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Africa is a continent endowed with significant resources – many untapped. What is important is that they be tapped in a responsible manner.

There is enormous potential in the continent's energy space, part of which relates to well-known natural reserves of fossil fuels and substantial hydropower.

In the larger scheme of things, the final solution to our energy requirements will be through a mix of various sources of energy. I believe that hydro and solar will play an important role in that mix, with a commitment to smart use, smart management and smart control. We cannot lose sight of the fact the 93 % of our hydropower is untapped, and that we have the highest solar radiation of all the continents.

We will certainly continue to burn coal for far longer than we should, and we are likely to see growth in nuclear generation as a critical component of the base load supply in future.

Most importantly, we need to ensure that we are able to interconnect our grids effectively in order to make optimal use of our resources – an area that is likely to see massive investment in infrastructure and research ... and important because it is energy that will serve as the catalyst to economic growth. There is no doubt that logistics and communications infrastructure are critical – but the real opportunities will come from the availability of reliable energy and how remarkable it would be if a significant portion could be from sustainable sources.

At the core of this is the need to build up a transmission network that will allow dynamic growth and stable interconnection of the grids. The challenge is enormous.

It is estimated that within the next decade in South Africa we will need to build more than 10 000 km of new transmission lines, and spend in excess R160 billion on energy infrastructure. Of that amount, less than R10 billion is for refurbishment – so we are speaking of new infrastructure.

These are not small numbers. The fact is that we

need to do this if we are to maintain the industry we have and grow the economy at anything near the required levels.

The continent is even more interesting: According to the Programme for Infrastructure Development in Africa (PIDA) it is anticipated that the energy needs of the continent will increase at around 6 % for the foreseeable future. This requires a growth in power generation capacity from the current 125 GW to 700 GW by 2040.

The investment required for this is spectacular – in the order of tens of billions of dollars per annum, an investment that is crucial if we are to achieve the goals that we need to reach.

My sense is that we will.



*Ian*

Ian Jandrell

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# Breaking the Surface

## Servo terminals move virtual ocean

By M Matuschke, Beckhoff

*In this installation large amounts of data are collected via sensors and must be transferred to the controller and processed very quickly. PC- and EtherCAT-based control provides the perfect solution for these requirements.*

Norwegian oil company, Lundin Norway, envisioned something rather unique to mark the 10<sup>th</sup> anniversary of the company. Lundin caused quite a stir when they presented their kinetic art installation at the ONS Energy Convention, the world's largest offshore energy trade show, which took place last year in Stavanger, Norway.

Five hundred and twenty nine Plexiglas tubes are moved continuously together in such a way that they simulate ocean waves, and at the same time symbolise the constant search for oil under water on the Norwegian continental shelf. A markedly complex and sophisticated project, both artistically and mechanically, as well as in terms of the control technology, it is also interactive. The project involved intensive cooperation between designers, architects, safety experts, and machine manufacturers, with Beckhoff as the control system supplier contributing to the success of this engineering marvel.

The overall artistic concept of the 'Breaking the Surface' installation, including the software engineering, originates from the Scandinavian Design Group (SDG). The objective was to create a work of art that expresses the identity of Lundin Norway. Lundin's business is in the exploration and extraction of oil resources on the Norwegian Continental Shelf, so what is more fitting than to create an abstract representation of a sub-surface landscape? The seismic recordings of the sea bed that geophysicists make in the search for oil reservoirs adopt a colour scale between pale yellow and deep orange, depending on the density of the reservoir, in order to visualise the different layers

of rock, gravel and sand in the stratigraphic models. This inspired the designers to colour the Plexiglas tubes bright orange. The virtual ocean waves undulating before the eyes of the viewer are therefore not blue, but vary from bright to saturated orange depending on the viewpoint and the density of the tubes staggered one behind the other. While one single pipe represents a single exploration well, the multitude of overlapping translucent pipes create a moving landscape of organic, rock-like formations on the first floor. If a person approaches the installation, the virtual ocean landscape opens up. The tubes are driven to a safe position, allowing the viewer to 'dive in', so to speak. With this interaction, the artists are deliberately alluding to the exploration of the sea bed for oil reservoirs.

### Art and technology in harmony

The mechanics and supporting structure of the kinetic installation, which was supplied by a Norwegian engineering firm consist of a framework of 23 steel girders, located in the ceiling between two stories of the building. With approximately five tons distributed over an area of 25 square metres, the construction of the framework represented a great challenge – one that was accepted by architectural firm Ctrl+N.

Each steel girder is equipped with 23 honeycomb-shaped stainless steel housings, every one of which accommodates – in the tightest of spaces – a Plexiglas tube, an AM8121 servomotor, a drive

I/O	– In/Out
IPC	– Industrial Personal Computer
PC	– Personal Computer
PLC	– Programmable Logic Computer

## Abbreviations/Acronyms

wheel, and six support wheels for guidance, as well as a capacitive sensor for position compensation. A 3D depiction of an undulating sea is created in the eye of the viewer, based on a cleverly devised relationship between speed, tube diameter, and the distance of the tubes from one another. These were implemented mechanically, with a total of 529 installed servomotors. The associated control electronics are located at both ends of the support structure and consist of an EK1100 coupler, and a set of I/O components, including: digital input terminals, servo terminals for controlling the servomotors, and buffer capacitor terminals for stabilising the supply voltage.

A total of 10 200 connection points must be processed, representing a challenge both mechanically and with regards to the control electronics. The compact design of the control and motion modules, above all the servo drives in a 12 mm terminal housing, was a prerequisite for the successful technical implementation of the artistic concept. The control system architecture encompasses three main components:

- Sensor and actuator level, consisting of EtherCAT Terminals and specific safety sensors
- PLC level, based on four C5102 Industrial PCs
- Superordinate application level

In order to enable the interaction between people and the kinetic sculpture, two overlapping sensor data levels were installed: a 40 m<sup>2</sup> capacitive sensor floor installed under the parquet flooring and four K4W sensors (depth cameras) installed in each corner of the room. The higher-level control application in openFrameworks was developed. Based on the data provided by the sensor floor and motion sensors, it encompasses a real-time model of the environment, for which a motion diagram is created to simulate the undulating movements.

### Complex control technology simulates swell

The application communicates with the four IPC platforms, which also control the servomotors via TwinCAT ADS. A great deal of openFrameworks add-ons were used for this application. In addition, three new add-ons for 'Breaking the Surface' for:

- Controlling the display and alignment of several Kinect point clouds in the same coordinate system
- Facilitating the transmission of data between openFrameworks and the control platform
- Directing the communication and visualisation of sensfloor data in openFrameworks

The set values of the motion diagram, which are programmed in C++, are imported into the automation software via the ADS interface. In connection with the ultra-fast bus system and the servo terminals, the point-to-point axis positioning software calculates the position for



The kinetic installation 'Breaking the Surface' consists of a field of 529 Plexiglas tubes, constantly moving in such a way that they create a 3D image of undulation in the eye of the viewer.



A total of 529 AM8121 servomotors and 529 EL7201 servo terminals were installed in order to move all the Plexiglas tubes.



Enclosed in a polyurethane crystal and labelled with the number of the exploration well, drilling samples from discovery sites in the Norwegian continental shelf are concealed in some of the tubes. They can be discovered by the visitor while interacting with the virtual ocean.



The compact electronics that control the 529 Plexiglas tubes are installed at both ends of the support structure. The controls consist of an EK1100 EtherCAT Coupler, digital input terminals, servo terminals, and buffer capacitor terminals.

each individual tube in a cycle time of 1 ms. An interpolating motion results, which the viewer perceives visually as natural undulation. If the sensors signal a movement, i.e. a person entering the 'ocean', then the axis positions of the undulation are overwritten; the position of the pipes in close proximity is adjusted to form a protective dome around the person moving around in the space. A thin metal ring, attached on the inside of each tube, gives a reference signal every time it passes the capacitive sensor inside the drive unit. This makes it easy and safe to double check and control our adjustment positioning algorithm which gives us the exact position of the tube at any time.

The higher PLC level consists of four C5102 Industrial PCs. One of the PLC's functions as the data communication and synchronisation level between the openFrameworks application App, and the three subordinated PLCs are each responsible for controlling one third of the servo axes. The PLCs accomplish the majority of the work by continuously adjusting the speed, acceleration, deceleration, and braking processes of each servo unit on the basis of the position specified by the higher-level application. Beyond that, these PLCs also manage calibration, position compensation, as well as speed and torque monitoring.

*In order to enable the interaction between people and the kinetic sculpture, two overlapping sensor data levels were installed.*

## Safe control of a virtual ocean

During the conception of the installation and its technical implementation, a great deal of attention was paid to safety requirements from the outset, in terms of both mechanical construction and the electrical system and sensors. After all, the installation was designed for interaction and should not pose any danger to people. Even the decision to use Plexiglas tubes was based on a well thought out concept intended to exclude any danger of injury. Plexiglas is light and the edges of the pipe openings can be rounded. Apart from that, the installation was designed in such a way that it functions with a low speed of movement. The sensor level in the floor enables sophisticated scanning of even the tightest spaces, and uses redundant scanning to ensure that no blind spots are possible. The objective of our security concept was to make it safe enough to avoid the use of safety precautions according to Safety Integrity Level, category 3, which would have

- Increasingly large amounts of data are being collected in industry.
- Data needs to be reliably managed and used in order to serve the needs of a controlled process or plant.
- Using PCs and EtherCAT has been shown to provide a viable means of doing this.





seriously impaired free access to this installation and its aesthetics. The interdisciplinary collaboration from everyone involved in this project, has enabled us to firmly stand behind 'Breaking the Surface' and happily say that it has been easy to proclaim that the installation is safe for human interaction.

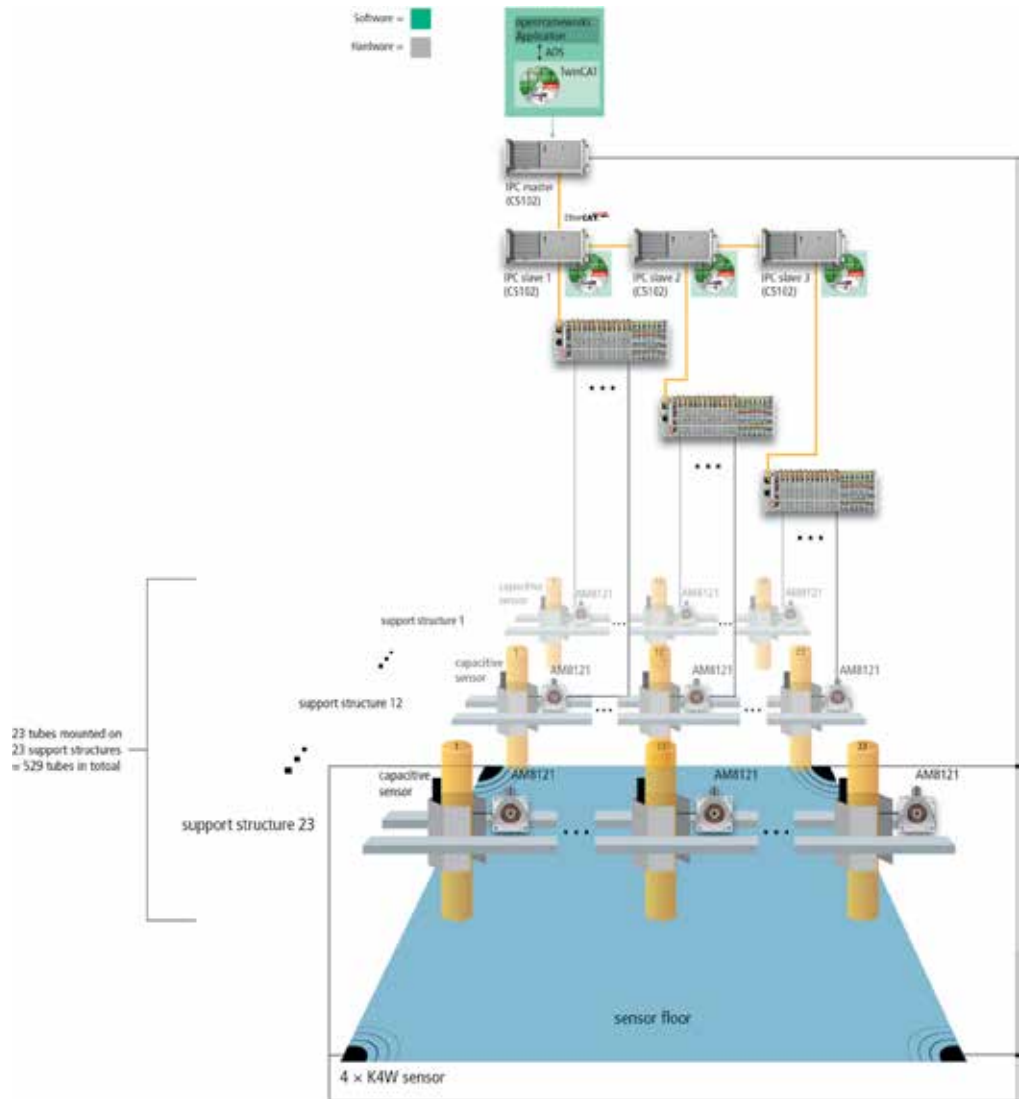
The impressive installation, which will soon be permanently on display at Lundin Norway's headquarters in Oslo, is rounded off by oil-filled crystals, which are concealed in some of the Plexiglas tubes. Moving through the virtual oil repository, the visitor can discover these crude oil samples from Lundin Norway's six most significant oil discoveries, including the giant 'Johan Sverdrup' discovery.

**Acknowledgement**

All images courtesy Abida, James Fox, Norway.

**Internet links**

- [1] [www.sdg.no](http://www.sdg.no)
- [2] [www.abida.no](http://www.abida.no)
- [3] [www.intek.no](http://www.intek.no)
- [4] [www.ctrln.no](http://www.ctrln.no)
- [5] [www.lundin-norway.no](http://www.lundin-norway.no)
- [6] [www.beckhoff.no](http://www.beckhoff.no)



Scan the QR code to see the 'Breaking the Surface' installation.



Michel Matuschke has a degree in engineering. Having joined Beckhoff Automation in Germany in 2007, he is currently the vertical market manager (stage and show technology). Enquiries: Kenneth McPherson. Email [k.mcpherson@beckhoff.com](mailto:k.mcpherson@beckhoff.com)

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## New release with focus on alarm system architecture and upgradability

**Schneider Electric's** StruxureWare SCADA Expert Vijeo Citect 2015 and CitectSCADA 2015 has become available. With across-the-board performance improvements, new functionality, as well as enhancements to the upgrade process from many previous versions, this major new release is our most scalable and robust version in years. During the development of this release, we put particular focus on alarm system architecture and upgradability. As a result, we are proud to claim alarm performance of up to two times faster than previous releases. In addition to online upgrade from v7.20, it is now possible to perform an offline upgrade from v5.21 directly to 2015 (excluding alarm history). Highlights include:

- Alarm performance and functionality improvements including page display, alarm counts, client footprint and server synchronisation
- Interface with external .NET assemblies through Cicode, making it easier to extend your system's functionality
- Partial Associations allow you to rapidly configure and maintain super genies and pop-up pages with dynamic associations through dynamic construction at runtime
- Manage your backups more efficiently with the ability to back up a complete project with all its included projects into a single backup file and restore all or selected projects
- Faster graphics development, with integrated Equipment graphics, allowing you to simply paste an equipment instance directly on a graphics page
- Native capability to run Vijeo Citect as a Windows Service, allowing for unattended operation of a system's servers

**Enquiries: Email [support@citect.com](mailto:support@citect.com)**

## Improving maintenance efficiency

**Yokogawa Electric Corporation** has introduced the SensTationpH/ORP measurement system, a scalable and integrated solution that combines the unique capabilities of the SENCOM pH/ORP sensors and the SMARTDAC+ data acquisition and control system. This solution eliminates the need for a pH/ORP transmitter and allows users the choice of any of the paperless recorders in the SMARTDAC+ series, each of which can connect to up to 16 sensors. In addition to supporting a wide range of analytical and data control applications, this solution improves maintenance efficiency. Liquid analysers are used in the oil, petrochemical, iron and steel, electric power, water supply, wastewater treatment, and many other industries. These analysers are necessary to control the quality of raw materials and products, monitor reactions, and manage water treatment. Conventional liquid analysers are composed of a sensor and a transmitter that converts the sensor's analogue signals into digital signals for transmission over communications networks and the real-time display of data.

**Enquiries: Christie Cronje. Tel. 11 831 6300 or email [Christie.cronje@za.yokogawa.com](mailto:Christie.cronje@za.yokogawa.com)**



## Streamlining automotive manufacturing in SA

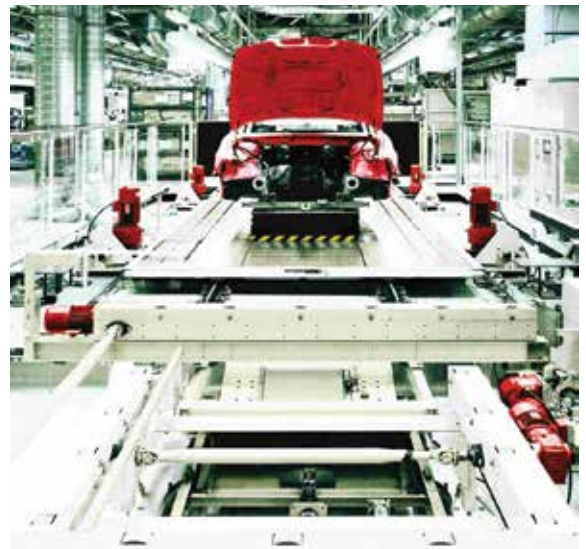
The automotive industry is based on 'just-in-time' (JIT) and 'just-in-sequence' (JIS) processes for material provision and production. JIT is a methodology aimed primarily at reducing flow times within production as well as response times from suppliers and to customers, while JIS is a specialised inventory strategy to achieve JIT, whereby components and parts arrive at a production line right in time as scheduled before they get assembled. Maximum system availability is, therefore, essential as any downtime results in high follow-up costs. **SEW-EURODRIVE** provides the local automotive industry with a unique product portfolio specifically designed to meet these requirements. SEW-EURODRIVE Port Elizabeth branch manager, Francois Sieberhagen, says that that the product offering ranges from individual components, to complete packages and system solutions.

