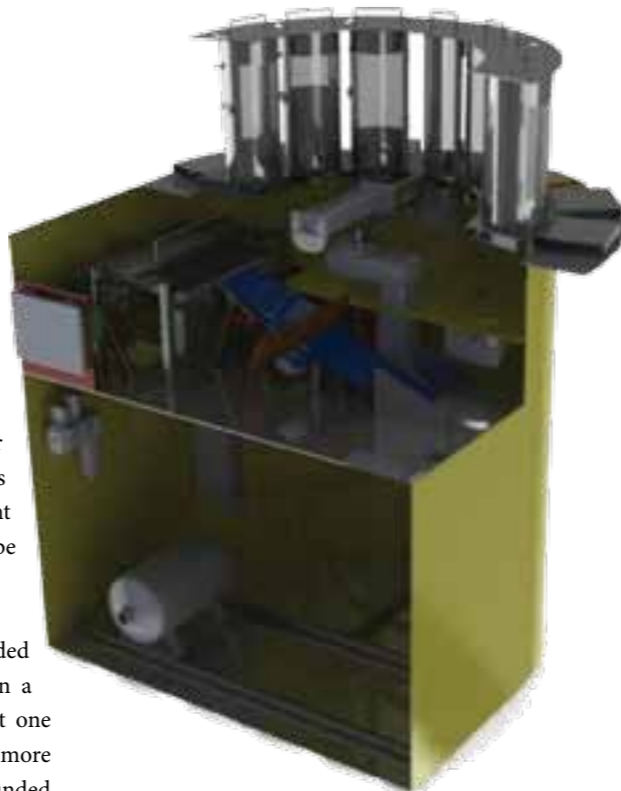
In finalising the design, the students decided that the machine should be mounted on a table and not be more than about one metre square with hoppers that are no more than 500mm high. It should have rounded corners and be insulated to allow it to function at temperatures of between nought degrees and 30 degrees. It is fully enclosed and operates at a pneumatic pressure of no more than six bars.

Controls – so the customer can customise the chosen burger – is achieved through a touchscreen interface. The customer selects a product before being taken to the selection confirmation menu on the touchscreen and once the product selection is confirmed, the burger is assembled and packaged.

There are many options in the custom selection menu including the type and number of patties, whether cheese is required or not, a choice of lettuce, tomato or both and a variety of sauces typically tomato, mayonnaise and barbecue.

If the BlitzBurger is to be used in a commercial restaurant environment, part of the machine will be inside the restaurant so the kitchen staff can refill the hoppers as required while the front of the machine will extend into the restaurant itself so customers can make their selections and collect their food.

The hoppers can be removed for easy cleaning and the modular design means they can be swapped with different ingredients if required. All pneumatic actuators are oil-less and since they operate at very low speeds, require very little servicing. This applies to the motors and servos as well.

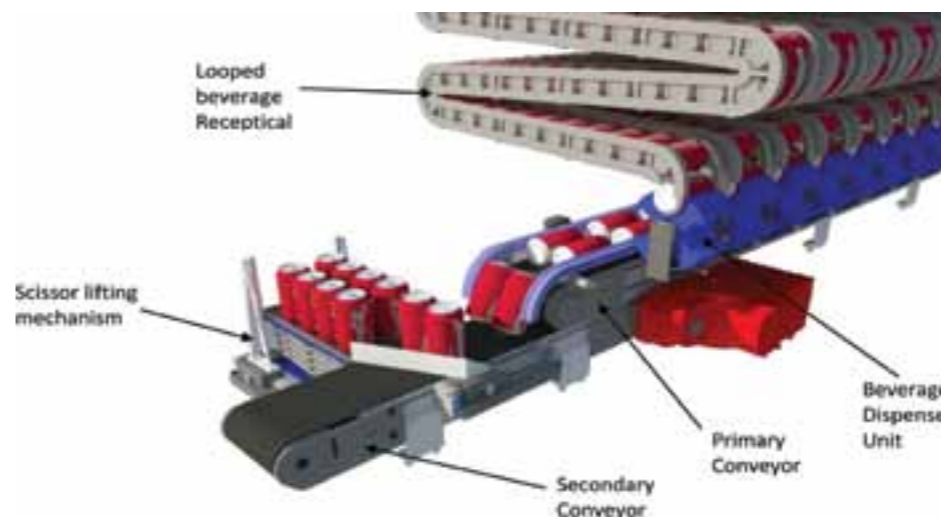


The BlitzBurger is made from nickel alloys, stainless steel and nylon. The machine costs R266 546 to build while the computer interface costs a further R5 500 and programming of the programmable logic controller – that runs the system – costs a further R250 bringing the total cost to almost R272 300 excluding profits or assembly. The design was sufficiently good to earn the BeKiCoDe team a commendation from the judges for their innovative ideas in making a machine that could be used to showcase various different components or could be adapted to work in a commercial restaurant.

