FEATURES:

- Industry 4.0 + IIoT
- Energy management + the industrial environment
- Sensors + switches
- Plant maintenance, test + measurement

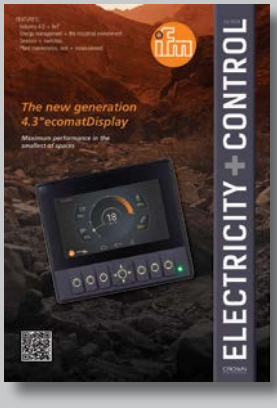
The new generation 4.3"ecomatDisplay

Maximum performance in the smallest of spaces

02/2024

ELECTRICITY+CONTROL

CROWN PUBLICATIONS



For monitoring mobile machines, ifm's 4.3" ecomatDisplay provides clear communication, precision and powerful performance in the most compact HMI module of the ecomatDisplay family.
(Read more on page 3.)

Editor: *Leigh Darroll*
Design & Layout: *Darryl James*
Advertising Manager:
Heidi Jandrell
Circulation: *Karen Smith*
Editorial Technical Director: *Ian Jandrell*
Publisher: *Karen Grant*
Deputy Publisher: *Wilhelm du Plessis*

Audited circulation Quarter 3 (July-September) 2023
Total print and e-editions 13 879

Published monthly by:
Crown Publications (Pty) Ltd
Cnr Theunis and Sovereign Sts,
Bedford Gardens, PO Box 140,
Bedfordview 2008
Printed by: *Tandym Print*
Telephone: *+27 (0) 11 622 4770*
E-mail: *ec@crown.co.za; admin@crown.co.za*
Website: *www.crown.co.za/electricity-control*

CROSS PLATFORM CONTENT INTEGRATION:
* Electricity+Control Magazine * Online Edition
* Weekly e-Newsletter * Website* LinkedIn

Electricity+Control is supported by
CESA SAEE Copper Development Association Africa SAAES

A fast-changing operating environment

The content featured in this month's edition reflects again the ongoing quest to ensure that we never stop learning. Or, phrased another way, there is always an opportunity to see what others in the industry are up to!

The topics in focus: Industry 4.0 + IIoT, Energy management + the industrial environment, Sensors + switches, and Plant maintenance, test + measurement, remind us that there is always an overlap across these critical aspects of industry, perhaps more than we imagine.

It was just the other day that energy management was not even a consideration; and energy efficiency in any device such as a sensor, or any other 'electronic' device, was simply not worthy of consideration.

But nowadays, site-wide communication systems ensure that we monitor and manage all aspects of the operating environment – including energy usage, temperature, level and so on. We assimilate all the available data and convert that into information on the site. The knowledge we extract from it allows us to optimise every aspect of our plant's operation.

The environment created by our access to modern tools allows for a far better understanding of all our operations. And this includes not just the way we make whatever it is that we make or deliver (in the case of a service) but how we monitor and manage the impact of the environment on our operations.

It strikes me that working around loadshedding, for instance, has become a daily need – but to do that appropriately has no doubt meant a revision of the way we operate, when we do certain things – and has forced a more dynamic approach to the business in which we work.

As we consider how to manage the energy security, we need to give thought to how we can manage with different levels of guaranteed energy at specific times. This is not to suggest that we will ever really be able to predict what the loadshedding schedule will be (save to say that it will be…) but that we may begin to consider new and innovative sources that may be able to provide a profile of energy that is not what we would anticipate in an ideal world – but perhaps appropriate in the world we are moving into.

The next important factor to consider is how our plant data can be visible remotely. The implications of this are the obvious one of convenience and the more critical one of recognising how vulnerable our operating systems can be, unless we take the precautions to secure them.

As our plants become more accessible to us all, as our move to the virtual world accelerates, and as we advance the automation of facilities and replace people with smart systems, we recognise that the future is nothing like we imagined. I am certain that the move to automate so many of our manual processes will accelerate far more rapidly than we ever anticipated.

It is therefore not possible to exclude the evolution of AI in everything we do. It's not that we have not been aware of this for more than a decade – it is simply that these technologies are so rapidly becoming mainstream that it is obvious now to everyone.

Whereas we used to argue that automation was an opportunity and a threat – we now are using the same arguments around AI. And although there was angst around the automation debate, there is no doubt that the benefits to any economy are obvious.

Regarding AI, the phrase I always note is that no one will lose their jobs to AI: rather, they may lose their job to someone who is better able to use AI than they are.

Worthy of consideration…

Ian Jandrell

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

CONTENTS

FEATURES

REGULARS

Maximum performance in the smallest of spaces

- High-brightness display for maximum readability even in daylight conditions
- High computing power and memory capacity offer sufficient capacity for demanding tasks
- Maximum freedom of communication thanks to the support of multiple protocols.

New standard in the compact class

Whenever clear communication, precision and performance are required in the smallest of spaces, the most compact member of the ecomatDisplay family is the perfect choice. Because the 4.3-inch HMI makes no compromises on human-machine interaction: 16 million colours, high-resolution display and good readability, even at extreme angles or in extreme lighting conditions, ensure clear information exchange in any situation.

Easy to connect, economical, communicative

Numerous connection options and a wide range of supported communication protocols allow for simple and extensive integration of the ecomatDisplay into the machine. Codesys 3.5 and the comprehensive ifm library of software modules enable convenient visualisation of the most relevant information.

Besides, the Linux-based operating system can be used for customisation, such as visualisation via QT. The powerful DualCore processor and the equally efficient DDR4 RAM ensure reliable processing of all data and control commands. For all these technical features, the compact HMI requires only five watts of power.

High-performance communication technology for mobile machines

With a powerful dual-core 1.4 GHz processor and low energy consumption of only 5 to 8 watts, the 4.3" ecomatDisplay is ideally equipped for the future. However, it is not only powerful, it also has communication capabilities. Whether Modbus server/client, CAN, CANopen, J1939, Ethernet protocols TCP/UDP, network variables via Ethernet or USB (optional), the ecomatDisplay always offers the right way and the right language to communicate with the mobile machine.

The 4.3" ecomatDisplay is also unbeatable in terms of operability – a version with RGB keypad (16 million colours) and a version with capacitive touchscreen (release 2024) meet all needs.

Units for operation and monitoring – in general

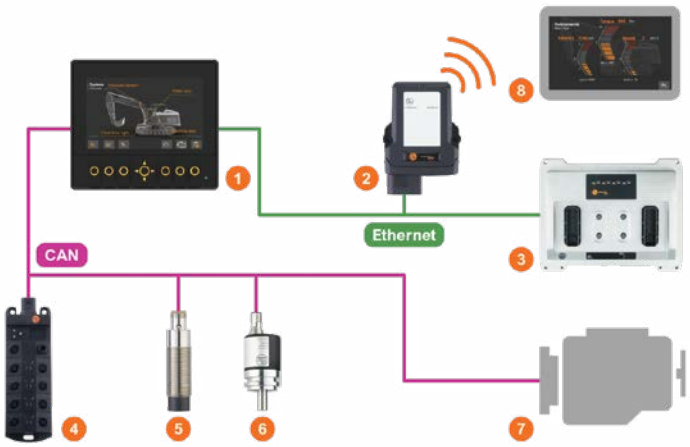
Ifm offers robust HMI programmable graphic displays for control, parameter setting and operation of mobile machines and installations. They can be used in conjunction with a mobile controller or as a standalone solution.

Some types have an analogue video input for connection to a mobile camera. Data and device functions are safely transferred via CAN interfaces.

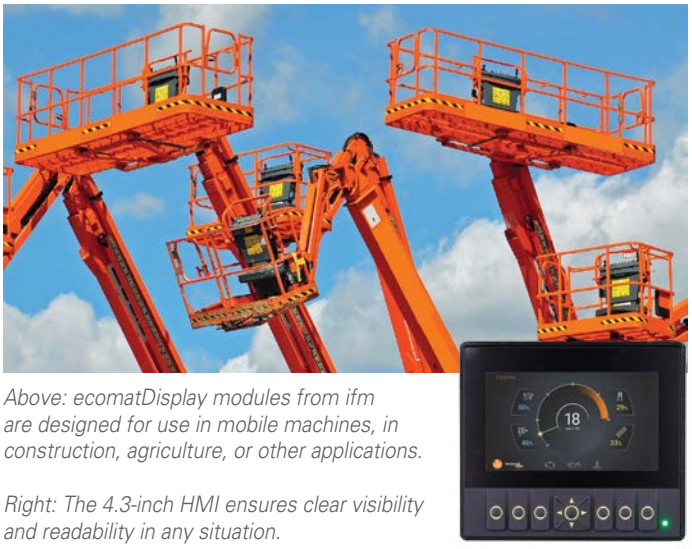
The displays feature freely programmable backlit function keys. Some are equipped with an additional navigation key, a potentiometer with pushbutton function or a touchscreen.

The units offer increased EMC levels and hold an e1 type approval. Due to the high protection rating of the housing, the modules are suitable for outside panel and surface mounting as well as for cabin installation in construction machines, agricultural machinery, or municipal vehicles.

The displays are available in different sizes. □



The system incorporates: 1. 4.3" ecomatDisplay, 2. mobile IoT, 3. ecomatController, 4. ioControl, 5. RFID, 6. Encoder, 7 Engine, 8. Tablet.



Above: ecomatDisplay modules from ifm are designed for use in mobile machines, in construction, agriculture, or other applications.

Right: The 4.3-inch HMI ensures clear visibility and readability in any situation.

For more information contact Product Manager Albert Louw at ifm
Tel: +27 (0)12 450 0400
E-mail: info.za@ifm.com
Visit: www.ifm.com/za/en

Managing cybersecurity in OT and IT convergence

Neels van der Walt, Senior Business Development Manager, Iritron (Pty) Ltd

Smart Mining and Smart Manufacturing and the drive towards the digitisation of the mining and manufacturing value chains, coupled with advances in technology, are driving an ever-increasing demand for operational information.

This includes the need for information on what is happening in the plant environment in real time as well as visibility into plant operations. Information is needed to make informed decisions, and to support compliance with environmental, social and governance (ESG) directives or regulations.

The triple bottom line of People, Planet and Profit is now more prevalent in business and to achieve cleaner, safer and smarter operations, while at the same time increasing throughput, requires timely information on which management can base decisions and actions.

Additional insight not previously available can be generated today by using technologies such as industrial artificial intelligence (AI) and machine learning (ML), but this requires historical plant data to train the models, and real-time plant data against which the live models can be run. The question that arises is how can we make real-time plant data and information available, securely, at scale and cost effectively to a wider range of users.

Operational technology (OT)

The physical plant environment and the operational technology from which the plant data originates is traditionally managed by engineers and operational specialists. The environment includes operational data interfaces that form an integral part of the operations and are critical for the safe operation of equipment and safety of personnel. In the past, the plant environment was mostly isolated from the connected outside world and the possibility of cybersecurity threats was minimal. Of primary importance is the availability and reliability of systems to ensure minimum plant downtime and the safety of equipment and personnel.

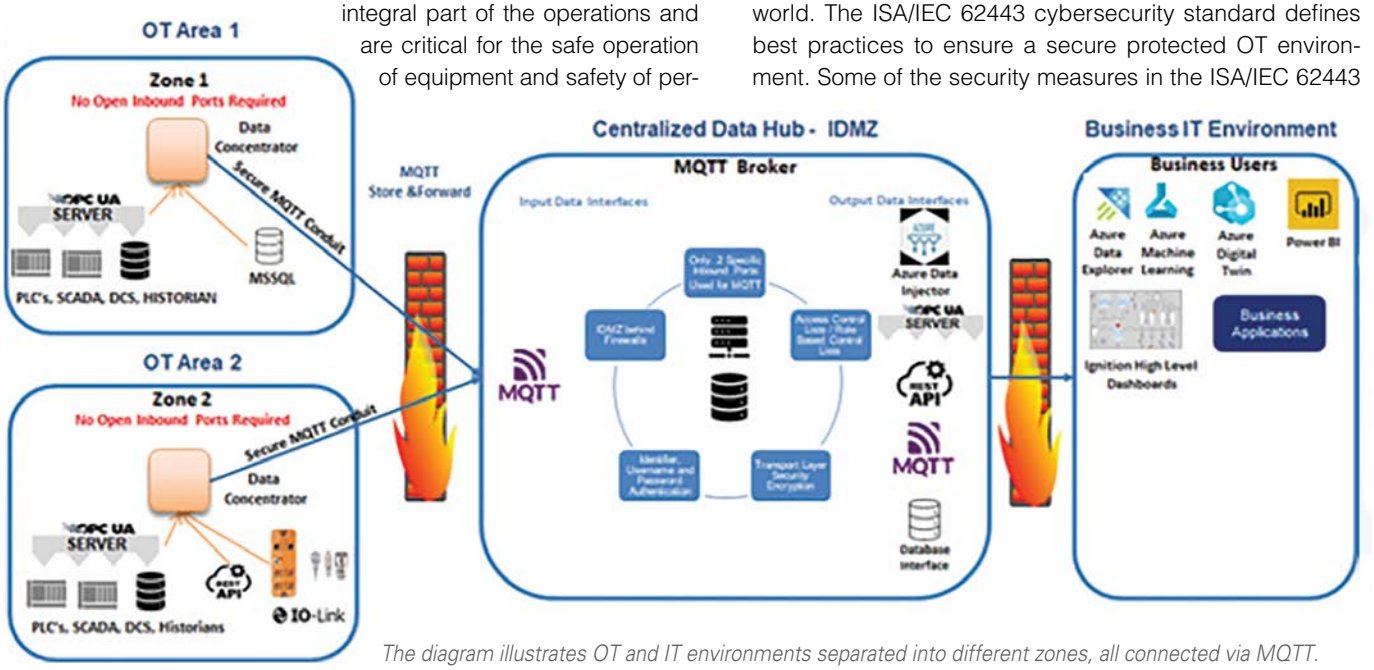
Information technology (IT)

On the other side of the business is the IT environment. This is where the business systems and applications such as enterprise resources planning (ERP) systems operate, and where the business users are connected by means of the in-house Local Area Network (LAN), or in some cases, the company's Wide Area Network (WAN). The IT environment is traditionally serviced by an IT Department and sometimes outsourced. The business environment is connected to the Internet, and a large number of business applications typically reside in the cloud, a trend that seems set to continue. In this environment, security is of primary importance due to cyber-intrusion threats from the outside world.

ISA/IEC 62443 cybersecurity standards with MQTT

The decision-making information requirements noted above are driving the convergence of the OT and IT environments. Companies are increasingly starting to integrate these technologies to enable the sharing of information between the plant and the business environments and to make plant information available to a wider spectrum of users.

This raises the concern of exposing the previously isolated OT environments to potential threats from the external world. The ISA/IEC 62443 cybersecurity standard defines best practices to ensure a secure protected OT environment. Some of the security measures in the ISA/IEC 62443



The diagram illustrates OT and IT environments separated into different zones, all connected via MQTT.

standard include segregating systems into zones and making use of secure conduits to integrate the data between the different zones.

The figure (see page 4) shows an example of using segregation with the MQTT – Message Queuing Telemetry Transport – protocol as a conduit to share data from the OT environment with the IT environment. MQTT can work in low bandwidth and a high latency environment and is a secure publish / subscribe protocol.

From the diagram, it can be seen that the OT environments are broken down into zones, and each zone has a data concentrator that collects data from sources, such as programmable logic controllers (PLCs), supervisory control and data acquisition systems (SCADA), plant historians, distributed control systems (DCSs) and OPC UA servers.

