

#### FEATURES:

- Industry 4.0 + IIoT
- Energy management + the industrial environment
- Measurement + instrumentation
- Transformers, substations + cables

12/2023

# ELECTRICITY + CONTROL



**ArmCoil**

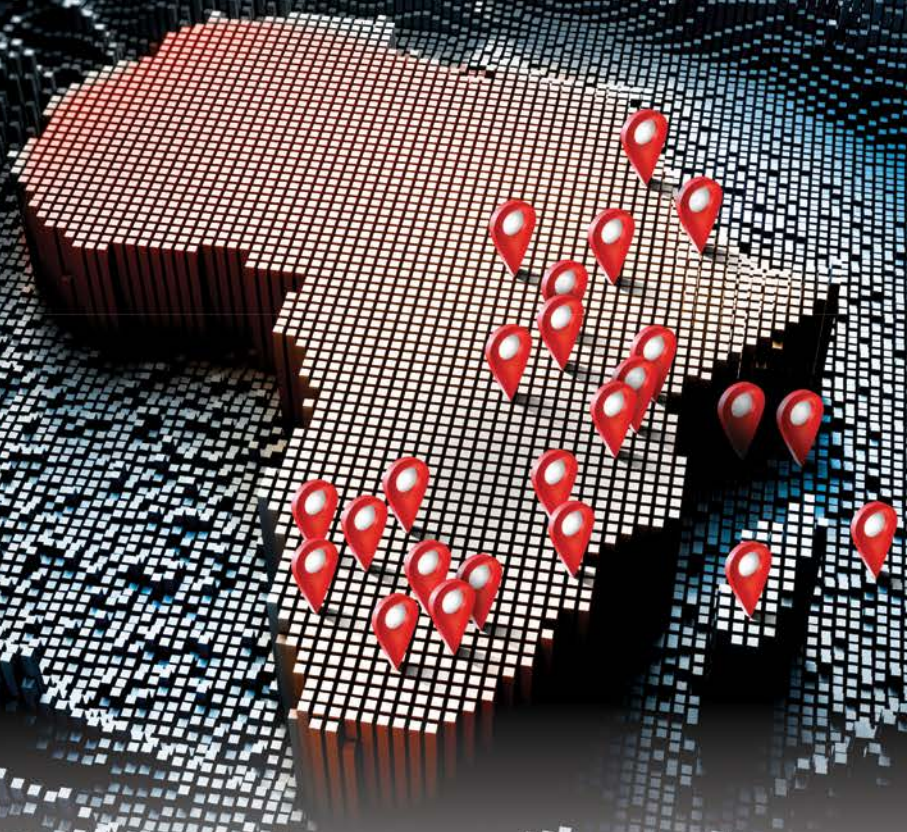
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## THROUGH POWERFUL PARTNERSHIPS

SEW-EURODRIVE is proud to welcome its phenomenal new, state-of-the-art headquarters in Johannesburg. The 26 000m<sup>2</sup> building is a major achievement for the South African and African engineering sphere. Gear units and motors from SEW-EURODRIVE have always set the trend and established a new standard in drive technology, and this building allows us to not only continue to supply quality products developed and assembled in-house but also gives SEW-EURODRIVE the opportunity to train and upskill staff and customers.

Our powerful partnerships with customers and suppliers allow us to offer customized solutions that meet the unique needs of each business. With our expertise and resources, we can help accelerate your success and drive you forward towards greater profitability and growth.

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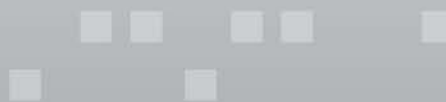


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Minimising life cycle costs and ensuring the reliability and longevity of transformers have always been a central focus in the management and maintenance of electrical power systems.

(Read more on page 3.)

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## Another year gone

It's another year gone. And what a year it has been. One of the interesting things to me is how evident it became to everyone that the country, in general, is in quite a bit of trouble.

For whatever reasons, things have slipped in an extraordinary way. What also became apparent is that it is the 'ordinary citizens' who, no doubt, have felt the brunt of this far more than other sectors of the population.

This raises so many questions on the ethos of how we manage as a nation; but it again emphasises the gulf that exists between private citizens trying to make a difference – and the organised institutions that one presumes serve the nation.

We saw Eskom spiral into its worst loadshedding ever – although there had been promises of a seemingly miraculous recovery; we saw our ports and rail systems struggling in the face of a barrage of obstacles.

And yet, as a nation, we survived.

As we see this year out, may I commend everyone reading this for the fortitude you have shown – in your personal capacity, as an employer or an employee – for not giving

up, for continuing to serve our industry.

Daily, I reflect on the difficulty that the manufacturing industry, among others, faces, challenged by the reality of the world in which we find ourselves – yet somehow managing to keep our heads above the water.

May you and your families – and your colleagues – have a truly wonderful year end and Festive Season.

For those of you able to take a break, may you return to the new year refreshed – and ready to continue to do all we can to save this economy.

And, of course, we will welcome you back in 2024 as loyal readers of *Electricity + Control*. I must extend sincerest thanks to the Editor, Leigh Darroll, and the team: Advertising Manager, Heidi Jandrell, Design and Layout artist, Darryl James, Circulation Manager, Karen Smith, and indeed to the Publisher, Karen Grant and Deputy Publisher, Wilhelm Du Plessis.

See you all in the new year. And have the break you so richly deserve.



*Ian*

Ian Jandrell

PrEng IntPE(SA), BSc(Eng) GDE PhD,  
FSAAE FSAIEE SMIEEE

### From the Publisher

We are very sorry to share with you the news that Heidi Jandrell, long-time Advertising Manager for *Electricity + Control*, has chosen to step away from the working world and enjoy more time with her family. Heidi will leave Crown Publications at the end of this year. She will be missed by many of you in the industry who have worked with her through her past 27 years of handling all the advertising bookings, schedules and material for the magazine and its allied platforms, and seeing to consistently correct placements. Heidi has built up a wide network of contacts and colleagues in the industry and, for us at Crown Publications, her leaving the title will mark a huge absence. Heidi has always been professional and thorough in her dealings with clients – and she has been thoughtful and committed to supporting clients with the best opportunities available to suit their objectives and budgets. One of

Heidi's remarkable attributes, in addition to her willingness always to help colleagues, is her buoyancy. Despite the many obstacles she has encountered in working through these years, she ALWAYS bounces back and presses on, opening up to new possibilities. She has been particularly steadfast through these past difficult years which have pushed the manufacturing and process industries, like many other sectors, and indeed the economy generally, into a very difficult operating environment – faced with extraordinary and sometimes demoralising challenges. We will miss her greatly. Nonetheless, we wish her all the best in this next and no doubt more relaxed chapter of her life. Thank you for staying the course with us Heidi.

*Karen Grant*

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# Proactive maintenance of transformers ensures power supply

Transformers, a cornerstone of electrical power systems since the inception of modern grid technology in the early 20th century, represent a substantial investment in these systems. The focus has consistently been on minimising life cycle costs to ensure the reliability and longevity of transformers. To achieve this goal, it is crucial to monitor operating conditions, insulation systems, and accessory components systematically, aiming to extend transformer life and reduce associated costs.

The identification and characterisation of faults and defects throughout the life cycle are essential to advance predictive techniques to minimise disruptions in the electric power supply system. The significance of power transformers in ensuring a continuous power supply underscores the need to address failures promptly, given the substantial financial and time investments required for replacements.

In response to these challenges, there has been significant progress in research and development of advanced technologies and predictive maintenance techniques. Numerous studies emphasise the optimisation of maintenance processes and diagnostics for substation equipment like transformers. However, the dilemma faced by many, particularly in sub-Saharan African nations and countries such as Brazil and India, revolves around the decision to replace or maintain aging units.

Proactive planning is crucial to managing stoppages effectively and making informed decisions. The objective is to prevent unplanned interruptions, ensuring uninterrupted electricity supply to critical facilities, large businesses, infrastructure, and domestic users. The term 'stoppage' signifies the interruption of equipment service due to defects or faults, and power transformers are particularly critical components, especially in regions where the transformers are nearing the end of their operational life.

In response to the increasing pressure to reduce costs,



Transformers constitute a critical component of electrical power systems.

ArmCoil developed the On-Site Condition Analysis (OSCA) service a few years ago. Leveraging its extensive experience in transformer repairs and manufacturing across South Africa and beyond, ArmCoil aims to provide cost-effective solutions to optimise transformer performance throughout the equipment's life cycle.

The OSCA service encompasses three phases.

## Phase 1: Equipment assessment and identification

Using non-intrusive methods, this phase involves visual inspections and oil sampling to gauge the overall health status of the transformer. The collected information helps map out substation locations, enabling prioritisation of transformers for service based on the criticality of their condition.

*Some oil sampling methods available are:*

- Dissolved Gas Analysis (DGA) – evaluating oil health and indicating possible internal faults
- Breakdown Voltage Test – assessing the insulating properties of the oil
- PCB Content – addressing health and environmental concerns related to polychlorinated biphenyls
- Acidity Content Test – measuring acidity increase over time
- Moisture Content Test – checking contamination through interaction between air and transformer oil
- Furanic Testing – determining paper deterioration in the transformer.

## Phase 2: On-site condition analysis service implementation

After prioritising assets from Phase 1, the OSCA service costs can be further reduced by targeting specific components or the entire asset over a period thereby increasing life expectancy. The goal is to minimise risk and increase availability. As one example, when an aged transformer is at risk of imminent failure, ArmCoil may provide a 'drop-in replacement' unit during the next maintenance shutdown to minimise downtime.

## Phase 3: Extended life cycle and reporting

This phase demonstrates the extension or improvement of an aged transformer's life cycle. Reports obtained during the on-site condition analysis indicate the reliability of assets and the exclusive service events provided by ArmCoil. Quarterly or annual recommendations for monitoring, oil sampling, and parts/asset replacement are proposed strategically, to reduce routine inspection expenditure and extend operational life expectancy. □



For more information visit: [www.armcoilafrika.co.za](http://www.armcoilafrika.co.za)

# EtherCAT – a leader in industrial communications technology



Martin Rostan, Executive Director, EtherCAT Technology Group.

*EtherCAT technology has demonstrated its value in practice as a high-performance real-time Ethernet technology for 20 years. The communication system, developed by Beckhoff, was first introduced to the market at Hannover Messe 2003 and has been an international standard since 2007. It is also an open technology – and widely used. At a recent breakfast seminar hosted by Beckhoff in Johannesburg, Martin Rostan, Executive Director of the EtherCAT Technology Group, set out the benefits of EtherCAT and explained the structure of the technology that gives it the edge.*

Leigh Darroll reports some of the highlights from Rostan's presentation here, together with additional information from the EtherCAT Technology Group (ETG).

Rostan began his presentation by highlighting why the bus system, as the basis for communications in automation, is so important.

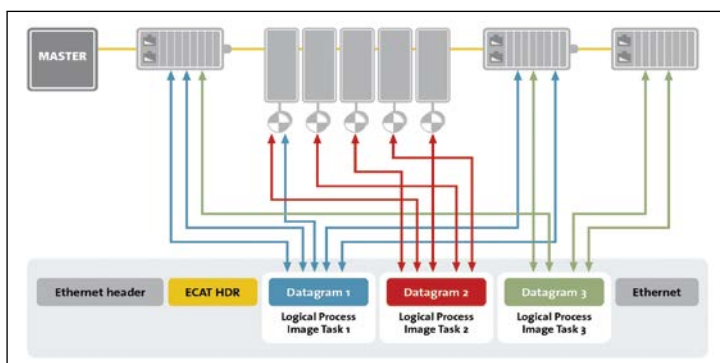
The bus system, he pointed out, is the core of the control architecture. It is the bus system that defines: the control system's performance, the choice of suppliers and components, the overall cost of the control system (especially if there are only a few suppliers), and whether the user has the option of centralised control or not.

Superfast controls, as in PC-based controls, require a superfast bus technology, and this is where EtherCAT excels.

## Network performance

Rostan noted some particular advantages that EtherCAT offers, compared to other well-established technologies like Ethernet IP and PROFINET. For one, it is faster. It enables significantly reduced reaction times within the control system. Precise synchronisation is another advantage, enabled by the distributed clocks incorporated into the technology. Further, EtherCAT Bridges provide for automatic synchronisation of several or multiple networks.

EtherCAT's key functional principle lies in how its nodes process Ethernet frames: each node reads the data addressed to it and writes data back to the frame all while the frame is moving downstream. This leads to improved bandwidth use and eliminates the need for switches and hubs.



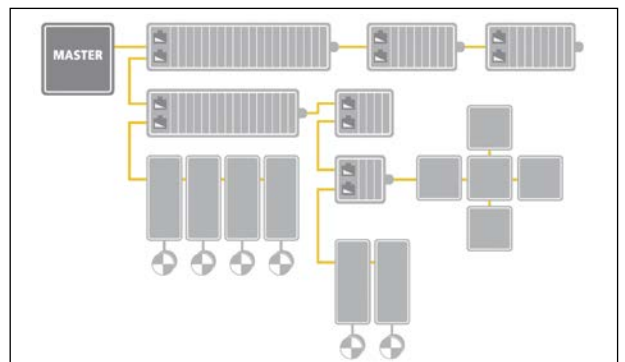
EtherCAT's key functional principle lies in how its nodes process Ethernet frames – and this makes it the fastest Industrial Ethernet technology.

The way EtherCAT processes frames makes it the fastest Industrial Ethernet technology – and the 'engineer's choice' for many applications – and it synchronises with an accuracy of less than a microsecond. This is a major benefit for all applications in which the target system is controlled or measured via the bus system. The fast reaction times work to reduce the wait times in the transitions between process steps, which significantly improves application efficiency. Furthermore, the EtherCAT system architecture typically reduces the load on the CPU by 25 to 30% in comparison to other bus systems (given the same cycle time). When optimally applied, EtherCAT's performance leads to improved accuracy, greater throughput, and thus to lower costs of production.

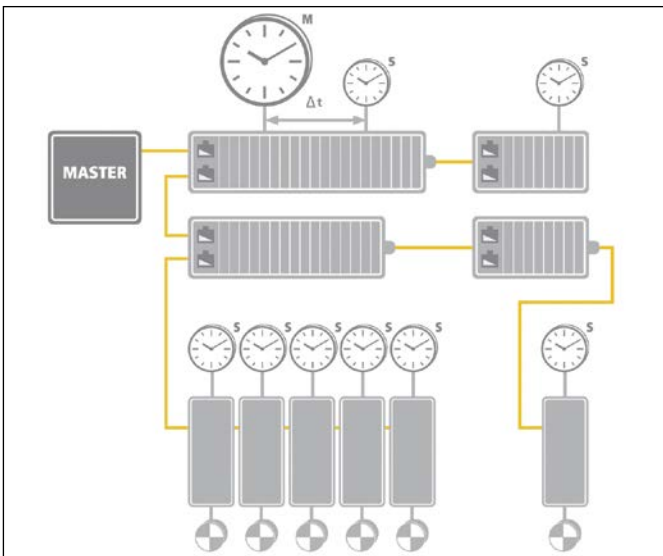
## Flexible topology

Additionally, EtherCAT wiring is more flexible, supporting various topologies. As an increasingly preferred option, EtherCAT P cabling combines communications and power in one cable.

In EtherCAT applications, the machine structure determines the network topology, not the other way around. In conventional Industrial Ethernet systems, there are generally limitations on how many switches and hubs can be cascaded, which, in turn, limits the overall network topology. As EtherCAT does not need hubs or switches, there are no such limitations. With EtherCAT, line, tree, or star net-



Flexible wiring allows for different network topologies – line, tree, star, or any combination of these.