### DISPENSE-HERE

The Cape Peninsula University of Technology (CPUT) chose a rather ingenious idea for their entry in the 2011 PneuDrive Challenge, deciding to build an automated, high-speed beverage-dispensing unit that can prevent the incessant crowds that congregate at drinks outlets during concerts, festivals, theatre performances and so forth.

The logic is simple: make it possible to dispense beverages quickly and efficiently so that more people are served more rapidly. And that's the only weakness in the system: the human interface because people have to order their drinks individually by computer touchscreen and it's people that will hold-up the system.



Having said that the four students from CPUT, JP Pepler, Gideon Pool, Gareth Hardman and Willie van der Walt looked at a number of options before deciding to design the automated, high-speed beverage-dispensing unit known as Dispense Here.

The design is intended to stop bottlenecks at drinks outlets by dispensing drinks from a large capacity, high-speed delivery system and, because of its modular design, more than one machine can be used at each event. The students say that their design provides an automated machine that is easy to maintain, intuitive to operate and can be adapted for different events. It is the width of a standard vending machine but about two or three times the depth because it has a much higher capacity.

Various options were considered including the use of magazine storage using a linear drive to deliver the beverages on a horizontal plane. Another option was using magazines that are gravity fed using solenoids to release them onto a conveyor and deliver them to a tray.

Both these options were discarded and, instead, the students chose an automated machine that works on the basis of a customer's card being swiped through a card reader and then a selection of drinks chosen using a large touchscreen interface.

Once the order is confirmed, the system would generate the order, load a tray with drinks in the vertical position and then lift that tray to bar level for collection.

When an order is generated, a scissors lift retracts from its extended position to the

conveyor height at the bottom. The beverage-dispensing unit, located at the bottom of each looped receptacle will hold the beverages.

Each beverage-dispensing unit will use a corresponding stepper motor, programmed to rotate the can by 90 degrees to allow the can to fall onto the conveyor in a horizontal position. The conveyor is just wide enough to hold two drinks in this position.

The entire system comprises:

- Looped beverage receptacles
- Beverage dispensing unit
- Primary conveyor
- Secondary conveyor
- Guide plate
- Tray mounted on a scissor-lifting mechanism.

The students calculations show that the time it will take for the eight drinks to be dispensed, travel down the two conveyors, be placed on the tray and lifted to bar height is, on average, 27,36 seconds, making it considerably quicker than the average barman working at a frenetic pace behind a counter manually filling orders.

Software controls the process for electronic transactions and starts Dispense Here's operations once the payment has been completed and authorised. It also controls all stock and cross-checks this with the payments received and drinks dispensed.

While the Dispense Here system did not win a prize, the students report that many lessons were learned while formulating the design and point out that the management of the system provide a valuable insight into the understanding of complete electrical sub-systems.

They also discovered that while much can be proven using equations, the reality is that a working prototype is the best way to assess all the variables in the design and, as errors in concept arise, these can be corrected. **Wn**

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

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

*Visit [www.pneudrive.co.za](http://www.pneudrive.co.za)*







In 1977 a 30-year-old male working for a company with a Defined Benefit Pension Fund would have been offered a Pension, on Retirement, at the age of 65. His Pension was calculated on 2% of his final salary for each year of service. This was a typical case study when I entered the Life Assurance Business with Legal & General.

BY I DEREK A. DINGWALL | FINANCIAL PLANNER

## RETIREMENT PLANNING IN A CHANGED WORLD

The average income was R1,000 per month, inflation was double digit, and salary increases were approximately 10% per annum. His final salary, at the age of 65, would be R28,000 per month, and the Company Pension would have been R19,620 per month. In addition, the Company would have paid all, or a portion of, his Medical Aid contribution for life. On death his widow would have received 50% of his Pension for life, and the Medical Aid would have continued.

### THEN THE WORLD CHANGED!

By the end of the 20th century, Companies had woken up to the fact that this Pension Fund model was not sustainable. Profits paid into the Pension Funds, to meet their obligations, were hampering the growth of the Company. They offered employees financial incentives to move out of the Defined Benefit Pension Funds and into either:

- A Provident Fund, which would give them a lump sum at retirement instead of a Pension or,
- A Defined Contribution Pension Fund, where they would have to make the choice of what type of Pension to purchase.