"Leading automotive manufacturers choose SEW-EURODRIVE, as the company provides cost-effective drive solutions that deliver more value over the long-term. We provide a modular design and a reduced number of variants that increases flexibility and minimises costs."

SEW-EURODRIVE products most commonly used in the local automotive industry are; standard gear motors, synchronous and asynchronous servomotors, MOVIDRIVE B application inverters, MOVIFIT FC decentralised standard inverters, MOVIPRO SDC decentralised standard inverters and MOVIPRO ADC decentralised application inverters. Sieberhagen indicates that the latest-generation SEW-EURODRIVE VARIOLUTION packages enable automotive manufacturers to considerably reduce both the complexity of their systems, as well as their installation costs. "Our drive technology and expert knowledge ensures maximum productivity, energy efficiency and reliability for clients' systems," he continues.

VARIOLUTION is essentially 'packaged-selling', with 80 % of the package being standard and 20 % customisable. This provides customers with some level of customisation on top of the benefit of a standard tried-and-tested solution. The benefits of such an offering is that the customer has to deal with fewer variables and suppliers during the process of setting up a new application.

**Enquiries: Rene Rose. Email [rose@sew.co.za](mailto:rose@sew.co.za)**



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## Fast and accurate data transmission

Leuze electronic has developed a data transmission photoelectric sensor that has a high optical transmission of 100 Mbit/s. Available from sole Southern African distributors **Countapulse Controls**, the device allows data transmission without cabling and without interference. Gerry Bryant, managing director of Countapulse Controls, says that the Leuze DDLS 500 optical data transceiver is able to instantaneously transmit all common Ethernet protocols up to distances of 120 metres. These protocols include Profinet, EtherNet IP, EtherCat, Ethernet TCP/IP and Ethernet UDP. Constant monitoring and noti-

fication of the signal level on the easy to read LED display allows quick reaction to issues like soiling of the lens, ensuring simplified maintenance and diagnostics. The modular design of the Leuze DDLS 500 includes an integrated bubble level for accurate installation. The patented single-hand adjustment of the instrument allows precise alignment of the data light beam. In addition, the device projects four laser spots on the floor along the intended light path, aiding in the easy alignment of the device at a distance.

**Enquiries:** Gerry Bryant. Tel. 011 615 7556 or email [bryant@countapulse.co.za](mailto:bryant@countapulse.co.za)

## Motion detectors provide automated light switching

**RET Automation Controls** has introduced the WLS28-2MQ motion detector switch for automated lighting. Banner's motion detector switches provide an efficient solution to automatically turn on or off the light in applications where a physical switch cannot be used or the placement of the switch is not useful.

Banner's motion detector switches are available in two options, an in-line module or built-in motion detector for the company's industry-recognised WLS28-2 LED Strip Light. The in-line module allows operators to place the motion detection switch away from the light, and can be used with any Banner dc voltage lights. The WLS28-2 with built-in motion detector models provide easy and fast installation in one place.

"The motion detection switch offers a simple, convenient lighting solution for applications that don't easily allow manual on/off switching," said Matt Hahn, technical marketing engineer for lighting at Banner Engineering. "For example, if the motion detection switch is inside of an electrical enclosure, it will automatically turn the light on when the door is open and off when it is closed."

The motion detector switches feature M12 connectors and rugged metal housing for secure, durable performance. Detector switches are rated for 12 to 30 Vdc. Banner's WLS28-2 LED Strip Light delivers a versatile lighting solution, featuring a space-saving, low-profile design and various lengths from 145 mm to 1 130 mm.

**Enquiries:** RET Automation Controls.  
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or visit [www.retautomation.com](http://www.retautomation.com)



## New software for inventory visualisation

Imagine communicating automatically with the supplier of your level and pressure instrumentation via a Web portal. Imagine a situation where the sensors you have installed on tanks or silos at your plant not only communicate with each other and your plant management system but also with your supplier.

Vendor-managed inventory (VMEI) programmes are not a new idea. Major companies across leading industries have adopted this business model as a way to optimise inventory management and supply chain efficiencies. The automated flow of information within a company or between partner companies creates transparency early on for the supplier and security of supply for the purchaser.

VEGA, one of the market leaders in the manufacture and supply of pressure and level sensors, has made a strong link out of something that until now was a critical weakness in the supply chain. The VEGA Inventory System allows sensors to communicate directly with VEGA fully automatically, and report the need for re-supply. With the help of the web-based software, VEGA assumes responsibility for the customer's stocks and makes sure they are always sufficiently supplied. The customer no longer has to assess his needs accurately and then make sure replenishments are ordered on time. VEGA Inventory System takes over this function. To accomplish this task, the software provides automatic alerts to VEGA, which in turn allows VEGA greater flexibility in their own resource and logistics management. The programme also includes a series of well-designed analytical and planning tools that enables optimised demand, inventory and delivery planning.

**Enquiries:** Chantal Groom. Tel. 011 795 3249 or email [Chantal.groom@vega.com](mailto:Chantal.groom@vega.com)

## Ethernet products for harsh environments

Netshield South Africa has introduced a range of Industrial Ethernet products, designed to assist industrial customers where networking equipment is exposed to extreme elements and environmental factors.

The use of Industrial Ethernet (IE) devices is specifically required for businesses that require a more resilient solution because of the environment in which their Ethernet network runs. To this end, IE devices are fully equipped with rugged connectors, and boast switches that can withstand extended temperature, ideal for those in industrial environments as well as automation or process control.

"South Africa has a large industrial focused industry where we see factories, smelters, heat treatment plants, manufacturing lines and even furnaces and packing plants," states Inus Dreckmeyr, chief executive officer at Netshield. "The components used in the plant process areas of these companies, must be able to function in environments where there are extreme temperatures, humidity as well as vibrations that exceed the ranges information technology equipment can usually work under.

"The use of fibre Ethernet in these IE environments reduces the problems usually associated with electrical noise and enables electrical isolation, which in turn helps prevent equipment damage," adds Dreckmeyr.

Enquiries: Tel. 012 841 0320 or email [sales@netshieldsa.com](mailto:sales@netshieldsa.com)

## Modernising and migrating Industrial Communication Technology

The number of communications protocols used in industrial automation is staggering...and still growing.

No company can afford to re-engineer or rip out their existing processes every time they add a new machine or want to collect data into their existing network from some legacy device that is still working well but not connected to the network.

Re-engineering is not the answer because no matter how careful you are, there will be problems, interruptions and downtime. And downtime does not pay the bills, cover the payroll or produce any profits. What you need is a plan that will allow you to layer new data communications technology over the top of what you already have.

Then you can gradually migrate your existing equipment and devices into your network, providing you with the ability to collect new kinds of data that will increase your profit margin. You can start your phased migration by deciding and prioritising what data you really need to collect or measure for your specific operation.

Once you have this list you can begin your phased migration. There are numerous protocol gateways on the market today that will allow you to quickly (and cost-effectively) integrate a new machine into your network or collect data from a legacy device.

These gateways act as translators from one protocol to another. They are relatively easy to install and once up and running, they allow your controller to 'talk to' devices that speak a different protocol as seamlessly as if it were all one network.

Enquiries: Visit [www.prosoft-technology.com](http://www.prosoft-technology.com)

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# Generation III+ VVER nuclear reactors

By D E Kolchinsky, A V Molchanov, V V Bezlepkin, A M Altshuller (St Petersburg Atomenergoproekt (a branch of VNIPIET)), Russia, and Ryan Collyer, Rosatom South Africa

*The common name for the Water-Water Energetic Reactor (VVER) is Pressurised Water Reactor (PWR). It is the most widely used nuclear power reactor technology in the world today.*

**V**VER (Water-Water Energetic Reactor) is one of the most successful and influential branches of nuclear power plant development, and the technology is widely distributed throughout the world. VVER technology was developed in house by OKB Hidropress, a research division of global nuclear company Rosatom, while the nuclear power plant projects using this technology were implemented by three engineering organisations of this company – Atomenergoproekt in Moscow, St. Petersburg and Nizhny Novgorod. However, the Russian VVER reactor and the materials used for its construction differ significantly from other PWR reactors. The main features of the VVER are as follows:

- Use of horizontal steam generators, which reduces the risk of corrosion and malfunction, facilitates repair and maintenance and ultimately reduces costs
- Use of hexagonal fuel assemblies, which increase the technical and economic characteristics of the fuel by increasing the duration of the campaign and the introduction of extended fuel cycles
- Preventing the release of fission products outside the sub-reactor cavity, based on completely independent systems and taking into account all requirements of the IAEA, including the 'post-Fukushima' standard SSR-2.1
- High-power pressure compensation system, ensuring a long, safe and failure free operation steam-generating unit

Fifty years' experience has been accumulated through the successful operation of NPPs using VVER technology and a total of over 1 400 reactor years have been achieved. Nuclear power plants with VVER-type reactors are built with the participation of Russian specialists

in Finland, Czech Republic, Slovakia and Hungary amongst other countries.

NPPs designed according to VVER-1000 technology were built in Russia (units 1 - 4 of Balakovo NPP, units 1 - 4 of Kalinin NPP, unit 5 of Novovoronezh NPP and units 1 - 2 of Rostov NPP), in Bulgaria (units 5 - 6 of NPP Kozloduy), in Ukraine (units 1 - 3 of NPP South Ukraine, units 3 - 4 of NPP Rovno, units 1 - 6 of NPP Zaporozhe and units 1 - 2 of NPP Khmel'nitski), in Czech Republic (units 1-2 of NPP Temelin), India (units 1 - 2 of NPP Kudankulam), Iran (unit 1 of NPP Bushehr), China (units 3 - 4 of NPP Tianwan).

NPPs designed according to the project 'NPP-2006' are currently under construction in Russia, Belarus, and Turkey and are expected to be constructed in Finland and Hungary.

The project has more capacity due to the increased capacity of the power units (not less than 1 150 MW with the possibility of increasing up to 1 200 MW), which will reduce capital and operating costs, as well increase economic efficiency of the project.

In addition to greater capacity, the project includes a combination of active and passive safety features: active safety systems are able to function when at least one of the alternative power sources is available.

Passive systems are able to function independently, without power, and without human intervention. The project also provides resistance to the design basis and beyond design basis accidents, calculated on a full-featured simulator — mathematical model of a virtual power unit.

The main principles underpinning the AES-2006 design are: Maximum use of proven technologies; minimum cost and construction

- HVAC – Heat, Ventilation, Air-conditioning
- IAEA – International Atomic Energy Agency
- NPP – Nuclear Power Plant
- PWR – Pressurised Water Reactor
- VVER – Water Water Energetic Reactor

Abbreviations/Acronyms

times; active safety systems in general for design basis accidents and passive in general for beyond design basis accidents; and reduction in the influence of human factors on overall safety.

Figure 1 shows the basic process diagram. The primary circuit consists of four loops (only two are shown in Figure 1 for clarity), each

loop having a reactor coolant pump and horizontal steam generator. The primary circuit has a single pressuriser. The secondary circuit includes a steam turbine-generator, condensate pumps, LP heaters, main condensate system, de-aerator, and feedwater system including HP heaters.

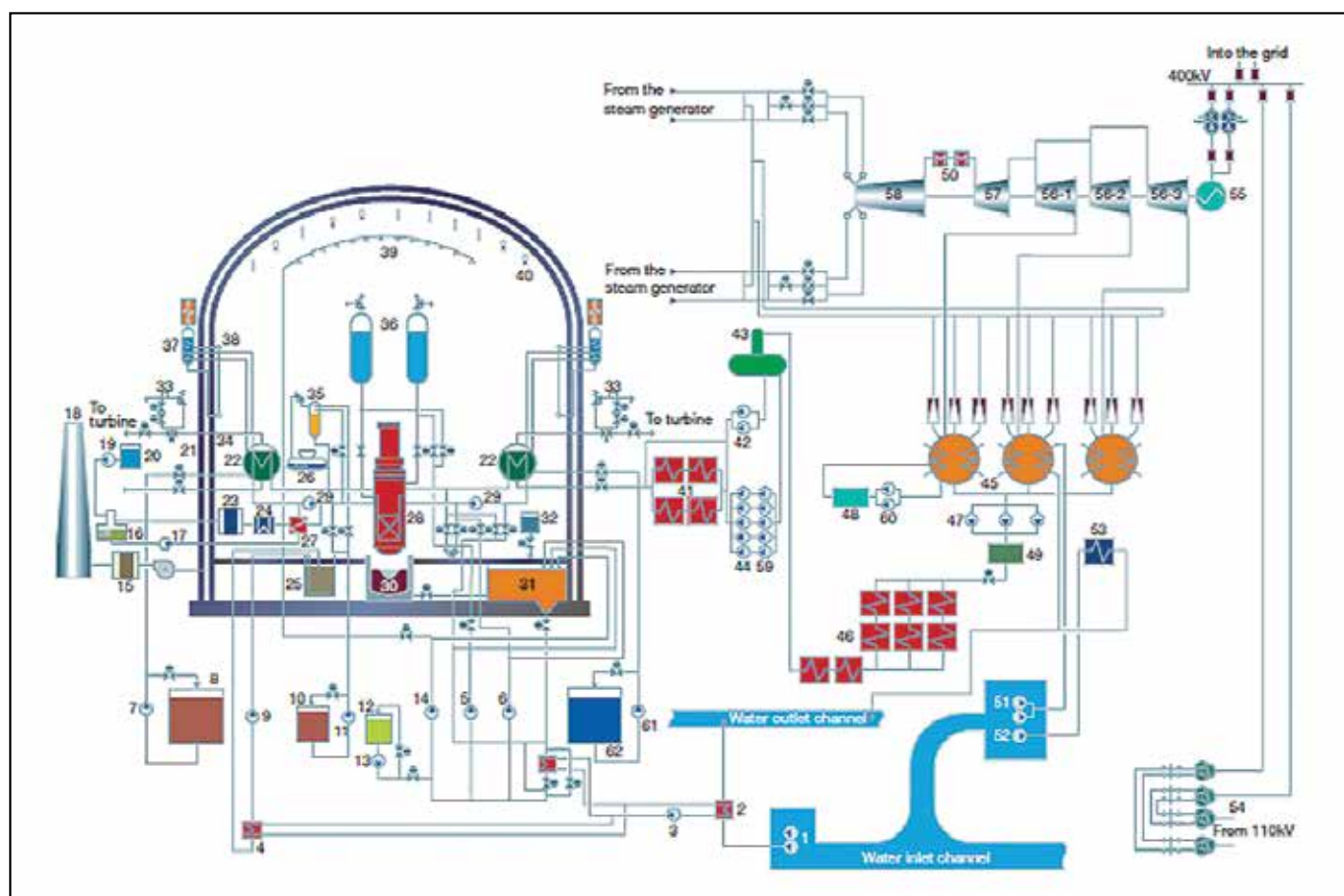


Figure 1: Basic process diagram.

- Key:**
- |   |   |   |   |
|---|---|---|---|
| 1 Essential cooling water (or 'service water') pump                   | 15 Filter   | 31 Emergency core cooling system sump and refuelling water storage tank | 47 Condensate pumps, first stage                    |
| 2 Intermediate cooling circuit heat exchangers for priority consumers | 16 Volume and chemical control system deaerator                           | 32 Alkali (NaOH) emergency reserve tank                                 | 48 Unit demineralised water plant                   |
| 3 Intermediate circuit pump   | 17 Volume and chemical control system pump                                | 33 MSIV, safety and relief valve assembly                               | 49 Main condensate treatment                        |
| 4 Spent fuel pool heat exchanger                                      | 18 Ventilation stack  | 34 Containment  | 50 Superheater                                      |
| 5 Emergency injection system, low pressure pump                       | 19 Controlled-leak pump   | 35 Pressuriser  | 51 Circulation cooling water pumps                  |
| 6 Emergency injection system, high pressure pump                      | 20 Controlled-leak tank   | 36 ECCS hydro-accumulators  | 52 Cooling water pump for turbine hall consumers    |
| 7 Emergency feed water pump   | 21 External containment   | 37 Passive heat removal system tank                                     | 53 Turbine hall consumers                           |
| 8 Storage tanks for high concentration boric acid                     | 22 Steam generator  | 38 Condenser for the containment passive heat removal system            | 54 Stand-by step-down transformer                   |
| 9 Emergencyboration system pump                                       | 23 Water treatment plant  | 39 Spray system   | 55 Generator  |
| 10 Storage tanks for boric acid solution                              | 24 After-cooler   | 40 Passive hydrogen recombiner  | 56 Turbine low-pressure cylinders                   |
| 11 Emergencyboration system pump                                      | 25 Spent fuel pool  | 41 High-pressure heaters  | 57 Turbine intermediate-pressure cyl.               |
| 12 Storage tank for chemical reagents                                 | 26 Bubbler tank   | 42 Electric-powered auxiliary feed water pump                           | 58 Turbine high-pressure cylinder                   |
| 13 Supply pump for chemical reagents                                  | 27 Regenerative heat exchanger for the volume and chemical control system | 43 De-aerator   | 59 Boost pump                                       |
| 14 Containment spray system pump                                      | 28 Reactor  | 44 Electric-powered feed water pump                                     | 60 Condensate pumps for unit demineralisation plant |
|   | 29 Reactor coolant pump   | 45 Condenser  | 61 Emergency feed water pump                        |
|   | 30 Core catcher   | 46 Low-pressure heaters   | 62 Demineralised water storage tank                 |

Table 1 shows the basic data of VVER AES - 2006. The heat supply capacity is given as 300 MWt (as at Leningrad the nearby town of SosnovyBor is supplied with district heating), but this is optional and the rated electrical power can be increased instead.