*Distributed clocks ensure precise synchronisation within processes automatically.*

work topologies are possible, or any combinations of these, with an almost unlimited number of nodes. The hot connect feature based on automatic link detection allows for nodes and network segments to be disconnected during operation and then reconnected – somewhere else, if need be, and if the master supports

this feature. The option of ring topology provides for cable redundancy. All the master device needs for this redundancy is a second Ethernet port; the slave devices already support the cable redundancy as they are. This makes it possible even to swap out devices during machine operation.

### Versatility

EtherCAT is suitable for centralised and decentralised system architectures. It can support master to master, master to slave, or slave to slave communications, and can incorporate subordinate fieldbuses.

### Simplicity

Rostan also explained that the technology is easier to configure, cost-effective and easier to implement.

Configuration, diagnostics, and maintenance are all factors that contribute to system costs. EtherCAT can be set to assign addresses automatically, which eliminates the need for manual configuration. A low bus load and peer-to-peer physics improve electromagnetic noise immunity. The network reliably detects potential disturbances at their exact location, which reduces the time needed for troubleshooting. During startup, the network compares planned and actual layouts to detect any discrepancies. EtherCAT performance also helps during system configuration by eliminating the need for network tuning. There are no

### Questions and answers

*Following the seminar, Leigh Darroll put two questions to Rostan, specifically looking at topical issues in the field of network technologies.*

#### *EtherCAT and Ethernet APL*

**Q:** The evolution of Ethernet APL (advanced physical layer) allows Ethernet reach to extend to multiple sensors and measurement instruments in the field and feed the data gathered in the field into the process management and maintenance systems. Does EtherCAT provide similar functionality or are specific adjustments required to enable it?

**Rostan:** APL is a new physical layer for Ethernet that is basically combining 10BASE-T1L (10 MB/s Single Pair Ethernet for up to 1 000 m) with an intrinsically safe power supply on the same wires ('2-WISE': Two-Wire Intrinsically Safe Ethernet). Regarding length, intrinsic safety and power, there are essentially two APL versions: trunk (1 000 m into Zone 1, up to 60 W, very limited intrinsic safety) and spur (200 m into Zone 0, up to 1 W, increased intrinsic safety).

APL was clearly developed with the process industry in mind: one key goal is to use the existing 4-20 mA or HART cabling for APL and Ethernet.

Since EtherCAT does not support 10 MB/s (there are no EtherCAT chips for such slow speeds), APL is not a suitable physical layer for EtherCAT. However, there are devices that connect APL equipment to an EtherCAT backbone network, such as the ELX6233 from Beckhoff. So, one can integrate APL into an EtherCAT system. Or, in other words: APL works together with EtherCAT, but EtherCAT does not use APL.

#### *Replacing legacy systems with EtherCAT*

**Q:** If a company were looking to change or upgrade existing plant automation systems to EtherCAT technology – replacing legacy systems – how easily can that be done?

**Rostan:** The effort required to upgrade an existing automation system to EtherCAT depends largely on the nature of the existing system. If it is already based on 100 MB Ethernet technology, the effort is relatively low: the cables can continue to be used. If modular I/O devices are already installed, it is sufficient to replace the bus couplers with EtherCAT couplers. If a star topology with switches was previously used: EtherCAT does not require switches but supports the star topology. The switches are then replaced by so-called junctions. These are devices that have more than two EtherCAT ports and therefore enable branches. Only one Ethernet port for the EtherCAT master/main device then needs to be available in the controller: the plug-in card for the previous bus master, if used, is no longer required, as the EtherCAT MainDevice is a software implementation in the controller. If a classic fieldbus was previously in use, the cables must of course also be replaced. However, one advantage of EtherCAT is that it is often not necessary to replace the previous system or the existing field devices completely in order to take advantage of EtherCAT. Cost-effective gateways are available for almost all known bus systems, so it is often possible to continue using many field devices. EtherCAT is then used as a backbone or for extensions, and existing devices that may not (yet) have an EtherCAT interface are integrated via the gateways. This option offers an elegant migration path: initially, only those subsystems that benefit most from the new technology are transferred to the EtherCAT world.





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*CTDI, based in the USA, produced an automated picking line that uses EtherCAT-based control, among other things, to more than double hourly throughput.*

switches or routers to configure and no complicated handling of MAC or IP addresses is necessary.

### Integrated safety

Where functional safety is required as an integral part of the network architecture, this is provided by Functional Safety over EtherCAT (FSOE). FSOE is proven in use through TÜV-certified devices that have been on the market since 2005. The protocol fulfils the requirements for SIL 3 systems and is suitable for centralised and decentralised control systems. With its Black-Channel approach and the particularly lean Safety Container, FSOE can also be transmitted via other bus systems. All these factors help keep system costs down.

### Cybersecurity

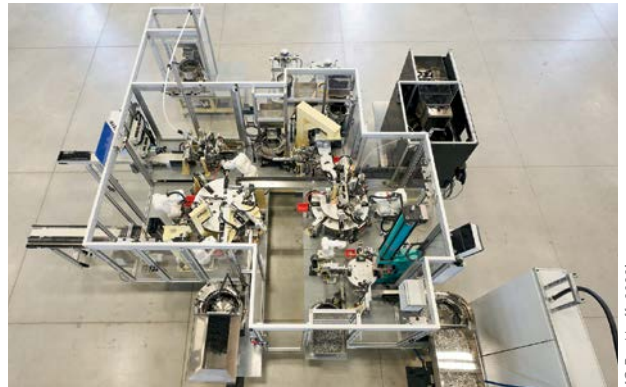
Cybersecurity is a universal concern. In this regard, EtherCAT network technology incorporates inherent cybersecurity as it is not based on Internet Protocol (IP) and operates distinctly within the hierarchical structure of the system architecture. The controller separates the fieldbus from the factory network.

### The EtherCAT Technology Group

Headquartered in Nuremberg and operating globally, the EtherCAT Technology Group keeps EtherCAT technology open for all potential users. It brings together EtherCAT device manufacturers, technology providers, and users to further the technology. It provides multiple Technical Working Groups where experts work on various specific aspects of the technology. All these activities are focused on one common goal: keeping EtherCAT stable and interoperable. That's why there is only a single version of EtherCAT, and not a new version each year.

The ETG holds Plug Fests annually in different parts of the world. These events provide a forum for EtherCAT device developers to test and ensure device interoperability. Using the official EtherCAT Conformance Test Tool (CTT), each manufacturer conformance tests its EtherCAT devices prior to their release. Following a successful test in an accredited test lab, the ETG awards the manufacturer a Conformance Certificate. The ETG also hosts international seminars and workshops and represents EtherCAT at various events around the world.

The EtherCAT Technology Group is an official partner of the IEC. Both EtherCAT and Safety over EtherCAT are IEC standards (IEC 61158 and IEC 61784).



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*The redesign of a car seat belt assembly machine at Sodexia's Global Tech and Automation Centre (GTAC), based in Canada, is a prime example of the benefits of EtherCAT-based control and drive technology.*

### Cost-effectiveness

EtherCAT delivers the features of Industrial Ethernet at a price on par with or below that of a classic fieldbus system. The only hardware required by the master device is an Ethernet port – no expensive interface cards or co-processors are necessary. EtherCAT slave controllers are available from numerous manufacturers in different formats. As these controllers shoulder all the time-critical tasks, EtherCAT itself does not place any performance requirements on the CPU of slave devices, which keeps device costs down. Furthermore, as EtherCAT does not require switches or other active infrastructure components, the costs for these components and their installation, configuration, and maintenance are eliminated.

These and other benefits see EtherCAT used in widely diverse industrial sectors: from robotics and automated guided vehicles to machine tools, packaging machines and printing presses, semi-conductor manufacturing machines, test benches, pick & place machines, and measurement systems, in power plants, substations, material handling applications and automated assembly systems, pulp and paper machines, cranes and lifts, farm machines, iron and steel works, furniture manufacturing equipment, wind turbines and more.

### EtherCAT G

EtherCAT handling 100 MB/s is by far the fastest fieldbus technology and is particularly suitable for I/O, sensor, and drive communication. As outlined above, it is EtherCAT's functional operating system that makes it so fast.

However, some complex motion, measurement or vision applications require extremely high bandwidth, above 100 MB/s. For such applications, EtherCAT G and EtherCAT 10G are introduced. Both build on the same operating principle as EtherCAT 100 MB/s and are fully compatible with EtherCAT. No software adaptation is required for the master in standard mode. All the technologies comply with IEEE Ethernet standard 802.3. □

For more information visit: [www.ethercat.org](http://www.ethercat.org)



# Safeguarding data sovereignty in a connected world

*The importance of data sovereignty and security creates complexity in a world where sharing information across borders generates huge social and economic benefits. Andrew Cruise, Managing Director of Routed, a local VMware Cloud Verified provider and VMware Principal Partner, highlights this point and the various factors to be considered.*

It is clear that in the digital age, data sovereignty is becoming more important, as data is increasingly generated and collected through various channels, including e-commerce, social media platforms and mobile devices.

Essentially, the term 'data sovereignty' describes the principle that a country has the authority and right to govern and control the data generated within its borders. Thus, the concept of data sovereignty gives governments the power to regulate the collection, storage, processing, and distribution of any data that originates within their country's borders.

Obviously, this will have an impact on cross-border data flows and international data-sharing agreements. Different countries adopt different data sovereignty policies, but broadly they are about demanding that data generated within the country be kept within the borders for security or regulatory purposes.

Complicating the situation is the recognition that data access and the sharing of such information across borders generates social and economic benefits – estimated to account for between 2.5% and 4% of GDP. In addition, data transfers across borders enable other critical activities, such as the sharing of essential information related to crime prevention, scientific research and innovation, anti-fraud and money-laundering activities, disaster management and climate change.

The issue of data sovereignty warrants close attention, not only to safeguard private data, but also to avoid legal liabilities relating to the failure to protect personal information.

A major reason for the complexity around data sovereignty is that the laws governing it vary considerably from one country to another, as do cloud service providers' agreements concerning privacy policies and user rights. Therefore, organisations operating across multiple countries or regions need to understand each country's regulations in order to comply with all applicable laws.

Although there is a common understanding of the term, there are, in effect, differing definitions of exactly what constitutes data sovereignty, and it is important that, as cloud service providers, we should obtain some form of industry-wide collaboration in defining and upholding the principles of data sovereignty.

Recognising these complexities, VMware suggests that the answer lies in sovereign cloud deployment, as this

is an option that is inherently more secure and offers better data integrity and data assurance.

In this respect, VMware is seeking to promote Sovereign Cloud Partnerships and the criteria used to select providers, but at the same time, it seeks to limit the number of providers in each region – thus ensuring the specific rarity of the 'cloud sovereignty' badge.

Among the requirements VMware prescribes is that such service providers should have locally sited data centres and, in terms of data security, they should be ISO and payment card industry data security standard (PCI-DSS) compliant. These are both areas in which Routed meets the requirements.

"At Routed," Cruise says, "we already segregate management networks from production networks, storage traffic from a host strategy, and we separate host traffic from public-facing web traffic. In addition, we have multi-factor authentication (MFA) in place and have been leveraging the principle of least access from the start of our operations. We believe that, if you do things properly from day one, you don't leave any doors open. Hence, Routed has been conscious of implementing security best practices on its infrastructure from the outset.

"Additionally, we understand that while we may have secured the back end as best as we can, poor security measures further down the value chain, like leaving ports open on firewalls, are difficult to mitigate. However, when it comes to issues of data resilience and data integrity, we have always had backup and replication products available to assist in a disaster recovery scenario."

Although there is no universal definition of what constitutes data sovereignty, it will always entail data locality within sovereign borders, data security and data integrity. Cruise emphasises that Routed is a South African company and has grown as a local business. "Although we do business outside of South Africa, our data centres are located within the country's borders. We are not using this as a springboard to scale elsewhere in the world, and this enables us to be the best local provider of services – with data security, integrity and performance as crucial elements of that," he says. □



Andrew Cruise,  
Managing Director,  
Routed.

For more information visit: [www.routed.co.za](http://www.routed.co.za)



*Equipped with Viasat's global satellite connectivity, the Forest Capsule solution can be used anywhere, to protect critical infrastructure, monitor agricultural assets, and for other applications.*

## Using IoT to detect wildfire risks

Global communications company, Viasat, Inc, has welcomed Insign Solutions, a provider of bespoke Internet of Things (IoT)-enabled solutions and services, to its ELEVATE programme.

ELEVATE is a growth programme, ecosystem, and marketplace for providers of software, hardware and solutions, and original equipment manufacturers in commercial land markets.

As an ELEVATE partner, Insign Solutions will provide customers with an IoT-enabled monitoring solution to mitigate the environmental threats of wildfires.

As part of the programme, Insign Solutions will benefit from Viasat's global L-band network, the satellite network for IoT. The robust, global connectivity of the L-band network will enable the Forest Capsule wildfire detection solution to deliver mission-critical environment monitoring to customers around the world, even from the most remote and challenging locations.

The Florida-based provider of end-to-end IoT solutions has developed the proprietary Forest Capsule to address wildfire detection. The device uses advanced sensor technology to monitor environmental elements such as temperature, humidity, and CO<sub>2</sub> levels to detect the earliest indicators of a potential wildfire. It also incorporates AI (artificial intelligence) algorithms to generate real-time alerts, providing an accurate GPS location and risk-level assessment of the detected threat via pre-set alarm options such as SMS and email.

With a compact, rugged design for durability, the Forest Capsule operates autonomously and has a 10-year battery life, which makes it suitable for remote environment monitoring. All operations are managed via an intuitive dashboard, significantly reducing the need for on-site inspections. Leveraging Viasat's IsatData Pro (IDP) service, the Forest Capsule also features integrated long-range gateways to ensure secure and always-on connectivity to power its monitoring capabilities.

The Forest Capsule solution gives customers in various sectors, particularly agriculture, energy, and utilities, the assurance of alerts and information critical to mitigating potentially devastating events. It can be used for various scenarios, such as early wildfire detection with real-time emergency alerts, protecting critical infrastructure and assets vulnerable to wildfires, enabling safer disaster management in hazardous environments like forest fires, and providing fire alerts to safeguard agricultural operations.

The environmental data the device passively collects can also be shared with non-profit organisations, independent scientists, and universities, aiding research efforts to address climate change.

The new partnership with ELEVATE will enable Insign Solutions to extend its solution offerings to a wider range of industries. As part of the programme, Insign Solutions will gain access to Viasat's broader partner ecosystem as well as collaboration opportunities to develop further

IoT solutions for its customers.

The ELEVATE marketplace will help Viasat attract new customers in locations without reliable connectivity, or those that have mission-critical connectivity needs. It gives customers access to a broad spectrum of satellite-enabled IoT solutions, developed by a range of providers, and designed to enhance the efficiency, safety, and sustainability of businesses.

Simon Hawkins, VP, Enterprise Commercial & Innovation at Viasat, said, "We are pleased to welcome Insign Solutions to the ELEVATE programme – the go-to destination for satellite IoT innovation. With Insign Solutions, we will accelerate the development of IoT solutions to meet clients' mission-critical requirements across diverse industries.

"We have a rich tradition of industry collaboration, and partnerships with forward-thinking companies like Insign Solutions give them access to our development programme and state-of-the-art satellite communication network to deliver ground-breaking solutions fast."

Tarkan Cakir, CEO at Insign Solutions, added: "Our decision to join the ELEVATE community aligns with our ethos of harnessing technology to make the world a safer place. This is an opportunity for us to take the Forest Capsule solution to new markets, and to enhance wildfire detection capabilities around the globe. Viasat's connectivity will enable this vision to become a reality.