Fear of losing their jobs played a large part in those employees who, by accepting the change, now faced the reality of fending for themselves. Thus the Company was relieved of any further obligation to pay a Pension or Medical Aid to retirees. Those who refused the incentive, and managed to retain their jobs, still enjoyed the benefits in the original Pension Fund after the age of 65.

### OUR BRAVE NEW WORLD!

Our male employee was offered a Defined Contribution Pension Fund and at the age of 65 had accumulated R2, 500,000 in the fund.

He can take R315,000 tax-free and is offered with the balance:

- A compulsory purchase single level annuity for life;
- A compulsory purchase joint level annuity for life;
- A compulsory purchase single increasing annuity for life;
- A compulsory purchase joint increasing annuity for life; or
- A living annuity where he can choose an income between 2.5% and 17.5%.

The funds are invested in Unit Trusts with the Assistance of a Financial Planner. Funds are chosen according to the Client or employee ~ appetite for risk, as the capital can fluctuate with the volatility of the markets.

In my opinion any of the above decisions should be

made in the presence of the spouse or partner as when option a, b, c or d is taken the decision is irreversible.

### THE RICHEST MAN IN BABYLON!

If you are starting your career it is important to understand the difference between:-

- Earning
- Spending
- Saving

Your first investment should be the purchase of the above book, "The Richest Man in Babylon". I guarantee this will peek your interest in investing wisely. Part of your wise investment SHOULD be a Retirement Annuity and Unit Trusts. If you are planning your Retirement in the next few years here are facts you need to consider:-

- How much will you need to live on each month?;
- Life expectancy; and
- Inflation.

### WHO CAN AFFORD TO RETIRE?

The Baby Boomers changed the world. Millions of babies, born after the second World War ended in 1945, are in their 60's. Their retirement is tipping the scales in Business and Governments throughout the world. Longevity is the challenge of the 21st Century. A 65-year-old male retiring in 1977 had an age expectancy of 5 years after retirement.

A Baby Boomer living a healthy life style, who has invested in a good medical aid with early detection of disease, can live until he is 100.

Thirty years longer than the 65 in 1977.

### RETIREMENT PLANNING IS NOW LIFE STYLE PLANNING!

International Retirement Planning is suggesting that, with a 30-year life expectancy after 65, we need to continue working and generating income. Survival will depend on;

- Mental;
- Physical; and
- Financial

To summarise, we must keep mentally and physically fit. The key to Life Style Planning is to own an income producing asset e.g.

- Rental property
- Own a business
- Your career

### SO LIFE GOES ON!

Do not stop!! Your "Bucket List" should never end. **wn**



# SAIEE CPD Courses 2012

For more information or to book your space, contact

BRENDON VILJOEN | T 011 487 9042 | E brendonv@saiee.org.za or SUE MOSELEY | T 011 487 9042 | E suem@saiee.org.za



## FINANCE ESSENTIALS FOR ENGINEERS

**BUDGETING FUNDAMENTALS:** Benefits & Methods; **MANAGING A BUDGET:** Preparation & Control; **EXPLORING THE GROUND RULES OF FINANCE:** Who needs Finance? **TRACT REVENUE AND EXPENSES USING FINANCIAL STATEMENTS:** The Income Statement, The Balance Sheet, The Cash Flow Statement; **EVALUATING PERFORMANCE:** Make Comparison, Determine Liquidity, Activity, Profitability and Solvency; **MAKING INVESTMENT DECISIONS:** The Investment Decision, Making Process, Conduct a CVP Analysis, Project Appraisal Techniques, Market Demand Calculation Details, Table of Discount Factors, Activity Worksheets.

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

## SHORT CIRCUIT CURRENT COURSE

**SHORT CIRCUIT CURRENTS:** Symmetry & Asymmetry, Calculation of short circuit currents, Arcing in circuit breaking, Current & energy limiting, Principles of arc interruption, Contact breakdown, Insulation medium, Arc voltage & extinction, Arc extinction  
**NATURE OF THE ARC:** Behaviour of electrical arcs, Electrical conductivity in gases, Arcing in air, Prospective short circuit currents, Arcing currents, Internal arc classification, Standards for internal arc testing, Requirements of IAC testing, Effects of the enclosure, Forms of separation in LV switchboards, Personal protection, Assembly protection.