Table 1: AES-2006 - basic data.

Service life (years)	60
Unit output, electric, low-sea-temp. site (MWe gross)	1198
Reactor thermal output (MWt)	3212
Heat supply capacity (MWt)	300
Availability (%)	>90
House load (including power for re-circulating cooling water supply) (%)	7
	37,0 gross
Power plant efficiency (turbine in condensing mode) (%)	34,5 net
Unplanned automatic scram per year	<1
Planned outage duration (annual)	4 x 16,2 x
over seven years of operation (days, max)	24, 1 x 30
Duration of outage required every eight years to include turbine disassembly (days, max)	40
Number of operating personnel (person/MW)	0,42
Design basis maximum fuel burn-up (average per fuel assembly) (MWd/kgU)	60
Fuel campaign duration (ie fuel life in the core) (years)	4
Refuelling frequency (months)	12(18)
Primary coolant temp. at core inlet (°C)	298,2
Primary coolant temp. at core outlet (°C)	328,9
Primary coolant flow rate through reactor vessel (m <sup>3</sup> /hour)	86
Primary coolant pressure at reactor vessel outlet (MPa)	16,20
Steam pressure at the steam generator outlet (MPa)	7
Steam production rate per SG (t/hour)	1602
Feed water temperature at SG inlet (°C)	225
Steam moisture content at SG outlet (%)	< 0,2
Total probability of core damage due to internal initiating events (per reactor year)	<7,37 x 10 <sup>-7</sup>
Total probability of accidental sequences involving large releases caused by containment bypass or initial lack of leak tightness	<3,71 x 10 <sup>-9</sup>
<b>Double containment dimensions:</b>	
<i>External, protective, containment (reinforced concrete)</i>	
Internal diameter (m)	50
Height of dome (m)	71,4
Thickness (cylindrical section) (m)	2,2
Thickness (dome part) (m)	0,8
<i>Internal, hermetic, containment (also reinforced concrete)</i>	
Internal diameter (m)	44
Height of the dome (m)	67,1
Thickness (cylindrical section) (m)	1,2
Thickness (dome part) (m)	1,1
Design basis overpressure (MPa)	0,4
Design basis temperature (°C)	150

**Safety concept of VVER Gen 3+ design**

The NPP safety is based on the principle of defence-in-depth – the use of a system of barriers against the spread of ionising radiation and radioactive substances into the environment as well as a system of technical and organisational measures to protect the barriers and maintain their effectiveness thereby directly protecting the population.

*The Russian VVER reactor and the materials used for its construction differ significantly from other PWR reactors.*

Table 2: Safety systems and auxiliary means for beyond design basis accident management.

Active safety systems and protection systems for design basis accident management:	Number of trains and capacity
High pressure safety injection system	4 x 100 %
Low pressure safety injection system	4 x 100 %
Emergency boration system	4 x 50 %
Emergency feedwater system and heat removal via atmospheric steam dump valves	4 x 100 %
Containment emergency spray systems	4 x 50 %
Residual heat removal system and reactor cooling	4 trains
Intermediate cooling (component cooling) system	4 trains
Essential cooling (service) water system	4 trains
HVAC system for safety systems rooms	4 x 100 %
Containment isolation valve system	2 x 100 %
Borated water storage system	2 x 100 %
Emergency gas removal system	2 x 100 %
Primary circuit overpressure protection	3 x 50 %
Secondary circuit overpressure protection (per steam line)	2 x 100 %
Main steam line isolation system (fast isolation valve + valve with electric actuator) (per steam line)	2 x 100 %
Emergency diesel generator power supply	4 x 100 %
Safety system activation	4 sensors/ parameter, 4 logic trains, each with 2/4 polling
Emergency reactor shut down system	4 sensors/ parameter, 4 logic trains with 2/4 polling for 1st level selection and 2 logic trains with 2/4 polling for 2 <sup>nd</sup> level selection
<i>Passive safety systems for design basis accident management:</i>	
Emergency core cooling system hydroaccumulator	4 x 33 %
Containment	
Containment hydrogen removal system	
<i>Auxiliary measures for beyond design basis accident management:</i>	
Passive heat removal via steam generators (SG PHRS)	4 x 33 %
Containment passive heat removal system	4 x 33 %
Core catcher	
Containment hydrogen removal system	
Volatile iodine chemical retention system	
HVAC system to maintain under-pressure in the containment annulus	2 x 100 %
Reactor core inspection shaft emergency water system	2 x 100 %

- Nuclear bulk energy generation will be part of the energy mix going forward.
- PWRs are the most commonly used nuclear power reactors in the world.
- Whereas nuclear generation is inherently safe, each experience in the world leads to improved design and implementation.





## Conclusion

In terms of civil engineering design, the AES-2006 buildings and facilities as well as process systems and important safety systems are constructed to withstand a design basis earthquake of 0,25 g and heavy aircraft (e.g. Boeing-747) crash. Even in the event of a meltdown, projects based on VVER III+ generation technology allow control over the accident for 72 hours. If one was to consider a

Fukushima-like scenario, Russian NPPs are able to operate autonomously for approximately one month. This is proved not only in the blueprint, but also in practice, in recent years, all this company's NPPs successfully passed drills on the Fukushima-like scenarios, of beyond design basis radiation accidents.

Denis Kolchinsky is MIR project chief engineer, Anatoly Molchanov is a department chief engineer, Vladimir Bezlepkin is the science and innovations director, Alexander Altshuller is the chief engineer of nuclear steam generation plants (St Petersburg Atomenergoproekt, a branch of ATOMPROEKT), and Ryan Collyer is employed by, Rosatom South Africa.

ATOMPROEKT JSC is the leading design company of State Corporation Rosatom. The company was established on 1 July 2013, having brought together the best nuclear designers of St. Petersburg – VNIPIET Lead Institute and Atomenergoproekt, St. Petersburg. The company has almost a century of experience and knowledge in comprehensive design of nuclear facilities. Today the company employs over three thousand competent experts who are developing the projects of the future. Enquiries: Ryan Collyer. Tel. 011 784 2554 or email rcollyer@rosatom.co.za

## ROUND UP

### Lighting design specialists

**Technology:** Lighting equipment and control technologies are developing at lightning speed. To provide proper design solutions that make use of the latest, most cost-effective technologies, lighting profes-

sionals must attend national trade shows and continually update product information and samples from hundreds of manufacturers around the world. Keeping abreast of newest weapons in the lighting arsenal has become time intensive and more essential. Independent lighting consultants do not sell or install equipment, nor do they depend on the recommendations of lighting sales people.

**Technique:** Illumination is a short-lived partner of architecture. Light is invisible until it strikes an object or surface. It is controlling this difficult, transitory medium that gives the lighting 'artist' the ability to create hierarchies, dynamics and mood. Lighting design has become a creative extension of architectural design, improving visibility and complementing form, programme and colour.

**Education:** Knowledge of physics, optics, electricity, ergonomics, business, codes, environmental issues, construction, vision and the art of design are all essential to creating great lighting solutions.

Lighting professionals must be well grounded and continually educating themselves to provide the best possible service. They do so in many ways including networking, reading trade magazines and

journals, attending and presenting seminars. This sort of give and take, along with healthy competition, drives the profession as a whole.

**Cost and payback of professional services:** Architectural lighting design is succeeding as a profession because of the many solid answers to this question: Why should an architect or owner pay for lighting design services when it can be done in house or by a salesperson at no additional 'cost'? The fee that a lighting designer charges is difficult to sell only when the extent and value of the services are not recognised. Those owners and architects who have benefitted from independent, skillful lighting designs realise that there are both short- and long-term paybacks that far outweigh the fees. Lighting designers can be a unique, value-added resource. In many instances, a lighting designer will actually reduce the project construction and operations costs.

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## ACWA Power to provide solar energy to SA's national grid

**ACWA Power**, Riyadh based global leading water and power developer, owner and operator across 10 countries, will undertake a molten salt solar project that will contribute approximately 50 MW to the country's current electricity generation capacity from early 2016.

As part of the South African Government's Renewable Energy Independent Power Producer Procurement (REIPPP) programme, the Bokpoort Concentrated Solar Power Independent Power Project (Bokpoort CSP Project) is currently in its commissioning phase at Groblershoop, situated near Upington in the Northern Cape – a province that boasts one of the highest solar radiation footprints in the world.

Bokpoort's Concentrated Solar Power technology effectively allows for the 'banking' of excess solar energy during the day, which can then be released after sun down; enabling consistent electricity supply during peak demand periods. The thermal storage capacity of 1 300 MWh, which is equivalent to about 9,3 hours of operation, is the largest ever adopted by a solar power plant of this class in the world. This makes CSP the only renewable technology at a commercial scale that is able to meet the country's daily peak demand, thereby helping to prevent load shedding.

The solar energy generated by the 658 000 m<sup>2</sup> of reflector area will be fed directly into Eskom's Garona substation, located next to the site, under a 20 year Power Purchase Agreement (PPA).

"We are proud to be a part of creating a sustainable future for South Africa through the reliable delivery of renewable electricity. This project allows for delivery of electricity at the lowest possible cost into Eskom's national power supply network, and will also enhance

local socio-economic development and long-term growth," said ACWA Power Chairman, Mohammed Abunayyan.

The Bokpoort CSP Project has led to the creation of more than 1100 local jobs during the peak of its construction – 390 from the surrounding community – and over 50 permanent employment opportunities will be made available during the operation of the power facility. In addition, the initiative has facilitated local shareholding in the project company and allowed for the participation of high level broad-based black economic empowerment (BBBEE) companies for construction, operation and maintenance.

In demonstrating its long-term commitment to South Africa and the community in which it will be operating, ACWA Power, has put upfront R5 M towards a number of development programmes in partnership with the Kheis Municipality.

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## LED light bar provides bright, even light

**RET Automation Controls** introduces the WLB92 industrial LED light bar from Banner Engineering. Featuring bright, high-quality and uniform light, the WLB92 is designed to increase worker productivity and ergonomics. With a rugged metal housing and shatterproof light cover, the WLB92 is optimal for a variety of industrial lighting applications including robotic work cell lighting and quality inspection, while having aesthetics suitable for an office environment.

The WLB92 LED light bar delivers a versatile lighting solution with models available in ac or dc voltage supply and multiple connection options, including ac quick disconnect and ac conduit. The WLB92 also features several mounting options, such as surface, swivel, snap and hanging brackets to accommodate diverse installation needs. To ensure continuous run and permanent installation, the WLB92 is equipped with industry-standard conduit knockouts. An optional dimming function is also available to allow users to customise light levels.

"Industrial lighting continues to grow as our customers find new applications and challenges," said Matt Hahn, technical marketing engineer (lighting) at Banner Engineering. "Banner's energy-efficient WLB92 light bar provides the quality, brightness and durability required with no maintenance time or additional costs." The WLB92

is available in 550 or 1 100 mm lengths. All WLB92 models offer enhanced light quality with bright, densely spaced LEDs to ensure even, bright and highly efficient illumination. Ac models are also DLC qualified and have a five-year warranty.

**Enquiries: RET Automation Controls.  
Email [brandon.topham@retautomation.com](mailto:brandon.topham@retautomation.com)  
or visit [www.retautomation.com](http://www.retautomation.com)**



# ACDC Dynamics

## LED Lighting and the importance of using a professional Lighting Designer



**A**CDC Dynamics prides itself in being at the forefront of technology when it comes to lighting and lighting design. Our LED lighting solutions offer a wide range of industrial, commercial and residential lighting products including our range of energy efficient lights and globes. Our lighting solutions range from IP20 to IP67 ratings and include a number of LED work lights, hi-bays, spot lighting, portable lamps, induction lighting, emergency lighting, industrial bulk heads, LEDT8 fittings, LEDT8 weatherproof linear lights, torches and head-lamps to name but a few.

As lighting makes up to 25 % of the average home and business energy budget, the electricity used over the lifetime of a single incandescent bulb, costs anywhere between five to 10 times the original purchase price of the lamp itself.

Light Emitting Diode (LED) lamps have revolutionised energy-efficient lighting. LED technology is advancing rapidly, with many new lamp styles available. All of these LEDs are available with standard bases which fit common household and industrial light fixtures. LEDs are the next generation in lighting design.

LEDs provide more value since the lifespan of the bulb is longer than that of normal CFLs. One of the problems associated with early LED lamps was glare – this has been overcome by an intelligent lens

design. The KL range of lamps available from AC/DC Dynamics, and all their distribution points nationwide, uses a specially designed lens that eliminates glare and provides very even light distribution. A truly innovative technology that reduces glare and eye strain.

Intelligent LED lighting provides the ability to adapt to the environment. This is achieved by selecting the best solutions in terms of effectiveness and efficiency, for the specific application and environment. This makes it important to focus on the correct design for the location and area that requires lighting, leading to the important question of:

### **Why use a professional light designer?**

There are some important questions that need to be answered when planning a new lighting project, specifically the following:

- Is 'good' illumination important to your project?
- What is a good lighting design?
- How is this achieved?

Light is a technically difficult, yet an astonishing, medium that requires mastery of varied and continually evolving disciplines. A lighting design practice integrates the art, science and business of illumination design and implementation far beyond concerns of pure visibility. Professional lighting designers bring solid technical acumen and sensitive design techniques to architectural and landscape projects.

But the value-added services they provide can make or break the success of a project. An owner or project designer may be unaware of the advantages an independent lighting consultant can bring to today's design and construction processes.

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or [info@acdc.co.za](mailto:info@acdc.co.za)





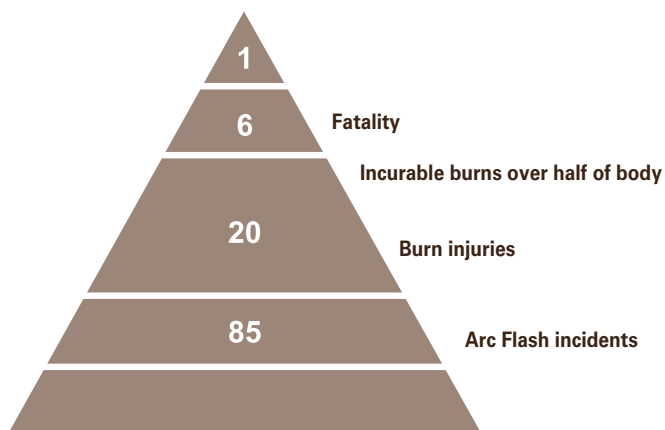
# IR windows

By S Edwards, R&C Instrumentation

*IR windows are intended to remove the risk of triggering an arc flash incident during a thermographic inspection.*

**D**uring an arc flash, temperatures can reach as high as 20 000 °C causing rapid expansion of hot air around the flash area. Copper busbars vaporise and plasma expands. Molten copper becomes hot shrapnel which destroys assets and anyone in its path.

A company in the United States (US) dealing in Infrared (IR) monitoring of hot spots, produced the following Arc Flash pyramid:



In the US, out of 85 arc flash incidents, 20 result in burns, six in burns to over half the body and one fatality. In Southern Africa few or no statistics are available but searching the net has come up with figures such as one to two fatalities per month. South African 'statistics' seem to indicate one in two months, but this, although already alarming, is not the full picture, as occurrences are often reported as 'explosions' or 'burn incidents' instead of arc flash. So, how can we make this safer?

We can cut the power before inspection. However, the first problem with this is downtime. Then there is the time from de-energising



ing the system to getting the green light to remove the panel. By the time the panel has been removed, things will have cooled down significantly, making thermographic inspection ineffective.

IR	– Infrared
MMC	– Motor Control Centre
NFPA	– National Fire Protection Association
OSHA	– Occupational Safety and Health Association
PPC	– Personal Protective Clothing
PPE	– Personal Protective Equipment
UL	– Underwriters Laboratories

## Abbreviations/Acronyms

fective. We could use resistive checking as is done when the panel is first manufactured. This is time consuming and has huge impacts on plant down time.

What about keeping the panel closed and doing the thermography through the closed panel?

A solution is available through the installation of IR windows, which means the inspection can be carried out efficiently with the energised system enclosed behind a closed door. In fact, the installation of IR windows will not only make the inspection process safer, but will also save costs. The common procedure for performing IR inspections in electrical panels and switchgear:

- Isolate equipment at MCC
- Put on PPE
- Open MCC door and remove covers
- Override mechanical interlock and switch power back on
- Leave on load for 20 minutes
- Perform IR tests on live electrical equipment
- Isolate and close panel door
- Re-instate supply to equipment

Have you ever seen your staff or contract labour in full Arc Flash resistant PPE? To say that it is not common may be a kind answer.