Data can also be collected from IO-Link smart sensors, databases and other applications using Representational State Transfer (REST) Application Programming Interfaces (APIs). The data concentrator securely connects to a MQTT broker located behind firewalls in an 'Industrial Demilitarised Zone' (IDMZ) and publishes the data to the broker. The system can include store and forward technology, to enable the buffering of data in the concentrator should network connectivity be lost momentarily. Data will be synchronised with the broker once the network is restored. The IDMZ can be on premises or in the cloud. The different OT areas in the diagram represent different plant areas on the same site, and/or plant areas from different sites.

The security features of MQTT ensure that no open inbound ports are required in the OT environment, interfaced data is encrypted, username and password authentication is implemented, and access/role-based control lists are made available. Once the data is in the IDMZ, it can be exposed to the IT environment via various interfaces including MQTT, Database Connectivity, REST APIs, OPC UA and transferring the data to Azure Cloud, from where business applications and users have access to it.

The MQTT Sparkplug B version of the MQTT protocol is ideal for smart mining and manufacturing and for industrial automation. It allows for context to be created on the lower levels and for this context to be pulled through to all top layers. Creating context provides for data to be converted into more meaningful information.

The value of information is proportional to the number of people that need the information and have access to it, and to the time it takes to become available. This means the information needs to be made available to everyone that needs to know and can take action as soon as possible during or after an event, in effect, in real-time.

Information is a strategic business asset and using it fully for the benefit of the organisation means the data from the OT environment needs to be made available to the IT environment in a secure, scalable and cost-effective manner, and based on best practices such as the ISA/IEC 62443 cybersecurity standard.

Sharing timely information securely with all users that need the information by way of the MQTT protocol, will enable organisations to maximise the value they derive from their information asset in a secure and scalable way. □

For more information visit: iritron.co.za

Local support for electronics design

TRX Electronics is the authorised independent representative in South Africa for Mouser Electronics, Inc. Mouser is widely known as one of the largest global distributors of semiconductors and electronic components, specialising in prototyping (no minimum order) quantities for engineering design and new product development.

Among the multiple components available through TRX Electronics for delivery in South Africa, together with dedicated customer service and local support, are Molex Brad M12 Power L-Code connector systems; and Infineon silicon carbine CoolSiC™ MOSFETs and diodes.

Molex Brad M12 Power L-Code connector systems deliver up to 16 A current per pin at 63 V ac or dc. The M12 connector systems feature a -25°C to 85°C operating temperature range, >108 Ohms insulation resistance, wires of 2.50 mm^2 thickness, and <5 milliohms contact resistance. The M12 connector systems provide an IP67-sealed interface and meet PROFIBUS and PROFINET International (PI) standards for PROFINET systems. Typical applications include power supplies of decentralised I/O, fieldbus controlled I/O boxes, small server/dc motors and drives, and in machine tools, presses, moulding, stamping, and automotive plants.

Molex Brad M12 Power L-Code connector systems are used in diverse applications ranging across automotive plants, robotics, machine tools, CNC control panels and more.

Infineon Silicon Carbide CoolSiC™ MOSFETs and diodes provide a portfolio that addresses the need for smarter, more efficient energy generation, transmission and consumption. The CoolSiC portfolio responds to customers' needs for reduced system size and cost in mid- to high-power systems, still meeting high quality standards, providing long system lifetime and guaranteed reliability. With CoolSiC, customers can reach high efficiency targets and see a reduction in operational system cost. The portfolio includes CoolSiC Schottky diodes, CoolSiC hybrid modules, CoolSiC MOSFET modules and discretes, plus EiceDRIVER™ gate driver ICs to drive silicon carbide devices.

For more information visit: www.trxe.com

Jan T'Hart, Yaskawa Southern Africa.

Looking ahead at robotics in manufacturing

Leading robotics and automation company, Yaskawa Southern Africa is embracing industry-shaping trends. Here, National Sales Manager, Jan T'Hart shares some insights on the future of automation, pointing to the trends set to redefine manufacturing in the country. Looking to the new year, Yaskawa is prioritising technological advances, industry-specific needs, and its commitment to sustainability.

Emerging technologies and innovations

Yaskawa expects to see a profound impact from advances in artificial intelligence (AI), anticipating enhanced perception and decision-making capabilities in robots. T'Hart highlights continuing advances especially in machine learning and deep learning, which are likely to extend the capabilities of robots. "This includes improved perception, decision making and adaptability to dynamic environments," he says. He also notes the role of edge computing: "Processing data closer to the source, using edge computing, can reduce latency and improve real-time decision making in robots. This is particularly important in applications like autonomous vehicles and drones."

Human-robot collaboration

Collaborative robots (cobots) and safety technologies are enabling closer interaction between humans and robots in shared workspaces. With these evelopments, Yaskawa expects to see the seamless sharing of workspaces between humans and robots in South Africa's manufacturing sector in the future, fostering productive and efficient working environments. "This is particularly relevant in manufacturing and healthcare settings," adds T'Hart.

Advanced sensing technologies

Efficiency, adaptability, safety, security and user-friendly design are key features of Yaskawa cobots.

Increased use of sensor technologies, including LiDAR or Light Detection and Ranging – a remote sensing method that uses light in the form of a pulsed laser to measure distances – and radar, as well as improved computer vision, will enhance the perception capabilities of robots. According to T'Hart, "This is important for navigation, object recognition, and interaction with the environment."

Addressing growing demand

"In preparation for the growing demand for robotics in industries such as manufacturing and logistics, our strategic approach at Yaskawa involves continuous product innovation, focusing on performance, precision and safety. Additionally, our emphasis on cobots, customisation and digitalisation aligns with the diverse needs of South Africa's manufacturing and logistics sectors, reflecting our commitment to meeting evolving demands," says T'Hart.

Yaskawa recognises the transformative role of AI and machine learning, enhancing robots' perception, adaptive decision-making, predictive maintenance, and task automation. These advances support the goal of incorporating intelligent automation to boost productivity and competitiveness in a rapidly changing global landscape. T'Hart adds that "the growing trend towards the use of cobots in industry means Yaskawa, like other manufacturers, must focus on developing cobots with advanced safety features and user-friendly interfaces to facilitate human-robot collaboration."

Efficiency and adaptability take centre stage in the company's commitment to user-friendly programming interfaces, simulation technologies, offline programming, and remote monitoring. These features enhance operational efficiency and cater to the evolving needs of South African industries aiming for streamlined processes and responsive operations.

Safety features, ease of programming, flexibility, human-centric design, and integration with other technologies define Yaskawa's approach to human-robot collaboration.

Autonomous robots

Keeping pace with emerging trends in automation, T'Hart emphasises, "For Yaskawa, like many other companies in the industry, embracing the principles of Industry 4.0 is essential. This involves the integration of digital technologies, IoT (Internet of Things), and data analytics to create smart and connected manufacturing systems." Additionally, Yaskawa's exploration of autonomous navigation, SLAM (Simultaneous Localisation and Mapping) technology, AI-based decision making, and integration with the IoT and Industry 4.0 positions the company at the forefront of trends in autonomous robotics. This approach aligns with the growing demand for autonomous solutions in South Africa, offering a glimpse into a future where machines operate with increasing independence.

Safety and security

In terms of safety and security, the company adheres to

industry safety standards and regulations relevant to the robotics sector. "Yaskawa's comprehensive approach to safety and security encompasses safety standards, advanced sensors, safe collaboration, access control, network security, and thorough risk assessments. This strategy addresses the need for secure and safe robotic systems in South Africa, especially in sensitive sectors where reliability is paramount," says T'Hart. He highlights collision avoidance systems as crucial to preventing accidents and ensuring the safety of human operators as well as the robotic system. "Yaskawa is looking to continue investing in technologies and design principles that facilitate safe human-robot collaboration. This includes developing collaborative robots with features like force-limiting and speed monitoring to ensure that robots can work alongside people without posing a danger."

Sustainability

In respect of the increasing focus on sustainability, Yaskawa places much emphasis on energy-efficient design, regenerative braking, low-power standby modes, material selection, recycling, and efficient production processes. These initiatives align with the country's commitment to environmental responsibility and demonstrate a holistic approach to minimising the ecological footprint of robotic systems.

Industry-specific trends

Yaskawa's recognition of the role of robotics in post-pandemic workplaces and the automation of e-commerce and logistics supports South Africa's evolving industrial landscape. "The Covid-19 pandemic accelerated the adoption of contactless technologies," says T'Hart. "For example, in the workplace, robots have been deployed to perform tasks that traditionally involve human contact, such as cleaning, disinfecting, and material handling. Now too, cobots are equipped with more advanced sensors and vision systems and have been employed to maintain social distancing in manufacturing and assembly lines. These robots can adapt their movements based on the proximity of human workers."

Strategic collaborations

Looking to future collaborations in 2024, T'Hart notes that collaboration with research institutions, universities and colleges can provide access to cutting-edge research and talent. He says Yaskawa will look at working with academic partners to stay informed about the latest developments in robotics and to contribute to continuing progress in the field. It also collaborates with companies that specialise in specific technologies, such as artificial intelligence, computer vision, or edge computing, which can enhance the capabilities of Yaskawa's robotic systems. "Integrating the latest technologies into our solutions can contribute to improved performance and adaptability," says T'Hart. □

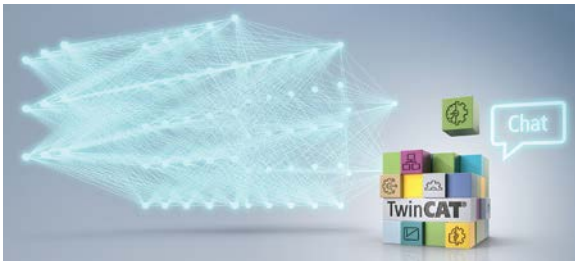
For more information visit: www.yaskawa.za.com

Fast and efficient AI-supported automation engineering

With TwinCAT Chat, large language models (LLMs) such as ChatGPT from OpenAI can conveniently be used in the TwinCAT XAE engineering environment to develop projects. Efficiency potential can thus be exploited, from control programming to corporate management.

Large language models offer several benefits for automation engineers as well as enterprise management. For automation engineers, LLMs have the potential to revolutionise the development process by automatically generating and completing code. This speeds up the entire process. In addition, users can even have LLMs create personal tutorials and specifically ask for solutions to problems that arise. From an enterprise management perspective, LLMs promote knowledge transfer within the organisation. They can act as a central knowledge base, storing valuable information and making it available when needed. In addition, LLMs can relieve the pressure on the support team by serving as the first point of contact for customer inquiries.

TwinCAT Chat was developed to integrate LLMs into control engineering, giving users a clear benefit when compared to using ChatGPT traditionally in a web browser, for example. This simplifies the development process significantly as communication and code exchange are seamlessly integrated. Furthermore, the basic initialisation of the LLM has been tailored



TwinCAT Chat opens up the new world of chatbot possibilities for the automation environment.

specifically to TwinCAT requests. The user can thus ask specific questions directly and does not first have to tell the LLM that they are using TwinCAT and that the code examples are expected in Structured Text. In addition, the generated code can easily be transferred, which saves developers time and prevents the errors that can occur when transferring code manually. For efficient interaction with TwinCAT Chat, simple one-click pre-tested requests can be used; these are specifically designed to improve the user's workflow. Other developments currently in progress include the automated creation of TwinCAT HMI controls and a chatbot interface to the extensive Beckhoff documentation system.

For more information visit: www.beckhoff.com

Democratising generative AI in software development

Siemens and Amazon Web Services (AWS) are strengthening their partnership to make it easier for businesses of all sizes and industries to build and scale generative artificial intelligence (AI) applications. Domain experts in fields such as engineering and manufacturing, as well as logistics, insurance or banking will be able to create new and upgrade existing applications with the most advanced generative AI technology. To make this possible, Siemens is integrating Amazon Bedrock – a service that offers a choice of high-performing foundation models from leading AI companies via a single API, along with security, privacy, and responsible AI capabilities – with Mendix, the leading low-code platform that is part of the Siemens Xcelerator portfolio.

Commenting on the partnership Roland Busch, CEO of Siemens, said: "By integrating Amazon Bedrock into our low-code platform, we are democratising generative AI technology and empowering everyone to create the applications customers need to become more competitive, resilient, and sustainable. Making smarter applications without programming expertise accelerates innovation and helps companies to tackle the shortage of skilled labour."

Adam Selipsky, AWS CEO, said: "Together, AWS and Siemens are empowering companies worldwide to create new capabilities, solutions, and value with generative AI. This partnership builds on our 10-year relationship with Siemens, giving customers across all industries the flexible, customisable, secure environment they need to take advantage of new opportunities with generative AI."

The combination will enable customers to select the generative AI model that best suits their specific use case and quickly and securely incorporate that model into their applications. This will make application development simpler, faster, and more efficient. Previously, when developers wanted to integrate generative AI models, they had to obtain access credentials, and write specialised function code. With the new Mendix-Amazon Bedrock integration, this can now be done with just a few clicks. Teams can create smart, industry-hardened applications without dedicated programming knowledge and users can interact with information easily via a graphical interface and the simplicity of drag and drop commands.

This innovation allows Mendix customers to apply generative AI to drive productivity within their workforce. For instance, using generative AI, a factory worker can find machine documentation faster and generate relevant visualisations without a need to search a database, manuals and records manually. A production engineer could also use generative AI to suggest machine adjustments to improve yield, and get suggestions on equipment adjustments, maintenance, or even spare parts to improve productivity in the factory. Customers do not need to build their own AI infrastructure and will be able to harness the power of their company's data with a high level of security and privacy, maintaining full control of their data.

Siemens and AWS technologies and services together support faster, simpler, customisable development of applications using generative AI.

Generative AI technology can supercharge applications with features like summarising and analysing lengthy technical or legal documents, translating content into different languages, or recognising images. Financial businesses can integrate automatic fraud detection in their software, and workers in a car factory, for instance, can improve quality based on AI analysis of millions of data points in the manufacturing line. With access to a selection of foundational models on Amazon Bedrock, users can easily select the most suitable model for the task and integrate it with a few clicks.

The collaboration expands on the long-established partnership between AWS and Siemens to help streamline the use of IT and cloud technology so it can be easily integrated in applications and machine workflows, making it more accessible.

Today, more than 50 million end users worldwide work with more than 200 000 applications built with Mendix's low-code platform, available as part of the Siemens Xcelerator portfolio. Low-code platforms are expected to grow substantially over the coming years. The technology enables developers to create applications by drag and drop with reusable components and software building blocks, which means they can build more software faster and with smaller teams.

Amazon Bedrock is a fully managed service that offers easy access to a range of industry-leading large language models and other foundation models from AI21 Labs, Amazon, Anthropic, Cohere, Meta, and Stability AI, along with a broad set of capabilities that customers need to build generative AI applications – simplifying development and supporting privacy and security. Users can also apply Guardrails to filter undesired content, adhere to responsible AI policies, or finetune their models using Knowledge Bases for Amazon Bedrock to give contextual information from private data sources and more relevant, accurate and customised responses. □

Energy efficiency is central to the energy transition

At COP28 in December 2023, the International Energy Agency (IEA) highlighted five key pillars that it sees are needed to keep the door open to achieve the goal of limiting global warming to 1.5°C by 2030.