**WHERE** SAIEE HOUSE, 18A Gill Street, cnr. Innes Road, Observatory, JOHANNESBURG  
**DATE** 3 April 2012  
**COST** R1,990 (incl. VAT) - 20% discount for active SAIEE members  
**CPD CREDITS** 1

## PRESENTATION SKILLS FOR ENGINEERS

**MASTERING NERVOUS TENSION:** Understand your nervousness, First time fever, The adrenaline rush, Dealing with nervous tension, Dispelling the fears, Some helpful habits, Developing focus; **PREPARATION:** Formulate your objectives, Identify the audience, Decide what reaction you want, Writing the speech/presentation, Preparing your notes; **PRACTICAL SESSION 1 – VIDEO TAKE AND ASSESSMENT STRUCTURE:** Preparation techniques – the newest, Developing an effective ‘hook’, Ways to package information, Sequential argument, Hierarchical decomposition, Question orientated, Pyramid; **THE DELIVERY:** The beginning, Get their attention, Establish a theme, Present a structure, Create a rapport, Administration, Holding attention, Enthusiasm, Removing negative thoughts, Regaining attention, Anecdotes; **THE MEANS OF DELIVERY:** The eyes, The voice, Expression, Appearance, Stance; **THE TECHNIQUES OF SPEECH:** Make an impression, Repeat, Draw a sign, Draw a picture, Jokes, Plain Speech, Short and sweet, The narrative, Rehearsal, Relaxation; **PRACTICAL SESSION 2 – VIDEO ASSESSMENT QUESTION TECHNIQUES:** Probing, divergent and echo questions, Fielding difficult questions, Best practices – questions; **EFFECTIVE LISTENING TECHNIQUES:** Paraphrasing, Giving feedback, Maintain healthy body language and eye contact.

**WHERE** SAIEE HOUSE, 18A Gill Street, cnr. Innes Road, Observatory, JOHANNESBURG  
**DATE** 18-19 April 2012  
**COST** R3,850 (incl. VAT) - 20% discount for active SAIEE members  
**CPD CREDITS** 2

## PROJECT MANAGEMENT

Your ability as a project manager to demonstrate best practices in project management – both on the job and through professional certification – is becoming the standard to complete in today’s fast-paced and highly technical workplace. This course offers a job-related approach to successful project management across application areas and industries.

**WHERE** JOHANNESBURG  
**PRESENTER** TONY LYDALL  
**DATE** 8 - 11 MAY 2012  
**COST** R8,050 (incl. VAT) - 20% discount for SAIEE members  
**CPD CREDITS** 4

## PHOTOVOLTAIC SOLAR SYSTEMS

Photovoltaic (PV) is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic power generation employs solar panels comprising of a number of cells containing a photovoltaic material. This course will provide the knowledge on how to inspect a site for the installation of a PV Solar System, provide the basic knowledge for installation, do necessary calculations for the correct applications, analyse different configurations and operating characteristics, provide the rules and regulations with regard to compliance of statutory requirements, and safety procedures and codes of practice. **CONTACT GILL NORTIER - SAIEE (KZN) 031 562 9537 or email saiee@iafrica.com.**

**WHERE** DURBAN  
**DATE** 17-18 MAY 2012  
**COST** R3,850 (incl. VAT) - 20% discount for active SAIEE members  
**CPD CREDITS** 2

## ELECTROMAGNETISM – TRANSFORMERS

**Part 1: FUNDAMENTALS - ELECTRIC & MAGNETIC FIELDS:** The source of magnetism, Charges & magnetic fields, Magnetic moments, Diamagnetic materials, Ferromagnetic & Paramagnetic materials, Magnets - attraction & repulsion, Magnetic poles, Vector multiplication; **THE B-H LOOP:** Properties of magnetic materials, Permeability, Grain oriented steels, Annealing process, Stresses in transformer cores, Factors influencing the B-H curve, Eddy current losses, Hysteresis losses, Grain oriented steels, Magnetizing current; **MAXWELLS EQUATIONS:** History of electromagnetism, The importance of Maxwell, Maxwells equations, Amperes, Faradays and Lenz’s laws, Electric fields, Electric & magnetic flux, Magnetic fields, Magnetic flux density, Currents & magnetic fields.

**Part 2: TRANSFORMERS - OPERATION & LOSSES IN TRANSFORMERS:** Basic principles of a transformer, Magnetic flux in transformers, Magnetising currents, Leakage flux, Transformer reactance, Phasor diagram of a transformer, Magnetic cores, Eddy currents & voltage drop, Skin effect & proximity effect; **TRANSFORMER CORES & COILS:** Types of transformer cores, Magnetic circuit designs, Core form & shell form cores, Core configurations, Core construction, Single phase & three phase cores, Types of transformer coils, Circular & Rectangular coils; **TRANSFORMER DESIGN, SPECIFICATION & TESTING:** Rated power, voltage & current, Tappings, Short circuit impedance, Transformer connections, Three phase & single phase transformers, Transformer connection symbols, Transformer cooling and coding, Temperature rise limits, Dielectric test requirements, Routine & type tests. **EMC:** Definitions, Degradation & damage, Electromagnetic interference, Mechanism of EMI, Coupling modes, Harmonic interference, Achieving electromagnetic compatibility, Electrostatics & Lightning, EMC Standards, High frequency & Low frequency interference, Actions regarding EMI and EMC.