### Solution

The solution lies in the installation of IR Windows in the electrical panels. There is:

- No downtime to open door
- No exposed live equipment
- No PPE required
- No sticking things into live panels

... *Most importantly... no one is hurt.*

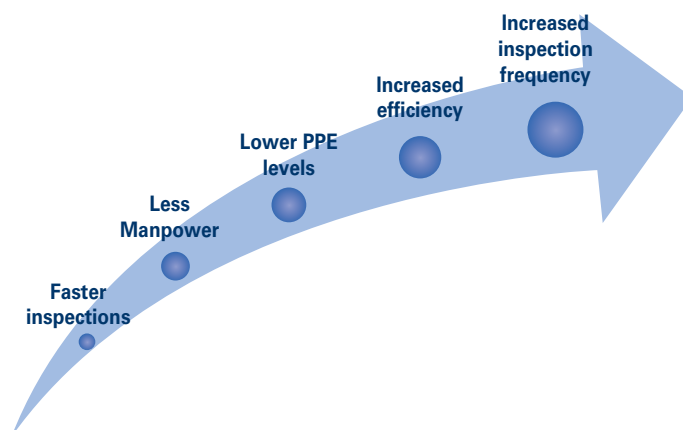


World leaders in switchgear manufacture have tested the IRISS Polymer version of the IR window and now offer Polymer IR windows as options when manufacturing switchgear.

The list of users is growing daily and across all manufacturing areas like power generation, paper and pulp, oil and gas, automotive and mining – to mention a few.

### How can we justify the installation of IR windows?

Look at the model below and put some time and costs to the different areas; you will be surprised just how much you are spending. Refer to the brief case study in this article and see how Stansted Airport in London did it.



### Types of IR window

There are two main types of IR Window, Crystal, (Calcium Fluoride) and Polymer windows.

**Calcium Fluoride** windows have been around for many years but have some disadvantages. They are very fragile so unable to contain an arc flash, they are hydroscopic so absorb water even if coated on the surface they absorb through the edges. This affects their Transmissivity of IR Energy, so need frequent calibration to give accurate readings. IR Inspection cameras utilise a wavelength in the 8 - 14 micron spectrum for best results, this is known as the Long Wave IR Spectrum Calcium Fluoride windows have good transmissivity in short wave but in long wave it drops off drastically around 9,5 to 10,0 micron. The life expectancy of a Calcium Fluoride window is about three to five years depending on the environment (humidity).

**Polymer** windows are the latest technology and have a good resistance to impact and load. They are resistant to water and low levels of acid and alkaline. The transmission of IR is very good and constant in Long Wave and Short Wave spectrums. They can be manufactured in almost any shape, dependent on application. They are guaranteed for the lifetime of the switchgear. This panel has undergone an Arc Flash test. You can see the bulging of the panel,

the heat damage to the label and the burnt off handle. The Polymer window remains intact.

IR windows are not intended to protect a user from an arc flash they are intended to eliminate additional triggers of an arc flash during an inspection and replace a high-risk activity with a risk reduction/elimination strategy during inspection. IR windows and closed-panel inspections help companies to comply with the OSHA and NFPA mandates to eliminate risk wherever possible; conversely, a protection strategy is acceptable only after other methods of risk elimination or reduction have been exhausted.



## Conclusion

NFPA 70E [1] lists removal of panels on electrical equipment as one of the riskiest activities that a worker can perform on that piece of equipment. The risk is elevated because the most common arc triggers occur either because the panel covers are open or as a result of removing the panel covers. Closed-panel inspection using IR windows will eliminate 99,9% of arc flash triggers during inspection. Therefore, the core benefit of IR windows is that they comply with the OSHA and NFPA 70E [1] focus on removing the risk of an accident – protection with PPE is only used as a last resort, and the implementation of engineered controls is only used where risk elimination and substitution are not feasible.

*Stansted Airport London installed 72 custom-made IR windows which allow the engineers to complete efficient, safe inspections of the fuses that feed terminal systems, such as computers and baggage belts.*

IR windows are intended to remove the risk of triggering an arc flash incident during a thermographic inspection. That being said, the windows should also offer the same level of structural integrity that UL746 [2] requires of other common meters and controls, and the same integrity that IEEE C37.20.2 [3] requires for impact and load of 'viewing panes'.



## Acknowledgement

The author presented 'IR windows' at the 2013 Electrical Arc Flash Conference organised by IDC Technologies.

## References

- [1] NFPA 70E. 2015. Standard for electrical safety in the workplace.
- [2] UL746. Plastic material properties.
- [3] IEEE C37.20.2. 1999. Metal-clad and station-type cubicle switchgear.

## Bibliography

- [1] ROI Case Study: Paper mill boosts RCM Programme with cost savings generated by its IR window programme. Martin Robinson. Level 3 thermographer, president and chief engineer, IRISS, Inc.

- Arc flash injuries are all too common, and every precaution needs to be taken to limit the risk.
- It is accepted that certain observations and measurements in electric panels must be done while the system is live.
- An IR window on an electric panel allows visual access to the internals with a reduced risk of arc flash.



take note



Born and educated in Yorkshire, England, Steve Edwards arrived in South Africa 26 years ago on a three-year contract. Involved since an early age in rotating equipment monitoring, he joined AECI (South Africa) in the consulting engineering department, he is now the owner of R&C Instrumentation, providing industries with industrial instrumentation and consulting services and applications design on infrared temperature monitoring and scanning. Enquiries: Tel: 032 946 2805 or email [stevee@randci.co.za](mailto:stevee@randci.co.za)

## Case Study:

### Stansted Airport, London

As the airport is open for business 24/7, Stansted's engineers only had four hours per night in which to conduct the predictive maintenance of low-voltage equipment. The entire inspection cycle was protracted and no system could be checked under load. This airport is classed as a strategic airport thus having to take re-directed traffic at any time of day or night. Any deviation from this ability is detrimental to air traffic safety around London and comes with large fines.

Chelmsford-based IRISS, clinched a deal with the airport to construct and install 72 custom-made IR windows which allow the engineers to complete more efficient safe inspections of the fuses that feed terminal systems, such as computers and baggage belts. Previously, the entire inspection cycle was a long process and it took engineers two nights to shut down the system and inspect just one electrical panel by hand. With the installation of the IR inspection windows and the help of a thermal imaging camera, checks of all the panels can be carried out in just five hours, making huge savings in survey times and equipment costs.



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UL & IEEE Certified

**Platinum Series CAP-T**  
Fixed and stable IR Transmission  
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## Periodic inspection of portable earthing and short-circuiting devices

Reduced cable cross-sections of portable earthing and short-circuiting devices (EaS devices) resulting from copper corrosion and breakage of conductor strands, or increased resistances in the connections, may have fatal consequences when earthing and short-circuiting devices are subjected to short-circuit currents. Therefore, portable EaS devices must be tested prior to each use and at regular intervals.

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EaS device based on static and dynamic measurements of the ohmic resistance. **DEHN AFRICA** offers this improved test for portable EaS devices on the customers' premises. An earthing and short-circuiting device is tested in three steps and the resistance values are compared with theoretically and experimentally determined limit values. The first step is the visual inspection for visible signs of damage. A static test is performed in the second step, in which the absolute resistance value is measured at the stationary earthing and short-circuiting device. Step three includes the dynamic test, which notes the measurement of the relative change in resistance at the moving earthing and short-circuiting device. The measurement of the resistance change value  $R$  between the non-moving and the moving EaS device is a new approach which allows for the detection of local damage, such as breakage of conductor strands in the conductor cable.

*Enquiries: Alexis Barwise. Tel. 011 704 1487  
or email alexis.barwise@dehn-africa.com*

## Launch of lightning impulse current laboratory

To prove the effectiveness of protection measures, it is often necessary to perform lightning current tests on complete systems. **DEHN's** newly designed test laboratory generates extremely high lightning currents with a peak value up to 400 kA in the standardised 10/350  $\mu$ s test wave form.

This powerful test laboratory allows for the testing of lightning protection systems for installations and systems requiring maximum protection. The performance of the test laboratory has been doubled so that lightning impulse currents twice as high as that required for the maximum lightning protection level (LPL I: 200 kA (10/350  $\mu$ s)) described in the latest IEC 62305-1 lightning protection standard, can now be simulated.

The test centre consists of five different laboratories, extending over a floor space of 800 m<sup>2</sup>. It is equipped with the latest devices and technologies essential for developing new products and practical solutions.

*Enquiries: Alexis Barwise. DEHN Africa. Tel. 011 704 1487  
or email alexis.barwise@dehn-africa.com*



## New premises for cable company

Local cable manufacturer, **Alvern Cables**, has moved into its newly constructed, premises in Branch Road, Driehoek, Germiston. The factory will be remaining in Knights, Witfield, and the extra space made available by this move will allow the installation of new state of the art equipment to make this cable company even more competitive in the market.

Commercial director, Stephen Liasides is upbeat about the move. "Our growth over the years necessitated this change and the new building is conducive to further progress"

Alvern Cables has been operating since 1967. As a privately-owned business, it started by manufacturing low voltage electrical cables for domestic and industrial use. In November 2014, in addition to Laurence Hendy (Managing director), Willem Smit (Financial director) and Stephen Liasides (Commercial director) - Dorothy Botsi-Thulare (Executive director) and Jaycen Padiachy (Works director) were included as shareholders, bringing the company to Level 2 B-BBEE - in keeping with current policy in South Africa.

New to Alvern Cables is a distribution division which specialises in buying and selling products that are in short supply, as well as cables for special purpose.

*Enquiries: Email [Stephen@alverncables.co.za](mailto:Stephen@alverncables.co.za)*



*Alvern Cables' accounts team: Estelle Buitendach, Anna Carelse, Jeaneth Mogofe, David Brodryk, Krish Govender and seated, Dorris Nkosi.*



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# Improving productivity in a temperature calibration laboratory

By R Ainsworth Fluke Calibration

*A company uses lean manufacturing principles to improve laboratory quality and productivity in its temperature calibration laboratory.*

Many calibration laboratories and instrument shops face the problem of delivering more accurate calibrations in less time and at lower cost. Although improving quality and performance while reducing cost is a difficult problem, it is also an old problem that manufacturers have been facing for years. Lean manufacturing, a concept pioneered by Toyota, offers an approach that may also benefit service as much as it does manufacturing. This article describes how.

Fluke Corporation (referred to in this article as 'the company') maintains a temperature calibration laboratory in American Fork Utah, providing NVLAP accredited calibration services (lab code 200348) from approximately  $-200\text{ }^{\circ}\text{C}$  to  $1\ 000\text{ }^{\circ}\text{C}$ . In spite of the laboratory's technical successes, Platinum Resistance Thermometer (PRT) calibrations still took too long and occasionally had to be repeated.

PRTs are calibrated in a high-capacity calibration process by comparing their measurements to those of a reference thermometer, using a high-accuracy thermometer readout and a 10-channel multiplexer. Several stirred-liquid baths and a liquid nitrogen comparator are used as temperature sources to achieve the overall range of  $-197\text{ }^{\circ}\text{C}$  to  $500\text{ }^{\circ}\text{C}$  (see *Figure 1*). A stirred-liquid calibration bath is one of the most accurate temperature sources used to calibrate temperature sensors.

PRTs are placed in the bath for comparison with the reference thermometer. The company uses a high-accuracy, high-stability reference called a Standard Platinum Resistance Thermometer (SPRT). The high-accuracy readout measures the resistance of the ultra-pure platinum sensing element in the SPRT and converts it to a calibrated reference temperature. This temperature is used to calibrate the resistances of up to 10 PRTs, which are switched sequentially by a multiplexer for measurement by the same high accuracy readout.

The calibration process used by the Calibration team is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) sponsored by the National Institute of Science and Technology (NIST). Accreditation is a result of a high level of competence and a lot of effort by the team and management. However there were still some issues that the team wanted to resolve.

Good calibrations just seemed to take a long time. With all of the procedures and quality checks necessary to ensure good work, it became difficult to keep the output level high. The team decided to investigate whether anything could be done to improve the efficiency of their processes without damaging quality.



*Figure 1: Full-sized stirred-liquid calibration baths used in a PRT Calibration process.*

PRT – Platinum Resistance Thermometer  
 SPRT – Standard Platinum Resistance Thermometer  
 NVLAP – National Voluntary Laboratory Accreditation Program  
 NIST – National Institute of Science and Technology

## Abbreviations/Acronyms

### Getting organised

The first step the team took to improve the process was to go to the actual place where the work is done, walk through the entire process and record what they found. During the process they would clean and organise the area, produce a more optimal work flow, and attempt to remove as many timewasters as possible.

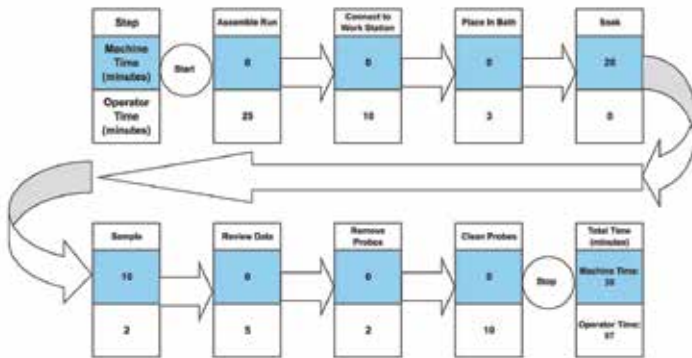


Figure 2: An example process map, showing each step and the associated machine and operator timing results.

A team of four people took three days to map, clean and organise the process. Unnecessary items were removed and tools were placed in appropriate locations to help improve process flow. Lean manufacturing tools, including process maps and spaghetti diagrams, helped them to identify problems and create a more optimal future state of the process.

### Process maps

Process maps show the steps in a process, how much work occurs at each step, and how much time each step requires. Process maps help make problems easier to see.

For example, a bottleneck occurs when one step in the process takes longer for a given level of output than the preceding step. Some bottlenecks are easy to spot, because a lot of work is piled up behind them. Others can be more subtle and may not become visible until the process map is developed.

It is not reasonable to account for every possible variable during this part of the exercise, but being as accurate as possible is important.

For example, the Calibration team recorded details such as removing probes from one bath, letting them cool and grabbing a paper towel to wipe the probes before placing them in the next bath.

After recording the process steps, the team measured the machine time and operator time required for each step and added it to the map. Once the process map was complete and the timings were added, a number of process bottlenecks became visible.

### Spaghetti diagrams

Another tool the team used to help optimise their work was a spaghetti diagram. A spaghetti diagram is simply a floor plan view of the process on which lines are drawn to represent where the operator walks while running a process (see Figure 3).

The first step is to draw a diagram of the current state, and the next step is to draw a diagram of the future state. In the case of the PRT process, the future state took several weeks to realise while new equipment was installed.

Just like the process map exercise, a spaghetti diagram exercise can be quite eye opening. For example, in a separate exercise, the company found that an operator was walking more than a mile to completely manufacture one of their products.

Simply keeping a tool near a workbench rather than in a distant toolbox can eliminate thousands of wasted footsteps and minutes per year.

### Identifying the wastes

After some investigation, the team identified three issues that created delays but did not add any value to a calibration:

- **Inefficient use of equipment.** Some equipment was used frequently by multiple technicians. These shared resources had to be managed very carefully or unnecessary delays would occur. In addition, long process idle times can result when the same equipment is used at multiple temperatures, because the temperature changes can take up to several hours.
- **Manual data collection and analysis.** Data collection and analysis were slow because data was manually transferred from reference readouts to desktop computers. Total time spent transferring and analysing data was estimated to be about 50 to 60 minutes per day.
- **Inefficient process layout.** The data and equipment problems

were predicted early on, but a third problem was harder to see, until the team made a map of the process they followed. They found that a technician could walk a very long distance just to complete a single calibration.

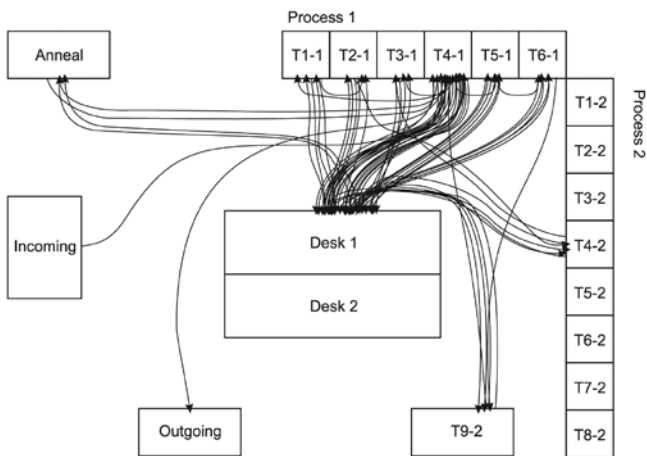


Figure 3: Spaghetti diagram showing the movement that occurred during a typical PRT calibration before the process improvement event.