"By leveraging Viasat's capabilities, technical support and expertise, the solutions we offer will be more reliable. Joining the ELEVATE platform will also equip us to better navigate the fast-paced tech environment in which we operate. We are excited about what we see as an opportunity for mutual growth." □

## AI and automation as workforce co-pilots

Artificial intelligence, together with automation, is changing the landscape of the modern workplace – and changing the way humans and technology interact. Rather than viewing artificial intelligence (AI) or automation as a replacement for human workers, we need to recognise these technologies as co-pilots in workplace collaboration. This is the view of Filum Ho, CEO of Apollo Studios®.

To grasp the full potential of AI in workplace collaboration, it's important first to distinguish between automation and AI and understand where each excels, Ho says.

### Automation and its role

Automation, including robotic process automation (RPA) and bot workers, is the foundation of streamlining and optimising routine, rule-based and repetitive tasks.

This form of technology involves software programs that are trained to mimic repetitive human actions to perform various assignments, in business or industrial processes. RPAs can operate 24/7.

This technology used to be exclusively available to large

*Continued on page 9*



## AR – a valuable tool for harnessing generational skills

Process automation technologies continue to evolve and with these constant changes and enhancements we are moving closer to Industry 5.0.

Hennie Colyn, Direct Sales Executive, Process Automation at Schneider Electric, suggests that where Industry 4.0 is about machine and system interconnectivity, the next industrial revolution will bring people back into the heart of the equation, with people and machines collaborating to share their combined strengths in new ways.

In this regard, retaining and growing process automation skills is especially important. As in many industries, process automation typically has several generations working together, each playing their part in the value chain. Technologies like augmented reality (AR) can help bridge some of the skills gaps.

“Augmented reality is a powerful technology when used appropriately,” says Colyn. “For instance, AR can be used to provide digital training – tablets can scan equipment and display step-by-step instructions as well as enabling photo taking and biometric thumbprinting for access control. The supporting software is cloud-based and will therefore provide regular updates on new skills required for the newest PLCs (programmable logic controllers).”

Colyn says that, like other industries, process automation is at risk of losing skills if the generation gap is not overcome soon. “We are finding that skills gaps are the result of generational shifts in the types of occupations people choose to pursue.

“To attract new talent, contractors are investing in technology and software to help bridge the gap between

the needs of the industry and the talents of the new generation. Technology like AR can also bring older, seasoned workers up to speed and overcome the disconnect between the generations,” he says.

Global non-profit organisation, Augmented Reality for Enterprise Alliance (AREA), says AR can be used to present critical, contextual information, real-time insight, and remote expertise to frontline workers at the point of need, directly in the user's line of sight, on industry-leading mobile devices and hands-free headsets.

“Augmented work instructions, 3D products, video tutorials, schematics, IoT data, and other digital content appear on top of the work environment, directing frontline workers to do the job efficiently and accurately the first time,” says AREA.

AREA also emphasises that with AR, senior technicians can be more accessible to less experienced workers. Using an AR-supporting device, junior technicians can instantly share their view of a machine with a remotely located expert who, in turn, will guide them through a particular task, speeding up problem solving.

“Schneider Electric's EcoStruxure Augmented Operator Advisor software architecture improves operational efficiency with AR, enabling operators to superimpose current data and virtual objects onto a cabinet, machine, or plant,” Colyn explains. “Importantly, the software combines contextual and local dynamic information for mobile users, enabling them to experience a fusion of the physical, real-life environment with virtual objects,” he says. □



Hennie Colyn, Process Automation at Schneider Electric.

*Continued from page 8*

er companies, but it is increasingly becoming available to businesses of all sizes – and especially SMEs. If they use the technology correctly, SMEs can benefit substantially from RPAs and potentially level the playing field with larger competitors, says Ho. In turn, this can help SMEs grow faster and create more jobs for South Africa.

In workplace collaboration, automation's role lies primarily in handling tasks that can be clearly defined, where human intervention is not necessarily required. Here, automation is supporting employees in their work by ensuring these tasks are completed accurately and promptly. With this support, human workers can focus their energy and capability on more complex, creative and strategic endeavours.

### AI has other capabilities

On the other hand, artificial intelligence (AI) is not just another tool, but one that augments human capabilities in unique ways. Unlike automation, AI and machine learning have the ability to learn, adapt and make decisions based on data analysis. These technologies can comprehend natural language, recognise patterns, and predict future outcomes.

In workplace collaboration, AI can assist in predictive

analytics, customer data management, natural language processing for chatbots, and in some cases, creative tasks such as content generation and recommendation systems. However, human intelligence is still required to vet these capabilities and ensure they make sense.

### Human-AI collaboration

The power of workplace collaboration is realised when automation and AI are integrated into human workflows. In this world, humans remain at the centre, contributing their creativity, emotional intelligence, and strategic thinking.

For organisations seeking to make the most of technological transformation, it is important that they understand the distinction between automation and AI. By striking a balance between people, automation, and AI, organisations can empower their workforce to achieve greater levels of productivity and innovation.

“Empowering the workforce is even more important when we consider the high level of unemployment in South Africa,” says Ho. “More than ever, we need to ensure that South Africans are upskilled and equipped from a young age to be able to adapt to the fast-paced technological changes that are changing our world.” □

# Mitigating lightning related risk in free-field PV plants – a practical approach

Ivan Grobbelaar, Technical Director, DEHN Africa



Ivan Grobbelaar,  
DEHN Africa.

**With the global focus on shifting to renewable energy, constant improvement of technology and the reduction of material costs are important factors in the success of this transition. With increasing sizes of utility-scale solar photovoltaic (PV) plants, the margin for error becomes smaller, from a budget perspective. Small mistakes in calculating implementation or operational costs can lead to extensive losses for the plant developers or owners.**

With larger installed capacities, there is also a potential increase in lightning related risk and potential loss due to lightning. This is dependent not only on the installed area, but also on the type of technologies selected and power purchasing agreements (PPA). Certain PV design schemes carry a smaller risk than others, and factors such as generation capacity required in terms of the PPA could lead to penalties for the seller if it cannot meet demand following losses due to lightning.

Having worked extensively with the renewable energy sector, we have identified a few key factors that need to be considered concerning lightning protection and earthing. If not addressed during the construction phase, these could have a significant impact on the operation of the PV plant. They can be narrowed down to four characteristics of lightning, where we specifically focus on three of the four points, as outlined below.

Lightning consists of an impulse waveshape (Double-exponential / Heidler function), as opposed to a sinusoidal waveshape, which we know from electrical engineering.

The four characteristics in referring to the lightning impulse are:

1. The peak value of the impulse (measured in kilo-amperes/kA) –  $I$ ,

2. Steepness of the lightning current impulse –  $di/dt$
3. Charge of the lightning current (measured in coulomb) –  $C$
4. Specific energy measured in  $A^2s$  –  $W/R$

These four characteristics, combined with specific installation errors, are typically at the root of damages on utility-scale PV plants. The installation errors relate mostly to:

- i. Poor grounding / earthing meshes
- ii. Large loops in cables (especially dc string cables)
- iii. Incorrect dimensioning of lightning protection systems (LPS)

## Poor grounding meshes

Lightning protection is defined according to SANS 62305 in terms of four lightning protection levels (LPLs), each with a maximum and minimum peak value, which are used in the sizing criteria for lightning protection components, systems and surge protective devices (SPDs). The ranges of the four levels are defined as in Table 1.

It is further prescribed in SANS 61643-32 that SPDs are required to carry a total of at least 10 kA lightning current for voltage limiting SPDs and a total of at least 20 kA for voltage switching SPDs. In the surge protection industry, some of the highest rated PV dc SPDs carry only up to 25 kA of lightning current and, referring to Table 1, it can be seen

that maximum peak currents may be expected up to 100 kA, even for the lowest levels of protection.

These requirements from SANS 61643-32 are based on the premise that PV plant should have a meshed earthing grid, which should be 20 m x 20 m; similar standards recommend up to 40 m x 40 m for larger plants. When a lightning strike enters the lightning protection system via air-termination rod interception, being conducted to earth, it should distribute along appropriate conductive parts and disperse into the soil, before reaching the equipment where the SPDs are installed. If enough lightning current is divided and dispersed, the SPDs with a 25 kA rating are not overstressed. Without an appropriate

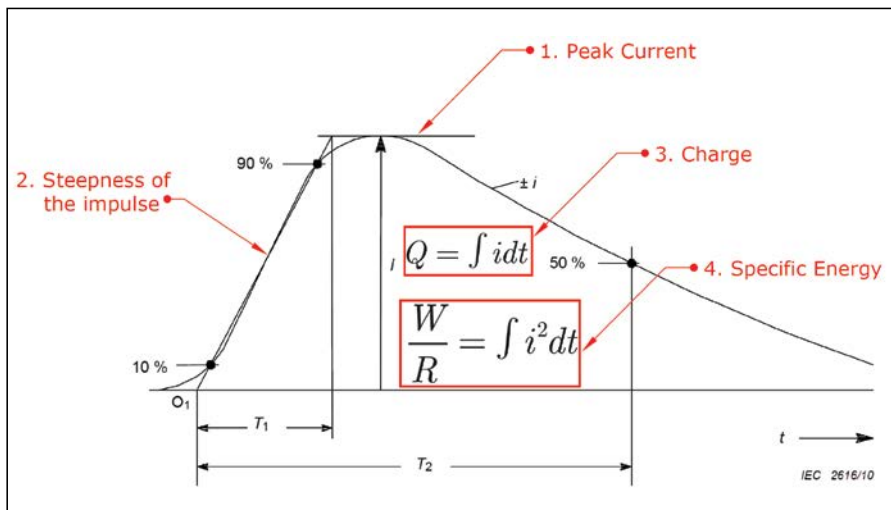


Figure 1: Lightning impulse waveshape (IEC 62305-1: 2010).



Lightning protection level	Minimum value (kA)	Maximum value (kA)	Probability of current being < maximum	Probability of current being > minimum
I	3	200	99%	99%
II	5	150	98%	97%
III	10	100	95%	91%
IV	16	100	95%	84%

Table 1: Lightning protection levels.

meshed earthing system, it could be possible that the *peak value of lightning current* would overstress the SPDs and thus lead to damage of equipment such as inverters, string combiner boxes, tracker motor controllers, and suchlike.

There are practical ways to achieve current distribution without having grids installed in the soil and these should be addressed early during the design stage. They could include using above-ground structures as natural components, or adding other current distribution paths that safely carry lightning currents.

Figure 3 shows the *peak lightning current values* through a string combiner box for different earthing mesh sizes.

### Loops in dc cables

It is commonly seen that the installation of dc string cables can lead to creating large loops. In such configurations, cables are unintentionally routed apart from each other under the PV modules (solar panels) where stringing includes the series and parallel connections of panels back to string combiner boxes or string inverters.

The *steepness of the lightning current impulse* is responsible for possible induced voltages on string cables. In Figure 4 it can be seen that the induced voltage is a factor of the *steepness of the lightning current impulse* as well as the size of the loop where voltages could be induced.

The induced voltage is calculated by:

$$U = M \times \frac{di}{dt}$$

Where M is the mutual inductance of the loop.

Figure 5 indicates the possible scenario on a free-field PV plant. If a lightning protection system is installed on a PV tracker structure, it is likely that lightning current will flow on the torque tube/ structure before reaching an earthing

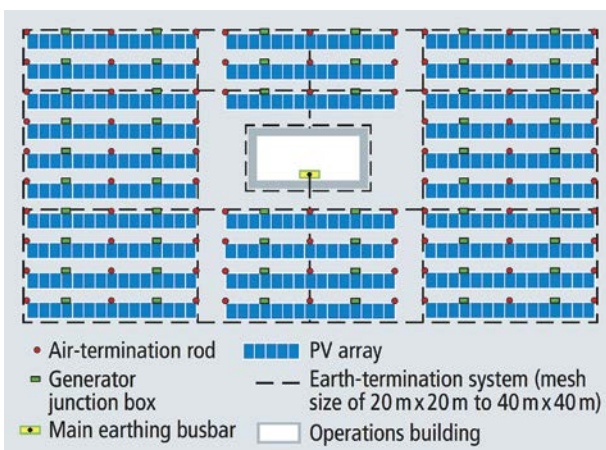


Figure 2: Meshed earthing system for current distribution in PV installation.

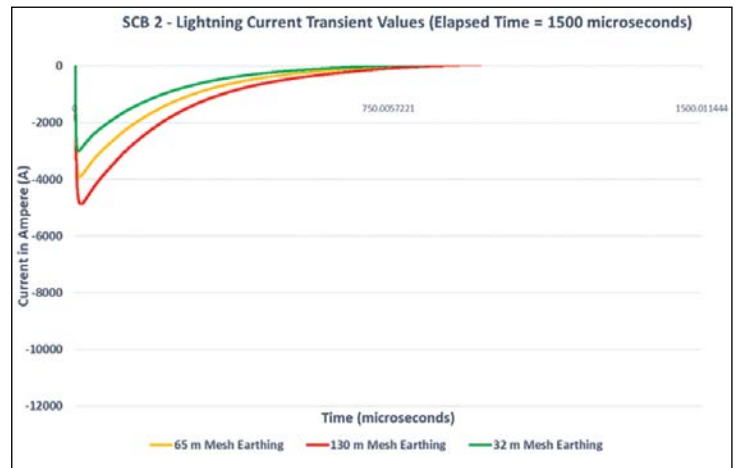


Figure 3: Lightning current in SCB for different earthing mesh sizes.

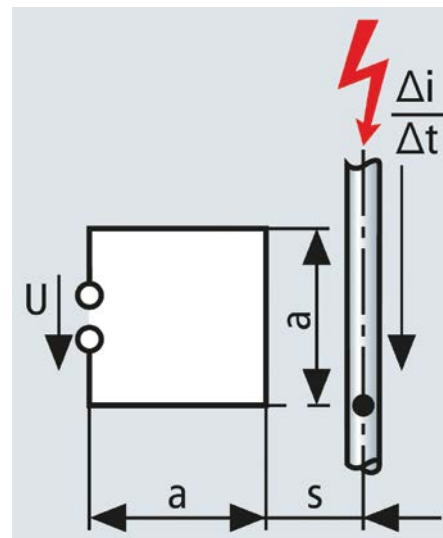


Figure 4: Induced voltage in loop due to current carrying component.

connection. It is thus possible that large amounts of current flowing on the torque tube, with a high *steepness of lightning current impulse*, could create a large induced voltage in PV dc loops in the surrounding area, if care is not taken to minimise the loop size (a). Large induced voltages would result in high voltage stress on SPDs, PV modules, and other electronic equipment and possibly also cause flashover into the dc string cables.