These central pillars for action through the next seven years are:

- Triple global renewable power capacity
- Double the rate of energy efficiency improvements
- Commitments by the fossil fuel industry, and oil and gas companies in particular, to align activities with the Paris Agreement, starting by cutting methane emissions from operations by 75%
- Establish large-scale financing mechanisms to triple clean energy investment in emerging and developing economies
- Commit to measures that ensure an orderly decline in the use of fossil fuels, including an end to new approvals of unabated coal-fired power plants.

The IEA stated that building consensus quickly around all these pillars is going to be essential. Encouragingly, at COP28, agreement appeared to be emerging around the first two pillars, with around 120 countries signing up to a Global Pledge on Renewables and Energy Efficiency. It noted that greater impact could be achieved if the pledge were adopted as part of the formal COP28 outcomes.

The IEA views energy efficiency as the first fuel in the energy transition.

Additional measures

However, none of the five pillars does enough without the others. And achieving them will also require a host of accompanying measures, such as expanding electricity grids, scaling up low-emissions fuels, and building more nuclear plants.

More broadly, the IEA was involved in numerous events at COP28, including the COP28-IEA High-level dialogue on building a 1.5°C-aligned energy transition. The event brought together world leaders, ministers, and a range of other energy decision makers to build consensus around pathways to limit global warming to 1.5°C.

The Annual Global Conference on Energy Efficiency 2024

In November last year IEA Executive Director Dr Fatih Birol and Kenya's Minister of Energy and Petroleum Davis Chirchir, confirmed plans to host the 9th IEA Annual Global Conference on Energy Efficiency in Nairobi, Kenya, from 21 to 23 May 2024.

The conference will bring together ministers, CEOs and other senior leaders to explore how international cooperation and accelerated ambition on energy efficiency can translate into substantive real-world progress.

The previous conference, held in Versailles, France, in June 2023, saw over 600 delegates from 90 countries in attendance. The event delivered the Versailles Statement, a pledge from 46 governments to support the goal of doubling global energy efficiency progress by 2030.

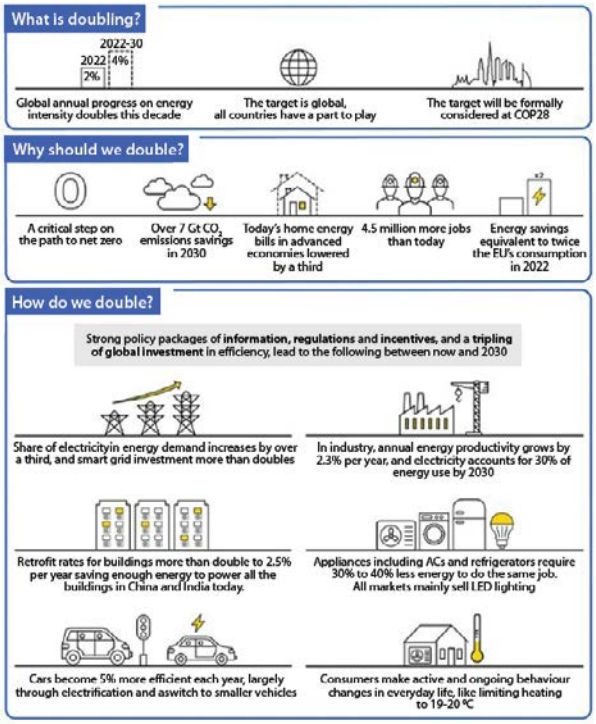
The 9th Global Conference, jointly organised by the IEA and the government of Kenya, will host discussions among leaders on the policies and measures needed to address the ongoing impacts of the global energy crisis. It will be the first time the event will take place in Africa and it will build on the momentum for greater energy efficiency action generated at the COP28 Climate Change Conference in Dubai**.**

Dr Birol said: "I am delighted that the next IEA Annual Global Conference on Energy Efficiency will be hosted in Nairobi. Efficiency must be the first fuel to drive the energy transition. It will play a critical role in creating jobs, growing industries, improving energy security and delivering affordable, modern energy services to all in emerging and developing economies. Not least on the continent of Africa where we need to scale up investment to ensure we deliver a just and people-centred energy transition."

In September last year the Kenyan government hosted the inaugural Africa Climate Summit in Nairobi, during which Dr Birol called for a New Energy Pact for Africa and urged the international community to support African countries in tackling energy access challenges across the continent.

Minister Chirchir said: "We are pleased to welcome the world to Nairobi again, to continue our journey of the energy transition. Energy efficiency will go a long way in enhancing affordability, access and socio-economic development, especially in developing countries."

Ahead of the conference, the IEA will host its second Energy Efficiency Policy Training Week for Africa in Nairobi in March 2024 to help build capacity among the next generation of policymakers in the region.



The IEA will host its 9th annual global conference on energy efficiency in Nairobi in May 2024.

One of the critical issues highlighted was clean cooking. The IEA aims to make 2024 a turning point for clean cooking in Africa and will host a global summit on this issue in the first half of the year.

Beyond clean cooking, the agency also sees a lot more to be done to support policies for energy transitions in Africa. It highlights Africa's immense renewable energy potential that has gone largely untapped. Despite being home to 60% of the best solar resources in the world, it has only 1% of global installed solar PV capacity. Leveraging the continent's natural endowments responsibly will be essential to support its development.

Doubling progress on energy efficiency

Energy efficiency, which the IEA views as the first fuel in the energy transition, is also high on the agenda for 2024.

In its latest *Energy Efficiency 2023* report, the agency recognises that policy makers around the world expanded measures to promote energy efficiency in 2023, helping consumers save money and improving the security and sustainability of the global energy system. However, the report shows that progress is not fast enough to meet the world's climate targets. While future technologies are being developed, doubling progress on energy efficiency is a critical step on the path to net zero emissions. □

For more information visit: www.iea.org

Major investment in solar power storage project

In a significant boost to South Africa's renewable energy sector, Old Mutual Alternative Investments (OMAI) recently announced a substantial investment in the country's energy infrastructure of about R158 million through its Hybrid Equity division.

This follows closely after the world's largest congress on climate change, COP28, where African leaders emphasised the need for significantly increased climate action and green growth financing across the continent.

Mujaahid Hassan, Co-Head of Hybrid Equity at OMAI, said, "Our investment in the Hydra Storage Project is a testament to our commitment to fostering sustainable energy solutions in South Africa. This project addresses the immediate challenges of loadshedding and aligns with our nation's climate change objectives."

Old Mutual Hybrid Equity has committed preference share funding to Hydra HoldCo, enabling the acquisition of a 35% equity stake in the TotalEnergies Hydra Storage Project. The Hydra Storage Project, a hybrid 216 MWp solar photovoltaic (PV) facility with 497 MWh battery energy storage, promises substantial social and economic benefits, including increased dispatchable renewable power generation, job creation, and reductions in greenhouse gas emissions. The project comprises three co-located sites in the Northern Cape that will have a contracted capacity of 75 MW at the delivery point from which energy is dispatched to the national transmission grid. Construction was due to begin in December 2023.

'This venture marks a significant milestone in South Africa's journey towards sustainable energy," said Christopher Aberdein, Director of Hydra HoldCo. "The Hydra Storage Project represents more than an investment; it's a major step forward in our country's energy independence and sustainability."

OMAI, a key player in the investment landscape, has driven innovative and impactful solutions across various sectors. With this latest venture, OMAI confirms its commitment to advancing South Africa's renewable energy capabilities.

The sponsor's first bid on the RMIPPPP issued by the Department of Mineral Resources and Energy was on 24 August 2020. The project was granted Preferred Bidder status on 18 March 2021 and reached Financial Close in December 2023. The RMIPPPP was designed to alleviate supply constraints by procuring 2 000 MW from a range of technologies that could be bid together to form one project.

Aberdein said OMAI's investment in the project is a financial endorsement of it and a strong statement of support for South Africa's renewable energy ambitions. "As the country continues to navigate the challenges of loadshedding and climate change, such strategic investments are crucial in shaping a sustainable and resilient energy future. We are proud to be part of the solution that will support the country's energy security, economic development and growth," he said. □

The case for including nuclear in SA's energy mix

Dr Andrew Dickson, CBI-electric: low voltage.

Dr Andrew Dickson, Engineering executive, CBI-electric: low voltage suggests that South Africa, in transitioning to a new, clean and sustainable energy platform, should include nuclear power in the energy mix.

South Africa has committed to net zero emissions by 2050, but the country's power crisis is putting achieving this goal in jeopardy. Cabinet has recently approved the Just Energy Transition Investment Plan and the allied Implementation Plan[1], which aim to guide South Africa's transition to a low carbon economy through the scaling up of renewable energy sources, while also meeting the country's growing energy needs and ensuring inclusive economic growth and employment. However, a balanced portfolio that includes nuclear power should be considered as a more holistic solution.

Dr Dickson highlights that nuclear power plants provide a stable baseload supply of energy. "Conversely, renewable energy sources like solar and wind have output gaps when the sun sets, or the wind stops blowing and therefore require complementary backup power or energy storage solutions to deliver dispatchable energy. Additionally, a typical nuclear reactor easily produces 1 GW of electricity per plant and requires about 3.4 km^2 of land to do so, whereas solar farms need between 116 km^2 and 200 km^2 to generate the same amount of electricity and wind farms from 670 km^2 to 930 km^2."

Moreover, he adds that, unlike renewable energy projects, which are currently hampered by transmission grid capacity constraints in provinces like the Northern Cape, Western Cape, and some parts of the Eastern Cape where these natural energy resources are abundant, nuclear power plants can be constructed in areas with greater grid capacity.

Looking at the role nuclear energy could play in combating climate change, Dr Dickson notes that nuclear power plants do not emit any greenhouse gases during operation, according to the World Nuclear Organisation[2]. "Furthermore, over the course of their lifecycle, nuclear plants are said to produce about the same amount of carbon dioxide equivalent emissions per unit of electricity as wind, and one third of the emissions per unit of electricity compared with solar. This does not take into account the carbon emissions footprint of grid-scale battery storage, including all steps in the manufacture of the battery from mining and refining of the materials used through to recycling the battery once it reaches the end of its lifespan."

In France, for example, 88%[3] of electricity is produced from zero emission sources with nuclear accounting for 63% of its energy mix and wind, 12%. This has led to the country becoming the largest producer of zero emissions power in the European Union and being far ahead of other EU countries in decarbonising electricity. France has committed to fully decarbonise electricity by 2035 and will phase out coal entirely by 2024.

"According to the CSIR's energy statistics, South Africa makes use of only 1.9 GW of nuclear power versus 3.4 GW of wind and 2.3 GW of solar," Dicksom points out. "Although there are concerns about the safety of nuclear power, largely due to two major accidents: Chernobyl in Ukraine in the the then USSR in 1986, and Fukushima in Japan in 2011, this does not compare to the number of deaths caused annually from pollution from coal-fired plants. A report by the Centre for Research on Energy and Clean Air has found that Eskom's coal power stations alone are responsible for some 2 200 deaths every year. By some accounts, nuclear power has been deemed one of the safest sources of energy – even more so than wind."

Dickson adds too the point that although it takes on average around eight years to build a nuclear reactor versus two to six months to construct a wind farm and eight to 12 months for a solar farm, in South Africa, delays in the Renewable Energy Independent Power Producer Procurement Programme have meant that these projects are not being built much faster. Additionally, he emphasises that with nuclear plants, the country would be able to generate gigawatts of electricity whereas renewable energy projects operate at comparatively smaller scale, producing a couple to several hundred megawatts in some cases.

"Increasing the amount of nuclear power in South Africa's energy mix could help to ensure a bigger, better and more stable baseload which, in turn, will help to bring about an end to loadshedding, spur economic growth and enable the country to meet its net zero emissions commitment," he concludes. □

References:

[1] https://www.thepresidency.gov.za/president-cyril-ramaphosa-pleased-milestones-reached-he-concludes-visit-cop28-dubai

[2] https://world-nuclear.org/nuclear-essentials/how-can-nuclear-combat-climate-change.aspx

[3] https://ember-climate.org/countries-and-regions/countries/france/

For more information visit: https://cbi-lowvoltage.co.za

Nadja Haakansson, Siemens Energy.

How do we achieve the energy future Africa needs?

Nadja Haakansson, Managing Director for Africa at Siemens Energy

In 2022, global emissions reached a record high of 36.8 billion tonnes of CO_2. During 2023 several months broke global warming records and scientists at the European Union's climate change service forecast that it could be the warmest year ever logged. With global energy demand expected to surge by some 25% by 2030 and emissions expected to continue to grow, we face energy poverty in combination with climate impact, for the most vulnerable populations in the world.

Some 775 million people still lack access to the most basic means of electricity; 600 million in Africa, and with the population growth rates the mounting challenges will have devastating outcomes, unless we unite to resolve the most significant hurdles.

The continent, which accounts for around 3% of total emissions globally, loses between USD 7 and 15 billion annually from climate change impacts and this is projected to climb to USD 50 billion by 2030. Africa also faces a climate finance gap of USD 213 billion between now and 2030, according to the African Development Bank Group (AfDB). Adding more urgency to the situation, Africa has the fastest growing population in the world, which is expected to reach 2.5 billion by 2050, according to the United Nations.

We need to implement the solutions that deliver energy in the most sustainable, reliable, and affordable way.

Writing just ahead of COP28, we look to the people who will convene there and that can make this a reality. What is required is that COP28 delivers, despite challenging global and geopolitical circumstances, the will and collective action that turns information sharing, marketing, and vague recommendations into tangible action plans. What matters is implementation to achieve the desired change.

Regional and global development finance institutions, global energy decision-makers, governments and companies all need to commit to supporting Africa in building the energy future it needs.

Recognising today's challenges

Although Africa accounts for a fifth of the global population, the region has attracted only 2 to 3% of global energy investment, according to the AfDB and the International Energy Agency (IEA) in their recent *Financing Clean Energy in Africa*[1] report.

A major reason for this has been that, historically, the overall risk profile for projects in Africa made them significantly more expensive to finance than those in advanced economies. This was exacerbated by higher borrowing costs due to the Covid-19 pandemic and Russia's war in Ukraine. Despite Africa's immense green energy potential, developers have often abandoned projects because they could not see their viability.

The AfDB and IEA propose the easing of financing costs to unlock a wave of clean energy spend in Africa. Currently, the cost of capital for energy projects in African countries is at least 2 to 3 times higher than in advanced economies and China.

According to the report, to deliver modern energy to all Africans by 2030, we will need to double the current energy investment in Africa. That means over USD 200 billion in spending per year, of which two-thirds will need to be directed to clean energy.

Siemens Energy is active in driving the development of renewable energy plants in Africa.

The commercial case for an African just transition

Two important recent announcements may go a long way to help mitigate climate financing challenges, by drawing attention to the opportunities and stimulating the commercial prospects that sustain-

able energy projects in Africa can offer.

The first is the African Development Bank's announcement[2] in late September that it would provide USD 25 billion in climate finance by 2025. As part of this, USD 20 billion will go to the Desert to Power programme to develop 10 000 MW of solar power across eleven countries in the Sahel region of Africa and provide electricity for 250 million people.

The second significant recent funding announcement for Africa is the #COP28 finance initiative between the United Arab Emirates (UAE) and Africa. In strategic partnership with Africa 50[3], an infrastructure investment platform with African governments as shareholders, the initiative brings together public, private and development capital from various sources in the UAE.

Its aim is to support African energy transition strategies, including enhanced regulatory frameworks and a master-plan for developing grid infrastructure, integrating supply and demand. The plan is to kickstart a pipeline of bankable clean energy projects in Africa, starting with 15 GW of clean power by 2030, by deploying USD 4.5 billion to catalyse an additional USD 12.5 billion from multilateral, public and private sources.