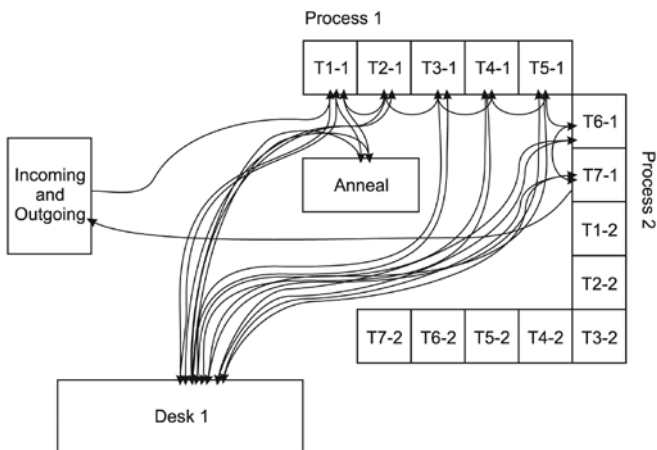


Figure 4: The revised laboratory floor plan allows the calibration process to flow naturally and efficiently, with fewer wasted steps and unnecessary movements.

## Eliminating the wastes

Once causes of wasted time were identified, the next step was to remove them. The team determined that they would need to relocate some equipment to improve process flow and strategically purchase other equipment to reduce process time.

This reduced the number of steps required to complete a calibration and eliminated bottlenecks that previously constrained output. Figures 3 and 4 demonstrate the changes made. As an example, the

team relocated some equipment to improve process flow and reduce the complexity uncovered by the spaghetti diagram (see Figure 5). Tools like clamps and rulers were placed at the point of use rather than in one central location in the lab.

*A stirred-liquid calibration bath is one of the most accurate temperature sources used to calibrate temperature sensors.*

Manual data collection from instruments to desktop computers was replaced with electronic data transfer by adding a wireless modem to each test station.

All of these changes together significantly reduced the amount of walking around a technician needed to do each day.

Even small improvements really add up. For example, a reduction of just ten wasted steps per day multiplies out to more than two thousand, six hundred steps per year.

In addition, the team found heating and cooling a single bath between 420 °C and 500 °C was causing a bottleneck that wasted several hours each instance. Owing to more frequent customer requests for the temperature 500 °C, the lab was becoming less and less productive with their existing setup. The team determined that an investment in a new bath dedicated to 500 °C would pay off by a significant increase in productivity.



Figure 5: A wireless modem and frequently used tools like rulers and clamps were placed on test stations for significant time savings.

## Automating for even more dramatic efficiency gains

With improved process layout and the major bottlenecks removed, the time came for the implementation of software to automate the gathering of data and data analysis.

Data is written into the software through wireless RS-232 adapters that connect each of the portable calibration stations to a computer

work station. Vital measurement statistics, as well as analysis tools such as curve fit analysis and probe repeatability, are built in so the operator can easily determine if a probe passes calibration.

Overall, the software has improved process productivity by about 30 %. Automatic data gathering and data analysis helped with this reduction, but the largest reduction in process time came from using decision rules to trigger data collection. Previously, technicians set timers for 20 minute soak times at each temperature point. Then it would take an average of 10 minutes to record and analyse the data.

Automating this process helped reduce the average time per temperature point from 30 minutes to about 12 (60 % improvement). Most importantly, the software has helped improve calibration quality, because each calibration was done right the first time and didn't have to be repeated to correct issues identified late in the process by a quality check.

**Conclusion**

In the end, the process capacity was increased using the same amount of floor space. By improving process flow, improving process layout, removing bottlenecks and adding automation, the process capacity increased by nearly 40 % accommodating future growth and improving time to ship by 55 %.

- Calibration of instruments is important – but it takes time.
- Like all processes, calibration can be optimised using well known techniques
- The case study shows that a process capacity increase of 40 % was achieved in a calibration lab.

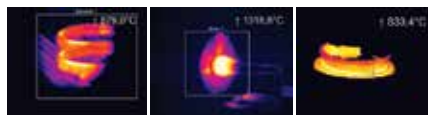


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Ron Ainsworth is the business manager for Process Calibration Tools at Fluke Calibration. After graduating with a degree in physics in 1998, he started his career in a primary temperature calibration laboratory in American Fork Utah. He has since had roles as a laboratory manager and marketing manager at Fluke Corporation.

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high chemical loads flange thermowells from stainless steel can be PTFE coated or protected with a Titanium or Tantalum mantle. Other characteristics include explosion protection thanks to intrinsic safety or an explosion proof design of the thermometer which contributes to the safety of the plant.

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**RET Automation Controls** is offering a wireless vibration and temperature sensor. Designed to effectively monitor machines for increases in vibration and temperature, the sensor measures RMS

velocity in millimetres per second or inches per second, and temperature. This enables the sensor to identify machine problems before they become too severe and cause additional damage or result in unplanned down time.

The sensor is optimised to work with 1-wire serial radio devices, such as Banner's wireless Q45VT Node, the P6 Performance Node and the Multi Hop M-H6 radio. Operators can easily set vibration thresholds based on the ISO 10816 standard. When a threshold has been exceeded, the wireless node can provide local indication, send the signal to a central location, and send the vibration and temperature data to the gateway for collection and trending.

"Banner's wireless sensor provides continuous vibration and temperature measurements to quickly detect any machine failure or potential problems," said Scott Pritchard, director of wireless global sales, Banner Engineering. "This allows facility managers to reduce labour costs by eliminating manual checks and the risk of human error. The wireless vibration and temperature sensor is ideal for a variety of machine monitoring applications, including motors, pumps, blowers and many other types of machines throughout a facility.

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# Keeping the lights on in smart buildings

By M Da Silva, Power Solutions, The Jasco Group

*Intelligent, connected technology is a growing trend, and property owners and managers, particularly in the retail space, are either constructing smart buildings from the ground up or retrofitting existing buildings with smart solutions.*

Smart solutions include connected security, surveillance and access control, heating and cooling systems, timed or motion sensor lights and building management systems that connect all of these systems and provide holistic data for improved building intelligence. However, all of these smart solutions rely on having available electricity in order to run, and are also often highly sensitive, which means that they require a steady supply of clean electricity. Power assurance and power quality solutions are thus essential for the continued operation of smart buildings.

## Hurting business

As the power crisis in South Africa continues, retail outlets and businesses are seeing significant loss of revenue, being unable to operate when the lights (and other systems) go out. For some businesses, such as supermarkets selling fresh and frozen goods, the impact of power outages with no backup power are greater than just the loss of foot traffic. Spoiled perishable goods could cost these retailers potentially hundreds of thousands of Rands a year. For other enterprises such as banks, no power means no transactions can be processed and poor customer service, resulting in significant loss of revenue. Even in instances where generators are installed, providing power assurance and backup electricity in the event of outages, this only addresses half of the problem – the power assurance side. Generator power is subject to a diesel or petrol-driven motor, which can result in fluctuating power voltages. In addition, generators take a few seconds to start up when outlet power is lost, and in those seconds of zero power equipment can be damaged. Power quality is essential, not only during outages but at all times to protect sensitive equipment from voltage fluctuations that could damage circuits and corrupt data, and this requires the implementation not only of generators, but also of Uninterruptible Power Supply (UPS) with Automatic Voltage Regulator (AVR) capability.

## Smart building solutions

While smart buildings offer a number of benefits to property owners as well as tenants, they require special consideration in light of the current power situation. Smart building solutions are typically controlled by IT infrastructure and equipment such as servers, which are highly sensitive to power anomalies such as harmonics, surges, dips and spikes. Protecting this equipment is essential or buildings face

the risk of lost or corrupt data, including all feedback data from smart equipment as well as the programming that controls this equipment. In addition, in a smart building, if the building management system goes offline, the entire building is offline, potentially creating security issues and other challenges. Smart buildings need to ensure they have a UPS in place that interfaces with the building management system, to perform a controlled shutdown if the generator fails, or to provide a bridge between outlet and generator power. An AVR, which remains online at all times, will ensure that power supply to all connected equipment is constantly clean and stable, minimising the risk of damage.

## Conclusion

In addition to protecting equipment and data, power quality and assurance solutions also have additional benefits for building owners. For example, property owners can maximise their rent per square metre, by offering an integrated solution of floor space with power assurance solutions. By guaranteeing customer uptime, landlords will attract a higher rental rate, while providing an essential service to their tenants. Furthermore, guaranteed uptime can be used as a competitive differentiator, as customers will be more likely to take up space in a building that can guarantee their continued operations during load shedding and power outages.

*The unstable power situation in South Africa has necessitated power assurance and power quality solutions.*

- Smart solutions rely on having available electricity in order to run.
- Smart buildings need to have a UPS that interfaces with building management.
- Intelligent, connected technology is a growing trend.



Marco Da Silva is the managing director of Power Solutions, The Jasco Group. Enquiries: Tel: 011 746 6800 or email marco.dasilva@jasco.co.za



# Time to focus on standby power system servicing

By J Ward, Powermode

*In South Africa, repeated 'load shedding' has highlighted the need for reliable standby power supply systems.*

It has also underlined the importance of serviceable Uninterruptible Power Supply (UPS) systems, power inverters and diesel generators – the 'go-to' options for most businesses to counter Eskom's severely-constrained and poorly resourced grid. Minister of Public Enterprises, Lynne Brown, has acknowledged that load shedding is here to stay thanks to Eskom's ageing plants and delays in getting the coal-fired Medupi and Kusile plants up to speed. This is putting the spotlight firmly on the readiness of back-up, emergency power systems to fire as required - at a moment's notice. Failure, particularly in the business world, is not an option. Preventative maintenance is key to keeping these systems in peak condition and fit for purpose. For example, regular servicing per a pre-planned schedule will address one of the biggest problem areas: Battery life is often shorter than expected as far as UPSs are concerned. Failing or failed batteries are at the heart of so many standby system disasters.

## Stress on UPS batteries

The reason for this is that UPSs are designed to provide back-up power for only short periods of time – not the two-to-four hour periods of load-shedding that are becoming common. These extended periods tend to drain UPS batteries completely, dramatically shortening their lifespan as they are stressed beyond their design parameters, a situation that is exacerbated if cheaper, lower-quality batteries have been installed.

## Exceeding capacity

Another cause of poorly performing UPS equipment is exceeding capacity. The power rating of the equipment plugged into a UPS' battery-supported outlets should not exceed stated ratings. The power rating for each piece of equipment attached

to a UPS should be regularly totalled and compared to the UPS' capacity which should be listed on its specification tab.

## Age of equipment

Poor performance can also be linked to the age of the equipment. For example, if a UPS (or its batteries) is more than two to three years old, and depending upon usage, it is possible that system performance and capacity have deteriorated and replacements are needed. A programme of diligent and committed planned maintenance and upkeep is mandatory for UPSs as well as power inverters and generators. In most modern installations these units may work together, interfaced using complex electronics, so the services of trained professionals are often necessary to supplement in-house activities.

## Preventative maintenance

Good preventive maintenance regimes will address standby power system reliability from many perspectives. For example, in a UPS system, the battery pack together with allied semi-conductors, wiring, resistors, breakers, capacitors and fans will all need to be checked. An approved maintenance plan will also address system health in linked or separately installed power inverters and include a raft of checks on diesel generators – including oil, fuel quality and operating battery function. Importantly, a well-maintained standby power infrastructure will minimise or more likely eliminate costly emergency service call-outs, and could extend the operational life of these systems and their components by 25 % to 50 %. The costs of preventive maintenance should be weighed against the potential costs of downtime to a business – not to mention the inconvenience of a black-out – particularly in retail environments.

Regular maintenance activities should be documented. Keeping a detailed record, listing upcoming maintenance activities and the dates on which past maintenance was performed, is vital to identify weaknesses in the system in the event of a breakdown. In this light,

*The UPS is designed to provide back-up power for only short periods of time – not the two to four hour periods of load-shedding that are being imposed upon South Africans.*





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## STANDBY + BACK-UP

a checklist of tasks, such as inspecting batteries for corrosion, looking for excessive torque on connecting leads and other fault-finding, helps maintain a disciplined approach to maintenance regimes. Moreover, a well-documented history of a standby power infrastructure can be of significant use when planning for equipment upgrades or replacements, or when troubleshooting.

### Conclusion

Importantly, acknowledge that critical components, such as batteries and capacitors, will wear out from normal use. The key is to be ahead of the game and anticipate failures through regular inspections and diligent maintenance before they become catastrophic. Bear in mind that usually UPS are scrapped from professional environments every three to four

years – well before they should be. Often, this is owing to problems stemming from bad servicing regimes and/or a lack of maintenance. The cost of replacing a UPS is often lower than cost of repair, further emphasising the value – and importance – of regular servicing.

- Loadshedding in South Africa has put the spotlight on the readiness of back-up, emergency power systems to fire at a moment's notice.
- UPSs are designed to provide back-up power for short periods of time.
- Good preventive maintenance regimes will address standby power system reliability from many perspectives.



take note



Jack Ward is the managing director of Powermode, a leader in the field of advanced power provisioning systems for medium to large corporations. The company designs, supplies and commissions a broad spectrum of innovative, turnkey power protection, management and generating solutions. He has more than 35 years of experience in the IT, telecommunications and power protection industries throughout Africa in senior executive roles. Enquiries: Email garrethj@powermode.co.za

## ROUND UP

### Supplying independent power to copper mines - DRC

**Master Power Technologies (MPT)** has supplied two copper mines in the Democratic Republic of the Congo (DRC) with stand-alone power generation capabilities totalling around 15 MVA. MPT's partner in the region, FG Wilson, installed the solutions and the company will continue to provide maintenance services to the mines. The mines in question have rich copper veins which were to be mined, but there was no utility power in the area. The mines therefore had to ensure they were able to generate enough power independently to support the long-term mining of the area. As a recognised power management solution provider in the area, Master Power was tasked with the project after winning the tender with FG Wilson P1250P3 diesel generators MPT was able to deliver a high quality 15 MVA power station solution to this remote area of the DRC. The power solutions were built and the main portion was tested in Caterpillar's UK facility, and again at Master Power's headquarters in Strijdom Park. The client then came from Australia to witness the testing prior to it being containerised and transported by road to the DRC. FG Wilson and MPT then reassembled the power solutions on site and ensured they were running optimally before the new mining operation started. The process of designing and delivering the solution took less than five months. More than simply supplying the solution, FG Wilson provides the mines with local service and warranty support from local FG Wilson dealers. The system was commissioned on site in the DRC in December 2014 and the mine owners are satisfied with the reliable and stable power supplied by the solution.

Enquiries: **Rory Reid. Tel. 011 792 7230 or email rory@kva.co.za**

## New metering simplifies southern Africa's power quality

The newest addition to Schneider Electric's PowerLogic portfolio of power and energy meters introduces power quality compliance and analyses capabilities that were once reserved for more advanced meters. In accordance with power quality standards IEC 61000-4-30

Class S and IEC 62586, the PowerLogic PM8000 series meters are ideal for helping to ensure contractual obligations for the quality of your electrical supply. The meters also have extensive power quality analysis capabilities, such as EN 50160 compliance, sag/swell detection, waveform capture, disturbance direction detection, and trending and forecasting, to help facility managers detect, mitigate and correct adverse conditions.



Power quality monitoring is crucial for power-critical facilities like hospitals, data centres, and large manufacturers. **Schneider Electric** designed the PM8000 series to aid with both PQ compliance monitoring and analysis. Data accuracy is assured to IEC 61000-4-30 Class S and IEC 62586 standards when verifying contractual supply levels. If a PQ event does occur, the patented disturbance direction detection feature helps identify the location by determining if it occurred upstream or downstream of the meter, so correcting the problem is much faster.

Engineered on a compact, modular and flexible platform, the PowerLogic PM8000 series meters have the versatility to perform nearly any metering job at key points throughout a facility. The highly-accurate, reliable meters are compliant with ANSI C12.20 Class 0.2, IEC 62053-22 Class 0.2S (real energy), and IEC 61557-12.

**Enquiries: Ntombi Mhangwani. Tel. 011 254 6400 or email [ntombi.mhangwani@schneider-electric.com](mailto:ntombi.mhangwani@schneider-electric.com)**

## Gen2 Switch elevator

Lost productivity due to ongoing load shedding in South Africa can be mitigated with the latest technological innovation from Otis – the Gen2 Switch elevator. The Gen2 Switch is powered by battery technology to ensure continued operation during a power outage,

"A major advantage of the Gen2 Switch is that it is designed to continue running even during power outages thanks to a built-in battery," said Hayley Elwen, marketing and business development manager, **Otis**. "Despite the recent increase in grid volatility leading into winter, the



Gen2 Switch provides property owners with the peace of mind that the lift in their buildings will continue running during power outages." Under normal running mode, the Gen2 Switch power supply charges a pack of batteries, which in turn supplies power to the lift motor. In the event of a power failure, the battery pack continues to operate the lift for up to 100 trips in an eight-story building. The battery system is compatible with alternative energy sources like solar panels and wind power. The battery is made of 97 % recycled materials, and is itself 90 % recyclable.

**Enquiries: Visit [www.otis.com](http://www.otis.com)  
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## Freedom and precision in modelling

Allplan has introduced the new version of its BIM software for architects and engineers. Equipped with powerful tools, Allplan 2016 increases flexibility in 3D modelling and supports efficient and intuitive workflows. One of the highlights is the integration of the Parasolid software 3D modelling kernel developed by Siemens' product lifecycle management (PLM) software business.

It gives users greater freedom and precision in creating volume and surface models, as well as in modelling of engineering works. With many improvements to the user interface, the new version also ensures smooth workflows. "Our customers face the challenge of designing and

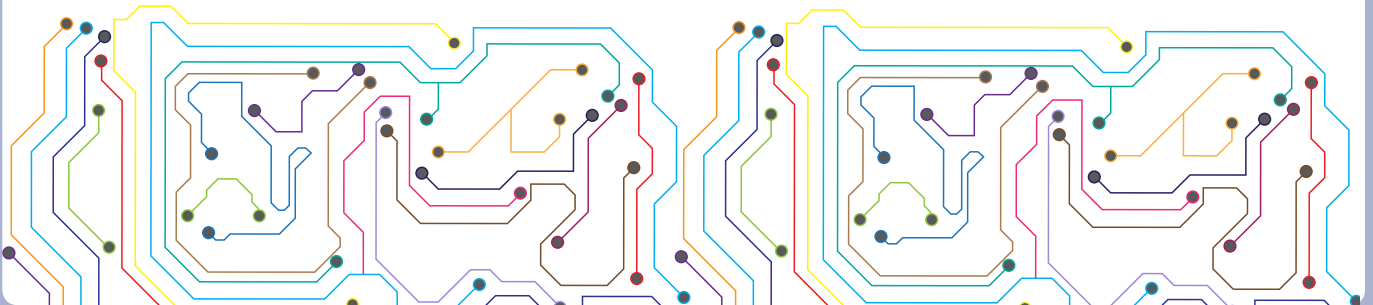
constructing increasingly sophisticated structures with ever more demanding time and cost pressures. We want to help them realise their creative and innovative concepts" says Dr Jörg Rahmer, general manager of Allplan. "With Allplan 2016, we have a powerful piece of technology at our disposal. Integration of the Parasolid modelling kernel from Siemens PLM Software is an important milestone in the consistent further development of Allplan in the areas of modelling and visualization. As the leading vendor of BIM solutions, our efficient workflows allow our customers to implement their BIM projects and help them provide greater transparency and cost security in design," Rahmer continues.

With the integration of the Parasolid modelling kernel from Siemens PLM Software, Allplan is matching the general trend towards increasingly free-form solids in modern architecture.

In practice, this means that architects need design software that they can use to create freeform solids down to the last detail and integrate with the design process.

The new 3D kernel in Allplan Architecture 2016 provides a new level of flexibility and precision when creating these structures: The new version makes it easier to modify 3D objects and improves the representation quality in the animation window.

**Enquiries: Email [jkaestner@allplan.com](mailto:jkaestner@allplan.com)**



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## 30 % of IT professionals yet to start Windows Server 2003 migration

A survey conducted by power management company **Eaton** has revealed that almost a third of IT professionals have yet to begin their migration strategies – Windows Server 2003 having come to an end on 14 July 2015. This worrying percentage comes despite the fact that Microsoft announced the plans back in April 2013. In light of its research, Eaton is advising those responsible for this process to not only migrate to a new operating system and update their IT application, but also take advantage of the benefits that modern power management solutions can offer. Eaton questioned 167 IT professionals across Europe, the Middle East and Africa in March 2015, and the results show that although most IT professionals are already using power management devices, they still do not necessarily consider replacing their existing devices with a more sophisticated power management solution as a part of their Windows Server 2003 migration.

Taking these findings into account, Eaton is therefore advising IT professionals to think about protecting their investments in software, equipment and time with virtualisation ready power management. Modern power management solutions integrate with virtual machine management systems so that they can be monitored and managed via a single display. Such solutions are also key for implementing business continuity policies on power and environmental events, as they shut down non-critical workloads during power outages to extend runtime for more critical workloads, initiate data replication, move virtual machines to unaffected zones or a back site, gracefully shut down virtual machines, and perform sequential equipment start-ups once power is restored.

**Enquiries: Sumaya Abdool. Tel. 011 874 4308 or email [sumayaabdool@eaton.com](mailto:sumayaabdool@eaton.com)**

## 'Cat kits' now in South Africa

**Caterpillar** and **Barloworld Power** have launched a combined initiative to assemble Cat electric power generators in South Africa to meet rising demand, reduce unit cost and promote localisation. As the first Cat equipment assembly unit to be established in South Africa, the new facility marks a significant milestone in the partnership between Caterpillar and Barloworld Power, its southern African dealer for Energy and Transportation. The generators are supplied in kit form and assembled locally from scratch, contributing to the drive for localisation and enabling the transfer of new and valuable skills to South African employees. This also enables the Cat units

to compete on a more even footing with locally manufactured equivalents. "The assembly facility is a major step forward in Barloworld Power and Caterpillar's growth aspirations across southern Africa," says Mark Mencil, executive director of Barloworld Power southern Africa.

"We are now assembling Cat branded generators at our Boksburg, Gauteng, premises that have the same highest quality standards for which Caterpillar is renowned worldwide. Barloworld Power can now offer truly competitive Cat products while aligning with government objectives in local employment and development."

"This initiative between Barloworld and

Caterpillar promotes localisation and leverages our excellent capabilities to provide a local solution for South Africa," adds Chris Monge, Caterpillar area manager. "This represents a significant investment in the local economy to support our growth strategy in the power business."

**Enquiries: Shivani Naidoo. Tel. 011 323 2683 or email [snaidoo@barloworldpower.com](mailto:snaidoo@barloworldpower.com)**



## Thermal capabilities demonstrated at Power-Gen

Within the framework of the world renowned POWER-GEN Africa conference and exhibition, Russian Atomic Energy Corporation **Rosatom** hosted a workshop on its thermal capabilities, 'Modern Russian Technologies for Thermal Power Engineering in Africa.' The workshop was attended by over 170 representatives from African large and medium companies and covered the prospects of cooperation in the sphere of energy development in Africa, highlighting the benefits of Russian power engineering technologies.

The company presented its extensive experience in the thermal power sector as well as in oil, gas and chemical industries. Rosatom's Engineering Division outlined its current portfolio in the construction and modernisation of 20 power units in Russia. It has designed and built more than 100 thermal and hydro power plants in the territory of the former USSR and foreign countries, including countries with subtropical, tropical and subequatorial climates (Algeria, Vietnam, Cuba, Egypt, Iraq, Korea).

The Power Engineering division and its associated enterprises displayed their capabilities in the manufacture of complex boiler island equipment as well as in building automated control systems for thermal, hydro- and geothermal power plants. Engineering

company Ziomar has manufactured over 700 boiler units with a total installed capacity of 66 GW, which have been installed in over 20 countries. Also highlighted was the experience in HRSGs (Heat Reserve Steam Generators), waste to energy projects and low capacity power engineering.

Dmitry Vysotsky, chief expert of International Business Development for ASE – NIAP – AEP highlighted the company's experience in turn key EPC projects, in both nuclear and thermal. "To date we have designed and constructed over 40 units in Russia, most of which are still up and running today," said Vysotsky. Russian export insurance agency EXIAR presented its outlook on potential development of cooperation between South Africa and Russia. To date the company has concluded two deals in Africa worth over \$100 M.

The demand for electricity in sub-Saharan Africa far outweighs the supply, currently 25 of the 54 nations on the continent are in the midst of an energy crisis. Only about a quarter of the sub-Saharan Africa's population have access to electricity, this means that 600 million people are living with limited or no access to a reliable supply of electricity.

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# Efficiency analysis of a three-phase power transformer

By R Gouws and O Dobzhanskyi, North-West University

*Industries are concerned about the cost of energy; and the lower efficiency of the transformer owing to energy that is lost in it.*

Transformers are key elements in the industrial processes into which they are integrated. Reliability is crucial to ensure uninterrupted power supply to motors, furnaces and smelters used in a wide variety of applications including primary aluminium and steel plants, mines, pump storage power plants, rail networks etc. For example, referring to ‘references’ in this article – in [1] authors discuss an importance of efficient transformers feeding electric railways. In [2] the authors touch a subject of transformers’ efficiency in petroleum industries. Article [3] discovers a use for efficient transformers in the cement industry. Authors in [4] focus on energy saving using efficient transformers in such industries as the iron-steel sector, non ferrous metal sector, a paper and pulp company, chemical industrial enterprise etc. Owing to a growing number of transformers used nowadays, the problem of their efficiency is a concern for many researchers. Efficient use of energy is one of the main problems of each industry [5].

The efficiency of a three-phase power transformer is affected by power losses. There are two main sources of losses: Winding and core losses which contribute to the total losses of the electrical system [5]. Core losses consist of the hysteresis losses in the magnetic core of the transformer.

Winding losses consist of the losses in the primary and secondary windings. They depend on the load current and are found as  $I^2R$ [5]. There are associated losses owing to harmonics but they can be neglected assuming that the supply voltage of the transformer is not distorted [6, 7, 8]. That is why it is crucial to operate a transformer as close as possible to its rated load condition.

## Materials and method

The materials which are required to conduct the practical tests at any industry and in a heavy current laboratory are:

- Three-phase transformer
- Three-phase voltage supplier
- Ammeter or multi-meter
- Current transformer

- Voltmeter
- Two wattmeters
- Connection wires

Before discussing the methods of how the transformer parameters are calculated, it is important to explain the important principles of machine operation and its equivalent circuit.

The behaviour of transformers can be considered by assuming that it has an equivalent ideal transformer. The imperfections, losses, magnetic leakage and an imperfect iron core, of an actual transformer are then drawn into the equivalent circuit by means of additional circuits or impedances inserted in between the primary source and secondary load [9]. The approximate equivalent circuit of the transformer is shown in Figure 1 [10].

There are basically two types of constructions that are in common use with transformers – namely shell and core type. The core type’s windings are wound around the two outside legs of the magnetic core and the shell type is wound in the middle of the magnetic core [9]. The alternating current flowing through the primary winding produces an alternating magnetic flux in the transformer’s core.

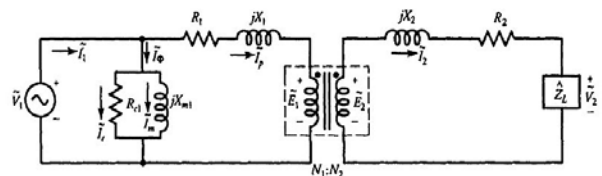


Figure 1: Equivalent circuit of the transformer.

This magnetic flux by itself induces Electromotive Force (EMF) in the winding placed at the secondary side. The frequencies of the supply voltage and induced EMF are the same. Owing to induced EMF in the secondary winding, current flows to the external load which is connected to its terminals. This way the power is transformed from primary to secondary winding [11].

Transformers can be connected in numerous ways such as either

$Y/Y$ ,  $\Delta/\Delta$ ,  $Y/\Delta$  or  $\Delta/Y$ . The efficiency of a transformer can be calculated by gaining the ratio of the output power ( $P_{out}$ ) to the input power ( $P_{in}$ ) [10]:

$$\eta = \frac{P_{out}}{P_{in}} \quad (1)$$

$P_{out}$  and  $P_{in}$  are found:

$$P_{out} = \text{Re}[V_2 I_2] \quad (2)$$

$$P_{in} = \text{Re}[V_1 I_1] \quad (3)$$

where  $V_1$ ,  $V_2$ ,  $I_1$ ,  $I_2$  – voltages and currents of the primary and secondary windings

It is important to note that no transformer will have an efficiency of 100 %. This introduces the possibility of a non-ideal transformer which consists of losses and effecting factors. It has been required to determine the unknown parameters of a given transformer by way of using the open and short circuit tests and performing calculations on the results gained. Thereafter, the calculated results must be used to determine the efficiency of the transformer.

Three-phase power transformers play significant roles in industrial sectors in terms of energy saving.

### Determining transformer parameters using open and short-circuit tests

To perform an open-circuit test, one winding of the transformer is left open while the other is excited. Availability of lower voltage sources, cause the low voltage side to be excited and all measurement equipment is connected on the same side as source.

Even with the transformer experiencing no-load, rated voltage must be applied carefully. Figure 2 shows the connection of the transformer and shows how the ammeter, voltmeter and two wattmeters are connected. As shown, the two wattmeter method is used so that the three-phase power can be calculated and not only the per-phase power.

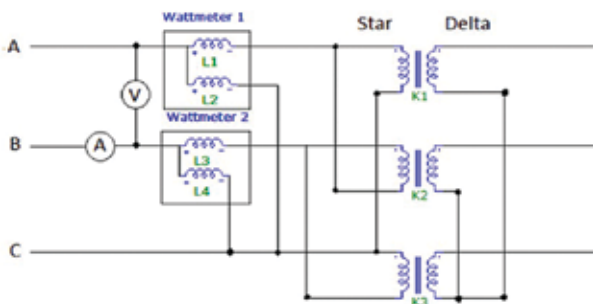


Figure 2: Connection diagram for open-circuit test.

The apparent power is given by the ammeter and voltmeter readings [10]:

$$S_{oc} = V_{oc} I_{oc} \quad (4)$$

where  $V_{oc}$  and  $I_{oc}$  – are open-circuit voltage and current respectively.

The lagging power factor angle can be calculated by using the apparent power calculated [ $S_{oc}$ ] and the active power ( $P_{oc}$ ) read from the wattmeter [10]:

$$\phi = \frac{1}{\cos \left[ \frac{P_{oc}}{S_{oc}} \right]} \quad (5)$$

The reactive power can easily be calculated with Pythagoras [10]:

$$Q_{oc} = \sqrt{S_{oc}^2 - P_{oc}^2} \quad (6)$$

The core-loss resistance and magnetising reactance can then be calculated by rewriting  $P=I^2R$  and using values already calculated [10]:

$$R_{cL} = \frac{V_{oc}^2}{P_{oc}} \quad (7)$$

$$X_{mL} = \frac{V_{oc}^2}{Q_{oc}} \quad (8)$$

For the short-circuit test, the low voltage side of the circuit is connected as a short-circuit, while the high voltage side's voltage is slowly incremented from zero V until the low voltage side reaches its rated current.

This test is designed to determine the winding resistances and leakage reactance. Rated current in each winding ensures a proper simulation of the leakage flux pattern associated with that winding. [9]. Figure 3 shows the connections that were made for the short-circuit test. The total resistance as referred to the high voltage side can be calculated by rewriting  $P=I^2R$  and using the readings from the wattmeter and the ammeter [10]:

$$R_{eH} = \frac{P_{sc}}{I_{sc}^2} \quad (9)$$

where  $P_{sc}$  – active power at short-circuit test,  $I_{sc}$  – short-circuit current.

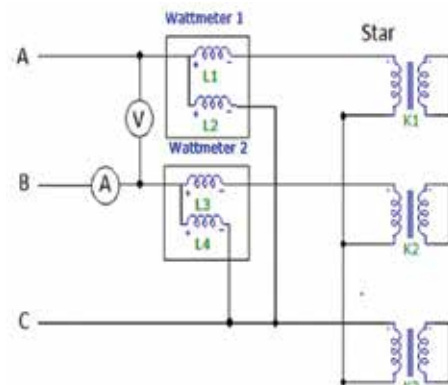


Figure 3: Connection diagram for the short circuit test.

The total impedance is calculated by using Ohm's law [10]:

$$Z_{eH} = \frac{V_{sc}}{I_{sc}} \quad (10)$$

where  $V_{sc}$  – short-circuit voltage

The total leakage reactance as referred to the high voltage side is easily calculated by using Pythagoras [10]:

$$X_{eH} = \sqrt{Z_{eH}^2 - R_{eH}^2} \quad (11)$$

The following equations can be used to segregate the winding resistances and the leakage reactance in order to draw an exact equivalent circuit [10]:

$$R_{eH} = R_H + a^2 R_L \quad (12)$$

$$X_{eH} = X_H + a^2 X_L \quad (13)$$

$$R_H = a^2 R_L = 0,5 R_{eH} \quad (14)$$

$$X_H = a^2 X_L = 0,5 X_{eH} \quad (15)$$

where  $a$  – is the ratio of number of turns on the low and high sides of the transformer;  $R_H, R_L, X_H, X_L$  – resistances and reactances of the winding on the high and low sides of the transformer

Figures 2 and 3 show the approximate circuits and the way the transformers must be connected in order to do the two tests. During the open-circuit test, as shown in Figure 2, the wattmeter measures the core loss in the transformer. It is important to conduct this test on the low voltage side of the transformer because it is safer and low voltage power sources are more common. From Figure 2 it can be seen that the power source supplies an excitation current under no load. The excitation current is responsible for the core-loss and the required magnetic flux in the core [9].

The short-circuit test, as shown in Figure 3, is mainly conducted to determine the winding resistances and the leakage reactance of the transformer. It is important to be extremely careful while doing this test because the applied voltage is only a fraction of the rated voltage. This concludes that core-loss and the magnetising currents are so small that they can be neglected. The test is done on the high voltage side for safety purposes. Here the wattmeter shows copper loss at full load [12]. As has been mentioned, efficiency is the ratio of the output and input power. In the analysed transformer there are two types of losses: Magnetic loss and copper loss. Magnetic loss is core-loss/ fixed loss and is the result of eddy-current and hysteresis loss. Copper loss is variable loss and is  $I^2R$  loss [9]. These losses can be shown through a power flow diagram (see Figure 4) [10]:

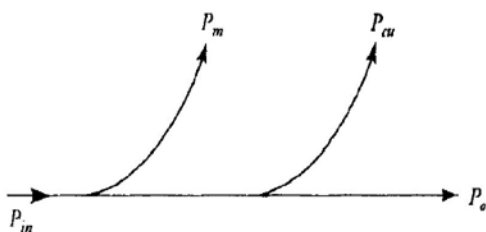


Figure 4: Power losses diagram of the transformer.