### Incorrect dimensioning of lightning protection systems

As indicated in Table 1, lightning protection is defined in

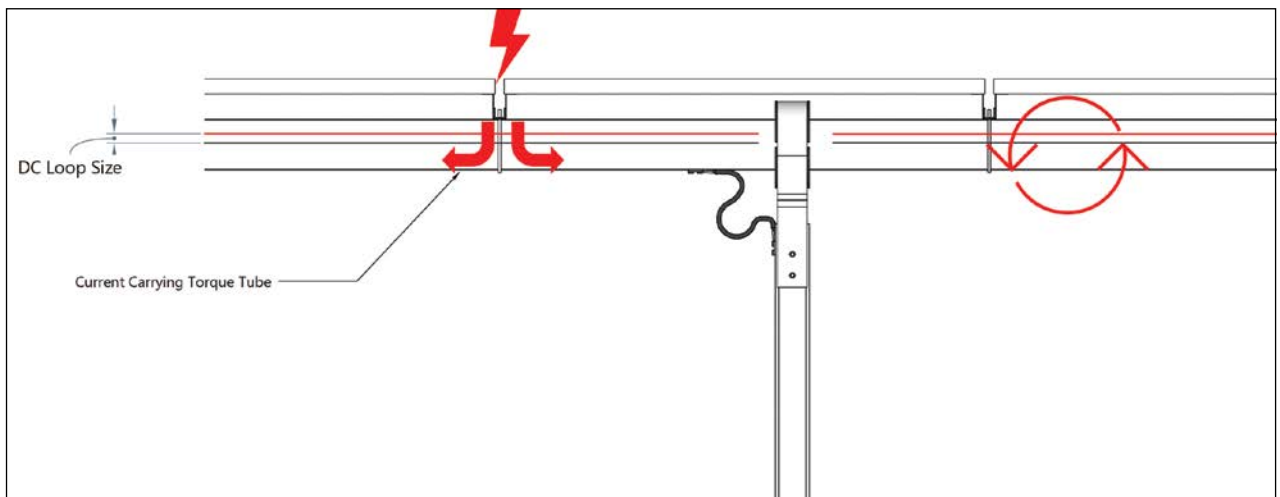


Figure 5: Induced voltage on dc string cables via tracker structure.

four levels (LPLs), each sized according to criteria for maximum and minimum peak values. We have seen how maximum values could overstress equipment, components and SPDs. It should also be noted that the minimum value of each LPL is important in the dimensioning and design of a lightning protection system (LPS).

Lightning protection systems can be designed using three different methods, where the most comprehensive is known as the Rolling Sphere method. The method is based on electric field strength theory, dating back to the experiments conducted by Benjamin Franklin using a kite.

The goal is to determine possible strike locations for a downward lightning strike, using a 3D sphere representing the electric field strength around the tip of the downward leader. Any object with which the sphere makes contact indicates a possible point where lightning could strike, that is, one offering a preferred lower-impedance path in comparison to air. For the most comprehensive lightning protection systems, focus is shifted to minimum lightning current values, to ensure smaller *peak value current lightning strikes* are also intercepted by designing with a smaller sphere, which would contact more objects. Figure 6 illustrates the concept.

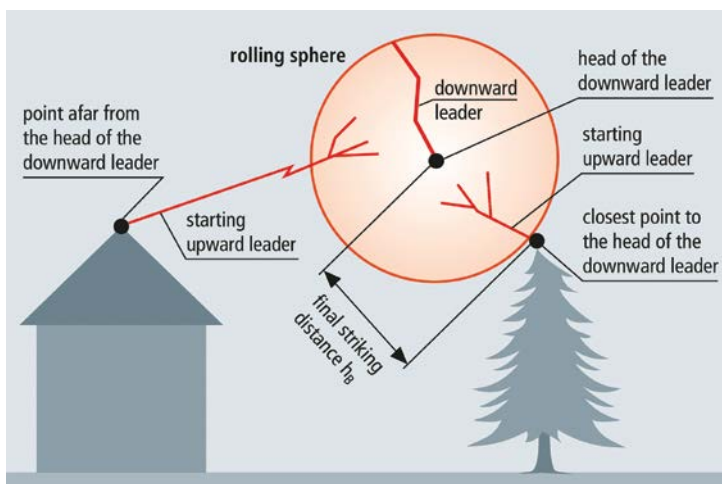


Figure 6: Concept of the 3D rolling sphere.

It is often seen as the outcome of the lightning risk analysis that a lightning protection system of LPL IV would be sufficient to protect the PV plant and keep damages below the tolerable value. In most cases this presents a risk, as the lightning risk analysis is conducted according to SANS 62305-2, which is aimed mainly at closed buildings and not free-field PV plants. Although the calculated outcome might indicate that LPL IV is sufficient, closer inspection may show it would be insufficient for a PV plant, if the differences of each PV plant are not taken into account.

SANS 61643-32 makes explicit recommendation that LPSs for PV plants should be designed to a minimum of LPL III, due to the fact that lightning strikes commonly fall below 16 kA in such open areas. In experience and practical studies (obtaining information from the South African Weather Service), it has been noted for various different plants that anywhere between 45 and 70% of lightning strikes in a single storm have had peak values smaller than 16 kA, and could possibly not have been intercepted by an LPL IV lightning protection system. Thus, the system would not be sufficient in protecting the PV area, and damages would exceed the residual losses indicated in the results of a risk analysis.

With the increase in demand for PV plants and in installation size, lightning risk also potentially increases. As the renewable energy industry is a cost-sensitive market, lightning protection is commonly overlooked, and this could result in high costs of damages and operational expenses. By addressing the three most common installation and design mistakes, it is possible to reduce the cost of lightning protection significantly and still maintain high levels of protection. It is strongly advised that these factors should always be considered when independent power producers, developers, installers, or owners of PV plants consult with a lightning protection engineering specialist. □

For more information visit: [www.dehn-africa.com](http://www.dehn-africa.com)



# Kitchen waste as a cooking fuel – it works

*Food scraps seem an unlikely ally in any battle – except in the one we cannot afford to lose. Dr Karen Surridge of SANEDI reports how two military bases in Limpopo are demonstrating that the battle to save the planet can be won one kitchen at a time.*

A man on a military base who talks and sings to what is in essence a high-tech compost heap is not an everyday sight. However, at South Africa's most northern air force base, on the outskirts of Louis Trichardt in Limpopo, civilian military member, Morris Rathumbu has forged a close relationship with the biodigester he has made his own over the past two years.

Air Force Base Makhado and the 523 Squadron (SQN) army base in the town of Louis Trichardt were selected, in partnership with the South African National Energy Development Institute (SANEDI), as the pilot sites for the Department of Defence's biodigester project in 2021. This saw the installation of a pre-cast biodigester at each base to turn kitchen food waste, which is normally sent to landfill, into biogas that is used for cooking.

The biogas plants consist of large, sealed anaerobic digesters in which waste material is decomposed to produce methane gas. The anaerobic digesters were installed underground at the bases, to make them unobtrusive and to prevent any unpleasant sights or smells around them. In addition to providing gas for cooking, the digesters produce an organic byproduct, called the digestate, which is an excellent organic fertiliser.

A relatively simple solution to the twin problems of waste management and increasing energy costs makes sense. However, a critical factor that supports their success – or often scuppers biogas projects, Surridge says, is people. "Biodigesters are the most labour-intensive renewable energy technology. I liken it to having a baby, and people don't believe that until they have a biodigester to look after and keep alive."

Literally. Biodigesting is an organic and biological process driven by the same bacteria that keep the human digestive system healthy. It is the live organisms that make every biodigester unique, with its own preferences and quirks. And that is why they require such care.

## *At Air Force Base Makhado*

"I know my biodigester likes more water on Wednesdays and the time it takes me to sing Happy Birthday twice gets enough water into the digester's daily diet," says Rathumbu. "I love this technology because it is like having a family. Learning about it has broadened my horizons."

Surridge remembers Rathumbu being immediately interested when she introduced the project two years ago. "It is thanks to his dedication that the biodigester is such a success at the air force base," she says. Where it usually



*Karen Surridge of SANEDI, together with civilian military member, Morris Rathumbu, who takes care of the biodigester at Makhado Air Force Base.*

takes a biodigester six months to become fully operational, Rathumbu's plant reached that point in only four months and in the two years since then it has run without a glitch. "I have not seen another project like this," Surridge says, "where a biodigester is this happy."

The upshot is that the digester produces enough gas for the stove-top cooking required to provide breakfast and supper for 220 people at the base, every day. This will amount to a predicted saving of around 116 MWh of electricity over the combined system's lifetime. Based on this performance, it will be possible to add two more biodigesters in parallel to power additional cooking burners and a water heater in the kitchen.

## *At the 523 SQN army base*

The pilot project at the 523 SQN base took a more roundabout route to success. Although the base commander had also adopted his biodigester from the start, the duties of a high-ranking officer limited the extent of attention he could give it. "Twice since July 2021 the biodigester had almost 'died' and had to be resuscitated," Surridge says – both times when the commanding officer had been away from the base. In the first instance, it seemed that cleaning fluids used to clean the sink in which the macerator is installed had somehow reached the biodigester and had quickly killed all the bacteria. In the second instance, the system

was fed too much undiluted starch, which clogged the pipes and the resultant gas build-up blew back into the kitchen through the sink. A messy failure.

Fortunately, neither of these incidents "killed the biodigester" and they provided useful lessons. Although it has taken almost 21 months to reach full capacity, 523's biodigester is now humming, producing enough cooking gas to prepare daily meals for the people stationed at the base.

#### *Performance data*

Over the past two years, Surridge has collected performance data from both biodigesters. This shows that to date, 17.5 MWh of electricity has been saved, 6.5 tonnes of CO<sub>2</sub> emissions avoided and 30 tonnes of kitchen waste diverted from landfill.

The two bases were chosen to demonstrate that biodigester plants can be tailored to specific needs and provide a range of solutions, and that they can be scaled up or down, depending on the energy requirements and raw materials available. "Two years down the line we can declare the pilot project a success," says Surridge.

Reflecting on what the project team has learned and will apply in future projects, Surridge emphasises again the human-centric nature of the technology. It is a live system that needs looking after, and while it's not a full-time job it is certainly a constant one. "This technology requires the mindset of doing something for the greater good," she says.

In addition, Surridge highlights the importance of integrating the system into the daily routines and rhythms

of a kitchen. The sink with the macerator that chops up the food scraps must be where the food preparation is done, and the gas burners close to the existing stoves and ovens. New ways to automate the system more are currently being assessed and would make adoption easier.

She says it takes about six weeks of feeding the system before it starts producing any gas and another two or three months before it is gas that can be used for cooking.

Once it works as it should, the rewards are plentiful. The military bases are saving money, supporting the environment and contributing sustainably towards the DoD's green soldiering initiative. Additionally, during loadshedding, gas from the biodigester has supported the AFB Makhado kitchen in serving hot meals. Furthermore, the more gas is used, the more the digester will produce. At present the gas is not storable and needs to be used as it is produced.

The biogas project is one of several waste recycling and energy saving programmes being undertaken by the SANDF in partnership with SANEDI. The DoD and SANDF want to reduce energy-usage costs, while ensuring that military bases have energy security in the context of the constrained energy system. The biogas project is also aligned with the SANDF's green soldiering concept under which environmental protection measures are being introduced in all its operations. □

For more information visit: [www.sanedi.org.za](http://www.sanedi.org.za)

## ENERGY MANAGEMENT + THE INDUSTRIAL ENVIRONMENT : PRODUCTS + SERVICES

### Rack-mounted three-phase online UPS

Power management company, Eaton, is introducing its latest rack-mounted three-phase online uninterruptible power supply (UPS) to the South African and East African markets. The new Eaton 93PX 15-20 kVA UPS combines high efficiency with a compact footprint, lower total cost of ownership (TCO), and improved cybersecurity, all aimed at providing stable power for critical IT, industrial, manufacturing, and other applications.

One power module and two battery packs, each occupying 3U of space, are required to achieve a fully operational solution. This makes the total space requirement for a comprehensive setup 9U. If the Maintenance Bypass module is also included, the total rack space required would be 12U. Parallel operation can be implemented to achieve redundancy or an expanded power rating. For added flexibility, the UPS can be deployed as a rack-mounted or freestanding (tower) unit. The large colour touchscreen rotates

automatically, using the built-in gravity sensor.

Optimising the use of Eaton technologies, such as the Energy Saver System (ESS), the 93PX is said to offer the lowest TCO on the market. With its unity power factor, it can power more servers than UPS units with equivalent VA ratings but lower power factors. This efficiency makes the Eaton 93PX UPS particularly cost-effective, providing for substantial savings in annual operating expenses due to reduced energy usage, power costs and cooling expenses.

The intelligent power management software of the 93PX UPS is compatible with all major types of virtualisation software. With the integrated intelligent features and the connection to the Eaton Brightlayer suite, users can monitor, control and optimise their energy usage, addressing issues as they arise or preventing them entirely. Additionally, the Eaton UPS has been designed to operate in harsh environments, so it is robust enough for applications outside of communications rooms.

To address the need for greater cybersecurity, the 93PX UPS is designed to include Eaton's Cyber Secured Monitoring. This feature provides faster responses to malfunctions, delivers regular, comprehensive reports on UPS performance, including predictive analysis, and facilitates lifecycle management. □

*Eaton's 93PX 15-20 kVA UPS combines high efficiency with a compact footprint and provides stable power for critical applications.*





## New grid allocation opens access to wheeled solar energy

SolarAfrica has announced the successful issuing of an Eskom budget quote (BQ) for the company's utility-scale solar PV project in the Northern Cape. This marks a significant milestone for the company and a major leap towards making wheeled energy available to South African businesses that could not previously access it.

The rules for grid capacity allocation have changed. A few months ago, Eskom levelled the playing field for projects participating in the Renewable Independent Power Producer Procurement Programme (REIPPPP) with a 'first ready, first served' approach – giving shovel-ready power generation projects priority in the queue over the projects that, in terms of the previous 'first come, first served' approach were taking up valuable capacity allocation but were not ready to proceed. For a project to be given the 'green light', it must undergo extensive and stringent evaluations before it can obtain a budget quote, which serves as official confirmation that the project has been allocated capacity on the national grid.

As one of the first private-sector providers to receive a BQ since the new rules were implemented, SolarAfrica worked carefully to meet all Eskom's strict criteria, the most important of which is having customers signed up and ready to use wheeled energy via Virtual Power Purchase Agreements (VPPAs). With several companies – including Vantage Data Centres, Attacq, and NCP Chlorchem – already signed up to SolarAfrica's VPPAs, the doors are now open for more businesses across the country to benefit from wheeling.

"Securing this type of grid capacity for wheeled energy is a game-changer," says David McDonald, CEO of SolarAfrica. "Typically, most grid capacity is already allocated to mega institutions and large-scale energy-intensive operations. With our holistic suite of solutions and our one-to-many wheeling arrangements, we can provide power to a wider range of commercial and industrial businesses to help them save substantially on their electricity bills and improve their carbon footprint significantly," McDonald says.

Regarding the issuing of BQs to independent power producers in the renewable energy sector, McDonald says: "A precedent has now been set in the sector where government acknowledges the role that private enterprises play in advancing sustainable practices and this sends a strong signal that the nation is serious about expediting the transition to renewable energy. This efficient approach to decision-making instils confidence in investors and demonstrates a willingness to adapt and embrace modern energy solutions."

The issuing of the BQ also supports customer confidence. "In light of Eskom's new rule, the BQ serves as a stamp of endorsement, reassuring our customers that we have lived up to the benchmarks we set for ourselves as a company, as well as the promises we have made to our clients. We made a commitment to



*With the BQ confirming grid allocation, SolarAfrica is set to start construction on its new Northern Cape solar PV project.*

provide power, and now, as we start construction we aim to wheel energy from this plant by 2025."

The issuing of BQs is not only for the benefit of IPPs like SolarAfrica; it benefits the country too. Although wheeling is not an overnight solution to loadshedding, it will go a long way in relieving power generation pressure off the state utility and further driving the adoption of renewable energy in South Africa. "By partnering with the private sector, Eskom can also benefit from the infrastructure investment and technological advances that independent power producers bring to the table. This means more providers can wheel energy into the existing grid, minimising disruptions, enhancing the overall efficiency of the energy system, and promoting the use of renewables," McDonald says.