In making the announcement, COP28 (then) President-Designate Dr Sultan Al Jaber said climate change contributed to a fifth of Africa's people being hungry, and the displacement of African citizens tripling in the past three years – dragging Africa's GDP growth down by at least 5% every year. Urgent intervention is therefore not just for the sake of the climate – it is too a socioeconomic imperative. Dr Sultan Al Jaber announced that support to address these issues would be available to any African government with "clear transition plans, robust regulatory frameworks and a real commitment to putting the necessary grid infrastructure in place".

Next steps to build the energy future Africa needs

Africa's need to achieve energy security and a just transition is clearly established. The funding side of the equation is gaining attention though not yet solved. Another piece that needs to fall into place is governance.

In a bid to mitigate high capital costs, amplify socioeconomic development, and ensure a just energy transition, African governments need to make more efforts to improve climate governance and policy frameworks, to address corruption, curb emissions, and enable investment in clean energy solutions and infrastructure.

To facilitate progress, regional governments need to reassess how they operate and recognise that energy is not a commodity but the foundation for social development, economic growth and prosperity. The absence of a resilient electricity supply hinders economic growth and slows down social development. The energy transition should be embraced as the most significant socioeconomic and environmental transformation since the Industrial Revolution.

African countries have never stepped into a UNFCCC COP gathering with more solid opportunities to accelerate the energy transition than was the case ahead of COP28. African governments now need to take the necessary concrete action to unlock the monumental support they finally have access to, while addressing the decarbonisation opportunity as a pivotal moment to establish a new market and accelerated industrialisation. This is the tipping point and time for action. □

The company is also involved in the development of transitional energy solutions.

For African countries, the energy transition and extending access to electricity represent the most significant potential for socio-economic development and environmental transformation.

References:

[1] https://www.iea.org/reports/financing-clean-energy-in-africa

[2] https://www.afdb.org/en/news-and-events/speeches

[3] https://www.africa50.com/

For more information visit:
www.siemens-energy.com/africa

Mervyn Naidoo, CEO, ACTOM.

One-stop power solutions

South Africa generates about 85% of its energy from coal. The national power utility, Eskom, can generate up to 45 000 MW per hour, although over recent years it has been unable to supply even 27 000 MWh to serve peak demand, resulting in power cuts or loadshedding that can last several hours a day.

According to some 2023 reports, loadshedding has cost South Africa 1.2 trillion rand since it was first implemented and has increased the cost of doing business considerably.

CEO of ACTOM, Mervyn Naidoo says one of the everyday impacts of loadshedding for business owners is the extra costs they incur each month to maintain standard operational levels – whether installing solar, UPSs or fuelling large-scale diesel generators.

In this context, ACTOM's market-leading technology and advanced products present a portfolio that can comprehensively address the issues facing the electro-mechanical industry. ACTOM offers large-scale infrastructure installations as well as smaller-scale solutions and support services. With 12 specialist and fully integrated divisions, the company is committed to meeting its clients' energy needs without compromising sustainability for future generations.

The concept of power islands is gathering interest worldwide and has already been implemented successfully in several countries. Naidoo explains that a power island is established as an independently operated network, or part of a network that is isolated after being disconnected from the interconnected system, and has at least one power-generating module or HVDC (high voltage direct current) system supplying power to the network and controlling the frequency and voltage.

These independent networks offer the best solution to meet the growing electricity demands of industrialised countries. Green power islands also reduce a facility's carbon footprint and support a cost-effective management strategy, reducing energy costs and providing a significant return on investment.

There are two states under which a power island can operate.

In synchronised mode, the plant is connected to a distribution system which, in turn, is connected to the utility grid. In this case, power can be fed into the grid or, if required, power can be extracted from the grid. Synchronised operation is enabled in both captive and independent power plants.

In islanding mode, the power plant is dissociated from the distribution system or power grid. In this case, the plant runs on house load, that is, a generator will generate enough energy to cater only for the in-house power requirement.

Generally, plants run synchronously with the grid because there is always some mismatch between power generation and demand. Additionally, if for some reason a power plant trips, it requires starting power that can be drawn from the grid. But usually, plants have the islanding mode enabled, which will automatically island or isolate the plant if there is some external disturbance in the grid, such as a voltage dip or an erratic frequency change, thus protecting the plant from external disturbance.

In the grid-connected mode, the host grid handles frequency and voltage regulation. However, in an islanded operation, a microgrid must be able to regulate internal frequency and voltage with appropriate controls. Droop control is a commonly accepted control system for power sharing among distributed energy resources (DERs) in a microgrid.

ACTOM offers a complete turnkey power island solution and is a leading supplier of premium specification and standard low voltage motors, gearboxes, speed reducers and motor starters. The company also custom designs and manufactures medium voltage motors for the mining, industrial, processing and utilities sectors in South Africa and globally.

According to Naidoo, "As ACTOM, we can deliver every element of a power island. We manufacture the boiler, the turbine, the generator, and the associated switchgear and control. ACTOM offers the full scope of products for an effective power island."

Here, the 12 ACTOM divisions work together to deliver an integrated solution within an efficient value chain.

The divisions include, among others, John Thompson supplying custom-designed and manufactured boilers and energy solutions; Marthinusen & Coutts, specialist in electro-mechanical maintenance, repairs and services; Static Power, specialising in the design and manufacture of ac and dc standby equipment for the industrial, telecomms, rail and renewable energy markets; and ACTOM Power Transformers which, alongside other projects, has designed and delivered low-cost transformers for several wind farms. ACTOM also incorporates smart technologies and IoT solutions as applicable in the equipment it manufactures.

Some of ACTOM's successes are evident in its completed projects and its contribution to keeping the lights on. The Ngodwana Biomass Fuel Plant installation, established under South Africa's Independent Power Producer Programme, was completed as a joint venture between John Thompson's Industrial Watertube Boilers and Lesedi Nuclear Services. The 25 MW power plant is adjacent to Sappi's Ngodwana pulp mill in Mpumalanga. The installation took 20 months to complete and John Thompson will operate and maintain the plant, comprising the boiler, turbine, and balance of the plant, over a five-year contract period.

ACTOM Power Transformers has designed low-cost transformers for wind farms, including 157 x 2 700 kVA pad-mounted, oil-natural, and air-natural transformers for the Noupoort, Khobab and Loeriesfontein wind farms, as well as the Kouga wind farm.

With renewable power generation and solutions in

Continued on page 15

New BESS provides energy resilience in critical applications

Vertiv, a global provider of critical digital infrastructure and continuity solutions, has introduced the Vertiv™ DynaFlex BESS, a battery energy storage system designed to enable energy independence and bolster sustainability efforts at mission critical facilities. Launched into the North American and EMEA markets, the Vertiv DynaFlex BESS provides for flexibility in the use of utility power and is another step in establishing a dynamic power architecture. The system allows organisations to leverage the capabilities of hybrid power systems that may include solar, wind, hydrogen fuel cells, and/or other forms of alternative energy.

The lithium-ion batteries in the new BESS provide long duration support for utility-scale energy, allowing seamless and repeated transitions between energy sources. When paired with the optional Vertiv DynaFlex EMS (energy management system), the Vertiv DynaFlex BESS enables advanced energy management strategies, such as demand management and sharing or selling energy back to the grid, which can result in reduced utility energy consumption and costs and potentially generate revenue for the parties involved.

According to Omdia's *Market Landscape: Battery Energy Storage Systems* report, "Enabling the battery ESS to interact with the smart electric grid is an innovative way of contributing to the grid through the balance of energy supply and demand, the integration of renewable energy resources into the power equation, the reduction or deferral of grid infrastructure investment, and the creation of new revenue streams for stakeholders."

Peter Panfil, Vice President, Global Power, at Vertiv said, "Sustainability has become a core tenet of many organisations' growth plans but concerns about operational resilience and growing stress on the grid have limited efforts to adopt alternative energy sources. The Vertiv DynaFlex BESS opens the full energy management toolbox. It allows organisations to leverage the strengths of these new energy generation assets and shifts the traditional utility provider to a complementary role in a more dynamic, efficient, and reliable mix of energy sources."

Wojtek Piorko, Managing Director, Africa at Vertiv.

Wojtek Piorko, Managing Director, Africa at Vertiv said, "It is becoming increasingly important for mission-critical facilities around the globe to find reliable sources of energy that can handle significant events or fuel access restrictions, and even more so in Africa, where many countries are experiencing serious grid constraints. The African Legal Support Facility in partnership with the Commercial Law Development Programme and Power Africa, note the implementation of battery energy storage systems (BESS) in their *Understanding Energy Storage* handbook, as an alternative to traditional power solutions, saying that 'energy storage is a powerful tool that can change the pathways to power that sector decision-makers can pursue'. It also refers to BESS as potentially being used as a mitigation measure to unlock grid capacity."

The Vertiv DynaFlex BESS is designed specifically for mission-critical environments, such as commercial industrial facilities, high-value manufacturing plants, data centres, and other facilities where power plays a critical role. The system's power conversion system (PCS) is designed to support 2 millisecond output, virtually eliminating any delays in shifting the load between hybrid power sources. Coupled with an uninterruptible power supply (UPS) system, the reliable, efficient Vertiv DynaFlex BESS reduces the risk of data centre outages and delayed diesel generator starts.

The UL9540A-tested lithium-ion batteries in the BESS are designed to minimise fire risks, are free-standing with a small footprint, and are designed for modularity. □

The Vertiv DynaFlex BESS is designed for mission-critical environments, such as commercial industrial facilities, high-value manufacturing plants, data centres, and similar.

Continued from page 14

high demand, the market can benefit from working with local manufacturers offering a range of services to deliver value and efficiency.

"ACTOM offers the full scope of Engineering, Procurement and Construction skills and services for plant installation, and beyond that, the operation and maintenance of the plant. We can manufacture all the required products and support the plant through its full life cycle, assisting customers to obtain optimised plant performance," Naidoo says.

For more information visit: www.actom.co.za

Modular substations for renewable energy

Renewable energy projects like those using solar and wind energy sources present particular demands on the electrical infrastructure, but there are opportunities for cost savings in both capital and operating expenditure. Managing Director of Trafo Power Solutions, David Claassen, highlights some key advantages of modular substations and dry-type transformers.

The growing renewable energy generation sector in Africa is realising the value of modular substations in solar and wind projects, and the suitability of dry-type transformers in these installations.

Claassen notes that solar photovoltaic plants and wind farms have an important characteristic in common: they both have to deal with multiple sources of generated energy. At a solar plant, for instance, there is typically a large area of solar panels – especially when the project is of utility scale – that requires many individual substations at different locations within the project.

"Depending on the output of the plant, it could require 30 to 100 substations to service the generation capacity," Claassen says. "This means a large number of essentially identical substations is required – which lends itself to factory-based production. In this way, projects gain the benefit of quality from dedicated workshop conditions, as well as the cost benefits related to economies of scale in respect of sheet metal, structural steel and other components."

When production is streamlined, completion of the units is also quicker, he says, and will likely be accomplished by a smaller team than would be required to build brick-and-mortar structures on a distant site. He notes that the locations chosen for these renewable energy projects – especially for wind farms – are invariably in quite remote areas, making logistics challenging.

The usual inputs for on-site construction such as water, sand and aggregate are often difficult to find nearby and can be costly to transport. The best places to generate energy from wind turbines are often found in hilly or mountainous areas, and there is usually little infrastructure to support the early on-site operations.

"We have seen many of South Africa's solar and wind power projects already incorporating a modular approach to inverters," Claassen says. "As a supplier of modular substations, we also specialise in dry-type transformers which are well-suited to these applications."

He highlights that dry-type transformers fit easily into compact modular substations along with the inverter, switchgear and ancillary equipment. And importantly, the design and operation of the transformers aligns closely with the sustainability philosophy that underpins the promotion of clean, renewable energy.

"It makes sense for renewable energy projects, which are leading the charge to supplement and over time replace fossil fuels, to employ technologies that do not rely on oil," Claassen says. "Unlike conventional transformers, which are cooled by oil, dry-type transformers are air-cooled and are much more environmentally friendly."

E-House or modular substation fitted with monitoring control panels specially for a renewable energy application.

The absence of oil as a coolant means there is no risk of oil contamination through leakage, and ensures higher levels of safety. The safety ranking of dry-type transformers allows them to be situated close to human traffic and even indoors – as the risk of fire or explosion is low.

With most renewable energy projects in South Africa and Africa being driven and funded by independent power producers, the cost per kilowatt-hour is paramount to their success. They are generally selling their electricity at a pre-agreed price to a utility or customer, so they need to control their capital and operating expenditure carefully.

"The manufacture of substations in a modular format provides a saving on the upfront capital, and dry-type transformers require minimal maintenance, providing savings on the plant's running costs," he says.

Other important technical factors also play a role in making dry-type transformers the best choice for renewable power applications. Claassen explains that transformers need to be purpose-designed, and in the case of solar plants especially, high ambient temperatures need to be considered in the design. The cooling system must be capable of managing the heat, so that the performance and service life of the transformer is optimised.

"Within our design for modular substations in the renewable energy space, we have multiple options for cooling, depending on the prevailing conditions," he says. "This includes naturally ventilated air, forced ventilated air or cooling strategies using heat exchangers based on either air or water."

He adds that Trafo Power Systems' transformer units for these applications are rated as Class H on both the low voltage and medium voltage windings.

"Another key aspect of the design is that transformers in a photovoltaic application experience a daily cycle of full load and no load, so there is frequent expansion and contraction of the windings that needs to be accommodated," he says. "Further to that is the non-linear supply from the inverter, so the transformer has to be designed for high harmonic content, which also translates into a temperature consideration."

Continued on page 17

Planning a harmonic mitigation strategy

Interestingly, in the UK, as in South Africa, a high number of manufacturing businesses are concerned about the impact of power blackouts on their operations. According to a Make UK survey, this is a concern for 60% of manufacturing bosses. The rise of non-linear loads in industrial environments, and the growing problem of voltage distortion, will only exacerbate these concerns. Here John Mitchell, Global Sales & Marketing Director at power quality specialist CP Automation, outlines the steps to harmonic mitigation.

In industrial facilities, power quality influences equipment reliability, lifespan and overall productivity. Voltage distortion can wreak havoc by damaging equipment, with symptoms including voltage notching, motor vibration, arcing on bearings, nuisance tripping, electromagnetic interference (EMI/RFI) and overheating.

Despite its importance, those working in production facilities rarely monitor power quality in real time. Consequently, they are unlikely to notice any power distribution issues until they impact production.

Identifying the problem

Uneven power distribution will affect how equipment operates – some machines may be overworking and others will not operate at capacity, leading to higher energy consumption in some areas. Harmonics can also accelerate wear and tear, reducing a machine's lifespan.

If a manufacturing team wants to add more equipment but is unaware of what is causing the capacity issues, it may turn to installing more equipment for power generation, like solar panels and generators. However, it would be more cost-effective first to survey the current power capabilities and invest in harmonic mitigation, instead.

Map the facility

A reliable power quality engineer will create a single line diagram of the factory, setting out the facility's electrical architecture from the transformer to the individual assets.

Looking at existing power quality measures will influence the harmonic mitigation strategy. For example, historically, motors were controlled with features such as direct online (DOL) and star-delta – resulting in a demand for 7 to 16 times their full load to start – and would operate at full speed. A DOL motor with a supply voltage distortion of 8% THDV (total harmonic distortion of the voltage waveform) will be limited to 85% of its power.