The input power and the output power are given mathematically by the equations (2) and (3). The copper losses are calculated as follows [10]:

$$P_{cu} = I_p^2 R_{e1} \quad (16)$$

where  $I_p$  – is the current in the primary winding

The magnetic losses are found by [2]:

$$P_m = I_{ph}^2 R_{e1} \quad (17)$$

This can be summarised with the following equation [10]:

$$P_{in} = P_{out} + P_{cu} \quad (18)$$

## Experimental results

In Figure 2, the voltage was taken between points A and B in the star configuration, it is, thus, the line to line voltage. To get the phase voltage the line to line voltage is divided by  $\sqrt{3}$ . The current measured is the per-phase current, but to calculate the power per-phase the power measured has to be divided by three. The Table 1 shows the per-phase measurements for the open circuit test. The parameters discussed are included in Table 1.

Table 1: Per-phase open circuit results.

Parameter	Value
Voltage (V)	11,55
Current (A)	1,5
Power (W)	9,16
$R_{eH}(\Omega)$	3,5
$Z_{eH}(\Omega)$	2 450
$X_{eH}(\Omega)$	2,87
$R_H(\Omega)$	1 707,32

For the short circuit test (see Figure 3), the voltage was taken between points A and B in the star configuration, it is, thus, the line to line voltage. To get the phase voltage the line to line voltage is divided by  $\sqrt{3}$ . The current measured is the per-phase current, but to calculate the power per-phase the total power measured has to be divided by three. Table 2 shows the per-phase measurements for the short-circuit test:

Table 2: Per-phase short circuit results.

Parameter	Value
Voltage (V)	11,5
Current (A)	1,5
Power (W)	9,16
$R_{eH}(\Omega)$	4,07
$Z_{eH}(\Omega)$	7,7
$X_{eH}(\Omega)$	6,54
$R_H(\Omega)$	2,04
$X_H(\Omega)$	3,27
$R_L(\Omega)$	2,04
$X_L(\Omega)$	3,27





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For all the efficiency calculations a per-phase load voltage  $V_2$  of  $220\angle 0^\circ$  is used. All calculations performed for the per-phase circuit. The load current  $I_2$  is given by the following calculation:

$$I_2 = \text{rated\%} \cdot \frac{\frac{s}{3}}{V_2} \theta \quad (19)$$

where  $\theta$  is given by the inverse cosines of the power factor, in this case  $30^\circ$ . The formulas will be shown completely for the 60 % rated load. The turns ratio  $a$  for the Y-Y configuration is  $220/220 = 1$ .

At 60 % the per-phase load current in the primary winding is:

$$I_2 = \text{rated\%} \cdot \frac{\frac{s}{3}}{V_2} \theta \quad (20)$$

The induced EMF in the secondary winding is:

$$E_2 = V_2 + [I_2 (R_l + jX_l)] \quad (21)$$

The induced voltage in the primary winding is given by:

$$E_1 = aE_2 \angle 30^\circ \quad (22)$$

The current in the primary winding of the transformer is given by:

$$I_p = \frac{I_2}{a} \angle 30^\circ \quad (23)$$

The per-phase source current is thus given by:

$$I_2 = I_p + E_1 \left( \frac{1}{R_c} + \frac{1}{jX_m} \right) \quad (24)$$

where  $R_c$  – is resistance of the core

The per-phase voltage supplied by the source:

$$V_1 = E_1 + [I_1 (R_H + jX_H)] \quad (25)$$

The power input is calculated as follows:

$$P_{out} = Re[V_2 I_2] \quad (26)$$

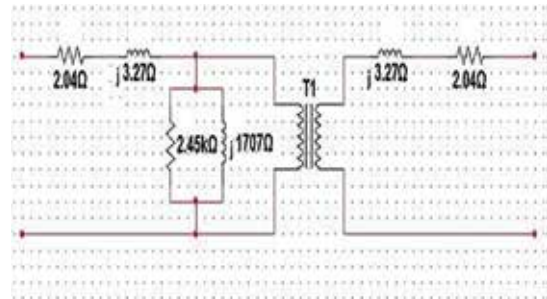
Lastly, the efficiency calculated by means of equation:

$$\eta = \frac{P_{out}}{P_{in}} \quad (27)$$

The calculated data for the transformer is enclosed in *Table 3*.

*Table 3: Transformer parameters.*

Parameters	Impedance ( $\Omega$ )
$R_c$	2 450
$X_m$	$j1707,32$
$R_H$	2,04
$R_L$	2,04
$X_H$	$j3,27$
$X_L$	$j3,27$



*Figure 5: The exact equivalent circuit of the transformer.*

The core-loss resistance and the magnetising reactance is much bigger than the winding resistances and the leakage reactance. The reactance of the low voltage and high voltage is as expected since the transformer has a one-to-one ratio and a Y-Y configuration was used.

The practical test was done on a 1 kVA, 380/380 V transformer. The following measurements were taken down during the laboratory test (see *Table 4*):

*Table 4: The laboratory readings.*

Parameters	Open circuit	Short circuit
Voltage (V)	120	20
Current (A)	0,05	1,5
Power 1 (W)	4	12,5
Power 2 (W)	2	15
Total Power (W)	16	27,5

As seen in *Table 4*, the short-circuit test was only done at a rated voltage and current and care was taken to not pass the rated current of the transformer. As expected, there is a great current at a low voltage.

The efficiency of the transformer was calculated at a rated load of 60 % to 90 % in 5 % increases and can be seen in *Table 5*.

*Table 5: Transformer efficiency at different rated loads.*

Rated load (%)	Efficiency (%)
60	88,160
65	88,720
70	89,188
75	89,580
80	89,909
85	90,186
90	90,419

- Many plants are served by a supply system that includes on-site transformers and substations.
- Transformer efficiency is an increasingly important parameter to understand, and the efficiency improves with loading (within the specified operating range).
- Open and short circuit tests can be effectively used to determine the machine parameter, and hence its efficiency.



Graphically, the change of efficiency at different loads is shown in Figure 6.

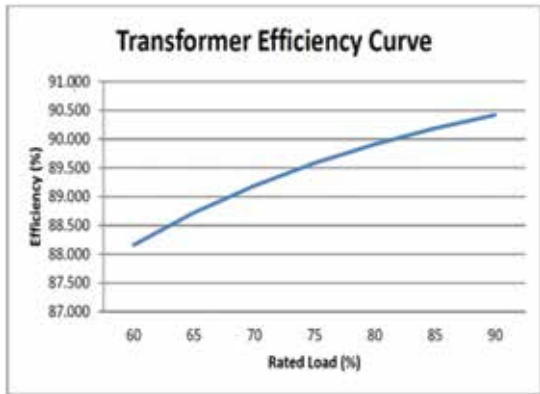


Figure 6: Transformer efficiency curve at different loads.

The transformer shows an efficiency of between 88 % and 99,5 % when operated between 60 % and 90 % of the rated load.

## Conclusion

The results show that the open and short-circuit tests are an effective way to calculate the parameters of a non-ideal transformer. The efficiency that was worked out, at certain percentages of the rated load, is in the range of 88 % to 90 %. The maximum efficiency of a 1 kVA should be in the range of 94 % [13]. The lower efficiency of the transformer can be ascribed to the inaccuracy of the equipment (ammeter, wattmeter and voltmeter) and to human error – reading off from the equipment. The difference can be ascribed to the saturation of the core as it is made out of magnetic material and previous uses can affect the core. As there is only a small difference it can be said that the parameters that were calculated with the measurements of the tests are correct and, thus, that the tests were successful. The graph of efficiency changing when the transformer operates at different loads demonstrates clearly how important it is to use the transformer at its rated load. Power losses of the transformer increase when the transformer operates out of its rated load. This causes the efficiency to go down. For industries it is important to know this phenomena, since when efficiency gets lower, energy is lost in the transformer.

## References

- [1] Zhengqing , Jianzhong W, Shibin L. Study on protection scheme for traction transformer of high-speed railway. Power and Energy Engineering Conference (APPEEC). March 2011.
- [2] Mitchell, GF. Application of transformers for the petroleum industry. IEEE Trans. on industry applications. September 1969.
- [3] Kump RK. Why should the cement industry do anything with their PCB transformers. Cement Industry Technical Conference. May 1993
- [4] Hulshorst WTJ, Groeman JF. Energy saving in industrial distribution transformers. May 2002.

- [5] Haggerty NK, Malone TP, Crouse J. Justifying the use of high efficiency transformers. Petroleum and Chemical Industry Conference. USA. September 1996.
- [6] Massey GW. Estimation methods for power system harmonic effects on power distribution transformers. IEEE Transactions on Industry Applications. Kansas City, March 1994.
- [7] Sharifian MBB, Faiz J., Fakheri SA, Zraatparvar A. Derating of distribution transformers for non-sinusoidal load currents using finite element method. ICECS 2003, Proceedings of the 2003 10<sup>th</sup> IEEE International Conference on Electronics, Circuits and Systems. December, 2003.
- [8] Jayasinghe NR, Lucas JR, Perera KBIM. Power system harmonic effects on distribution transformers and new design considerations for K factor transformers. IEEE Sri Lanka Annual Sessions. September 2003.
- [9] Hughes E. Electrical technology, 5th ed. New York, USA: Longman publishers. 1977.
- [10] Guru BS and Hiziroglu HR. New York, United States of America: Oxford University Press. 2001.
- [11] Einstein College of Engineering, Lecturer notes. <http://www.einsteincollege.a-c.in>
- [12] Theraja BL and Theraja AK. A textbook of electrical technology, 5<sup>th</sup> ed. India: S Chand & Company. 2006.
- [13] Carroll & Meynell. Carol & Meynell Transformers. <http://www.carollmeynell.com/technicaltransformers.htm>



Rupert Gouws holds a Ph.D. degree in Electrical and Electronic Engineering from the North-West University (Potchefstroom campus). He has consulted to a variety of industry and public sectors in South Africa and other countries in the fields of energy engineering and engineering management. Currently he is appointed as an associate professor specialising in energy engineering, electrical machines and control at the North-West University. The Engineering Council of South Africa (ECSA) registered him as a Professional Engineer and the Association of Energy Engineers (AEE) certified him as a Certified Measurement and Verification Professional (CMVP).



Oleksandr Dobzhanskyi holds a M.S and Ph.D degrees in Electrical and Computer Engineering. He graduated from Louisiana State University (USA) in 2012. Currently he is taking his postdoctoral research at the North-West University in South Africa. Enquiries: Tel. 018 299 1902 or email [Rupert.Gouws@nwu.ac.za](mailto:Rupert.Gouws@nwu.ac.za)

## Kouga Wind Farm project – challenges

The **ACTOM** group's medium voltage switchgear business unit, ACTOM MV Switchgear, has frequently demonstrated its adaptability and technical capability of developing and producing cutting-edge equipment to best suit new applications as they arise. Its development of a medium voltage compact substation for use in wind farm power generation is no exception.

Within a relatively short period it successfully developed and produced 36 kV compact substations – also known as pad-mounted transformer kiosks (PTKs) – for use at the Kouga Wind Farm at Oyster Bay in the Eastern Cape.

The 80 MW Kouga Wind Farm, comprising 32 wind turbine generators (WTGs), was completed late last year and is now operational. It was one of the major renewable energy projects in the 'Window 1' first phase of South Africa's national renewable energy programme launched two years ago.

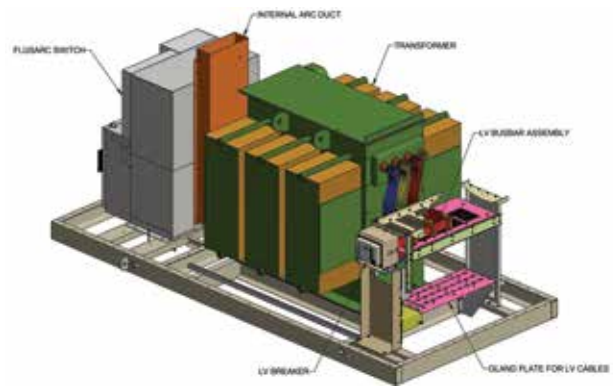
ACTOM Power Systems, the group's substation project management business unit, was awarded the R150 M electrical balance of plant contract for Kouga, comprising building a 33 kV/132 kV substation to link the wind farm to the Eskom power grid, providing and installing the 660 V/33 kV PTKs at the bases of each of the WTGs and installing the collector network linking them to the main substation.

ACTOM MV Switchgear was subcontracted to develop and produce the PTKs, while ACTOM Power Transformers was assigned the task of designing and manufacturing the transformers for the PTKs.

"The project was a new challenge for all three of us," commented John McClure, ACTOM Power Systems general manager. "Being our first balance of plant contract for a wind farm, for our business unit it chiefly involved getting to grips with the complex grid compliance requirements, in addition to designing the cabling clusters in the collector network."

The project posed unusual technical challenges for both ACTOM MV Switchgear and ACTOM Power Transformers, which had to develop substantially different forms of equipment in their respective fields than they had previously been called upon to devise for new applications. Furthermore, they had to achieve their respective goals within tight time constraints. Greg Whyte, ACTOM MV Switchgear's design and development manager, explained: "With renewable energy, particularly wind farms, the transformer power and voltage ratings exceed the scope of traditional miniature substations, where the maximum power rating is 1 000 kVA and the rated voltage is up to 24 kV. So for the Kouga project we were clearly venturing into uncharted territory, where the required rated power for the PTKs was 2 800 kVA and the rated voltage 36 kV."

**Enquiries: John McClure, ACTOM Power Systems. Tel. 011 430 8700 or email john.mcclure@actom.co.za**



A schematic drawing of the pad-mounted transformer kiosk (PTK) developed by ACTOM MV Switchgear for the Kouga Wind Farm's wind turbine generators.

## Integration of wind farms in southern Brazil

**Alstom** has been awarded a turnkey contract worth approximately €100 million from Eletrosul Centrais Electricas S/A (Eletrosul) to integrate wind farms located at Rio Grande do Sul State, all situated at the southernmost tip of Brazil, into the country's transmission grid. This project is scheduled for commercial operation in March 2018. To complete this project, Alstom will lead a consortium to provide a turnkey solution, including the supply of two new substations and the extension of six existing substations, which will connect the power from the wind farms substations. This project, known as Lots A1 & A4 from the Brazilian Electricity Regulatory Agency (ANEEL) auction, opens the door to further integration of renewable energies, empowering the country to better forecast its wind energy capacity for the next six years, playing a key role in strengthening Brazil's transmission system. Alstom will supply its products, software and automation technologies with equipment produced locally at Canoas and Itajuba sites, in Brazil.

"The southern region of Brazil has huge wind energy potential and will now be able to fully optimise this alternative energy, ultimately creating diversity in the overall energy mix for over 30 million people. This contract reinforces Alstom's leadership in



supplying customer-centered solutions and an expert, local engineering team on the ground to bring innovative technologies to optimize grid performance," says Sérgio Gomes, Vice President of Alstom Grid in Latin America. Alstom has been present in Brazil for 60 years and has completed over 30 transmission turnkey projects in the country in the 230 kV and 500 kV market.

**Enquiries: Email virginie.hourdin-bremond@chq.alstom.com**

## Induction motor with highest power density in its class

When it comes to technology, there seems to be no denying that smaller is better. The more advanced the world becomes in its capabilities, the more we rely on technologies to help us realise our maximum potential. More than ever, heavy industry is experiencing the same pressure to process more without compromising operational performance. Today, GE Power Conversion announces its latest induction motor leading the way in facing the challenge. With over one hundred years of experience in developing induction motor technology, the N37 induction motor is an upgrade to the well-established N3 motor line. It builds on a time-proven design with cutting-edge mechanics in order to meet heightened customer demands on footprint and performance. Working to decrease the component weight, GE Power Conversion achieved an induction motor design with a dramatically increased power per kilogram ratio. At a lower frame size than conventional induction motors, this compact design translates to space savings and lower weight, essential both in onshore and offshore applications. The N37 squirrel-cage induction motors operate at 50 Hz and will soon be available in 60Hz. The N37 is among the most efficient motors in its class. GE's solution works to reduce energy waste while simultaneously reducing the operator's environmental footprint. "We're constantly facing tougher demands in the power conversion industries – customers want products that are simplified, streamlined and compact but nevertheless meet increasing performance expectations," said Luc de Camas, product leader, GE Power Conversion. "GE is responding to this call with the N37, which retains all the benefits of tried and tested technology but has been adapted to bring increased convenience to the operator." The N37 launch marks the first of GE Power Conversion's induction motors to be standardised for a wide range of industrial applications.

Enquiries: Email [paul.floren@ge.com](mailto:paul.floren@ge.com)



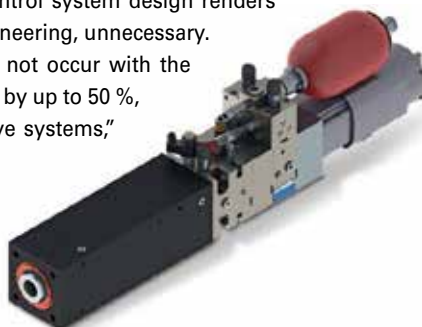
## Energy consumption reduced by up to 50 %

"Voith Turbo's advanced new closed loop differential pump (CLDP) servo drive design is simple. The heart of the unit is an integrated servo pump consisting of a servo motor and an internal gear pump. Its flow rate is perfectly matched to the cylinder surfaces of a differential cylinder," says Grant Robinson, Voith Turbo vice-president – EMEA Division, Mining and Metals Southern Africa.

The unit also includes intelligent control via fieldbus connection, a pressure limiter, and a small compensating tank. This control system design renders other components, such as expensive valve engineering, unnecessary.

"Energy losses caused by throttle effects do not occur with the CLDP. This increases the machine energy savings by up to 50 %, compared to machinery using conventional drive systems," adds Robinson.

Enquiries: Terry-Lynn McIntosh. Tel. 011 418 4000 or email [Terry.McIntosh@voith.com](mailto:Terry.McIntosh@voith.com)



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## Coal mine methane into electric power

**Barloworld** put the spotlight on the potential of coal mine methane at a customer event in Johannesburg. Sharing the podium with Caterpillar and industry experts, Barloworld Power focused on its capabilities in the gas segment, which is still relatively untapped in southern Africa. Only 2 % of South Africa's energy demand is currently met by gas.

Nalen Alwar, Barloworld Power's business development manager: Gas for southern Africa, says the potential value of harnessing methane from coal beds is significant as South Africa is the sixth largest coal producer in the world with reserves estimated at 30 billion tonnes, half of this mined underground.

It is estimated that mining of known reserves will continue for well over 100 years. Methane is a naturally occurring gas formed during the mining of coal. It is highly flammable and hazardous to mining operations, which means that coal seams have to be degassed prior to mining.

As a greenhouse gas, methane released into the atmosphere does 20 times more damage than carbon dioxide. This is cause for serious concern as coal mining is still the world's biggest contributor to feedstock for electrical power generation. Unburnt methane can remain in the atmosphere for nine to 15 years.

Alwar said greenhouse gas emissions in the USA decreased by more than 20 % between 1994 and 2005 due to increased recovery and utilisation of coal mine methane. Alwar explained that methane

could be safely extracted and, following a treatment process, fed into Cat gas generator sets to produce electric and thermal power. "Infrastructural and energy efficiency projects can be undertaken by coal mining companies to generate their own electricity or provide revenue earning opportunities as independent power producers (IPPs)."

**Enquiries: Shivani Naidoo. Tel. 011 323 2683 or email [snaidoo@barloworldpower.com](mailto:snaidoo@barloworldpower.com)**

*Barloworld Power experts sharing the advantages of converting coal mine methane to electric power (from left): Nalen Alwar (business development manager: Gas); Mark Mencil (executive director: Barloworld Power southern Africa); Pravesh Kalyan (project manager); and Steven Moss (product support operations manager).*



## Reliable sewage submersible pumps

LEO's XSP range of single-phase sewage submersible pumps is designed for wastewater drainage in factories, construction sites and commercial facilities. The pumps are also ideal for drainage systems in municipal treatment plants as well as in methane pools and for field irrigation.

The XSP range is reliable, durable, economical and effectively transfers liquids with solids of up to 15 mm as well as long fibres. With the distinct design of the wetted parts, the pump has a wide flow range with a total head (non-overload) feature. The XSP is anti-corrosive as it is constructed from stainless steel and special cast iron material. Complete drainage is achieved due to the bottom suction structure and its large channel helps to prevent the impeller from clogging. A float switch automatically turns the pump on/off according to the change in the liquid level. In addition, a protector in the motor automatically shuts off the pump in case of overheating or over-current, thus ensuring safety and reliability in unfavourable environments. LEO is represented locally by **Raptech**.

**Enquiries: Carl Mulock. Tel. 011 693 5110 or email [enquiries@raptech.co.za](mailto:enquiries@raptech.co.za)**



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## Sensor wins international awards

ifm electronic's PN pressure sensor has won two renowned design awards. The iF Design Award and the international Red Dot Design Award, two of the most important awards a well-designed product can win. ifm's PN pressure sensor was officially awarded the Red Dot Design Award in Munich from 4928 entries submitted from 56 countries.

The PN pressure sensor is the new generation of ifm's popular sensor, now with new functions and features. The sensor's head is still black and the orange ring is still its distinctive mark. LEDs on the side for switch point indication are now clearly visible from a distance and from the rear. LEDs for the units of measurement are positioned outside the display, making the display larger. The two-coloured display facilitates readability for the customer. As soon as a measured value in the plant is incorrect, the display changes from green to red - if requested and programmed.

The menu operation is also simpler. Three pushbuttons with integrated symbols can be activated either with a tool or finger making setting of the sensor easier. Thanks to the sensor's 345° rotation, the user saves time during alignment.

Enquiries: Tel. 012 450 0370  
or email [info.za@ifm.com](mailto:info.za@ifm.com)



## Bizz Buzz

### Comtest to represent Tektronix and Keithley in SA

Tektronix and Keithley, worldwide suppliers of test equipment for engineers focused on electronic design, manufacturing, and advanced technology development, have appointed **Comtest** as their authorised distributor in South Africa and selected countries in southern Africa. With headquarters in Oregon, USA, Tektronix and Keithley have, for the past 65 years, provided engineers' solutions for test, measurement and monitoring problems, solved design challenges, improved productivity and dramatically reduced users' time to market.

Enquiries: **Barend Niemand** on 010 595 1821  
[sales@comtest.co.za](mailto:sales@comtest.co.za)

### Foundational skills to manage networked, industrial control systems

Rockwell Automation, in collaboration with Strategic Alliance partner Cisco, has launched a new training course to help IT and OT professionals overcome the challenges of converging their network technologies. The new training helps candidates prepare for the recently introduced Cisco Industrial Networking Specialist certification. The hands-on, lab-based course Managing Industrial Networks with Cisco Networking Technologies (IMINS) provides the foundational skills needed to manage and administer networked, industrial control systems. IMINS will be held in South Africa from the 17 to 21 August 2015 at Rockwell Automation's offices.

Enquiries: **Peet Pelser**. Tel. 11 654 9700 or email  
[ppelser@ra.rockwell.com](mailto:ppelser@ra.rockwell.com)

## National Bandana Day - 12 October 2015

Take a stand and show you care about people with serious blood disorders like leukaemia. Buy and wear your bandana on 12 October and contribute towards saving a life. The slogan this year is

'We  Bandana Day!'

The campaign is fun, hip and happening and involves Ambassadors of Hope for The Sunflower Fund. Buy your brightly coloured bandana from Pick n Pay, RoundTable, selected Makro stores and the online shop, Zando from 15 August. It is all about saving lives.

Funds raised through National Bandana Day go towards paying for the expensive tissue typing (DNA) tests for new stem cell donors to join the South African Bone Marrow Registry (SABMR). Behind the campaign, stand the cancer patients who face a very daunting task of fighting for their lives. This unfortunately is a reality for countless people and for many, their only hope is to receive a life-saving stem cell transplant.

Enquiries: **Lauren Corlett**. Tel: 021 701-0661 or visit [www.sunflowerfund.org.za](http://www.sunflowerfund.org.za)

### '2015 Go-Live Project of the Year'

Namibia's national power utility, **NamPower**, has been named as the winner of enterprise information management (EIM) leader, OpenText's 'Go-Live Project of the Year' for 2015. The Windhoek-based organisation, nominated for this award by EIM partner, Datacentrix, received top honours at the recent OpenText Innovation Tour 2015, which included an African leg of this event for the first time this year. As part of its strategic, long-term vision to drive innovation across the whole of the organisation through digitisation, NamPower implemented SAP Extended Enterprise Content Management (SAP xECM) on a consolidated EIM infrastructure across the organisation. This assisted the company to enforce its records management policy, thereby improving access to information, reducing paper wastage and storage costs,

Enquiries: Visit [www.datacentrix.co.za](http://www.datacentrix.co.za)

## Africa-wide affordable robotics challenge

If teaching a young child how to do something is challenging, teaching a robot to 'think' for itself to navigate through a maze can be even more so.

The **University of Johannesburg (UJ)** would like to draw 'bright sparks' into its engineering education and training programme, says Willie Viljoen, manager at the Technolab, UJ. "We aim to create a pipeline of future engineering students for our university," he says. "Technolab makes robotics accessible and affordable to learners in Johannesburg through various programmes, aimed at boosting STEM: Science, Technology, Engineering and Mathematics education."

In July, TechnoLab entered into a partnership with the South African Institute of Electrical Engineers (SAIEE), which further extends its services to disadvantaged learners and also makes possible a continent-wide robotics challenge.

"The partnership with SAIEE makes it possible for us to take our weekly robotics classes to schools in Soweto, Alexandra and the Johannesburg inner city.

We are in talks with various schools about extending our programme," says Michael Ettershank, manager of the Robot Science project at UJ TechnoLab.

The SAIEE partnership makes possible the first UJ-hosted AfrikaBot robotics competition, says Ettershank.

Learners from schools across Africa, and even developed countries like the USA and Europe, are all invited to enter the AfrikaBot competition. The initiative will be launched on 3 October 2015, with the first continent-wide competition in October 2016. AfrikaBot is billed as 'the world's most affordable robotics competition'.

"Learners from all schools, colleges and universities have a whole year to build and customise their robots for AfrikaBot 2016," continues Ettershank. "They can learn by watching videos on their cellphones on how to build their robots on our website at [www.robotscience.co.za](http://www.robotscience.co.za) and our YouTube channel.

This way they can start preparing right away for a career in electrical or electronic engineering. With the SAIEE partnership we will be sponsoring and training disadvantaged learners to enter AfrikaBot 2016."

**Enquiries: Therese van Wyk.  
Tel. 011 559-6332 or  
email [theresevw@uj.ac.za](mailto:theresevw@uj.ac.za)**

## New energy app puts 'power' into the hands of utilities and their customers

**Screaming Power**, a company focused on bringing mobility and data connectivity to the energy industry, is introducing branded apps to small / large utilities and energy providers alike. This template solution set provides a premium mobile experience for customer communications, while driving cost savings and efficiencies for utilities.

Why keep struggling with the old technologies? Websites are not viable for direct communications with customers and mail, email and phone connectivity is expensive to manage. Now imagine an energy ecosystem we can build together. Screaming Power's apps provide automated delivery and payment of electronic bills plus much more to reduce operational overhead, merge multiple systems and eliminate special processes by providing real-time communications directly to customers with quantifiable savings.

The platform enables 2-way communications to provide a gateway for innovation. Information, advice, key messages, education, operations / outage management and conservation management can be provided in one simple tool. Save time and money by communicating directly with all customer segments and "enable" them to securely share information with you and others to promote a "smart grid" and a "smart community".

"With our template mobile solution, we can mobilise an energy provider in weeks with minimal footprint on the existing IT infrastructure," says Gary Michor, chief executive officer of Screaming Power. "We have created an efficient, cost-effective solution for both large and small utilities. Out of the box the solution already handles electricity, water and natural gas information." Using standardised layouts and leading edge mobile technology, it provides a solution to help modernise the energy industry without burdening energy providers with escalating costs to communicate with customers.

Download our free end-user app to see a small sample of the capabilities your branded app could have. Search for 'Screaming Energy' on BlackBerry, iOS and Android. Or request a demo.

**Enquiries: Gary Michor@gmichor@screamingpower.com or visit [www.screamingpower.com](http://www.screamingpower.com)**

## Wise investments ensure long-term efficiency and cost savings

According to **Aerzen Airgas** marketing coordinator Andreas Stubel, the company offers highly-efficient equipment that can assist operations in considerably reducing energy bills. He admits that the initial purchasing cost is a dominant factor in the decision making process.

"This makes the introduction of more expensive but efficient equipment challenging. Understandably, buying equipment at the lowest price makes financial sense, but the misconception lies in the fact that cost saving decisions are based primarily on short-term financial goals," he says.

Stubel points out that purchasing standard or cheaper equipment does not save money, and may in fact cost more in energy consumption and maintenance in the long-run. "Bearing this in mind, Aerzen Airgas offers the local market the Aerzen Delta Hybrid rotary lobe compressor, an oil-free air conveying alternative to standard roots blowers," he continues.

The Delta Hybrid is designed to be an optimised combination between a blower and screw compressor, and makes use of a patented twisted rotor profile. It is designed for a variety of applications where air and neutral gases must be conveyed oil-free. These include; wastewater treatment plants, the chemical industry, power plant technology and for the pneumatic transport of powder and granulate goods.

The Delta Hybrid is available in four models: L, S, H and E. The L model has been designed for pressure ranges up to 800 mBar. The S model for 1 000 mBar and the H model for pressures up to 1 500 mBar at sea level. The E model is a vacuum machine with a maximum negative pressure of -700 mBar. The Delta Hybrid is effectively an in-between solution, as it crosses the pressure range between roots blowers and low pressure screw compressors.

**Enquiries: Aerzen Airgas Andreas Stubel. Tel. 011 474 2193 or email [astubel@airgas.co.za](mailto:astubel@airgas.co.za)**





## 'Inspiring Innovations' at Phoenix Contact breakfast

On 25 June 2015 Phoenix Contact hosted a breakfast at the Randpark Golf Course to introduce their most recent innovations. The company believes in investing in fundamental research which results in the development of high quality products that address special requirements in industry. An example of this is the unique 6 mm safety relay. Something previously thought to be impossible to achieve is now possible with their relay technology. These PSR mini safety relays are an exciting new innovation.

Phoenix Contact has reinvented surge protection through the use of the new Safe Energy Control technology with spark gap without line follow current. The new SEC range is low maintenance and easy to install. These were just two of the inspiring innovations introduced at the breakfast.

**Enquiries: Dereck Stayne. Tel. 011 801 8200**



Bruce Patton,  
Kevin Preston,  
Patrick Rowland,  
Sean Hadley,  
Peter Mauff,  
Dereck Stayne,  
Tony Rayner  
and Kevin Mann  
(Phoenix Contact).

## Schneider Electric hosts successful services event for installed base customers

Global specialist in energy management, Schneider Electric, recently held a two-day event to showcase its expertise in installed based services at its Midrand Schneider Electric Campus. Over 130 customers, representing industries such as Water and Wastewater (WWW), food and beverage; electrical utilities; Mining, Minerals and Metals (MMM); and facility management, attended the informative sessions by local and international Schneider Electric experts. The event highlighted that installed base services should be developed to assist companies in increasing productivity, reliability and safety; mitigating risk and limit downtime; keeping equipment up to date and extending its lifespan; cutting costs and increasing savings; and improving return on investment.

ity, reliability and safety; mitigating risk and limit downtime; keeping equipment up to date and extending its lifespan; cutting costs and increasing savings; and improving return on investment.

**Enquiries: Ntombi Mhangwani.**

**Tel. 011 254 6400 or email**

**[ntombi.mhangwani@schneider-electric.com](mailto:ntombi.mhangwani@schneider-electric.com)**



Chris Cowling (principal cyber security consultant), Rodrigo Garcia (service business manager), Bongani Twala (field services, Africa), Raedah Saman (field services business development director for Africa), Makhoul Lebeze (process automation field services business development director), Danie Badenhorst (field services, South Africa), Mahesh Ananda-Kumar (E and P operate offer category manager), Europe and Africa zone), Karthik Perumal (projects and engineering centre) – advanced energy expertise – energy efficiency and thermal expert).

**Legrand**



*Johan Bosch  
General manager*



*Brian Ndlozi  
Export manager*

**Stanley Black & Decker**



*Riaan Olivier  
Head of South African business  
and of African business*

**PROCEN TEC**



*Pieter Barendrecht  
Managing director*

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17 – 19 August 2015, Cape University of Technology  
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**8<sup>th</sup> annual SA Innovation Summit 2015**

26 – 29 August, Cape Town Stadium  
Enquiries: Tel. 012 844 0674 or  
email [info@innovationsummit.co.za](mailto:info@innovationsummit.co.za)

**4<sup>th</sup> Annual Infrastructure Africa**

1 – 2 September 2015,  
Sandton Conference Centre, Johannesburg  
Enquiries: Email [liz@infrastructure-africa.com](mailto:liz@infrastructure-africa.com)

**4<sup>th</sup> Annual Environmental Crimes Conference Compliance, Enforcement, Prosecution**

9 – 10 September 2015,  
Indaba Hotel, Fourways, Johannesburg  
Enquiries: Email [bookings@intelligencetransfer.co.za](mailto:bookings@intelligencetransfer.co.za)

**Generators Conference and Exhibition**

10 – 11 September 2015, Focus Rooms, Sunninghill  
Enquiries: Tel. 011 325 2485 or  
email [christophere@mogorosicomms.co.za](mailto:christophere@mogorosicomms.co.za)

**54<sup>th</sup> Annual Occupational Risk Management Conference and Exhibition:**

NOSHCON - 15 – 18 September 2015, Champagne Sports Resort, Central Drakensberg, KwaZulu-Natal  
Enquiries: Visit [www.nosa.co.za](http://www.nosa.co.za)

**25<sup>th</sup> AMEU Technical Convention 2015**

4 – 7 October 2015,  
Sandton Convention Centre,  
Johannesburg  
Enquiries: Jean Venter. Tel. 011 061-5000

**Environmental Management Systems Course**

21 – 22 October 2015,  
Johannesburg  
Enquiries: Thieda Ferreira. Tel. 041 582 2043 or  
email [info@entf.co.za](mailto:info@entf.co.za)

**10<sup>th</sup> Southern African Energy Efficiency Convention (2015SAEEC)**

11 – 12 November 2015,  
Emperors Palace  
The Southern African Association for Energy Efficiency (SAEE) aims to become the Association in Southern Africa that brings all energy stakeholders in the region together.  
In order to achieve this synergy, the SAEE is hosting the 10th Southern African Energy Efficiency Convention (2015SAEEC), as an event serving the energy management-, environmental-, facilities building upgrades-, energy engineering-, cogeneration-, power generation-, and efficiency improvement industries.  
Enquiries: Erika Kruger. Tel. 018 290 5130  
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