As part of the larger Starsight Energy merged group, SolarAfrica, with this confirmation of the BQ, is further supporting the group's vision of being the leading pan-African provider of on- and off-site renewable energy solutions on the continent.

"We are always looking for opportunities to cross-leverage innovation," says Charl Alheit, Group Chief Investment Officer. "Establishing a utility-scale solar farm in South Africa will allow us to replicate its success in other regions to meet country-specific energy and wheeling requirements."

SolarAfrica's first utility-scale wheeling project, known as SunCentral, will break ground within the next few months in De Aar in the Northern Cape. This is one of several utility-scale projects the company is developing. SunCentral will consist of three phases, with a total of up to 1 GW in available allocation. Phase 1 will offer around 300 MW which will be generated by more than 560 000 solar panels. Once completed, this will allow SolarAfrica to wheel solar energy generated in De Aar to various commercial and industrial businesses across South Africa before the company starts on construction of Phase 2. □

## Additives enable savings on generator running costs

BMG has teamed up with Liqui Moly – a global leader in additives, motor, transmissions and hydraulic oils – to offer cost-saving solutions to the local generator market.

“As South Africa continues to face the challenges of daily loadshedding and unplanned power outages, many companies are investing in alternative sources of power supply to maintain operations. Although emergency power generators are a popular choice to keep businesses running, the costs associated with running and maintaining them are often overlooked,” says Carlo Beukes, Business Development Manager, Agricultural, Automotive and Lubrication divisions at BMG. “Generators often operate at low efficiency rates, resulting in exorbitant diesel consumption and a significant erosion of company profitability.

“There are many reasons generators have a high oil consumption at times, including the use of incorrect or poor-quality oil, which causes deposits to form on the piston and oil scraper rings which then seize. This means the crankcase chamber can no longer be sealed against the combustion chamber and, as a result, fuel contaminates the oil that enters the combustion chamber where it is also burned.

“Liqui Moly lubricants and additives, which have been specially developed to reduce wear and extend maintenance intervals, ensure generators function efficiently and remain always operational. The use of additives makes fuels more stable and more ignitable, to achieve greater



*BMG has teamed up with Liqui Moly to enable savings on generator running costs.*

efficiency, particularly with lower fuel quality. In addition, the use of additives reduces pollutant emissions and fuel consumption. Additives in the fuel can also improve the cetane number, clean the system and keep it clean. This means less fuel is needed and there are fewer defective parts. In turn, generator downtime is reduced. Liqui Moly additives also protect the entire fuel system from corrosion.

“BMG and Liqui Moly specialists have joined forces to offer the local generator market a dependable solution that yields major savings in generator running costs. The costs of diesel and maintenance for generators can mount up to

*Continued on page 17*

## Eskom opens first of its kind battery energy storage project

On 9 November 2023, Eskom officially opened the first of its kind and largest Battery Energy Storage System (BESS) project in South Africa and in Africa. The Hex BESS project in Worcester in the Western Cape is the first installation to be completed under Eskom's flagship BESS project, announced in July 2022 and intended to help alleviate the pressure on the national electricity grid. It offers one way to help address South Africa's long-running electricity crisis. By introducing more storage capacity, the BESS project will strengthen the grid and, at the same time, contribute to diversifying the energy generation mix. It will use large-



*The Hex BESS installation is designed to store 100 MWh of energy and, together with about 2 MW of solar PV capacity, forms part of Phase 1 of Eskom's overall BESS project.*

scale utility batteries with a total capacity of 1 440 MWh per day and a 60 MW PV capacity.

The Hex site is specifically designed to store 100 MWh of energy, enough to power a town such as Mossel Bay or Howick for about five hours. It forms part of Phase 1 of Eskom's BESS project which includes the installation of about 833 MWh additional storage capacity at eight Eskom Distribution substation sites in KwaZulu-Natal, Eastern Cape, Western Cape and Northern Cape. This phase also includes about 2 MW of solar photovoltaic (PV) capacity.

Eskom Group Executive for Distribution, Monde Bala said: “We are grateful to the funders of the Eskom BESS project, and to our construction partner Hyosung Heavy Industries. This is proof of what we can achieve when we work as a team and in collaboration with industry and local communities.”

The BESS technology offers a versatile solution to improve overall grid performance and is in line with South Africa's commitment to the just energy transition to a more resilient and sustainable energy future. The initiative demonstrates Eskom's commitment to finding innovative solutions and embracing new technologies in preparation for the new era in the energy distribution landscape.

“We are pioneering the implementation of the BESS

*Continued on page 17*



Continued from page 16

five times more than the cost of Eskom electricity.

"As an example, an average-sized generator can consume up to 60 litres of diesel per hour. In intense loadshedding cycles, a single generator can use 720 litres of diesel per day," says Beukes.

"Over the past three months, we have conducted accurate tests on site at BMG World in Johannesburg. The results show a reduction in diesel consumption, ranging between 11% and 18% across the five generators used in the trial. When we consider the high volume of diesel consumed daily, these cost savings quickly accumulate. And by reducing diesel costs, a company's earnings are boosted significantly."

Liqui Moly's Super Diesel Additive – which has been specially formulated for modern engines, fuels and demanding running conditions – contains a mixture of agents with cleaning, dispersing, material-protection and cetane-number increasing properties.

According to the BMG and Liqui Moly team, Super Diesel Additive has many benefits, including optimising engine performance, reducing fuel consumption and increasing the lubricating properties of the fuel. It also offers high wear resistance and corrosion protection and is formulated to boost the cetane number and clean the injection system, preventing the build-up of deposits and maintaining clean injection nozzles. Clean combustion is important because it protects the diesel particulate filter and prevents premature clogging. Super Diesel Additive also improves cold-start properties, reduces injector failures, ensures smooth operation and reduces the risk of engine failures from oil dilution.

**For more information visit: [www.bmgworld.net](http://www.bmgworld.net)**

Continued from page 16

technology to deliver a large-scale commercial project that will serve to validate the technology's feasibility and benefits. The successful implementation will pave the way for wider adoption and possible export of the technology to other regions beyond the borders of South Africa," said Eskom General Manager: Distribution, Operations Enablement, Velaphi Ntuli.

"The Hex project is a demonstration of what Eskom teams can do in finding alternative, innovative and lasting solutions to address the country's electricity challenges," said Eskom Group Executive for Generation, Bheki Nxumalo.

The Hex project benefitted the local community of Worcester directly by employing about 250 local community members, supporting twelve early childhood centres with playground and educational material, the donation of computers and five hundred full school uniforms. Further corporate social investment projects are to be executed before the end of March 2024.

On completion of this first phase, Eskom will implement Phase 2 of the project which includes the installation of a further 144 MW of storage capacity, equivalent to 616 MWh, at four Eskom Distribution sites and one Transmission site. The solar PV capacity in this phase will be 58 MW.

With the rollout of these technologies and the disciplined execution of its Generation Recovery Plan, Eskom will provide the much-needed megawatts to address the current capacity constraints.

**For more information visit: [www.eskom.co.za](http://www.eskom.co.za)**

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*The extended range of REVCON RHF-Active harmonic filters covers higher and lower power ratings than previously.*

## Expanded range of active harmonic filters

To help businesses better mitigate power harmonics in variable frequency drives (VFDs), power quality specialist CP Automation has expanded its range of REVCON RHF-Active harmonic filters.

The units use pioneering silicon carbide (SiC) technology to offer significant benefits compared with traditional components using insulated-gate bipolar transistors (IGBTs). The range of filters now extends to higher and lower power ratings than previously.

In addition to the existing 15 A, 35 A and 55 A units, CP Automation can now supply RHF-Active filters rated to 3.5 A, 100 A and 150 A. The filters provide harmonic mitigation from the 2nd to the 61st orders, as well as power factor correction and imbalance compensation. A typical switching frequency of 50 kHz increases efficiency and eliminates high harmonics, and the compact footprint facilitates retrofitting. Like the existing range, the units are modular – so they can be scaled to meet higher demands.

"This is a complete shift in technology usage," says John Mitchell, Global Sales & Marketing Director at CP Automation. "By developing SiC technology, REVCON is pushing the boundaries of the traditional limitations of the hardware and enabling significant savings in energy efficiency and space."

Expanding the range of filters provides benefits to facilities in several ways. First, organisations currently using several smaller units around a facility can streamline their operations by switching to a single, large unit within a centralised system.

For example, a single 150 A unit could allow consoli-

dation of site-wide mitigation to one room. In addition, the modularity of the filters means that by combining two or more of the larger units, much greater demands can be met – up to 450 A per cabinet, or more if multiple cabinets are combined.

Second, by facilitating mitigation at the device receiving power, the smaller units can assist organisations that need decentralised harmonic mitigation facilities and don't have the space for a larger, centralised system. For example, in a commercial bakery, each individual mixer machine could have its own 3.5 A filter, creating self-contained units without the need for a centralised mitigation system.

The compactness of the smaller filters could benefit original equipment manufacturers wanting to create low-harmonic equipment. Built-in filters can provide protection without significantly impacting footprint.

A further benefit of the filters is that they are self-commissioning in most applications. Rather than requiring an engineer to visit the site regularly, assess the power network and adjust harmonic mitigation accordingly, REVCON's RHF-Active filters have built-in intelligence that monitors the power and allows live autocorrection, should the power profile change.

Power profiles can shift for various reasons – with variations in load characteristics, for example – but an automated, self-commissioning system immediately adapts to ensure consistent protection.

REVCON's harmonic mitigation solutions can help businesses conform to regulations and standards, such as G5-5 recommendations on harmonic disturbance, EN 50160 or IEEE 519. □

## A new energy-efficient and scalable UPS

Vertiv, a global provider of critical digital infrastructure and continuity solutions, recently introduced the Vertiv™ Liebert® APM2 to its portfolio of uninterruptible power supply (UPS) systems. The Liebert APM2 is an energy-efficient and scalable power solution, compatible with lithium-ion (Li-ion) and VRLA batteries. It has a compact design and can scale from 30 kW to 600 kW in a single unit. Up to four matching units can be paralleled to provide additional capacity or redundancy. It offers significant energy savings compared to less efficient alternatives. The Liebert APM2 is a CE certified UPS system, available in 400 V in the EMEA region, Latin America, and Asia.

To serve the increasing power needs of edge computing applications, and meet the space constraints typical to such sites, the Liebert APM2 delivers a greater power output in a smaller footprint than similar capacity solutions, with Liebert APM2 models requiring up to 45% less space than Vertiv's previous UPS model, Liebert® APM. The Liebert APM2 can be installed in-row, in-room, against-the-wall, or back-to-

back, providing further application flexibility.

"Vertiv created the Liebert APM2 in response to the need for a compact and efficient product that delivers dependable power quality and availability to the network edge," said Kyle Keeper, Senior Vice President of Global AC Power at Vertiv. "The UPS is Vertiv's cutting-edge solution for handling increasing power infrastructure needs without necessitating a complete system overhaul."

The Liebert APM2 operates with high energy efficiency in all modes, up to 97.5% in double-conversion mode; up to 98.8% efficiency when operating in dynamic online mode, which draws power through the bypass line and uses the inverter for balanced output and as an active filter; and up to 99% when operating in ECO mode, which takes advantage of stable grid input conditions to leverage the bypass line. All modes are automated based on user preferences. The intelligent paralleling feature of the Liebert APM2 facilitates load sharing among multiple power modules, even across multiple units. This enables balanced unit runtime and offers automatic failover for enhanced system availability. Intelligent paralleling has also been shown to contribute to energy efficiency. □

*The new Liebert® APM2 UPS is designed to serve edge and mid-sized applications.*



## Better World products support sustainability in industry

RS South Africa, a global omni-channel provider of industrial product and service solutions for industrial customers, has launched its Better World product range. Products in the range have made sustainability improvements and are supported by trusted certifications and eco-labels. This will make it easier for RS customers – engineers, innovators and problem solvers – to make more informed purchasing decisions based on the sustainability credentials of products. In addition, a major focus of the range will be on products that save energy and/or water and cut CO<sub>2</sub> emissions, helping customers to reduce their environmental impacts and help tackle climate change. To achieve this, RS is working closely with its 2 500 global supplier partners to bring the latest cleaner and greener product solutions to the range.

Across industry, sustainability is increasingly a top business priority. However, it can be difficult for individuals and businesses to know which products or services incorporate environmental, social and governance (ESG) considerations in the way they are designed and made.

Market research reports that 89% of B2B buyers say if it was easier to identify sustainably certified products, they would be more likely to purchase more sustainable products. 55% of B2B buyers with sustainability goals say it is difficult to source suppliers that follow sustainable practices. Among this group, 81% of buyers agree this difficulty is holding their company back from achieving procurement sustainability goals (Amazon Business: State of Business Procurement Report).

RS South Africa has made it easy for people to identify its Better World range. Each product in the range is tagged with a Better World badge, and with a simple click customers can read about the product's sustainability certification or energy label, accredited by expert organisations.

To achieve a robust framework for the product range, the company partnered with trusted experts and selected more than 40 sustainability certifications and energy labels to highlight key products that meet or exceed sustainability standards and are better for the environment.

Over the coming year, RS plans to develop its model to recognise improvements in sustainability at different stages of the product lifecycle. It aims to offer more products that are made more sustainably and help customers lower their environmental impacts.

"Our customers want to purchase trusted products that are sustainably and responsibly made, and which help them to reduce their energy, water or resource consumption. We know it can be difficult to understand which products really are the best or the 'greener' choice," said Christian Horn, Chief Product and Supply Chain Officer at RS. "The Better World product range will make it easier for our customers to be informed and select products that will help them design, build, maintain and protect their business more sustainably and safely."

The RS Group itself has received global recognition as the 'Best Company for Sustainability Reporting' in the industrial sector at the Corporate ESG Awards. Commenting on this achievement, Andrea Barrett, VP Social Responsibility and Sustainability at RS Group, said: "We were delighted to win this award. It is testament to the progress we have made since launching our 2030 ESG action plan in November 2021." □



*The RS Better World range of products and service solutions is now available in South Africa.*

## High power, high reliability dc/dc converters

CINCON is a globally recognised manufacturer of power supply solutions. In its catalogue, TME features a wide range of products supplied by CINCON, including the CHB series of dc/dc converters.

The CHB converters are available in a range of power ratings, from 50 W up to 350 W. They are designed for THT (through-hole technology) mounting. Body dimensions vary between 57.9 x 61 x 12.7 mm and 57.9 x 61 x 13.2 mm. The units are fitted with all key protections, such as: over voltage protection (OVP), short circuit protection (SCP) and over temperature protection (OTP). They have an operating temperature from -40°C to 100°C.

Input voltage for the CHB series of converters ranges from 9 V to 425 V dc (depending on the model), usually with a 2:1 ratio between the minimum and maximum value. Output voltage can reach anything from 5 V to 48 V dc, and output current varies between 1.78 A and 70 A. The converters allow for the output voltage to be adjust-

ed within  $\pm 10\%$  of the nominal value. Efficiency ranges between 82.5% and 92.5%.