**WHERE** JOHANNESBURG  
**DATE** 16 - 17 MAY 2012  
**COST** R3,850 (incl. VAT) - 20% discount for active SAIEE members - RETIRED MEMBERS: R1,925  
**CPD CREDITS** 2



# Mentorship

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



**“Time is a great teacher. Unfortunately, it gives way too many tests and it doesn’t grade on a curve.”**

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

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

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

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

and Mentor have enough time to communicate any concerns or advice they have.

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

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

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

**Prospective SAIEE Mentors**

*If you feel you that you have the time and interest to help mentees, please contact Ansie Smith on 011 487 9050 or [smitha@saiee.org.za](mailto:smitha@saiee.org.za). In addition you gain CPD credits for when you are required to re-register. **WIN***





# SAIEE Membership

## What's In It For Me?

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

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

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

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

Being a member has significant career benefits, as

membership holds prestige and recognized status in the profession. SAIEE gatherings provide excellent opportunities for its members to interact with normally inaccessible senior leaders in the industry. Letters after your name indicate your membership grade and are a useful measure of experience.

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

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

### APPLICATION REQUIREMENTS FOR SAIEE MEMBERSHIP

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

To avoid unnecessary delays in the process it is important to highlight the problems regularly experienced within the administration with received applications:-

Many applicants do not read the list of requirements. We require the following documents:

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

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

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

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

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

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

# Membership Fees

## Effective January 2012

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

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

### NOTE

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

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

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

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

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



2012

# 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](mailto:minx@saiee.org.za)

## March 2012

2	Council Meeting	SAIEE House
12-16	Certified Energy Manager Course	Emperor's Palace, Gauteng
26-29	Power & Electricity World Africa Expo	Sandton Convention Centre, Johannesburg
29	SAIEE AGM	SAIEE House
30	Call for Papers - Power Africa 2012	University of Witwatersrand, JHB

[www.energytrainingfoundation.co.za](http://www.energytrainingfoundation.co.za)

## April 2012

6-15	Rand Show	JHB Expo Centre
20	Climate Reality Breakfast Briefing	venue t.b.c.
26-29	Decorex	Cape Town Intl. Convention Centre
28	Notification of acceptance of Papers	Power Africa 2012, Wits, JHB

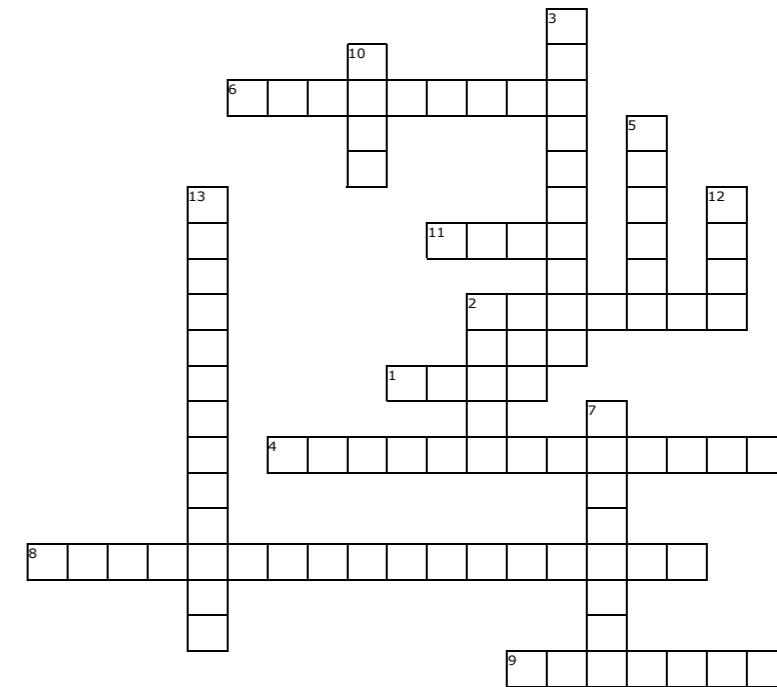
[www.randshow.co.za](http://www.randshow.co.za)  
Presented by Jeuness Park

Have some fun and stand a chance to win R1000. Complete the Power issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, Power Crossword Puzzle, P.O. Box 751253, Gardenview, 2047* or email it to [wattnow@saiee.org.za](mailto:wattnow@saiee.org.za). The completed crossword puzzle should reach us by no later than **30 April 2012**. The winner of R1000 will be announced in the May issue of the *wattnow* magazine.