CP Automation's Revcon harmonic filters can be installed to mitigate harmonic interference in industrial electrical systems.

To correct those motor control methods, typically tuned power factor correction (PFC) would have been installed. Upgrading to VSDs or soft starters allows for greater control of the plant processes, reduced energy consumption, and simultaneously, improved power factor, making the PFC installed unnecessary.

Power quality specialists will take measurements to understand power capacity and usage across the site. A week of monitoring gives engineers sufficient visibility into operations and the possible cause of problems.

Best practice

Reducing harmonics is key to solving any issues with power quality and distribution. The equipment used on site and severity of harmonic distortion can influence what equipment to use, such as active and/or passive harmonic filters.

Ensuring compliance with relevant industry standards and regulations will also be key to effective harmonic mitigation. Engineering Recommendation G5/5 for example, provides a set of design limits for harmonic voltage level to ensure that loads are not exceeded. It also sets out best practice on the harmonic assessment process.

Review

It is important to assess power distribution after installation of new equipment to check that the upgrade has delivered the intended result.

Facilities managers can install equipment that monitors harmonics and power quality in real time. If there is an issue or a problem in the facility that needs investigating, power quality specialists can access the monitoring equipment remotely and conduct root cause analyses.

As shown by the Make UK report[1], blackouts represent a significant concern for manufacturing facilities, so improving resilience, reducing costs and boosting efficiency is key. By taking the time to assess the facility, gain visibility into power distribution and implement an effective harmonic mitigation strategy, facilities can deduce the cause of their problems and maintain power quality.

CP Automation can assist clients in assessing their facilities and planning a suitable harmonic mitigation strategy. □

Reference:

[1] https://www.makeuk.org/insights/reports

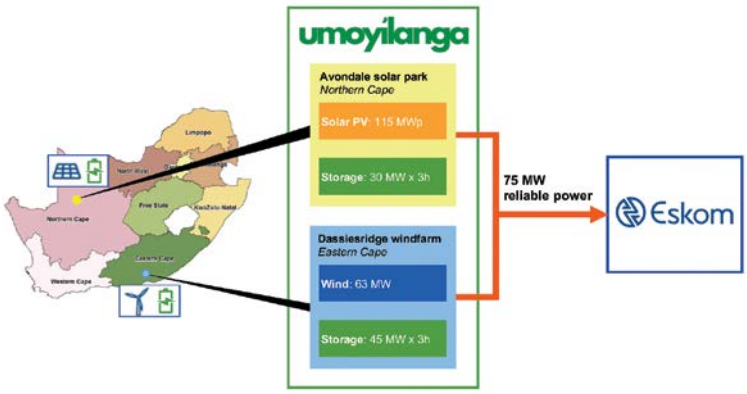
Continued from page 16

Claassen emphasises that Trafo Power Systems has extensive in-house design experience to meet these requirements, and project management expertise in engaging effectively with clients, engineers and other stakeholders on each project.

"It is crucial that wherever substations and transformers are supplied to renewable energy projects, the designers have a thorough understanding of thermodynamics," he says. "There is a considerable risk of poorly designed units overheating if they are operating outside of their design limits; the results can be catastrophic if all the project parameters are not fully considered." □

Further progress on RMIPPPP hybrid power project

EDF Renewables achieved Commercial and Financial Close on its Umoyilanga Project on 28 November 2023, reaching Commercial Close with the Department of Mineral Resources and Energy, and then concluding Financial Close with Nedbank, RMB and DBSA. This follows the signing of the Power Purchase Agreement (PPA) with Eskom, and the Implementation Agreement (IA) with the Department of Mineral Resources and Energy on 30 August 2023.



The Umoyilanga hybrid project, combining solar, wind and battery energy storage, will deliver 75 MW of dispatchable power.

The consortium of EDF Renewables, as a leading international renewable energy supplier, and Perpetua Holdings (Pty) Ltd, a privately held investment company was awarded the Umoyilanga project bid in the South African government's Risk Mitigation IPP Procurement Programme (RMIPPPP), in March 2021. Early works have started, and the construction phase will now begin, with commercial operation date (COD) expected in May 2025.

The project combines solar, wind and battery storage technologies to offer dispatchable and reliable power to the national electrical grid. It will operate as a virtual power plant, combining generation from two sites which are 900 km apart: Avondale in the Northern Cape, with 115 MW of solar PV and 30 MW of battery storage, and Dassiesridge in the Eastern Cape, with 63 MW of wind and 45 MW of battery storage.

The combination of wind and solar resources with battery energy storage will enable Umoyilanga to provide 75 MW on demand between 05:00 and 21:30, as required by the terms of the PPA, and demonstrates that renewable energy can provide reliable, dispatchable power at a competitive price.

To achieve this, batteries at Dassiesridge will generally charge from the wind energy at night, discharging power in the morning until the sun rises. The solar installation at Avondale will supply the bulk of the energy during the day, supplemented by wind energy from Dassiesridge. Excess solar energy will be used to charge the batteries at Avondale, which will discharge after sunset. A sophisticated energy management system will give instructions to assets across both sites to optimise the power supply in real time, depending on weather forecasts and Eskom's requirements. The low-carbon electricity produced, will help to meet the electricity needs of 120 000 households for 20 years, based on the Eskom residential consumption average of 3 319 kWh/household.

To deliver the Umoyilanga project, EDF Renewables has signed contracts with major contractors for each technology including:

- a turnkey EPC Agreement with China Energy Engineering Corporation (CEEC), to proceed with the final design, procurement and construction of the 115 MW Avondale PV plant
- a Turbines Supply and Installation Agreement with Vestas, to proceed with the erection of 14 wind turbines of 4.5 MW at Dassiesridge
- a Wind Balance of Plant Contract with Power Construction and Adenco Construction, to build all required infrastructures at Dassiesridge, and
- a Battery Energy Storage System Supply Agreement with Sungrow Power Supply, to deliver battery systems to both sites.

The project has committed to providing around 890 job year opportunities for local South African citizens (measured in job years), during the construction period across Dassiesridge and Avondale. It has also committed to contributing more than 40% of the capital expenditure to local content (procurement of South African goods and services). Over the 20-year operational period, 1% of revenue will be dedicated to local communities, through socio-economic initiatives.

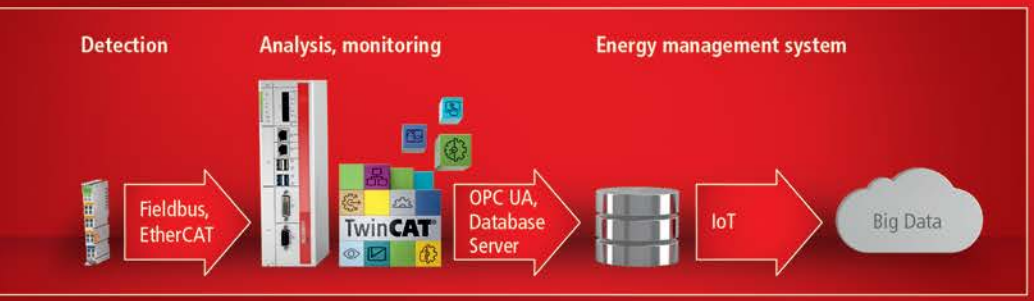
Tristan de Drouas, CEO of EDF Renewables in South Africa, said: "The Commercial and Financial Close of the project marks an important milestone before the launch of the construction phase. Our teams are particularly proud today, because this flagship project demonstrates that wind and solar technologies, combined with batteries, can deliver flexible power competitively. We look forward to implementing the project, and in doing so, supporting the South African government's and our ambitions to develop low-carbon energy solutions for the future, which will also help to solve the country's loadshedding crisis."

Perpetua Holdings director, Logan Govender added: "We have forged a sound collaboration and a strong partnership with EDF Renewables on this project and we are excited by the innovative and high impact contribution that together, we are confident it will deliver to South Africa." □

Effortlessly integrated into the system: Transparent energy data management via PC-based control

Power | Heat, gas | Water | Air pressure | Temperature | Condition monitoring

In support of cost-optimising energy management solutions, PC-based control from Beckhoff offers the ability to monitor, measure and analyse energy data via a monitoring system that is completely integrated into the standard control system. Feature-filled I/O components enable highly precise and transparent acquisition of all energy data for a company – from the administration through to every single actuator in every production facility. The data are processed and analysed using TwinCAT automation software, so savings potential can be fully exploited, creating the basis for DIN EN ISO 50001 compliance.



Scan to discover more about the benefits of transparent energy data

New Automation Technology **BECKHOFF**

New biogas gensets provide CO_2 neutral baseload and backup

Rolls-Royce has introduced new mtu Series 4000 biogas gensets for power and heat generation, setting new standards in efficiency, power density and life cycle costs. Vittorio Pierangeli, Vice President Global Powergen at the Rolls-Royce business unit Power Systems said: "The new Series 4000 L64FB engines are designed for global use and are extremely robust, showing consistently high performance even under extreme conditions of ambient temperature, humidity and altitude." The first 12-cylinder system was delivered to starch producer Tongjit in Thailand, to supply electricity and hot steam to the factory.

Rolls-Royce is now offering new mtu Series 4000 biogas gensets for power and heat generation, setting new standards in efficiency, power density and life cycle costs.

mtu biogas solutions help industrial customers save on electricity costs by generating their own electricity and they provide a stable power supply in the event of power outages. The basis for the development of the new series is the experience gained with the predecessor models (L32 for biogas and L64FNER for natural gas), which have proven themselves worldwide. In total, Rolls-Royce has supplied more than 4 000 Series 4000 gensets for natural gas, biogas and other gases to the global market.

Peak efficiency of 44.1%

The 12-cylinder version already available offers an electrical output of 1 521 kWe with a new peak electrical efficiency of 44.1% and an overall efficiency of more than 90%. Compared to the previous Series 4000L32FB model, output has been increased by 30%. The system's compact design ensures the smallest footprint and highest power density in its class. As a result, the new 12-cylinder variant delivers just as much power as the 16-cylinder variant of the previous L32 model. The other cylinder configurations (8V, 16V, 20V) are also available to order for delivery through 2024.

84 000 hours until major overhaul

The development of the new mtu Series 4000 L64FB biogas gensets also focused on reduced life cycle costs and ease of maintenance. With an engine lifetime of up to 84 000 operating hours until major overhaul, the new mtu gensets set new records. For plant operators, the long service life offers substantial cost efficiency. To meet the world's strictest exhaust gas standards (such as 44th BImSchV in Germany), the genset can optionally be combined with a suitable exhaust gas aftertreatment system from the mtu product portfolio.

CO_2-neutral, reliable and predictable

Biogas-fuelled mtu gas systems provide CO_2-neutral, reliable and predictable electricity as well as heating and cooling energy. The electricity can serve the customer's own needs and contribute to grid stabilisation as baseload electricity and balancing power. Thus, in times of energy crisis and non-constant wind and solar energy, biogas systems serve as a constant, environmentally friendly and flexible source of electricity.

In addition to agricultural applications, the gensets are in demand for use at wastewater treatment plants (sewage gas), landfill sites (landfill gas) and in food processing, for example. □

Moving towards low-carbon energy independence in agriculture

Taking a significant step towards using cleaner energy in the agricultural sector, Yellow Door Energy, a leading sustainable, renewable energy partner for businesses, has signed a multimillion-rand power purchase agreement (PPA) with Overyssel Boerdery, one of the largest growers and suppliers of potatoes in South Africa, with the aim of taking the farm off-grid in the near future.

The PPA signed between Yellow Door Energy and Overyssel Boerdery will see the installation of a 1.8 MW hybrid renewable energy and micro-grid system.

As the appointed independent power producer (IPP), Yellow Door Energy is responsible for financing, designing, commissioning, building, operating, and maintaining the renewable energy plant for the duration of the agreement with the commercial farm, closing the gap on energy security for critical farm operations.

Hans Van der Walt, CEO of Overyssel Boerdery, expressed his enthusiasm about the partnership, saying, "This collaboration, through a power purchase agreement with Yellow Door Energy, is a strategic move towards securing our farm's energy needs. The installation of the hybrid renewable energy microgrid system will ensure unin-

Continued on page 21

One of the world's largest hybrid solar-battery projects now online in SA

In December 2023, Scatec ASA, a leader in renewable energy solutions, officially started producing and supplying electricity to the national grid from the three Kenhardt plants in South Africa's Northern Cape.

The Kenhardt project is designed to make a notable impact on the renewable energy landscape as one of the world's first and largest hybrid solar and battery storage facilities. With an installed solar capacity of 540 MW and a battery storage capacity of 225 MW/1 140 MWh, the project will deliver 150 MW of dispatchable power from 05:00 to 21:30, year-round, to the national grid in terms of the 20-year Power Purchase Agreement with Eskom.

With a total investment of about USD 1 billion, the Kenhardt project is the largest commitment in Scatec's history and will generate solid returns to the company's shareholders. The project debt is provided by a group of lenders which includes The Standard Bank Group as lead arranger and British International Investment (BII).

"Today, we embark on an exciting journey into a new era of energy solutions. The Kenhardt project symbolises a technological triumph and a commitment to shaping a sustainable future," said Terje Pilskog, CEO of Scatec. "This is more than a power plant; it's a testament to the limitless potential of integrating solar and battery storage to meet the evolving energy needs of today and tomorrow. I would like to congratulate the team of Scatec 'changemakers' who have delivered this innovative project on schedule, within budget and with good HSSE performance, and I thank all partners and stakeholders who have been integral to this success."

A hybrid solar and battery storage plant integrates solar and battery technologies, overcoming intermittency challenges and bolstering grid stability. With the ability to deliver reliable power in low or no sunlight, the integrated storage enhances overall reliability. Dispatchable power production and the release of stored energy during times of peak demand make plants like this ideal for meeting region-wide energy needs during high consumption periods.

The three Kenhardt plants together have an installed solar capacity of 540 MW and battery storage capacity of 225 MW.

Jan Fourie, (then) Executive VP of Scatec Sub-Saharan Africa, emphasised the significance of this endeavour, saying, "This is not just about powering homes, it's about empowering communities. The Kenhardt project showcases the resilience and reliability of renewable energy, proving it to be a stable source of electricity capacity for the grid. Dispatchable renewables are the future."

At peak construction some 2 600 workers were employed on site, a high proportion of them being women, supporting local employment and community benefits. Overall, the project spans 879 hectares, measuring 10 km north to south. Construction started in July 2022 and included the installation of almost 1 million PV modules. The battery facility comprises 456 units, each the size of a shipping container, weighing 30 tonnes. More than 9 000 km of cabling (equivalent to the distance from Norway to South Africa) serves the site. Notably, in a competitive bid, this hybrid plant outperformed fossil fuels, confirming renewables' rise as the most cost-effective electricity source.

Scatec holds 51% of the equity and H1 Holdings, its local Black Economic Empowerment partner, owns the balance of 49%. This collaboration aims to generate power and to foster sustainable economic growth. □

Continued from page 20

terrupted operations and is in line with our commitment to sustainable farming practices."

The PPA entails the implementation of a 1.8 MW hybrid renewable energy and microgrid system, enabling seamless transition between different energy sources. Over 3 200 PV panels will be installed, together with a 2 900 kWh battery energy storage system (BESS) and a micro-grid distribution system. The overall solution, covering an area of over 20 000 m^2, is expected to produce 3.4 million kilowatt-hours of clean electricity in the first year of operation, equivalent to reducing carbon emissions by 3.5 million kilograms. The renewable microgrid system will form the base of a complete solution to enable the farm to go off grid in time, fortifying its operations against the challenges posed by worsening power outages.

Rory McCarthy, COO of Yellow Door Energy, said, "We are honoured to partner with Overyssel Boerdery on this landmark project, enabling this commercial farm to secure its energy supply and improve its resilience. This is Yellow Door Energy's first project in South Africa and demonstrates our commitment to support South African commercial industries in opening access to the cost-effective low-carbon and reliable supply of energy through our PPAs."

Yellow Door Energy's PPAs enable industrial and commercial businesses to secure their energy supply and reduce their energy costs while maintaining focus on their core business and enjoying the benefits of energy independence. □

Temperature controllers for diverse applications

Electronic controls are widely used and in industry they are found wherever there is a need to control a process, machines, or various devices.

They may be used, for instance, to feed coal into a furnace when needed, to control heat treatment with clockwork precision in a glassworks or steelworks, and to maintain the required environmental parameters in chemical laboratories.

The Korean company Autonics has become a leading global supplier of electronic temperature controllers. Autonics is a multiple award-winning manufacturer of solutions for industrial automation and as a global brand providing high-end products it competes with industry giants.

The company began manufacturing controllers in 1977 and demand for its products led it to open more branches in South Korea. Building on its domestic success, it expanded into foreign markets, including Japan, Indonesia, the USA and China. Today, the company has branches in 12 countries around the globe and offers its products and support to customers worldwide.

The Autonics portfolio includes sensors, measurement systems and laser marking systems. Here TME focuses specifically on the temperature controllers and I/O modules that are in its catalogue.

Temperature controllers (known in their simplest version as thermostats, and in more advanced versions as temperature regulators) are devices whose main task is to read and analyse temperature and then intelligently control the settings to obtain a set value. In design, a controller is usually a small cube (with each plane between 50 and 100 mm long) equipped with a digital LED or LCD display and a number of buttons for intuitive manual control. Enclosures vary depending on the application and mounting location.

Alarm outputs are an additional option offered in advanced controllers. The sensor, made of materials characterised by appropriate conductivity and resistance to high temperatures, such as platinum, copper or nickel, is responsible for measuring temperature. The sensors will be used in different temperature ranges, depending on the material used. The operating temperature of the controller itself generally falls in the range from -20°C to around 90°C.

Other sensors used in temperature controllers are thermocouples, which allow for temperatures above 1 000°C to be measured. Because they are used in industrial applications such devices, are designed to operate in demanding workshop conditions. High-quality products are IP65 rated, providing a barrier against contaminants such as dust or liquids. Communication between the temperature regulator and the control computer is seamless, so readings can be analysed and archived in real time.

In operation the temperature controller transmits a signal to the actuator (for example, a heater or an air-conditioning unit) indicating that the temperature differs from the set value and needs to be adjusted. The heating or cooling system then switches on and runs until the controller's computer signals again that the set temperature has been reached.

TK Series panel-mounted module.

TX controller with an alarm output.

Applications

Simple temperature controllers are found in many everyday appliances. Autonics, as a leading manufacturer, offers controllers that are used in more complex systems – in glassworks or steelworks, as noted above, as well as cement plants, and conventional and nuclear power plants. Temperature controllers are used wherever constant temperature maintenance or adjustment is required.

TK and TX temperature regulators

Autonics has various models of temperature regulators in its portfolio, two of which are new to the TME catalogue.

The TK series comprises high-quality PID controllers characterised by a fast sampling cycle (up to 50 ms), with accuracy of ± 0.3%. These controllers can be used to carry out both heating and cooling processes. The controller can be programmed via the control panel on the enclosure or via a USB cable connection from a PC. Settings can be conveniently changed via the free DAQ Master software. The large LED backlit display facilitates reading and controlling the device even in dark rooms. With its compact design, the controller can fit into the limited space of any control cabinet.

ARIO I/O modules are compatible with the DAQ Master software so no additional software is needed.

The TK series of solutions helped reduce the size of the unit by 38% compared to previous models and improved the speed of sampling cycles. The devices are available in several enclosure versions, which means they can be applied in almost any configuration. In the event of a heater burnout, the TK series models protect the user by activating a pre-set alarm.

Continued on page 23

Versatile, high-performance gas detectors

Many prerequisites come into play when selecting gas detection instruments, including maximum flexibility, high performance and minimal installation costs. Additionally, modern expectations extend to smart features and the ability to detect explosive, toxic or asphyxiant gases. The list of potential solutions soon becomes short. One proven and increasingly popular option is the iTrans 2 fixed gas detector from Teledyne Gas & Flame Detection.

Offering smart sensor capabilities that support an intelligent electronics platform, the iTrans 2 provides one or two points of detection from a single head for maximum flexibility, with both readings shown on the standard-issue LED and display. Gas sensors are mountable directly to the transmitter, or remotely.

For the detection of explosive and toxic gas, or oxygen, the iTrans 2 accepts infrared, catalytic bead or electrochemical sensors. Specifically, in addition to the LEL (lower explosive limit) sensor range, the iTrans 2 is configurable with a 0 to 100% volume methane infrared sensor for biogas applications and CO_2 infrared sensors ranging from 0.5% to 100% volume. All are pre-calibrated using smart technology to enable automatic sensor recognition and data transfer. The device displays sensor life data automatically after each calibration.

Offering cable-saving and time-saving installation, the iTrans 2 is suitable for almost any application via common configurations that include 3-wire (4-20 mA) and 4-wire (digital ModBus) models. Both allow for full use of the gas detector's features and options and can be used with all iTrans 2 sensors.

The gas detectors offer analogue 4-20mA and digital RS-485 Modbus outputs. The HART communication protocol is optional, enabling remote communication across the 4-20mA signal for diagnostics, commissioning and calibration. A simple magnetic wand further supports ease of use by allowing full transmitter configuration and calibration without opening the explosion-proof housing.

The housing is supplied as standard in epoxy-coated aluminium, with an optional 316 stainless steel version available for corrosive environments. Operating temperature range is -40°C to +75°C. Although this robust specification is ideal for many heavy industry applications, the iTrans 2 also serves well in smaller systems and boiler rooms, for example. It is suitable for sectors that extend from oil and gas, offshore drilling, utilities and petrochemicals, to water and wastewater treatment, and food and beverage production. Certifications include CSA, ATEX, IECEx, INMETRO, CCC and China Ex.

With smart sensor capabilities that support an intelligent electronics platform, the iTrans 2 provides one or two points of detection from a single head for flexibility.

Notably, the microprocessor-controlled transmitters are capable of plug and play, standalone operation or multi-point system configuration. The monitor's standalone operational ability is delivered via optional onboard relays that can activate alarms, horns or fans, and can also shut down a system without the need for return wiring to a central control panel.

With high levels of versatility and functionality, the iTrans 2 from Teledyne Gas & Flame Detection has proven itself in wide ranging applications. □

Continued from page 22

The controller is suitable for both manual and automatic operation. The product is equipped with relay/ SSR/ and analogue outputs.

The TX series controllers, similar to those in the TK series, have a 50 ms sampling cycle and an equally high accuracy of ±0.3%. The large and easy-to-read display and a slimmed-down enclosure (the rear part of the controller has been shortened by 30%) offer clear advantages. Programming the controller can be done using the DAQ Master software. The compact controller is equipped with the most important buttons for controlling the device, making operation simple and intuitive.

ARIO I/O modules

Based on its continuous research Autonics regularly introduces new products to the market and, as well as the controllers described above, these include the input/output modules from the ARIO series.

These I/O modules are compatible with DAQ Master so no additional software is needed to control the modules along with other electronic solutions by Autonics. industrial Ethernet Fieldbus communication is used for control via an industrial PC or a PLC. The ARIO series consists of a range of input/output, power, power supply and temperature modules. For more demanding applications, they can be expanded to include up to 64 modular units.

With a hot-swap system incorporated, active module components can be replaced during operation without the need to reboot or shut down the device. The ARIO I/O modules keep track of parameters and provide real-time diagnostics of input and output signals. Solid workmanship and robust, compact construction make for many years of reliable operation in tough industrial conditions.

For more information visit: www.tme.eu/za

Optris PI 640i IR camera and HD Video fitted with outdoor protective housing.

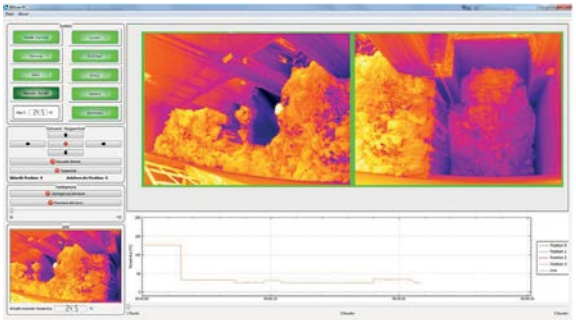
Compact IR camera for outdoor monitoring and fire detection

The Optris PI 640i is the smallest measuring VGA infrared camera, with a body sized 45 x 56 x 90 mm and weighing only 269 to 340 g (depending on the lens). It counts among the most compact thermal imaging cameras on the world market.

The Optris PI 640i is a product package designed specifically for outdoor condition monitoring and fire detection. With an environmental protection rating of IP66 and an integrated air purge the unit provides reliable 24/7 operation under harsh conditions. The built-in heater/fan has an extra wide operating temperature range from -40°C up to 50°C. The IR camera has a spec of 640 x 480 pixels and delivers pin-sharp radiometric images and real-time HD videos at 1280 x 720 pixels. The USB Server (PoE) ensures easy integration of both camera streams (IR and VIS) in the video management systems.

Areas of application

The high-resolution infrared camera PI 640i finds use in all industrial applications where pin-sharp infrared pictures and videos are essential for process monitoring, condition monitoring, early fire detection and optimisation.



Screen shot of the visual image on camera alongside IR reading of the same area.

The real-time thermographic images also prove especially valuable for surveillance and quality assurance in the automotive sector, in the plastics industry, and in the semiconductor as well as photovoltaic industries.

The unit can be delivered with industrial thermal imager equipment and is supplied with an extensive licence-free thermography software package.

For more information visit: www.instrotech.co.za

South Africa leads the way in PDS technology

Booyco Electronics, an original equipment manufacturer specialising in mine safety equipment, has seen a surge in demand for its Proximity Detection Systems (PDS) and Collision Prevention Systems (CPS) since South Africa implemented the Mine Health and Safety regulation focused on trackless mobile machinery in December 2022. Booyco's PDS and CPS offer vehicle-to-pedestrian and vehicle-to-vehicle detection capabilities which help to reduce collisions involving trackless mobile machinery and mineworkers and, in turn, to reduce fatalities and injuries.

A decade ago, the mining sector faced a grim reality with 270 fatalities per year. However, the industry has made significant strides in reducing these numbers by 20% annually, resulting in improved safety records.

In 2021, the industry saw a slight setback with an increase in fatalities and injuries, but progress remains evident as 49 fatalities – though still too many - were recorded last year.

Proximity Detection Systems (PDS) and Collision Prevention Systems (CPS) offer crucial vehicle-to-pedestrian and vehicle-to-vehicle detection capabilities.

Anton Lourens, CEO of Booyco Electronics, notes that South Africa's mining industry has been proactive in adopting technologies and innovative products to foster behavioural changes that support safety.

With stricter mine safety legislation in place, the company is focused on ensuring compliance with South African proximity detection and collision prevention systems requirements.

Lourens says the Minerals Council South Africa played a key role in promoting understanding and mediating around the Mine Health & Safety regulation and identified concerns related to equipment supply, installation, and maintenance. In addition to implementing PDS systems, some mining houses are keen to take ownership of product maintenance – and this requires comprehensive training for in-house personnel, which creates further opportunities for Booyco Electronics to expand its workforce.

"Significantly, South Africa was the first country to regulate PDS deployment in mining, attracting interest and engagement not only locally but also internationally," Lourens says. Booyco Electronics, in business for over 17 years, has developed its product line to meet diverse operational needs. However, Lourens emphasises that PDS alone cannot guarantee safety improvements and that overall CPS success hinges on buy-in from all stakeholders and implementation through an integrated approach.

"The mining industry's openness to adopting new technology varies, but most mining houses have been quick to embrace advanced technology systems, including PDS and CPS. Better connectivity and data management are also priorities, aiding in safety, efficiency, and productivity enhancement," he adds. □

Signal conditioning ensures accurate measurement and monitoring

Measurement and control of physical properties are the foundation of all critical industrial technologies. Here, Ian Loudon, International Sales and Marketing Manager at remote monitoring specialist Omniflex, explains how we convert raw signals and the challenges of protecting them in industrial environments.

The Omniterm TXB COTS signal conditioning unit.

Automation for Industry 4.0, process control, data acquisition and alarm processing all rely on the conversion of physical signals to a standardised, usable format, that engineered systems can reliably use to manage industrial processes.

At its simplest, signal conditioning is the process by which physical properties such as temperature, humidity, pressure, vibration, frequency, presence or absence, relay logic, and flow are converted by transducers into usable electrical signals, suitable for measurement and control systems. Any electronic device that detects and quantifies a physical property like this is referred to in industry as a transducer.

We can think of signal conditioning as an interface between the plant and the field. Control and monitoring systems are sensitive and need to be protected from harsh environments. Voltage spikes, high temperatures and electrical noise are all potentially damaging, and signal conditioning provides protection to mitigate these harsh field conditions, typically using electrical isolation (galvanic or optical), noise immunity and surge protection mechanisms.

Field devices or transducers in a process are normally wired back individually from the process to marshalling panels, where the signal conditioning system again converts the signal to the industry standard range of 4-20 mA. From there, multiple signals are run together in multi-core cables to control systems.

4-20 mA is used for a number of reasons. 4 mA is equivalent to 0 per cent, minimum value, and 20 mA equivalent to 100 per cent, or maximum value. This can be interpreted by the measurement and control system and expressed in SI units. The signal conditioner also allows the field signal to be amplified and zoom in on a portion of the transducer's range.

This standard exists because a voltage output would result in a volt drop on the cable, introducing an error in measurement, whereas the current output over a long distance can be actively compensated in the system circuitry with voltage manipulation. Additionally, using four mA as a 'live zero' makes it very easy to detect a system fault, for example a cable break, as the current will fall to true zero.

Challenges of signal conditioning

Electromagnetic interference (EMI) is one of the biggest challenges in signal conditioning in industrial environments: any factors that jeopardise the accurate transmission of signals to the control system must be addressed. To resolve this, the signal conditioning system is electrically isolated from the plant at an industry standard of 1 500 Vac, meaning this is the maximum difference between input and output that the signal conditioner can handle without breaking down.

Signal amplification and attenuation are also issues that require attention. If signals have to travel long distances, tens or even hundreds of metres, they can attenuate because of wire resistance. Consequently, an inaccurate signal reaches the control system. Similarly, amplification of low-level voltage signals is complex, as any interference or non-linearities can be amplified along with the desired signal.

All these challenges are mitigated by the 4-20 mA current range. Current signals naturally withstand EMI better than voltage signals, particularly over long distances. Other control devices can share the current loop as part of the control system.

Signal conditioning is an essential mechanism for industrial plants to collect information about, and monitor, their processes, and only through precise design can plant engineers ensure reliable incoming data flow. Technical issues like signal attenuation, EMI and process safety are all important to consider, but industry standard ranges for signal current and electrical isolation keep things running smoothly.

Omniflex supplies a commercial, off-the-shelf (COTS) signal conditioning unit, the Omniterm TXB that can help plant owners and engineers avoid costly problems in industrial process monitoring. □

A signal conditioning station.

For more information visit: www.omniflex.com

Condition monitoring and predictive maintenance in mining

Specialist condition monitoring company, WearCheck, again showcased its range of mining-related predictive maintenance techniques, products and services at the 2024 Investing in Africa Mining Indaba in Cape Town's ICC from 5 to 8 February 2024.

Technical manager, Steven Lumley, and a team of technical experts from WearCheck were on hand to demonstrate the company's world-class technology-based solutions.

Says Lumley, 'Africa Mining Indaba gives us the opportunity to introduce our unique condition monitoring services to potential new customers, and to present our newest techniques to existing clients. We always enjoy catching up with our 'family' of the many familiar players in the African mining arena with whom we have been interacting as a company for the past 47 years.'

Roger Henwood, WearCheck technician, conducts rope testing analysis.

WearCheck's core service is the scientific analysis of used oil, fuel and other fluids. This entails analysing fluid samples for trace particles, which indicate which component is suffering unusual wear patterns. The test results are assessed by a team of specialised diagnosticians, who advise on a course of remedial action, if it is required.

Additional predictive maintenance techniques offered – which are applied based on the machinery and components being monitored – include asset reliability care (ARC) services, transformer chemistry services and advanced field services (AFS) such as non-destructive testing (NDT), technical compliance (TC) and rope condition assessment. The company also offers lubrication enabled reliability (LER), providing clients with bespoke solutions to ensure their lubrication systems are well managed, efficient and cost effective.

WearCheck's service offering also includes water analysis through Set Point Laboratories, which analyses the quality of wastewater, groundwater and surface water in areas surrounding mining and exploration sites.

The water division caters to various needs. For example, ensuring that effluent/wastewater is compliant with municipal by-laws and environmental safety standards is essential for the safe disposal of wastewater into streams and rivers.

Additionally, ground and surface water quality analysis allow for determination of water safety for use on equipment, drinking, washing and other purposes.

For more information visit: www.wearcheck.co.za

Quick turnaround on overhaul of compressor motors

In August 2022 Marthinusen & Coutts Zambia was requested by a smelter based in the Copperbelt to provide an in-country repair solution on two critical 4.5 MW compressor motors. It was given only three weeks in which to overhaul and recommission the motors.

The scope of work involved the dismantling, cleaning and assessment of all parts, dynamic balancing of the rotors at operating speed using M&C Zambia's in-house 12-tonne balancing machine, supply of new bearing assembly parts, assembly of the motors and no-load testing and laser aligning the motors on site.

"On dismantling both motors we identified that the stator coils indicated partial discharge and the stator wedges had deteriorated significantly over time. We consequently requested the M&C workshop in Cleveland, Johannesburg, to provide partial discharge treatment of the stator coils and to manufacture the stator wedges that needed to be replaced," said Eugene Lottering, General Manager, M&C Zambia.

Dynamic balancing of the rotors at operating speed was done using M&C Zambia's in-house 12-tonne balancing machine.

To ensure all the work complied with international standards, M&C also sent a senior technician from Johannesburg to assist the local team on the contract.

"Our team is well experienced in how to approach and action the different stages throughout the overhaul of such motors. We have successfully completed various medium voltage overhauls up to 4 650 kW. The motors were no-load tested at 11 kV with exceptionally good results and the customer then gave us the go-ahead to commission the motors," Lottering added.

He highlighted that "Installing them on site turned out to be a complicated procedure, especially the alignment of the motors to the compressors."

The motors were finally tested on load, recording satisfactory vibration levels of below 1.34 mm per second.

"The motors were successfully installed and commissioned three days before the scheduled deadline for completion," Lottering noted.

For more information visit: www.mandc.co.za

Pressure gauges and hydrogen: choosing the right instruments

Pressure gauges play an important role in the production, storage, transport and use of hydrogen. In almost all applications, they monitor the pressure at measuring locations that require on-site indications without the need for external energy, or serve as a backup for electronic systems. As an alternative energy source in combatting climate change, hydrogen – H_2 – has promising potential, but poses some challenges for measurement technology. Christopher Ott BEng – Product Management, WIKA Alexander Wiegand SE & Co. KG, here looks at what this means for the use of pressure gauges.

Hydrogen is the smallest molecule. It therefore quickly penetrates many materials (permeation) or causes embrittlement. For this reason, stainless steel pressure gauges with wetted parts made of 316L are most suitable for hydrogen applications, especially in the high-pressure range. For example, the WIKA models 23x.30 and 23x.50 serve well. This is because selected austenitic steels, such as 316L, are resistant to embrittlement by H_2.

Permeation in pressure gauges

Permeation by hydrogen plays only a minor role in pressure gauges, in contrast to electronic pressure measuring instruments or diaphragm seals where the hydrogen that diffuses into the instruments can falsify the measuring result. Such effects can be ruled out with pressure gauges as a result of the measuring principle. Nevertheless, in the event of permeation over a long period of time, hydrogen can escape through the measuring element into the case of the pressure gauge. Due to the case design (plastic components, among other things), a concentration equalisation then takes place during normal operation. It is therefore always recommended to use the pressure gauge in a ventilated environment.

In most applications, H_2 occurs in gaseous form and is usually exposed to pressures of between 60 bar (initial bottling) and 1 000 bar (filling stations). The EN 837-2 user standard for the selection and installation of pressure gauges recommends pressure gauges in safety version, at least level S2, for gases and pressures >25 bar. With stainless steel pressure gauges, however, the safety versions S1 (like the WIKA model 23x.50) and S3 (WIKA model 23x.30) are the market standard.

For more information visit: www.wika.co.za

Wika stainless steel encased pressure gauges are suitable for use in hydrogen applications.

Maintenance is critical is managing water and wastewater

In a time of water shedding, climate change and aging infrastructure, the importance of maintenance and support in the water and wastewater (WWW) sector cannot be overstated.

Peter Marumong, Cluster WWW Segment Leader and Sarika Andhee, Marketing Leader, Field Services Anglophone Africa at Schneider Electric, emphasise that regular maintenance plays a critical role in the sustainable provision of safe, standards-compliant, water. Furthermore, in South Africa, industry requirements such as the Green and Blue Drop certifications require continuous measurement and monitoring to ensure equipment runs optimally and the water treatment and distribution plants meet stipulated standards.

Although regulatory requirements and procurement policies present challenges, the industry is becoming increasingly aware of the consequences of neglecting maintenance. The ever-present and growing need for reliable water supply – and the deteriorating state of infrastructure – have highlighted the urgency of prioritising maintenance.

The WWW services lifecycle

The typical stages in a customer's equipment lifecycle include planning, installation, operation, optimisation and renewal. These stages are all crucial in maintaining optimal equipment performance throughout its lifecycle.

Service contracts are important in ensuring regular maintenance is carried out and maximising uptime and performance of water treatment plants. Experience has demonstrated that delays in maintenance can result in the deterioration of wear-and-tear components causing unnecessary downtime. With a condition-based maintenance approach, service providers can now use sensors to monitor the state of plant assets and ascertain

Peter Marumong and Sarika Andhee of Schneider Electric.

risk to the plant's operation. This provides key predictive insights which can be used to make informed decisions.

With budget limitations, water plant managers also need to improve performance and control of aging infrastructures. This is an area where modernisation or the retrofitting of new solutions prove cost effective and use of the latest technologies supports enhanced performance. When products are fitted with sensors, new technologies can add layers of intelligence for effective monitoring and enable remote monitoring capabilities, which assist operators in identifying breakdowns more quickly and improving repair turnaround times.

Partnerships in WWW plant management

In the WWW sector, collaboration with equipment manufacturers is key. This facilitates the transition from reactive to predictive maintenance and equips WWW plants and plant management teams with the tools and knowledge to address issues before they become critical.

Maintenance should be factored into the daily operations of WWW plants. The future of clean, consistent water supply relies on a number of key factors – and the proactive maintenance of infrastructure is fundamental among these. □

Online partial discharge testing services

Having an appreciation of the current status of assets in a power system is essential to ensuring reliability. This information is even more critical today given the demands on our ageing electrical grid infrastructure. Partial Discharge (PD) detection is an important tool in understanding the health of the dielectric and therefore the health of electrical assets. Online PD testing of medium voltage (MV) and extra high voltage (EHV) cable systems offers a non-intrusive and non-destructive testing approach.

Online PD testing enables PD measurement with the asset connected to and energised by the power system, with no need for service interruption.

Performing the PD measurement with the asset connected to and energised by the power system (online) offers a number of benefits. These include:comprehensive analysis, convenience, and flexibility, using a variety of sensors.

Doble has over 30 years' experience employing online testing technology in assessing power cables. It has a database containing thousands of results on various cable systems – PILC, PE, XLPE, TR-XLPE and EPR – all of which have been evaluated by its team of experts.

The Doble online condition assessment process also offers further benefits. It enables evaluation of longer lengths of cable because of reduced signal attenuation due to acquisition of electrical PD signal at a lower frequency (16 kHz to 30 MHz), and enables improved overall assessment of the cable as a result of proprietary noise rejection algorithms which permit the measurement to be performed at a lower frequency.

A team of highly experienced engineers provide an accurate assessment of the status of the cable. □

Teaching for Net Zero Awards

Among the many activities at COP28 held in Dubai, in the UAE, in December 2023, the International Renewable Energy Agency (IRENA) and the UAE announced the winners of the Teaching for Net Zero Awards. The campaign was launched in collaboration with members from the Energy Transition Education Network, a multistakeholder partnership established by IRENA with the support of the UAE at COP27.

The six winners came from Belgium, Benin, Bhutan, Colombia, Morocco and Nigeria. Each winner demonstrated innovative teaching methods to help inspire students and educate them about how and why we need to accelerate the energy transition.

IRENA's Deputy Director-General, Gauri Singh, said: "Educating students of all ages about renewable energy is essential for a successful energy transition. Teachers play a pivotal role in ensuring that youth have the knowledge, values and skills needed to accelerate the momentum and make students aware of the behavioural changes we all need to make to embrace a new energy system. Many countries are blessed with inspiring, innovative teachers. But many teachers around the world lack the resources, capacity and confidence to teach their students about renewable energy solutions and climate action. That is why IRENA and the UAE developed the Teaching for Net Zero Campaign, an initiative that aims to empower educators with tools, knowledge, resources, training and best practices. Through this initiative, we are helping teachers to become torchbearers for the call to triple renewable energy capacity."

The UAE Permanent Representative to IRENA, Dr Nawal Al Hosany said: "A just and inclusive energy transition is not possible without involving our youth in the process from the earliest stages of their development. Students of all ages must be taught, tutored and empowered with a clear understanding of the role renewable energy plays in improving energy access and efficiency. The Teaching for Net Zero Campaign gives students the head-start they need by equipping teachers with the knowledge and skillsets to provide accurate information about the energy transition to a future system, fuelled by renewable solutions."

In the Teaching for Net Zero Campaign IRENA and the UAE invited primary and secondary school teachers, educators in higher and vocational education, and non-formal educators from around the world to submit their unique teaching practices. Each winner received a sponsored trip to COP28 to share their experiences and to represent the Teaching for Net Zero Campaign. The educators presented their work at the Greening Education Hub managed by the UAE Ministry of Education, which also collaborates in the campaign contributing to the development of curriculum guidance. Other campaign activities at COP 28 and beyond include the launch of Teaching for Net Zero teaching resources, workshops for educators, and promotion of good practices.

The winners announced at COP28 included the following teachers.

Vinciane Scheuren (Belgium), Project Manager, *Scienceinfuse UCLouvain*, organised a 'Generation Zero Watt' challenge with the aim of reducing energy consumption in primary schools in the Walloon region of Belgium. Students became energy detectives, carrying out energy audits of the school to identify where too much energy was being used and problem solving how to make their schools more energy efficient.

Winners of the Teaching for Net Zero Awards, announced at COP28, come from countries around the world.

Zoulkifirou Sambo Mama (Benin), Renewable Energy and Energy Efficiency Engineer, Esmer Academy, organised a renewable energy focused science camp for children aged 8 to 13 with a twofold objective: to introduce children to science and present them with information and ideas for preserving the environment around them.

Jennifer Obiorah (Nigeria), Founder, Team UpCyclers, founded Team Upcyclers, a community-based project that addresses climate change and energy poverty in the education sector. This initiative promotes sustainable development goals (SDGs), climate, and energy education in schools and in camps for internally displaced persons. It donates solar devices to students to promote SDG 7 – Affordable and Clean Energy and SDG 13 – Climate Action.

Cesar Barraza (Colombia), Professor of Engineering, *Universidad de La Sabana*, designed a course to introduce students to cutting edge technologies, barriers and opportunities to develop sustainable systems in the framework of a just energy transition. The course combines challenges and service-based learning methodologies to allow students to develop clean energy solutions to tackle an essential service issue affecting marginalised communities in Colombia.

Manoj Sharma (Bhutan), Lecturer, Royal University of Bhutan, developed renewable energy infrastructure within the campus of the Royal University of Bhutan, including solar photovoltaic (PV) technologies, solar thermal technologies, electric vehicle technologies, a kitchen waste to energy initiative and simulation facilities for wind power technologies. All these improvements created a space for students to learn about the design of solar PV, hydropower, wind power and biomass systems, and to study the use of these technologies in achieving net zero emissions by 2050.

Noureddine Hamri (Morocco), Founder & Renewable Energy Engineer, Turn Up the Light, set up energy education workshops in the Berber Nomadic Communities to enhance their resilience against climate change and promote energy literacy.

For more information on the Energy Transition Education Network and the Teaching for Net Zero Awards visit: www.irena.org

Widening disparities and growing threats in cybersecurity

With 'cyber insecurity' still featuring prominently among the top ten risks in the World Economic Forum's (WEF's) *Global Risks Report*, a new report explores the key trends shaping the global cybersecurity landscape.

Released at the WEF's annual meeting in Davos in January, the *Global Cybersecurity Outlook 2024*, developed in collaboration with Accenture, provides a snapshot of the multifaceted challenges in the global cybersecurity landscape. While increased geopolitical tensions and economic instability continue to concern industry experts, the report spotlights widening cyber inequity and emerging technologies, such as artificial intelligence, as key rising risks for the year ahead in the fast-growing cybersecurity sector.

The report distils insights from industry experts and global executives about key cyber trends that leaders will need to navigate in 2024, based on a series of surveys carried out between June and November 2023. Given the increasingly complex cyber threat landscape, the report also calls for concerted collaboration, across borders and industries, to counter these interrelated threats and build a more resilient environment.

"As the cyber realm evolves in response to emerging technologies and shifting geopolitical and economic trends, so do the challenges that threaten our digital world," said Jeremy Jurgens, Managing Director, World Economic Forum, Switzerland. "We urgently need coordinated action by key public-private stakeholders if we are to collectively address these complex, ever-evolving threats and build a secure digital future for all."

The increasingly stark divide between cyber-resilient organisations and those that are struggling has emerged as a key risk for 2024. The number of organisations that maintain minimum viable cyber resilience is down 30% compared to the previous year. While large organisations have demonstrated notable gains in cyber resilience, small and medium-sized companies showed significant decline.

This growing inequity is being fuelled by macroeconomic trends, industry regulation and, crucially, early adoption of paradigm-shifting technology by some organisations. In addition, the cyber skills and talent shortage continues to widen at an alarming rate. Only 15% of all organisations are optimistic about cyber skills and education significantly improving in the next two years.

In an interconnected world this growing rift means no organisations are completely safe. According to the report, external partners are both the greatest asset and the biggest hindrance to the cybersecurity of any organisation. 41% of the organisations surveyed that suffered a material incident in the past 12 months say it was caused by a third party.

"No country or organisation is spared from cybercrime, yet many are direly underequipped to face the threats effectively, and we cannot have effective global response mechanisms without closing the capacity gap," said Jürgen Stock, Secretary-General of INTERPOL. "It is crucial that key stakeholders work collaboratively towards immediate, strategic actions that can help ensure a more secure and resilient global cyberspace."

Emerging technologies, such as artificial intelligence (AI), are another key trend to watch according to this year's outlook. Fewer than one in 10 respondents believe that in the next two years generative AI will give the advantage to defenders over attackers, and about half of experts surveyed agree that generative AI will have the most significant impact on cybersecurity in the next two years. Its rise is stoking fears among experts about the exacerbation of long-standing challenges, with around half of the executives surveyed saying that AI-driven advances in adversarial capabilities of cyber criminals (phishing, malware, deepfakes) present the most concerning impact of generative AI on cybersecurity.

Despite these concerns, experts also highlighted an encouraging increase in focus on the importance of cybersecurity globally, particularly at the executive and CEO levels. The report also indicates that incorporation of cyber resilience into organisational risk management is becoming more common.

"Cyber resilience is increasingly dependent on a C-suite team that collaborates closely and communicates security priorities across the business and the industry," said Paolo Di Cin, Global Lead, Accenture Security. "This approach provides a clear view of cyber risks and allows security to be embedded from the start in all strategic business priorities as well as across third parties, vendors and suppliers."

The WEF's Global Cybersecurity Outlook 2024 spotlights widening cyber inequity and emerging technologies like AI as key rising risks.

For more information visit: www.weforum.org

Long duration energy storage beyond grids

Long Duration Energy Storage (LDES) mostly refers to delayed electricity to cover increased intermittency as grids adopt more solar and wind power. A new Zhar Research report analyses the very different needs and technologies for LDES beyond grids. The 300-page report is entitled: *Long Duration Energy Storage LDES Beyond Grids: Markets, Technologies for Microgrids, Minigrids, Buildings, Industrial Processes 0.1-500 MWh 2024-2044.*

Dr Peter Harrop, CEO of Zhar Research says, "The very idea of a grid involves power supplied anywhere on the system so GWh storage is attractive even when it involves massive earthworks such as pumped hydro and underground compressed air and hydrogen. For LDES, there is also some place for advanced batteries, conventional or redox flow, and liquid gas storage, but the tables are turned when we go off grid or to systems using grid only as backup. These smaller systems are often in sensitive locations, so forget the massive earthworks and prioritise aspects such as modules, small footprint (by being stackable), extreme safety and rapid installation even in buildings. Then the weaker contestant becomes the dominant players.

"In our analysis, this beyond-grid market of under $0.5 billion today becomes over $52 billion in 2044. A powerful driver of this is the megatrend to self-generation – making electricity yourself, where you need it – seeking empowerment, security and predictability of costs. These beyond-grid systems already average a higher percentage of solar power, and therefore that intermittency, than is seen in grids. However, wind power is less prevalent so this is a very different market. Companies such as Invinity and CellCube have already installed hundreds of appropriate units, initially short duration, but now increasingly to meet the need for 12 hours duration of delayed discharge with one month in prospect. Others with appropriate technology for beyond-grid are mostly operating in the grid space, missing what may be their best opportunity, and one with less competition."

Zhar Research finds that there may never be much demand for seasonally delayed electricity with months of subsequent discharge in beyond-grid applications. However, it finds that about one month of delay and subsequent discharge will become a large, additional beyond-grid LDES business, causing some technologies to fall by the wayside.

The report looks closely at this technology roadmap, research pipeline and intended product launches. It presents 2024-2044 forecasts in 26 lines and compares and profiles among others, 52 RFB (Redox Flow Batteries) players, to take one promising example. Infograms and projections put the beyond-grid LDES opportunity in the context of the total LDES opportunity with numbers for both.

As well as the executive summary with key conclusions and a detailed 2024-2044 roadmap, the Introduction presents LDES chemistry versus physics approaches and ways of reducing the need for LDES. It offers readers an understanding of how beyond-grid is about more than microgrids and minigrids, including data and trends for wind, solar and other intermittency and the cost issues.

Through eight chapters the report compares various LDES technologies and plots a levelised cost of storage (LCOS - $/kWh) trend versus storage discharge time for the many options. It reviews RFB in detail because these batteries are important for beyond-grid, although their grid LDES opportunity may be threatened by emerging 'giant' options; the many RFB chemistries are assessed together with progress so far on the respective technologies.

The new research report looks at different technologies in development for beyond-grid long duration energy storage.

Primary LDES options beyond grids

The appraisal of advanced conventional construction batteries (ACCB), which provide primary LDES options beyond grids looks at sodium sulphur, iron-air, zinc, molten metal, nickel-hydrogen and other batteries. The report suggests that many of these battery technologies have better LDES options beyond grid. Again, it emphasises the commercial opportunity 2024-2044, considering company profiles, intentions, SWOT appraisals and parameter comparisons. In a further chapter, liquid gas – in the form of liquid air and liquid carbon dioxide batteries are assessed.

Most other technology options have severe siting restrictions which is little problem with grids but more restrictive with beyond-grid applications which are intended to make multiple diverse sites capable of being independent. These other LDES storage options beyond grids include solid gravity energy storage (SGES), advanced pumped hydro energy storage (APHES) and electro-thermal energy storage, (ETES). For example, although solid gravity storage by Energy Vault involves massive grid facilities, Gravitricity goes smaller by re-purposing a Czechia mineshaft, having identified 14 000 disused mine shafts that could be swiftly turned over to gravity-based energy storage. This chapter also looks at how APHES is specifically aimed at avoiding the severe siting and permitting restrictions of traditional pumped hydro but, on current evidence, it seems it will still be more appropriate for grids than off-grid applications.

In summary, the Zhar Research reports suggests that the beyond-grid LDES market is largely neglected because, so far, it is a small business. Nonetheless, that presents an opportunity because the research indicates it could become a large business where many companies can succeed if they address the very different needs of this market.

For more information visit: www.zharresearch.com

Understanding the impact of amended environmental legislation: NEMLAA4

Paula-Ann Novotny, Senior Associate at Webber Wentzel

Paula–Ann Novotny, Webber Wentzel.

In the continually evolving arena of environmental legislation, the National Environmental Management Amendment Act 2 of 2022 (NEMLAA4) emerges as transformative, poised to introduce a substantial shift in South Africa's environmental legislative landscape. Since the inception of the One Environmental System (OES) in 2014, NEMLAA4 stands as the most significant legislative overhaul, addressing prevailing issues, deterring non-compliance, and augmenting enforcement mechanisms within the mining and industrial sectors.

A holistic view

NEMLAA4, promulgated into law on 30 June 2023 (barring certain sections noted below), introduces sweeping changes that ripple across various statutes, predominantly the National Environmental Management Act, 107 of 1998 (NEMA), and four Specific Environmental Management Acts (SEMAs): Air Quality Act 39 of 2004, Waste Act 59 of 2008, Protected Areas Act 57 of 2003, and Biodiversity Act 10 of 2004.

Key provisions and amendments

Financial provisioning revamp

A pivotal amendment under NEMLAA4 is the restructuring of financial provisioning (FP) for Rehabilitation and Closure (R&C). While initially targeted at the mining sector, this reform extends to empower the Minister to impose FP on other industries. The distinction between general R&C principles (Section 24P) and mining-specific principles (Section 24PA) marks a shift in specificity, outlining stringent regulations governing funding, vehicles for financial provisioning, fund usage, and drawdown approval processes.

Expanded municipal enforcement

NEMLAA4 broadens the authority to issue Section 28 directives – addressing breaches of the environmental duty of care – to municipal managers. This amplification of enforcement powers casts a wider net, intensifying regulatory oversight beyond national and provincial departments.

Rectification processes reinforced

Historically, Section 24G of NEMA allowed post-commencement rectification for unlawful activities, often exploited by entities initiating activities without the requisite .licences. NEMLAA4 bolsters these rectification processes, imposing public participation requirements, mandatory cessation of unlawful operations, and escalated administrative penalties, raising fines up to R10 million. The scope of such applications has also been extended to include successors-in-title and persons in control of land where unlawful activity has occurred as applicants.

Altered dynamics in appeals

NEMLAA4 brings changes to the suspension of approvals during appeals, permitting applications to the appeal authority to lift suspensions pending the outcome of the appeal. On the other end, appeals against administrative enforcement action will not automatically suspend the directive or pre-compliance, but applications to suspend such directions are now similarly permissible on good cause shown.

Empowered inspectors and designation

Ministers now hold the authority to designate staff members as well as regulatory state organs as environmental inspectors, fortifying regulatory control and ensuring specialised oversight within the enforcement framework.

Amendments to the SEMAs

Amendments to the Specific Environmental Management Acts relating to Air quality, Waste management and land contamination, Protected areas, and Biodiversity relate primarily to particular processes to be followed, specific provisions and restrictions, and clarification on respective licensing authorities.

Although NEMLAA4 marks a substantial leap forward, certain proposed amendments are yet to come into effect, presenting potential future shifts in South Africa's environmental legal framework. These include pending amendments to the Air Quality Act and the Waste Act.

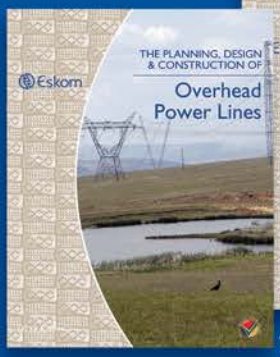
Embracing environmental transformation

NEMLAA4 represents a pivotal juncture in South Africa's environmental management journey, ushering in new stringent compliance and reinforced enforcement. The far-reaching amendments, effective from 30 June 2023, signal a commitment to responsible environmental stewardship and delineate a path towards sustainable industrial practices. As future amendments linger, industries and stakeholders should prepare for evolving compliance standards and remain adaptable to the dynamic legislative landscape, to support a harmonious coexistence between industrial progress and environmental preservation.

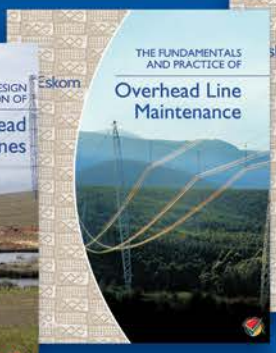
For more information visit: www.webberwentzel.com

Eskom

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 acrued by Eskom over the years, as a guide and legacy and to serve as a source of reliable, reputable and highly technical information.

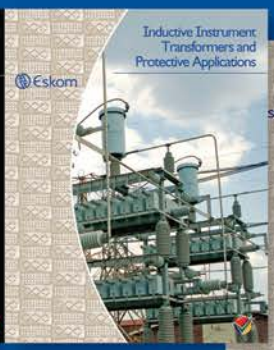


Volume I: The Planning, Design and Construction of Overhead Power Lines



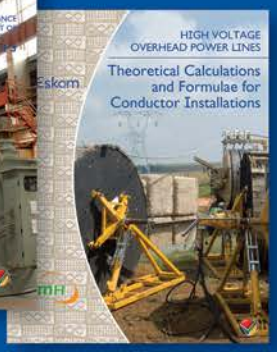
Volume 2: The Fundamentals and Practice of Overhead Line Maintenance

Volume 3: The Practical Guide to Outdoor High Voltage Insulators

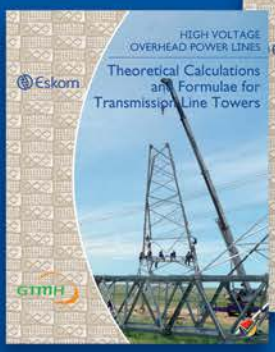


Volume 4: Inductive Instrument Transformers and Protective Applications

Volume 5: Theory, Design, Maintenance and Life Management of Power Transformers



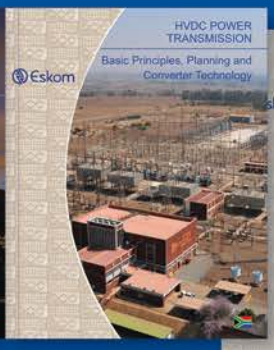
Volume 6 (Part 1): High Voltage Overhead Power Lines: Theoretical Calculations and Formulae for Conductor Installations



Volume 6 (Part 2): High Voltage Overhead Power Lines: Theoretical Calculations and Formulae for Transmission Line Towers

Volume 7: Corona in Transmission Systems: Theory, Design and Performance

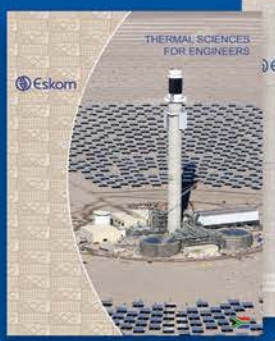
Volume 8: Power Quality in Electrical Power Systems: A Holistic Approach



Volume 9 (Part 1): HVDC Power Transmission: Basic Principles, Planning and Converter Technology

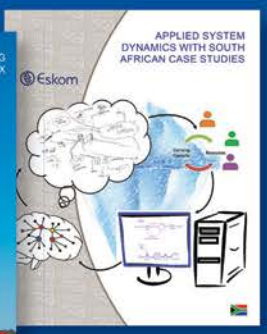
Volume 9 (Part 2): HVDC Power Transmission: Lines Book

Volume 10: Thermodynamics for Students and Practising Engineers



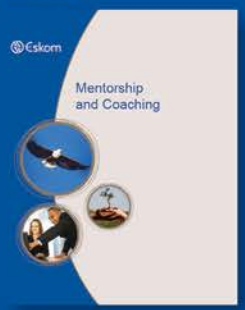
Volume 11: Thermal Sciences for Engineers

Volume 12: Basic Engineering Toolbox

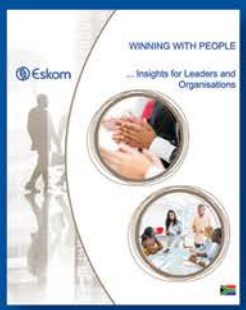


Volume 13: Applied System Dynamics with South African Case Studies

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.



Volume 1: Mentorship and Coaching



Volume 2: Winning with People ... Insights for Leaders and Organisations

Volume 1: Procurement Management Key Concepts and Practices

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.

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.

Contact: Sanjeev Bisnath
Tel +27 11 629 5072 Email: sanjeev.bisnath@eskom.co.za

Visit our website: http://www.eskom.co.za/AboutElectricity/EskomPowerSeries/Pages/Our_Products.aspx

Issued by Research, Testing and Development (Innovation Circuit) • Eskom Holdings SOC Ltd Reg No 2002/015527/30

Tough 4.3" ecomatDisplay

Easy to connect, economical, communicative

New standard in the compact class

Whenever clear communication, precision and performance in the smallest of spaces are required, the most compact member of the ecomatDisplay family is the perfect choice. Because the 4.3-inch HMI makes no compromises when it comes to human-machine interaction: 16 million colours, high-resolution display and good readability even at extreme angles or in extreme lighting conditions ensure clear information exchange in any situation.

Tel: +27 12 450 0400
www.ifm.com/za

ifm – close to you!