CINCON's CHB products can be applied in IT, industrial, medical and illumination systems. Due to their high efficiency, they will also serve well in electric vehicles. Some models have been manufactured in compliance with the EN5 0155 standard covering the shock and vibration requirements for railway applications. These converters can also be used in information technology systems, as they meet the requirements of the IEC/EN/UL 60950 safety standard. As the manufacturer, CINCON has sought to achieve a high level of reliability in the components. It estimates Mean Time Between Failures (MTBF) of the converters to be one million hours of operation at full load. □

**For more information visit: [www.tme.eu](http://www.tme.eu)**



*CINCON's dc/dc converter: CHB150W12-72S24.*

# Using the right maintenance tools can deliver energy savings

***Businesses worldwide face the dual challenge of rising fuel costs and environmental energy taxes; there has never been a more critical time to focus on reducing utility costs. Here, Sanid Usanovic reviews how a German food and beverage plant makes the Fluke ii900 Industrial Acoustic Imager a standard maintenance tool to achieve significant energy savings.***

For the efficient management of plant operations, the critical considerations for the energy manager include product quality, safety, downtime, and, of course, energy use. A production plant in Germany has set itself the goal to reduce greenhouse gas emissions by 25% by 2030 (using 2015 as a baseline) and turned to the Plant Energy Manager to help deliver that target. One way of achieving the goal is to reduce energy use. How can the plant energy manager accomplish this without impacting product quality, safety or downtime?

## Reducing environmental impact

Manufacturing firms worldwide are reviewing the efficiency of operations to reduce costs and drive down their environmental impact. Led by sustainability officers and supported by energy managers, efforts to lower energy usage are helping to decrease the environmental impact of production and contribute to global and local efforts to counteract climate change.

In 2011, the International Organisation for Standardisation (ISO) introduced its voluntary standard for the design, implementation and maintenance of an energy management system. Developed by a technical committee, ISO 50001, like other ISO standards, is intended to be realised across various industries and encourages adopters to implement a 'Plan, Do, Check, Act' framework for energy management. Since the Paris Agreement was adopted in 2015, the drive for more sustainable industrial operations to reduce the effects of climate change has accelerated.

In taking a stand against climate change and committing to reduce its greenhouse gas emissions, the bottling plant in Germany in focus in this article identified reducing



*The maintenance teams at the plant play a key role in ensuring efficient operations.*

the plant's indirect emissions from energy use as one crucial element of the programme. Specifically, this considers the emissions resulting from the generation of the electricity purchased by the company from the utility provider.

One area that came under review was how to tackle the energy wasted through leaks in compressed air systems. The Carbon Trust estimates that industry in the UK uses over 10 TWh of electricity to produce compressed air, making it the direct root cause of over five million tonnes of CO<sub>2</sub> emissions a year (The Carbon Trust: *Compressed air – business opportunities*).

## Compressed air as a resource

Approximately 90% of all companies use compressed air in some aspect of their operations, such that it is sometimes referred to as the fourth utility. However, compressed air is often generated on site, unlike other energy sources such as gas, electricity or water typically supplied to the site by an external utility provider. The manufacturing companies using compressed air are responsible for its efficient production and distribution.

Although many people may see compressed air as being as free as the air around them, due to the nature of the process, a significant proportion of the energy a compressor uses to compress the air is lost as heat. It is an energy-intensive process, and the environmental impact that electricity production can have makes it anything but free.

Once produced, compressed air is used to automate processes, package products, provide motive power, or generate other gases on site.

Clearly, the waste of this expensive resource needs to be minimised. The priority is to set up a leak reporting and



*The bottling plant is using the Fluke ii900 to locate compressed air leaks in the Clean-in-Place system, the syrup maker, and other areas.*



repair programme. This will give the plant manager an indication of where the troublesome connectors and lines are sited and allow for a repair strategy to be formulated to ensure the system is kept working efficiently.

### The cost of compressed air leaks

The energy consumption of the compressed air systems in the food and beverage processing plant constituted a cost of some R6 million per year. It is estimated that if there were no maintenance system in place, the losses due to leaks in the network would be between 25 and 30%. Implementing a maintenance regime from this starting point would clearly present potentially significant energy cost savings. Although it is always the goal, it is almost impossible for any plant to achieve a 100% leak-free compressed air system. The target for good practice is to keep energy losses due to leaks between 8 and 15%, and for best practice, between 6 and 8%.

### Maintenance methods

When checking for leaks, it is important to note that some components of a compressed air system are especially vulnerable, such as pneumatic cylinders, flanges, filters, tools, presses and drop hammers, which should be checked first.

Traditional ways of detecting leaks include listening for hissing sounds or coating joints with soapy water and checking for bubbles. The soapy water method is inefficient and inadequate for most manufacturing facilities, considering their size and the scope of compressed air lines. Many cannot hear the hissing of air leaks in a quiet environment, let alone an operational bottling plant.

Ultrasonic leak inspection offered an improvement on the soap and water method. Ultrasonic tools use microphones to identify the sounds associated with escaping air/gas, in a range of about 38 to 42 kHz. They convert sound captured in this range into audible sound and rely on human hearing to identify whether a noise is a leak. That makes the detection subjective and reliant on specific skills and training.

Large manufacturing companies like the bottling company in focus may outsource checks and inspections for leaks in compressed air networks. Specialist companies will carry out annual checks that could deliver what would be considered good practice levels of leakage, of between 8 and 15%. However, in this case, a new testing regime was sought, one less reliant on annual checks through a third-party vendor, in order to decrease the energy losses further by reducing leaks in the network.

The plant agreed to test the industrial acoustic imagers from Fluke to check for leaks in its compressed air systems.

Recent developments in industrial acoustic imagers, such as the Fluke ii900, have introduced an array of microphones that provides for the visualisation of the sound field within an expanded field of view. This enables maintenance teams to locate air, gas, or vacuum leaks in compressed air systems visually, very quickly and accurately. It makes it possible to detect leaks even in noisy environments and from a distance. Consequently, maintenance programmes can be carried out while the plant is operational.

The detected leaks are displayed on an LCD panel, so a user with little-to-no experience can detect leaks immediately. The acoustic imagers can evaluate the distance to the target and es-



*Using tools such as acoustic imagers can bring enhanced savings to maintenance routines and reduce energy costs, especially in manufacturing plants with high compressed air demands.*

time the size of the leak, making it easier to prioritise a repair schedule.

Importantly, solar loading on the facility and wind are environmental factors that must be considered in checking the compressed air system. Solar loading occurs when one or more sides of a structure are uniformly heated by the sun, which can mask temperature differences such that they are not visualised by the acoustic imager. Similarly, wind moving over a structure can wipe away thermal signatures or create unexpected pressure differences, leaving some problems undetected.

The bottling plant has started using the Fluke ii900 to locate compressed air leaks in:

- Conveyor systems
- Tubing, piping, flanges and valves in the Clean-in-Place system, the syrup maker, and the CO<sub>2</sub> blender
- Hard-to-reach gated areas.

The equipment can report an estimated size of the leak. From that data, it is possible to estimate the company's energy cost and evaluate the return on investment that effective leak detection and repair offers. Further, in terms of delivering a targeted reduction in carbon emissions, quantifying the energy lost is an essential feature so that the reduction in greenhouse gases can be calculated.

The Plant Energy Manager at the bottling facility said, "I was excited by this innovative technology from the time I first heard about it. The imager was purchased primarily to localise leaks in the compressed air systems used throughout the plant. We have already seen enormous energy savings."

### Looking ahead

As energy prices continue to increase, the need to reduce energy costs and deliver on shared sustainability goals intensifies. Many more consumer goods manufacturing companies are taking on sustainability and energy managers to reduce waste and spotlight opportunities to run the plant more efficiently. □

*For more information visit: [www.comtest.co.za](http://www.comtest.co.za)*



AMETEK Land has relaunched its SPOT pyrometer range with enhanced features for various industrial applications.

## Pyrometers relaunched with additional features

AMETEK Land, a leading manufacturer of monitors and analysers for industrial non-contact temperature measurement, has relaunched its market-leading SPOT pyrometer range with enhanced features to serve a range of industrial applications.

The new SPOT+ family offers a wide spectrum of temperature measurements from 50 to

3 500°C and a selection of different wavelengths for applications that include metals processing, glass, cement and lime kilns and foundries. The range includes monochromatic and ratio pyrometers, fibre optic heads and sophisticated algorithm pyrometers for the production of complex materials such as aluminium and galvanised steel.

The incorporation of new communications interfaces makes the SPOT+ ideal for Industrial Internet of Things (IIoT) factory automation applications in addition to traditional 4-20 mA signals. Ethernet/IP, REST API and Modbus TCP/IP are standard on SPOT+, and an integrated web server provides easy access for control and setup using a standard browser. Upgraded cybersecurity functions reduce the risk of unauthorised access to the instrument's functions.

An integrated video camera provides a visible light process view alongside infrared temperature measurement, which allows sighting to be carried out safely and easily. As the video images are available via the web-server and AMETEK Land's IMAGEPro software, alignment can be checked remotely and images logged for quality purposes.

The SPOT+ can be used in harsh environmen-

tal conditions, and in hazardous area zones 1, 2, 21 and 22 when mounted in LAND's high-specification EXSH enclosure. With response times down to 1 ms, SPOT+ pyrometers are also suitable for fast-moving processes.

AMETEK Land's SPOT pyrometers are built on extensive research and development and have always been at the leading edge of measurement technology. The new SPOT+ enhancements offer improved connectivity for easy integration with control systems, and the assurance that data transmission is secure. Upgraded electronic and electromechanical components ensure reliable and accurate operations, backed by AMETEK Land's 36-month warranty and supported by an extensive range of accessories for installations in the most demanding applications.

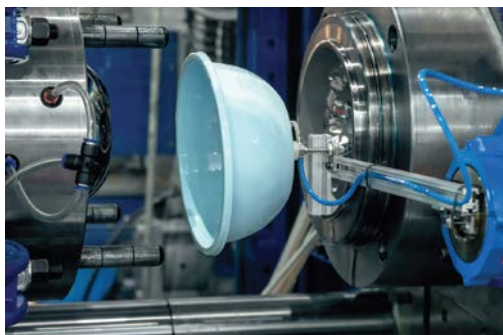
Dr Fiona Turner, Head of Product Management said: "The principles of infrared temperature measurement don't change, but over the last 10 years, there have been significant advances in automation and Industrial Ethernet. Customer focus on product quality and process efficiency has driven an interest in big data – and a risk of cyberattacks.

"I'm excited about the potential in using SPOT+ instruments for background temperature and emissivity correction of thermal imaging systems in IMAGEPro software. SPOT+ pyrometers provide more than temperature measurements – emissivity outputs are key indicators of product surface quality, and the facility to log visible light process images alongside infrared temperature measurement provides new insights into process conditions and product quality."

AMETEK Land products are available in South Africa through Johannesburg-based Protea Automation Solutions. □

## Supporting efficient production and process quality

Ifm's SBT type flow sensors support quality and efficiency in production processes, in injection moulding plants, for example, or tyre production or meat substitute



Providing continuous monitoring of conformal temperature control, the SBT flow and temperature sensor supports reliable process quality.

production. The sensor quickly and precisely determines the flow rate of the medium used for the conformal temperature control to heat or cool the mould, depending on the process step. In the process, it is not affected by air bubbles. With high repeatability, deviations from the setpoint are detected at an early stage, even when the flow rates

are very low. Hence, costly material waste due to premature or incomplete cooling is avoided.

Depending on the nature of the heating or cooling medium, the channels incorporated into the injection mould for conformal temperature control can become clogged over time. Deposits such as lime or dirt particles can reduce or prevent the flow of the heating or cooling medium. The SBT's precise sensor technology helps to identify maintenance requirements in the clogged piping system quickly and to prevent quality degradation.

Monitoring the flow and temperature has proven its worth in temperature control processes. It allows for the energy consumption of the production process to be monitored and optimised through precise control of temperature and flow.

**For more information visit: [www.ifm.com](http://www.ifm.com)**

## Think big, start small, scale fast

With its newly launched Asset Monitoring Gateway (AMG) Turck Banner introduces a scalable condition monitoring system that helps plant operators optimise and maintain critical equipment. Users can start with a few connected sensors and add more as their needs grow. The asset monitoring system can be sized to suit requirements. It is simple and quick to assemble and operate.

The gateway includes SNAP ID technology which enables it to identify a wired sensor automatically, understand what data the sensor is providing, then share and present the data in easy-to-understand units, for pressure or current, for example. The AMG allows for real-time insights into operation and performance of the assets in a facility by collecting and analysing data from up to 20 connected sensors, allowing the plant operator to make informed decisions about an asset; decisions that can increase productivity, save energy and prevent unexpected maintenance issues.

The AMG features a user-friendly, no-code setup and the ability to recognise, automatically, an array of compatible wired sensors that measure vibration, differential pressure, temperature and humidity, tank level and more. Sensors can be selected to suit the user's application and to monitor almost any asset in a facility, such as conveyor systems, industrial fans, pumps, electric motors, compressed air systems, and dust-collection units.

Deploying the AMG is quick and simple. Critical system information is easily viewed locally via the onboard touchscreen display, or remotely using the optional Turck Banner Cloud Data Services (CDS) platform, which provides access to the data in customisable online dashboards. This data offers maintenance and production teams real-time insights to evaluate operational performance.

### **Maximise uptime and increase efficiency**

The AMG with SNAP ID provides condition monitoring for predictive maintenance. Both the AMG and the optional CDS platform allow users to access, store and export critical data collected by connected sensors. From the device data, trends can be identified, maintenance requirements predicted, and costly equipment failures avoided, preventing unplanned downtime.

With Turck Banner wired sensors installed, the touchscreen display on an AMG can be used to view machine performance and provide comprehensive automation intelligence. Additionally, the optional CDS platform allows users to set up, customise and monitor online dashboards to gain global visibility into equipment from anywhere.

For a single asset, installing the AMG is easy. Using standard M12 connectivity, compatible wired sensors simply plug into the gateway and work. The sensors all use the same simple connections and can monitor various points. They are preconfigured to begin processing



*Installation of an Asset Monitoring Gateway with SNAP ID, monitoring vibration.*

data to the gateway automatically. No special expertise, laptop, or programming is needed. No matter what type of sensors are used, the gateway automatically identifies and communicates with them.

The onboard touchscreen display allows the user to commission the sensors, create unique names for sensors and groups, set warning and alarm thresholds and additionally, to enable vibration monitoring software – VIBE-IQ. The software uses machine learning to simplify the process of setting warning and alarm thresholds for rotating assets like motors and gearboxes. VIBE-IQ continuously monitors vibration for changes and sends warnings and alarms automatically to support optimal performance and prevent unplanned downtime. It does all the complicated analytical work, simplifying the monitoring process for users.

Furthermore, the onboard lighted indicator on top of the asset monitoring gateway shows the status of assets at a glance, even from a distance. When the indicator is green, all assets are operating normally. A yellow or red light indicates a warning or alarm, helping maintenance teams quickly identify an asset that is not performing as it should be.

Using the Turck Banner CDS, basic dashboards are auto generated on commissioning, and users can build a dashboard tailored to suit their needs. Drag-and-drop widgets and the ability to load images to the dashboard let the user build exactly what is needed to visualise operations. Customised alarms and alerts can be created based on the levels the user chooses for the sensors installed on equipment. These can provide remote users with email or SMS alerts, based on preset parameters. If multiple shifts are running, time constraints can be set so the right people get notified at the right time.

With the AMG it takes just a few simple steps to set up an end-to-end condition monitoring solution: install the gateway, connect and commission the sensors, then install the sensors – enabling users to 'Think big, start small and scale fast'.

**For more information visit: [www.turckbanner.co.za](http://www.turckbanner.co.za)**



# Electricity grids globally need upgrading

*Although the path to 1.5°C remains open, meeting this goal will require substantial investment not only in new technologies, but also in the world's energy infrastructure. Without this, progress on tackling climate change and ensuring reliable supplies of electricity could be put at risk. In a recently released report, Electricity Grids and Secure Energy Transitions, the IEA flags electricity grids as potentially the weak link in the chain. The report provides a first-of-its-kind stocktake of grids worldwide.*

**W**e have already seen in South Africa how grid constraints are limiting the integration of new renewable energy into the electricity supply system. This is in fact a global challenge. The report published by the IEA identifies a large and growing queue of renewables projects, worldwide, waiting for the green light to be connected to the grid. It pinpoints 1 500 gigawatts' worth of the projects that are in advanced stages of development.