# R1000

*win*

ALGAE-X, THE TANK CLEANING SPECIALISTS, ARE THE PROUD SPONSOR OF OUR CROSSWORD PUZZLE.



### ACROSS

- The number of kg of good quality coal used to produce 10 kWh.
- This technology is critical to make renewable energy dispatchable.
- Landfill or biogas mainly consists of Methane and what other gas?
- What new discovery in 2012 promises to increase the efficiency of thin film solar PV cells?
- What is the most efficient artificial lighting source?
- Which thermodynamic cycle is used in gas turbines?
- The SI unit of power.

### DOWN

- What is the maximum level on the International Nuclear Event Scale (INES)?
- What is the intensity of incoming solar radiation incident on a unit horizontal surface at a specific level called?
- ESKOM Pumped Storage Scheme currently being constructed.
- ESKOM has recently completed construction of two gas turbine power plants in the Western Cape. One is Ankerlig. What is the other called?
- According to the New Scientist, what source of energy causes the most deaths per kWh produced?
- The power output of a wind turbine is proportional to the \_\_\_ of the wind-speed.
- What type of power generation has the highest theoretical efficiency (>90%) for converting the source energy into electricity?

Terms and conditions: 1. Only one entry per person. 2. Winners will be notified via email. 3. Incorrect information will automatically disqualify the entrant. 4. Anybody may take part except the office staff of the SAIEE, their family members and members of the Publications Committee. 5. *wattnow* magazine and the SAIEE cannot take any responsibility for lost entry forms or any damage, losses or injuries related to the draw of the prize. 6. The winner must be prepared to be photographed and such photograph will be published in the relevant issue of the *wattnow* magazine. 7. Closing date for entry is 30 April 2012. 8. The winner will be announced in the May issue of the *wattnow* magazine. 9. The Managing Editor's decision is final and no correspondence will be entered into.

**ALGAE-X**

**It is too late to clean your tanks when the lights go out!  
Contaminated Fuel is guaranteed to cause Genset Failure**

Contact us to discuss tank cleaning services and systems  
Tel: 031 205 9666 [info@algae-x.co.za](mailto:info@algae-x.co.za) [www.algae-x.co.za](http://www.algae-x.co.za)



# SAIEE COUNCIL MEMBERS

# SAIEE COUNCIL MEMBERS

GRADE	NAME & SURNAME	CONTACT DETAILS	EMAIL ADDRESS	GRADE	NAME & SURNAME	CONTACT DETAILS	EMAIL ADDRESS
President	Andries Tshabalala	011 820 5094	andries.tshabalala@actom.co.za	Fellow	Mario Kuisis	011 326 2708	Mario@martec.co.za
Deputy President	Mike Cary	011 425 3497	carymbc@netactive.co.za	Fellow	Jacob Machinjike	011 800 3539	Jacob.machinjike@eskom.co.za
Honorary Treasurer	Mike Cary	011 425 3497	carymbc@netactive.co.za	Fellow	Dr. Nhlanhla Mbuli	011 629 5115	nhlanhla.mbuli@eskom.co.za
Senior Vice President	Paul van Niekerk	011 789 1384	paul@vdw.co.za	Fellow & Past President	Ian McKechnie	012 667 5151	ianmac@gafrika.com
Junior Vice President	Dr. Pat Naidoo	031 409 3130	pat@patnaidoo.co.za	Fellow & Past President	Alan Meyer	011 616 4997	alan.meyer@wits.ac.za
Immediate Past President	Dr. Angus Hay	011 585 0490	angus.hay@neotel.co.za	Fellow & Past President	Benjamin Ngulube	011 979 4571	satransformers@lantic.net
Honorary Vice President	Graeme Hopewell	041 373 6758	graemeho@iafrica.com	Fellow	Prof. Jan-Harm Pretorius	011 559 3377	jhcpretorius@uj.ac.za
Fellow	Bill Bergman	011 465 3501	william@bergman.co.za	Fellow	Mark Strydom	011 827 9124	marks@chicontrol.co.za
Fellow	Tony Britten	011 629 5033	Tony.britten@eskom.co.za	Fellow	Prof. Rex Van Olst	011 717 7220	r.vanolst@ee.wits.ac.za
Fellow & Past President	Stan Bridgens	011 487 9048	s.bridgens@saiee.org.za	Fellow	Derek Woodburn	011 609 5013	woodb1@mweb.co.za
Fellow	Hermann Broschk	011 820 5260	hermann.broschk@actom.co.za	Senior Member	Jane-Anne Buisson-Street	011 646 0756	buisson@mweb.co.za
Fellow	Prof. Mike Case	011 559 6332	mikecase@global.co.za	Senior Member	Dario Campetti	011 764 6538	dario@campetti.co.za
Fellow	Max Clarke	011 476 5925	mppc@mweb.co.za	Senior Member	John Dal Lago	011 800 2657	John.dallago@eskom.co.za
Fellow	Viv Cohen	011 485 2567	vivcohen@telkomsa.net	Senior Member	Dr. Ken Nixon	011 717 7203	ken.nixon@wits.ac.za
Fellow & Past President	Ron Coney	011 564 2300	rongconey@gmail.com	Senior Member	Patrick O'Halloran	011 490 7485	pohalloran@citypower.co.za
Fellow & Past President	Viv Crone	011 266 1500	vivcrone@gmail.com	Senior Member	Alan Paul	087 943 9000	alanpaul@mweb.co.za
Fellow & Past President	Mike Crouch	011 728 2852	michaelac@intekom.co.za	Senior Member	Leon Staphorst	012 841 3236	lstaphorst@csir.co.za
Fellow	Tom Eichbaum	011 652 2226	Thomas.eichbaum@siemens.com	Member	Tebogo Bhulose	011 800 8442	Tebogo.Bhulose@eskom.co.za
Fellow	Dr. Hendri Geldenhuys	011 871 2149	Hendri.Geldenhuys@eskom.co.za	Member	Prof. Willie Cronje	011 717 7224	willie.cronje@wits.ac.za
Fellow & Past President	John Gosling	011 651 6266	gosling@worldonline.co.za	Member	Wayne Fisher	011 679 3481	wayne@bergmanfisher.co.za
Fellow & Past President	du Toit Grobler	011 407 8431	du.toit.grobler@sappi.com	Member	Dr. Mike Grant	011 717 7256	m.grant@ee.wits.ac.za
Fellow & Past President	Rod Harker	021 553 2632	raharker@telkomsa.net	Member	Nhlanhla Maphalala	011 202 6438	Nhlanhla.Maphalala@za.abb.com
Fellow	Roland Hill	012 645 3134	roland.hill@landisgyr.com	Member	Hope Mashele	011 350 0537	Hope.nga.mashele@gmail.com
Fellow	André Hoffmann	011 235 1731	andreleohoffmann@gmail.com	Member	Silas Moloko	011 635 8000	smoloko@tis-sa.com
Fellow	Isaac Kruger	011 254 6400	Isaac.kruger@za.schneider-electric.com	Member	Shamendran Pillay	012 671 4565	Shamendran.pillay@gmail.com
Honorary Fellow & Past President	Les James	011 672 5244					



**Kwa-Zulu Natal Centre  
Chairman | T.C. Madikane**

Postal Address | P O Box 2704, Durban, 4000  
T| 031 209 2235 F| 031 209 2455 E| tcm@igoda.co.za



**Vice Chairman | Veer N. Ramnarain**

Postal Address | Postnet Suite No110, Postnet La Lucia, Glenashley, 4022  
T| 031 311 9008 F| 086 693 4283 E| ramnarainv@elec.durban.gov.za



**Western Cape Centre  
Chairman | Marius van Rensburg**

Postal Address | Vygieboon Singel 8, Durbanville, 7550  
T| 021 980 3777 E|marius.Vanrensborg@eskom.co.za



**Secretary | Dave Martin**

Postal Address | No 2 Fiford Crescent, Tokai, 7945  
T| 021 712 6463 E|Dave.martin@absamail.co.za



**Southern Cape Centre  
Chairman | Willem du Toit**

Postal Address | P O Box 1880, George  
T| 044 874 6992 E|wdutoit@telkomsa.net



**Eastern Cape Centre  
Chairman | Sarel Schoombie**

Postal Address | Private Bag X6011, Port Elizabeth, 6000  
T|041 504 3290 E|Sarel.schoombie@nmmu.ac.za



**Mpumalanga Centre  
Chairman | Elyssa Spreeth**

Postal Address | PO Box 432, Secunda, 2302  
T|017 614 5029 E|elyssa.spreeth@gmail.com