Grids have formed the backbone of electricity systems for more than a century, delivering power to homes, factories, offices and public institutions, hospitals, schools and others. And their importance is only set to rise as electricity's role in energy systems increases. However, according to the report, there are clear signs that grids are not keeping pace with the rapid growth of key clean energy technologies such as solar, wind, electric cars and heat pumps. As the demand for electricity expands, the demands on grids increase. Where countries are adding renewable energy projects at a fast pace – they need more power lines to connect them and high-functioning electricity grids to ensure reliable supplies for end customers.

The new IEA special report examines the urgent upgrades required to physical infrastructure and the ways in which grids are planned and managed – quantifying the costs of delayed action. And it provides key recommendations for policy makers, highlighting what is necessary in areas such as investment, regulation and planning.



*Significantly higher investment in large-scale transmission projects is urgently needed worldwide to upgrade electricity grids and accommodate new clean energy.*

## Policy, planning, and investment

Without greater policy attention and investment, shortfalls in the reach and quality of grid infrastructure could put the goal of limiting global warming to 1.5°C out of reach and undermine energy security.

The report indicates that achieving all national climate and energy goals will require adding or replacing 80 million kilometres of power lines by 2040 – equal to the extent of the entire existing global grid. This is reflected in a detailed country-by-country analysis carried out for the report. Major changes to how grids operate and are regulated are also essential, and annual investment in grids, which has remained broadly stagnant, needs to double to more than USD600 billion a year by 2030.

Highlighting 1 500 gigawatts' worth of renewable energy projects that are in advanced stages of development and waiting for the green light to be connected to the grid, the report notes that this is five times the amount of solar PV and wind capacity that was added worldwide last year.

IEA Executive Director Fatih Birol commented: "The recent progress we have seen in clean energy developments in many countries is unprecedented and cause for optimism, but it could be put in jeopardy if governments and businesses do not come together to ensure the world's electricity grids are ready for the new global energy economy rapidly emerging. This report shows what is at stake and what needs to be done. We must invest in grids today or face gridlock tomorrow."

## Strategic actions

A new scenario developed for the report, the Grid Delay Case, examines what would happen if grid investment is not scaled up quickly enough and regulatory reforms for grids are slow. It finds that cumulative carbon dioxide (CO<sub>2</sub>) emissions between 2030 and 2050 would be almost 60 billion tonnes higher due to a slower rollout of renewables that results in higher fossil fuel consumption. This is equivalent to the total CO<sub>2</sub> emissions from the global power sector over the past four years. It would put the global temperature rise well above the Paris Agreement target of 1.5°C, with a 40% chance of exceeding 2°C.

The report identifies several strategic actions that can make a difference. These include expanding and strengthening grid interconnections within countries, between

countries and across regions to make electricity systems more resilient and allow them to better integrate rising shares of solar and wind power. The report recommends that governments back large-scale transmission projects to ensure grids are prepared for further strong growth in renewable power. And it urges grid developers and operators to embrace digitalisation to enable the grids of the future to be more resilient and flexible.

The need for decisive action is urgent because of the long lead times involved in modernising and extending grids. New grid infrastructure often takes five to 15 years to plan, permit and complete – compared with one to five years for new renewables projects, and less than two years for new charging infrastructure for electric vehicles.

Improving and expanding grid infrastructure in countries worldwide will require stronger international collaboration.

Emerging and developing economies, excluding China, have seen a decline in grid investments in recent years, despite robust growth in electricity demand and ongoing efforts to meet energy access goals.

“Ensuring the developing world has the resources it needs to build and modernise electricity grids is an essential task for the international community,” Dr Birol said. “By mobilising financing, providing access to technology and sharing best practices on policies, leading economies can help improve people’s lives, strengthen sustainable development and reduce the risks of climate change.” □

For more information visit: [www.iea.org](http://www.iea.org)

### Power system digitalisation is key

Digital technologies can improve the functioning of power grids significantly to help integrate clean energy sources successfully, and power system digitalisation also calls for substantial investment, particularly in emerging and developing economies.

A separate report released earlier this year by the International Energy Agency, states that digital technologies could save USD1.8 trillion of grid investment globally through to 2050 by extending the lifetime of existing grids and helping to integrate renewables and minimise supply interruptions. However, failing to upgrade and digitalise network infrastructure effectively, could cut economic output in emerging and developing countries by almost USD1.3 trillion as reduced productivity, lost sales and wasteful outlays on backup generation push up costs and put net zero targets at risk.

*Unlocking smart grid opportunities in Emerging Markets and Developing Economies* is the first flagship report of the Digital Demand-Driven Electricity Networks Initiative (3DEN). It was released in June this year.

Electricity is the fastest-growing source to meet final energy demand and will continue to outpace growth in total energy consumption over the next 25 years. The IEA estimates that electricity demand in emerging and developing economies (excluding China) will grow by around an additional 2 500 TWh by 2030, roughly equivalent to five times the current demand of Germany.

Expanded electrification and greater reliance on variable solar and wind power, as well as electricity storage, requires more sophisticated approaches to match demand and generation, especially during peaks. Chronic underinvestment has left many electricity grids unable to cope with such challenges.

Electricity supply interruptions can also affect critical infrastructure, water and food supplies, access to medical assistance, telecommunications, and mobility, with serious repercussions for human health and wellbeing. Moreover, the inefficiency resulting from technical losses in grids account for around 1 gigatonne of CO<sub>2</sub> emissions annually, equivalent to twice the emissions of all the cars in Europe.

The report indicates that digitalisation is a key enabler to

overcome some of the obstacles facing electricity networks, operators and utilities today. Digital solutions enable utilities to better predict demand and supply imbalances, and to locate and fix faults more quickly. But current global investment in grids is far short of what is required for net zero emissions by mid-century. The report states that annual investment will need to more than double to around USD750 billion by 2030, from around USD320 billion today.

Dr Fatih Birol, Executive Director of the IEA, noted on the release of the report: “While much attention goes to solar panels and electric vehicles, it is grids that connect everything together. By digitalising grids, we can make power systems more reliable and secure, and utilities can better manage the balance of electricity supply and demand.” He also made the point that the longer we wait to upgrade and digitalise our grids, the more expensive it will become.

3DEN is a cross-agency initiative of the IEA to accelerate progress on power system modernisation, backed by Italy’s Ministry of Environment and Energy Security.

Gilberto Pichetto Fratin, Italian Minister of Environment and Energy Security has said: “Digitalisation offers tremendous opportunities to enable more sustainable, reliable, efficient, and affordable power systems, and contributes to achieving climate goals. Targeted actions and strategic investments are required, starting now. The scale of this transformation is huge, and strong international cooperation and knowledge sharing are key. We are delighted to collaborate with the International Energy Agency and UNEP, in the 3DEN project, to accelerate clean energy transitions globally, particularly in emerging economies and developing countries.”

In conjunction with the 3DEN project, the Italian Ministry of Environment and Energy Security has launched a smart grid pilot programme, managed by the United Nations Environment Programme (UNEP). Projects are currently being implemented in Brazil, Colombia, India, and Morocco. The achievements and lessons learnt from these projects are being used to inform IEA analysis and policy guidance on grids and digitalisation, a growing area of focus.

## Working with EPCMs to deliver mining infrastructure

The demand for metals and minerals continues to surge, turning the spotlight onto the mining sector and bringing greenfield and brownfield mining projects into focus. Ensuring these ventures are executed efficiently within time and budget limits, requires a tailored strategy. Often, this means relying on the expertise of an Engineering, Procurement, and Construction Management (EPCM) contractor.

David Claassen, Managing Director of Trafo Power Solutions, believes in the importance of partnering with EPCM professionals and says the key to successful partnerships lies in understanding the EPCM domain. Established in 2017, Trafo Power Solutions specialises in dry-type transformers and has established robust collaborations with EPCM contractors around the world, in South Africa, Africa, Australia, and Canada, and elsewhere.

Claassen attributes the company's consistent successes to several principles it observes in its approach to projects. These include: understanding the project complexities, fostering effective communication, flexibility in adjusting to evolving project scopes, access to proven technology and products, and delivering timely results.

"It's essential to understand that each project has its uniqueness, and our team successfully navigates this by



*Dry-type transformers from Trafo Power Solutions are designed to fit into any space to deliver the power needed.*

adopting an understanding strategy, emphasising the importance of collaboration to manage the complexities," he says. "Our deep understanding of the project process helps us pinpoint and provide the most suitable solution, tailored to the customer's needs."

EPCM contractors handle the work of detailed engineering and design. Trafo Power Solutions contributes by suggesting alternative solutions where suitable, ensuring efficient procurement, avoiding redundancy, and supporting the best outcomes for every project.

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A HyPact hybrid switchgear unit from GE Grid – 11 such units, including 132 kV and 66 kV units, will be supplied to the new Sekelduin substation.

## Switchgear contract for new Swakopmund substation

ACTOM Energy Namibia (AEN) has been awarded a R100-million contract by Namibia Power Corporation (NamPower) to design, manufacture, supply, install and commission specialised switchgear and substation protection and automation systems for a new indoor 132/66/33 kV substation the utility is to establish in Swakopmund, Namibia.

The new Sekelduin substation, due to be completed in early 2025, is being constructed to meet increased demand for power resulting from rapid growth of the coastal city and surrounding areas and to cater for future expansion in the region.

Apart from the transformers, all the substation

equipment will be supplied by ACTOM group divisions and business units: ACTOM High Voltage Equipment, ACTOM MV Switchgear and ACTOM Protection & Control, working with their respective international technology partners.

Struan Steele, General Manager at AEN said: "NamPower initiated the construction of a substation building on the outskirts of Swakopmund to house all the substation equipment, to protect it from the salty air blowing in from the ocean. This would cause corrosion and deposits of coastal pollution if the substation were to be erected in a conventional open yard."

Consequently, the 132 kV and 66 kV switchgear from GE Grid, ACTOM High Voltage Equipment's international technology partner, will comprise hybrid equipment in which air-insulated switchgear (AIS) and gas-insulated switchgear (GIS) are combined into single switchgear units. These units are much more compact than the equivalent AIS units normally used in open air substation yards.

HyPact HV switchgear is well-proven and used worldwide in similar applications. In total, 11 HyPact switchgear units – six 132 kV units and five 66 kV units – will be supplied by GE Grid to the project.

The 33 kV switchgear for the new indoor substation will comprise a 4-panel switchboard of type GHA single busbar GIS switchgear from Schneider Electric, ACTOM MV Switchgear's international technology partner.

This product is already widely used in South Africa and many other African countries. MV Switchgear will assemble the switchboard, as well as design, manufacture and assemble the LV compartments for the

panels, at its Knights, Germiston, plant.

The protection, automation and control system, which will be supplied by ACTOM Protection & Control (P&C), will provide the required protection and control of the HyPact switchgear units and the GHA switchgear panels. The system is designed and manufactured by P&C using product and services from leading US-based international company Schweitzer Engineering Laboratories (SEL).

The system, based on the international standard for communication between the primary plant and the substation IEDs, IEC61850-9-2, was first introduced in 2005 and has been in use in NamPower substations since 2009. It makes use of an Ethernet network which replaces the traditional analogue cabling between the protection and metering IEDs and the primary plant comprising current and voltage transformers as well as circuit breakers and switches.

The main advantages of substation automation and communication equipment based on this standard are:

- Replacement of all substation cabling with a fibre-optic LAN, with associated cost savings
- Establishing redundancy, which is difficult with analogue cabling
- Flexibility in the design and maintenance of the automation system throughout the life of the substation
- Reduction of copper cabling and the associated risk of cable theft.

P&C will collaborate with SEL in the design, manufacture, installation and testing of the substation automation system for the Sekelduin substation project.

"We are looking forward to working with NamPower and SEL to deliver on this project, which will be a first for us," commented Herman Mare, P&C's General Manager.

All the control cabling for the project will be manufactured and supplied by ACTOM's longstanding associate Metal Fabricators of Zambia (ZAMEFA), based at Luanshya in the Copperbelt.

Installation and commissioning of the substation equipment will be undertaken, under supervision by ACTOM, by Megatron Engineering Namibia, a Windhoek-based Engineering, Procurement and Construction Management (EPCM) contractor, which AEN has previously subcontracted to install electrical equipment for various projects around the country.

**For more information visit: [www.actom.co.za](http://www.actom.co.za)**

# Moving forward with the QCTO

*Roland Innes, Group Chief Executive Officer, DYNA Training*

South Africa's Quality Council for Trades and Occupations (QCTO) is a driving force in addressing South Africa's skills shortages across industries. Positioned in the Post School Education and Training (PSET) sector, the QCTO has been charged, essentially, with shaking things up to address the inequalities of the past. As South Africa moves forward, all sectors, employers and employees need to be prepared to embrace the transformation already under way. For the QCTO, the goal is to ensure that occupational qualifications and programmes are accessible and credible to all, to meet the demand for the skills that will take South Africa into the future.

## A skills development ecosystem

Looking at the country's unemployment crisis, the need for change is clear. The current system is simply not producing the skills and technical competencies required at sufficient speed or scale. QCTO CEO, Vijayen Naidoo has said that we need to move people through skills development into employment as quickly as possible. Noting that the current qualification system is inadequate, Naidoo emphasises that we need to create pathways to employability. This requires a change in thinking – and the building of skills development ecosystems, leaving behind the old system that saw each industry operating as an island. For this, we need to understand how all industries, sectors and skills fit together and facilitate their alignment into responsive, agile, interconnected systems.

## A skilled and capable workforce

The gazetting of the Occupational Qualifications Sub-Framework (OQSF) in October 2021 laid the groundwork for this change, a foundation for the QCTO's vision to develop a qualified, skilled and capable workforce. The purpose of the OQSF is to facilitate the development and registration of quality-assured occupational and trade-related qualifications, part-qualifications, and skills programmes from the National Qualifications Framework (NQF) Levels 1 to 8, to meet the needs of existing and emerging sectors. The aim is to provide a system through which all school leavers, learners, professionals, workers, unemployed individuals and those classified as NEET (not in employment, education or training), can be equipped with relevant, sustainable and transferable competencies to support lifelong employability.

## Alignment across industries and players

The QCTO's role, Naidoo says, is to establish and maintain occupational standards and qualifications for skills programmes, by industry for industry, with an emphasis on quality assurance of these standards and qualifications for the workplace. Skills Development Providers (SDPs) will need to align with other bodies in the PSET sector, including Sector Education and Training Authorities (SETAs) across industries. Although the QCTO was originally intended to replace the SETAs, it seems this is unlikely to happen. The SETAs have an important role to play, and with their proximity to industries, are here to stay. However, there is a need for greater alignment between the different

SETAs. Where there are currently different accreditation policies per SETA, this makes cross-industry interaction difficult. Work has already begun on a single unifying accreditation policy, which the QCTO will be charged with auditing.



*Roland Innes, Group CEO, Dyna Training.*

## The need for artisanal skills

The National Skills Development Plan (NSDP) set a target for the country to produce 30 000 artisans each year by 2030, having identified artisanal skills as critical for economic growth and social development. Naidoo says that although we are already producing about 20 000 to 21 000 artisans annually, ticking the numbers boxes is not enough when the quality of those qualifications is still questionable. In the transition from the so-called 'old trades' to the new, he emphasises the importance of Technical and Vocational Education and Training (TVET) colleges and private training facilities to support the quality component of occupational qualifications and skills development.

## Simplified for effectiveness

Integrated system planning is required to support a single, national, short OQSF that promotes synergy, simplification and effectiveness. This should guide the development and quality assurance of occupational qualifications for skills programmes that respond to South Africa's developmental needs, and the work of learning organisations that are responsive to changing industry demands. The new OQSF allows vocationally trained graduates greater freedom of choice for further study, or direct access to the workplace. The system is designed to structure occupational qualifications that are directly relevant to the workplace with the clear goal of helping people secure employment.

It also recognises skills programmes such as short courses or 'micro-credentials' and adopts a more systematic approach to incorporating programmes that are developed to address immediate skills needs, making it easier for people to gain valuable skills and improve their employability. Thus, it allows for such micro-qualifications to be systematically designed and quickly developed. This will support students with micro qualifications to progress towards a full qualification if they choose to do so.

## Accreditation

Responsibility for SDP accreditation lies now with the QCTO and the SETAs. SDPs have to apply to be accredited for the various qualifications they offer; the QCTO handles the first phase of the process and then refers the programme to the relevant SETA for verification. The accreditation process is designed to ensure that SDPs meet the required standards for quality training and offer a curriculum, learning materials and assessment methods aligned with the relevant occupational qualification. Once approved, the QCTO will issue the SDP with a certificate of accreditation, which needs to be renewed every five years.

*For more information visit: [www.dyna-training.co.za](http://www.dyna-training.co.za)*



# Look beyond the hardware to improve solar, clean energy tech

Adam Zewe, MIT News, Massachusetts Institute of Technology

To continue reducing the costs of solar energy and other clean energy technologies, scientists and engineers will likely need to focus, at least in part, on improving technology features that are not based on hardware. This is the finding of a team of MIT researchers which they reported, together with the mechanisms behind it, in *Nature Energy* earlier this year.

Although the cost of installing a solar energy system has dropped by more than 99% since 1980, this new analysis shows that “soft technology” features, such as the codified permitting practices, supply chain management techniques, and system design processes that go into deploying a solar energy plant, contributed only 10 to 15% of total cost declines. Improvements to hardware features were responsible for the lion’s share.

However, because soft technology is increasingly dominating the total costs of installing solar energy systems, this trend threatens to slow future cost savings and hamper the global transition to clean energy, says senior author of the study, Jessika Trancik, a professor at MIT’s Institute for Data, Systems, and Society (IDSS).

Trancik’s co-authors include lead author Magdalena M Klemun, a former IDSS graduate and postdoctoral student who is now an assistant professor at the Hong Kong University of Science and Technology; Goksin Kavlak, a former IDSS graduate and postdoctoral student who is now an associate at the Brattle Group; and James McNerney, a former IDSS postdoctoral student and now senior research fellow at the Harvard Kennedy School.

The team created a quantitative model to analyse the cost evolution of solar energy systems, capturing the contributions of both hardware technology features and soft technology features.

The framework shows that soft technology hasn’t im-

proved much over time – and that soft technology features contributed less to overall cost declines than previously estimated.

Their findings indicate that to reverse this trend and accelerate cost declines, engineers could look at making solar energy systems less reliant on soft technology to begin with, or they could tackle the problem directly by improving inefficient deployment processes.

“Understanding where the efficiencies and inefficiencies are, and how to address those inefficiencies, is critical in supporting the clean energy transition. We are making huge investments of public dollars into this, and soft technology is going to be essential to making those funds count,” says Trancik.

“However,” Klemun adds, “we haven’t been thinking about soft technology design as systematically as we have for hardware. That needs to change.”

## The hard truth about soft costs

Researchers have observed that the so-called “soft costs” of building a solar power plant – the costs of designing and installing the plant – are becoming a much larger share of total costs. The share of soft costs now typically ranges from 35 to 64%.

“We wanted to take a closer look at where these soft costs were coming from and why they weren’t coming down over time as quickly as the hardware costs,” Trancik says.

In the past, scientists have modelled the change in solar energy costs by dividing total costs into additive components – hardware components and nonhardware components – and then tracking how these components changed over time.

“But if we want to understand where those rates of change are really coming from, we need to go one level deeper to look at the technology features. Then things split out differently,” Trancik says.

The researchers developed a quantitative approach that models the change in solar energy costs over time by assigning contributions to the individual technology features, including hardware features and soft technology features.

For instance, their framework would capture how much of the decline in system installation costs – a soft cost – is due to standardised practices of certified installers – a soft technology feature. It would also capture how that same soft cost is affected by increased photovoltaic module efficiency – a hardware technology feature.

With this approach, the researchers saw that improvements in hardware had the greatest impacts on driving down soft costs in solar energy systems. For example, the efficiency of photovoltaic modules doubled between 1980 and 2017, reducing overall system costs by 17%. But about 40% of that overall



*The costs of solar energy installations have dropped substantially over the years, but recent research indicates the need to look at “soft technology” costs to achieve further savings.*



*Soft technology costs could include simplifying permitting practices, supply chain management and system design processes, among other factors.*

decline could be attributed to reductions in soft costs tied to improved module efficiency.

The framework shows that, while hardware technology features tend to improve many cost components, soft technology features affect only a few.

"This structural difference is evident even before data is collected on how the technologies have changed over time. That's why mapping out a technology's network of cost dependencies is a useful first step to identify levers of change, for solar PV and for other technologies," Klemun notes.

### Static soft technology

The researchers used their model to study several countries, as soft costs can vary widely around the world. For instance, solar energy soft costs in Germany are about 50% lower than those in the US.

The analysis showed that because hardware technology improvements are often shared globally this led to dramatic declines in costs over the past few decades across locations. Soft technology innovations typically are not shared across borders. Moreover, the team found that countries with better soft technology performance 20 years ago still have better performance today, and those with worse performance did not see much improvement.

The country-by-country difference could be driven by regulations and permitting processes, cultural factors, or by market dynamics such as how firms interact with each other, Trancik says. "But not all soft technology variables are ones that one would want to change in a cost-reducing direction, like lowering wages, for instance. So there are other considerations, beyond just bringing the cost of the technology down, that we need to think about when interpreting the results," she says.

The analysis points to two strategies to reduce soft costs. For one, scientists could focus on developing hardware improvements that make soft costs more dependent on hardware technology variables and less on soft technology variables, such as by creating simpler, more standard-



*The analysis indicates two possible strategies to reduce soft costs: developing hardware improvements that could simplify soft technology variables, or focusing only on soft technologies to improve efficiencies.*

ised equipment that could reduce on-site installation time.

Or researchers could target soft technology features directly, without changing the hardware, perhaps by creating more efficient workflows for system installation or automated permitting platforms.

"In practice, engineers will often pursue both approaches, but separating the two in a formal model makes it easier to target innovation efforts by leveraging specific relationships between technology characteristics and costs," Klemun says.

"Often, when we think about information processing, we are leaving out processes that still happen in a very low-tech way through people communicating with one another. But it is just as important to think about that as a technology as it is to design clever software," Trancik notes.

In future, she and her collaborators want to apply the quantitative model they created to study the soft costs related to other technologies, such as electric vehicle charging and nuclear fission. They are also interested in better understanding the limits of soft technology improvement, and how better soft technology could be designed from the outset.

This research is funded by the US Department of Energy Solar Energy Technologies Office. The paper is titled *Mechanisms of hardware and soft technology evolution and the implications for solar energy cost trends* as was published in *Nature Energy*.

For more information visit: <https://news.mit.edu/2023>



*Ketso Motjuwadi, civil and resilience engineer, Royal HaskoningDHV.*

## COP28: a crucial year for Africa's climate action

*Ketso Motjuwadi, Sustainability Lead at Royal HaskoningDHV*

The clock is ticking. We have less than five years to prevent irreversible global temperature increases beyond 1.5°C, a point of no return, as illustrated by the Climate Clock in New York's Union Square.

In 2023, alarm bells are ringing louder as we grapple with record-breaking temperatures and unprecedented flooding in many parts of the world.

COP28 takes place in Dubai this year, hosted by the Government of the United Arab Emirates from 30 November into early December, and the need for climate action is widely evident. The Conference of Parties (COP) of the UNFCCC (United Nations Framework Convention on Climate Change), established in 1994, aims to combat climate change by uniting countries and stakeholders worldwide. COP 28 will seek to build on previous successes and pave the way for future ambitions to tackle the global challenge of climate change effectively.

The battle is far from won. According to NASA, for instance, the month of July 2023 was the hottest month ever recorded in global temperatures.

COP28 President-Dr Sultan Al Jaber has said: "To keep 1.5°C within reach we must act with ambition and urgency to reduce emissions by 43% by 2030."

This is a tall task that requires cooperation around the globe.

At COP27, South Africa introduced its Just Energy Transition Investment Plan (JET IP). The JET IP covers the initial period of five years (2023- 2027), giving effect to the historic Just Energy Transition Partnership (JETP) that was forged at COP26 between the government of South Africa and the governments of France, Germany, the United Kingdom (UK), the United States (US), and the European Union (EU) (forming the International Partners Group [IPG]). The JETP saw the IPG commit to providing funding of US\$8.5 billion over the next three to five years to support SA in its transition towards becoming a low-carbon climate-resilient economy, one that could serve as a model for other countries. Funding has since increased, drawing in commitments from other countries, and the JET IP has been reviewed and refined to take account of broader stakeholder consultations.

This as South Africa continues to face crippling power cuts, with ongoing loadshedding, and an intensified debate around the issue of prolonging the life of existing but aging coal-fired power stations.

Another pivotal outcome of COP27 was the establishment of a Loss and Damage Fund, intended to assist vulnerable nations affected by climate-induced natural disasters. Funding could support early warning systems, disaster preparedness, and infrastructure improvements. But details on which nations will contribute and how much remain unclear. Representatives from 24 countries have been involved in a transitional collaboration process to de-

termine contributors and distribution methods.

COP28 brings some promise, notably in the anticipated presentation of the inaugural Global Stocktake (GST), which will evaluate progress on the Paris Agreement.

Additionally, the Pacific Island nation of Vanuatu is seeking an international court's legal opinion on states' climate obligations, potentially setting a precedent for climate justice and the focus and implementation of the Loss and Damage Fund.

Vanuatu's prospective success might inspire African countries to advocate for climate-resilient water infrastructure, agriculture, and a just transition to renewable energy. Initiatives such as the African Cities Water Adaptation Fund, Resilient Agriculture Innovations for Nature, and the Just Energy Transition Investment Plan for South Africa could be influenced.

The European Union aims for a more sustainable future, with EU nations committing to a global phase out of fossil fuels at COP28.

Continuing growth in renewable energy is encouraging. According to UK-based energy think-tank Ember, in 2022 renewable energy accounted for 12% of the world's electricity generation. The International Energy Agency's 2023 World Energy Outlook anticipates that 90% of new electricity demand over the next three years will be met by clean energy sources like wind, solar, and nuclear energy. This shift could make renewables the biggest source of electricity globally, providing 35% of the world's electricity.

Taking all the above into consideration, there are at least three areas where governments and stakeholders can look to make progress at this year's COP28: infrastructure development, green technology innovation, and skills and training.

With regard to infrastructure development, we can expect discussions at COP28 to focus on improving infrastructure to reduce greenhouse gas emissions. This should provide more opportunities to address challenges in designing and building sustainable infrastructure, as well as better resource management in water and energy builds.

In terms of green technology innovation, increased funding and collaboration around green technologies are becoming increasingly critical in our world, and we need to do all we can to nurture and grow this space.

And thirdly, as sustainability and climate-related projects become more prominent, engineering firms will need to invest in training and upskilling their teams to work on these projects effectively.

COP28 has the potential to accelerate sustainable policies and actions. For African nations, meaningful change requires solidarity, collaboration, perseverance, advocacy, and strong partnerships across public and private sectors, working together with nations sharing similar interests and concerns.

*For more information visit: [www.royalhaskoningdhv.com](http://www.royalhaskoningdhv.com)*



# Asset Monitoring Gateway with SNAP ID



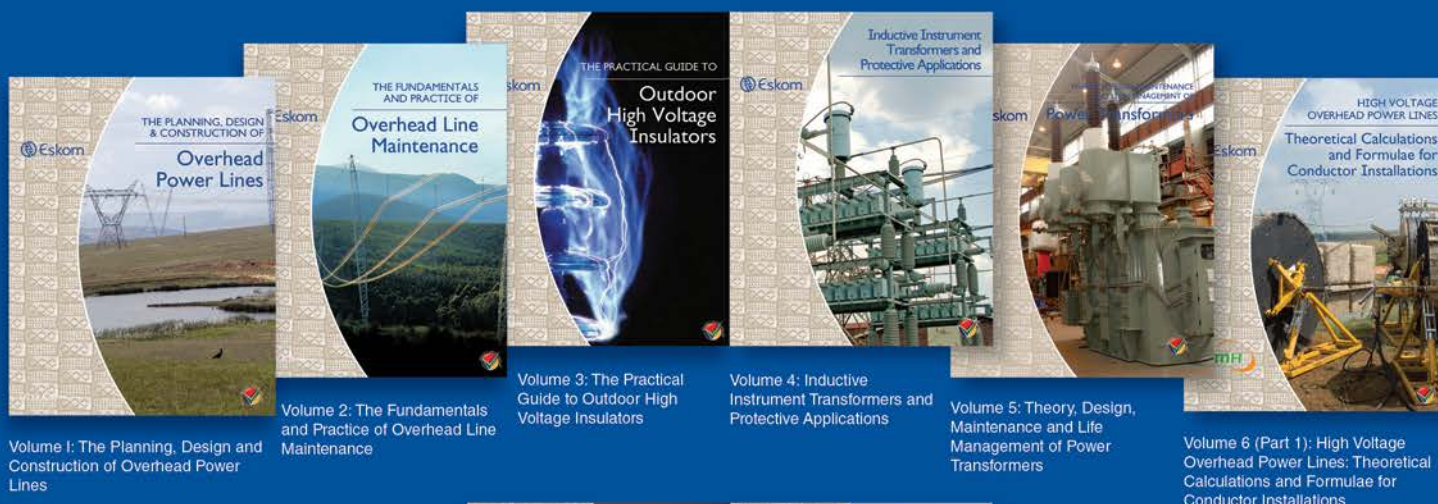
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The Eskom Power Series was conceived in response to the continuing worldwide loss of critical technical skills and experience. The aim of the series is to promote international best practice, including experience accrued by Eskom over the years, as a guide and legacy and to serve as a source of reliable, reputable and highly technical information.



Based on the success of the Eskom Power Series and the Eskom Leadership & Management Series, the Professional Development Series was created. It aims at developing various professions within South Africa so that large state-owned enterprises and the private sector can grow and facilitate job creation in the country. Unlike the Power Series, both the Eskom Leadership & Management Series and the Professional Development Series have a broad readership, including those residing in the private sector, State Owned Companies (SOCs) and academic institutions.

The Eskom Leadership & Management Series was introduced by Eskom at the request of readers and stakeholders of the Power Series who felt that the series should be expanded to include non-technical topics. These topics are often not well understood by technical practitioners and can pose a risk to the sustainability of their businesses. To date, the Power Series team, with assistance from experts in the various fields, has produced two volumes.



Eskom has also published: GENERATION, TRANSMISSION AND DISTRIBUTION: A large Southern African utility. This is an introduction to the technology that has developed, over time, in response to growing demand in the electricity utility industry in South Africa. It provides a 'soft-landing' for those who need, or want, to engage with the technology in a large electricity utility.

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