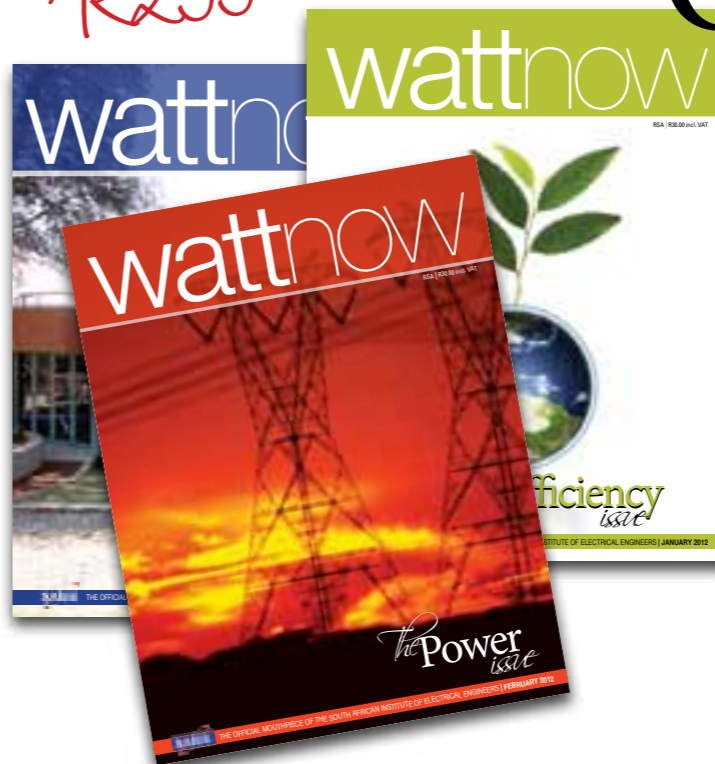


# wattnow



THE OFFICIAL MOUTHPIECE OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS

*Subscribe today!  
R299 - 11 issues*



## GET YOUR OWN COPY TODAY!

The **wattnow** magazine, published by the South African Institute of Electrical Engineers (SAIEE), highlights the exciting worlds of technology and electrical engineering. Topics include robotics, rockets, automotive developments, nanotechnology, biomedical engineering, astronomy, telecommunications and other technologies of tomorrow. If you are not a SAIEE member, but would like to receive your own copy of the **wattnow** magazine, then subscribe today.

Subscribe to your very own copy of **wattnow** magazine today! For a mere R299 for 11 issues, you can stay up-to-date with events, news and technology in the electrical engineering industry. Fill in the form below and fax it to 011 487 3002 or email it to minx@saiee.org.za. Payments can be made in cash, eft or bank deposits.

Title: \_\_\_\_\_ Initials: \_\_\_\_\_ Surname: \_\_\_\_\_

Postal Address: \_\_\_\_\_

Code: \_\_\_\_\_

Contact: \_\_\_\_\_ (H) \_\_\_\_\_ (W) \_\_\_\_\_ (M) \_\_\_\_\_

Email address: \_\_\_\_\_







Conference & Exhibition  
6 - 8 November 2012  
Sandton Convention Centre  
Johannesburg, Republic of South Africa

[www.powergenafrika.com](http://www.powergenafrika.com)

# GLOBAL TECHNOLOGY FOR LOCAL SOLUTIONS

## About POWER-GEN Africa

The inaugural POWER-GEN Africa event will provide comprehensive coverage of the power needs, resources, and issues facing the electricity industries across Sub-Saharan Africa.

Global attention is being paid to Africa's power requirements as the continent continues to experience rapid growth and development, driving the need for more widespread and reliable electricity.

With POWER-GEN Africa's conference and exhibition focusing on all aspects of the power industry and bringing together the world's leading power equipment suppliers with those developing power infrastructure in this dynamic region of the world, this is a new event you cannot afford to miss.

## Invitation to Exhibit

If your company supplies products or services to the power generation and transmission and distribution industries in Africa, then POWER-GEN Africa is essential to reaching the key industry professionals and decision makers.

A three day event, POWER-GEN Africa serves the industry's information and networking needs with a dedicated trade show floor featuring the prime movers in the power industry.

## For further information on exhibiting, please contact:

Leon Stone  
Rest of the World  
Exhibit Sales  
T: +44 (0) 1992 656 671  
E: [leons@pennwell.com](mailto:leons@pennwell.com)

Hanlie Delport  
Sub-Saharan Africa  
Exhibit Sales  
T: +27 (082) 908 2295  
E: [info@siyakula-events.co.za](mailto:info@siyakula-events.co.za)

FOR FURTHER INFORMATION PLEASE VISIT [WWW.POWERGENAFRICA.COM](http://WWW.POWERGENAFRICA.COM)

Owned and Produced by:



Owned and Produced by:



Presented by:

