# wattnow

THE OFFICIAL PUBLICATION OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS

## ELECTRICAL TECHNOLOGIES

APRIL 2025

SAIEE

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Dear **watt**now Reader,

Electrical technologies constantly evolve, but these changes occur gradually rather than daily. Innovations and refinements emerge over weeks, months, or even years.

In this issue, our first feature article, "Taking Power Conversion to the Next Level," on page 34, explores how many mobile electronic products require lower-profile solutions while also facing increasing power demands. This trend is particularly evident among consumers and mobile devices.

Our next feature article covers the "Fundamentals of Electromagnetic Compliance." Smaller devices necessitate smaller electronic components, which helps reduce electromagnetic interference (EMI). You can read more about this on page 44.

We also highlight the recent SAIEE Annual Awards, held on March 14th, where we celebrated our deserving award winners. The full story is on page 4.

The SAIEE is also proud to announce that we have a WhatsApp Channel. Click here to join and receive updates instantly. The QR code is on page 21.

Looking ahead, the May issue will focus on cables, and the submission deadline is April 14th, 2025. Please email any contributions to minx@saiee.org.za.

Herewith the April issue - enjoy the read!

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# SAIEE Annual Awards - winners announced!

**On Friday, March 14, 2025, The South African Institute of Electrical Engineers (SAIEE) celebrated its annual award winners at an event held at The Focus Rooms, Johannesburg.**

The event was attended by engineering practitioners and their partners, who were dressed in their best attire. The Master of Ceremonies for the evening, Mr Kgomotso Setlhapelo, remarked that it was always refreshing to see the progress made in the industry by the winners.

The 115th Annual Awards ceremony, held in collaboration with Revive Electrical Transformers, recognised significant contributions by individuals in South Africa's electrical, electronic, telecommunications, and computer engineering sectors.

The SAIEE President's Award, sponsored by Revive Electrical Transformers and open to all living individuals, was presented to **Lomile Modiselle**. A dynamic and results-driven professional with a successful technical background, Modiselle has worked in the municipal distribution network for over twenty years. Due to a family emergency, Lomile couldn't accept her award in person, so the SAIEE will hand over her prize at the next council meeting, scheduled for May 9, 2025.

**Dumisa Ngwenya** was awarded the SAIEE Engineer of the Year Award, sponsored by ACTOM. This award is given to a SAIEE member who has worked energetically and voluntarily to promote electrical science and its applications to benefit SAIEE members and the Southern African community. Mr Ngwenya is a seasoned technology executive with over 25 years of extensive ICT experience, including over 15 years in senior leadership roles across IT, operational technology, and digital transformation. He is an expert in designing and executing technology strategies, governance frameworks, and risk management initiatives.

**Krystle Nageshar** won the SAIEE Engineering Excellence Award, sponsored by Exxaro. This award recognises a SAIEE Member, Senior Member, Fellow, or Council Member who has excelled in Electrical Engineering. She serves as the Chief Engineer for Medium-Voltage/Low-Voltage (MV/LV) Operations, where she plays a crucial role in advancing operational standards, optimising network performance, and enhancing the overall efficiency of power distribution systems.

The SAIEE Women in Engineering Award recognises female members of the SAIEE who have excelled in Electrical Engineering and demonstrated their dedication to supporting the organisation's aims and objectives.

The award is given to those with outstanding mentorship skills and integrity in their business dealings. This year, our award winner is **Devaksha Maharaj**, a highly skilled electrical engineer professionally registered with ECSA with 17 years of experience in the industry. Her specialisation in energy, power systems, and renewable energy integration has allowed her to lead several high-impact projects. These include designing and implementing a 20 MW solar PV plant that has significantly boosted renewable energy generation in her local community.

The SAIEE Young Achievers Award, sponsored by PWD Xperts, is given to young professionals who have shown outstanding achievement, creativity, and leadership in electrical and electronic engineering, regardless of the size of the company they work for. This year's winner is **Bongo Nkwanyana**, an ambitious young professional passionate about mentorship and leadership. This Young Achiever is the founding chairperson of the Young Professionals Network at the South African National Transmission Company. He has spearheaded several initiatives, including organising a school outreach program that engaged more than 300 learners in grades 10 to 12 and encouraged them to consider careers in STEM, with a particular focus on engineering.

The SAIEE Centre of the Year Award is given to a Centre that meets its annual KPIs set by the SAIEE CEO and Finance Committee. The **Central Gauteng Centre** was awarded the 2024 SAIEE Centre of the Year for meeting its KPIs.

The 2024 SAIEE Annual Awards, in collaboration with Revive Electrical Transformers, would not have been possible without the tremendous support of our sponsors. They are:

- Revive Electrical Transformers – naming sponsor
- Cullin Africa – Bronze sponsor
- Comtest – Welcoming drinks sponsor
- Exxaro – Award sponsor
- ACTOM – Award sponsor
- Eaton – Wine sponsor
- PWD Xperts – Gold sponsor

*SAIEE Engineering of the Year, sponsored by ACTOM: From left: Mervyn Naidoo (ACTOM), Dumisa Ngwenya (winner), and Pascal Motsoasele (SAIEE President).*

*SAIEE Engineering Excellence Award, sponsored by Exxaro: From left: Seeralan Chinaboo (Exxaro), Krystle Nageshar (winner) and Pascal Motsoasele (SAIEE President).*

*SAIEE Women in Engineering Award. From left: Leanetse Matutoane (SAIEE), Devaksha Maharaj (winner) and Pascal Motsoasele (SAIEE President).*

*SAIEE Young Achievers Award, sponsored by PWD Xperts. From left: Sicelo Xulu (PWD Xperts), Bongo Nkwanyana (winner) and Pascal Motsoasele (SAIEE President).*

*SAIEE Centre of the Year: The Central Gauteng Centre "The Radicals" delegation with Mantsie Hlakudi (Gauteng Centre Chairperson).*

# SAIEE Annual Awards - a few of our guests....

# SAIEE Annual Awards - a few of our guests....

Dessert & Ne

# Launching of the SAIEE Renewable Energy Chapter

**The South African Institute of Electrical Engineers (SAIEE) officially launched its Renewable Energy Chapter, marking a pivotal step in advancing sustainable energy solutions and addressing South Africa's energy challenges.**

## LEADERSHIP AND OBJECTIVES

The executive committee, led by Chairperson Dr. Tonny Mhondiwa, consists of:

- Vice Chairperson: Nhamo Dhlamini
- Marketing Lead: Devaksha Maharaj
- Technical Lead: Sechaba Malahleha

The chapter's 2025 strategic plan prioritises collaboration, knowledge sharing, and meaningful industry contributions.

Key focus areas include Just Energy Transition, Community Microgrids, Small-Scale Embedded Generators, Renewable Energy Technologies, Energy Planning and Policy, Regulatory Boards and Compliance, Renewable Energy Financing, and others, as captured in the figure below.

## MEMBER ENGAGEMENT & KNOWLEDGE SHARING

To foster active engagement, collaboration and professional development, the chapter will host:

- Webinars & Podcasts – Exploring cutting-edge trends and insights
- Workshops & Seminars – Facilitating hands-on learning and networking opportunities

Additionally, a dedicated website is under development to serve as a central hub for resources, discussions, and event updates.

## GET INVOLVED

The SAIEE Renewable Energy Chapter welcomes all professionals who are passionate about shaping the future of renewable energy in South Africa. Join us and contribute to this transformative journey!

Email: rechapter@saiee.org.za
Website: www.saiee.org.za
WhatsApp Group

Let's drive innovation and sustainable energy solutions together for a brighter future!

SAIEE
RENEWABLE ENERGY CHAPTER

# Vertiv™ Unify delivers real-time visibility, comprehensive control, and advanced analytics

**Vertiv (NYSE: VRT), a global provider of critical digital infrastructure and continuity solutions, recently announced the launch of Vertiv™ Unify.**

Vertiv™ Unify is a unified control platform designed to simplify, standardise, and streamline data centre operations by integrating visibility, management, and reporting of critical power and thermal infrastructure while providing scalability and flexibility.

As the only leading provider of the full suite of power train and thermal chain equipment, Vertiv now enables seamless integration and coordination across systems.

As AI-driven workloads and hyperscale data centres expand, operators face growing challenges in maintaining efficiency across power and thermal infrastructure.

The Vertiv Unify consolidated management platform provides convenient monitoring, management, and control of critical digital infrastructure for enhanced system performance.

This decentralised system is available to approved users from virtually any device, empowering facility and data centre managers with access to actionable insights for improved decision-making. "Data centres require an integrated approach to infrastructure management that reduces complexity and enhances performance," said Andrew McClintock, global offering manager at Vertiv.

"Vertiv Unify accelerates system deployment with plug-and-play functionality, offers unlimited scalability, and provides real-time visibility into power and thermal infrastructure for more informed decision-making."

The system provides plug-and-play configurations, simplified energy usage reporting, and global and site-specific scalability. It also offers an unlimited licensing model for unlimited clients, screens, tags, connections, and devices, allowing access and information to all required stakeholders.

Vertiv™ Unify is backed by Vertiv's industry-leading support and lifecycle services, a global organisation trained to provide end-to-end support to protect and optimise critical operations.

Learn more about Vertiv Unify software and Vertiv's portfolio of power, cooling, and services solutions at Vertiv.com.

# Smart Tech: A Solution to SA's Worsening Water Crisis

*Dr Andrew Dickson*
*Engineering Executive: Low Voltage*
*CBI-Electric*

**South Africa's water crisis is intensifying as failing infrastructure, droughts, and shrinking reservoir levels strain municipalities. Gauteng is already facing level one restrictions, while eThekwini's water curtailments will continue until September. With demand set to outstrip supply by 17% in five years, urgent solutions are needed.**

Dr Andrew Dickson, engineering executive at CBi-electric: low voltage, urges national and local governments to adopt smart technologies to tackle water shortages. "Without clear data, we're guessing the extent of the problem. Smart tech delivers real-time insights to identify inefficiencies and predict future demand. "

He recommends implementing IoT-powered smart meters to precisely track and monitor water usage. "By leveraging Artificial Intelligence (AI) and Big Data Analytics (BDA), municipalities can transform this data into accurate demand forecasts, optimise available supply, and proactively plan for potential shortages."

"These technologies also pick up patterns and performance trends, enabling predictive maintenance to prevent equipment failures, costly repairs, and service disruptions," notes Dr Dickson. "At the same time, proactive interventions extend the lifespan of infrastructure, ensuring long-term efficiency. This approach has already proven effective in Australia, where monthly peak demand dropped by 10% and A$100 million (R1.174 billion) in new infrastructure costs were deferred for four years."

Additionally, he highlights that smart meters detect leaks or unusual usage spikes in real time, helping to reduce water wastage. "Speedy leak identification and repair safeguards revenue, conserves supply and stabilises the network. Given Gauteng's high water losses, where one in four litres supplied by Rand Water is lost to leaks, adopting this technology could be a game-changer."

With South Africans consuming an average of 235 litres water per person per day - 36% more than the global average - Dr Dickson points out that smart meters can influence consumer behaviour. "By providing detailed consumption data for activities like flushing a toilet or running a dishwasher, customers can see the direct impact of their actions. During the Western Cape drought, the combination of smart meters and behavioural shifts led to a 15%-26% reduction in water use across 105 schools, saving around 380 kilolitres per school."

Regarding the affordability of smart water metering for local and national governments, he says, "While the upfront investment is high, the long-term returns ensure water security. The revenue lost to leaks alone could offset the cost of smart infrastructure in the short term.

Minimising losses ensures a more stable financial base, enabling investment in infrastructure and maintenance which is crucial given that 29% of the country's water systems are in critical condition."

While South Africa's ongoing energy crisis could complicate the implementation of smart water solutions, Dr Dickson explains that we cannot wait to act.

"Critical systems, like pump stations, are already equipped with backup power. And while we can live without electricity, we cannot survive without clean water - that must be our priority." wn

# Fluke 376 FC True-RMS Clamp Meter With IFlex

*Fluke 376 FC KIT comprises: True-RMS Clamp Meter with iFlex, 18-inch or 36-inch iFlex® Flexible Current Probe, TPAK magnetic hanging strap, TL75 Test Leads, Two AA batteries (Installed) and Soft carrying case.*

**Fluke, locally represented by COMTEST, a global technology leader in the manufacture of compact, professional electronic test and measurement tools and software, has on offer the Fluke 376 FC True-RMS Clamp Meter with iFlex - the most advanced troubleshooting tool for industrial and commercial electricians.**

The 376FC is part of the Fluke Connect family of wireless test tools that enables you to log, trend and monitor measurements while remaining safely away from the arc flash zone through Bluetooth connectivity.

## FIND THE CAUSE OF COMPLEX PROBLEMS

The 376 FC clamp meter uses an integrated low-pass filter to accurately measure non-linear signals, such as adjustable speed drives, electronic ballasts and other non-linear loads. The clamp also uses proprietary inrush measurement technology to filter out noise and captures the motor starting current exactly as the circuit protection sees it.

## MEASURES:

- Voltage to 1000 V AC or DC
- Resistance to 60 kΩ with continuity detection
- Min, max, average, and inrush recording to capture variations automatically
- 500 mV DC measurement range to interface with other accessories
- 1000 µF capacitance measurement
- Work safely and conveniently
- The 376 FC clamp carries a CAT III 1000 V, CAT IV 600 V safety rating, designed to offer you the highest possible protection in a test tool.

The included 18-inch or 36-inch iFlex flexible current probe provides easier access to large conductors in tight spaces. The flexible probe:

- Expands the measurement range to 2500 A AC
- Allows frequency measurement to 500 Hz with body jaw and iFlex

## WHAT'S IN THE BOX:

- Fluke 376 FC True-RMS Clamp Meter
- 18-inch or 36-inch iFlex® Flexible Current Probe
- TPAK magnetic hanging strap
- TL75 Test Leads
- Two AA batteries (Installed)
- Soft carrying case

Email COMTEST: sales@comtest.co.za or visit www.comtest.co.za for more information.

*Fluke 376 FC True-RMS Clamp Meter with iFlex in application*

# How climate change puts SA's water at risk, and why PPPs can help

**The impacts of climate change on South Africa's fresh water resources are becoming increasingly apparent, and without urgent interventions, new infrastructure models and private participation, the water crisis could exceed already worrying predictions.**

This is according to water and wastewater treatment industry stakeholders and experts on the advisory board of the upcoming IFAT Africa trade fair.

Organised by Messe Muenchen India and Messe München GmbH, IFAT Africa is the only conference and trade fair for water, sewage, refuse and recycling in Southern Africa, which will be held alongside Analytica Lab Africa, the only trade fair for laboratory technology, analysis, biotechnology and diagnostics in South Africa, in July this year.

South Africa, one of the 30 driest countries in the world, is grappling with water infrastructure and management challenges that put its water security at growing risk, which is exacerbated by climate change.

Belvana Abeli, Green Economy Portfolio Manager at Wesgro, says: "The impacts of climate change are increasingly evident, with erratic rainfall patterns and more frequent and intense droughts and floods, making water management incredibly challenging. Sea level rise threatens coastal freshwater sources, and increased evaporation due to higher temperatures exacerbates scarcity. Environmental degradation also plays a major role. Deforestation, soil erosion, and pollution all compromise water quality and availability."

Abeli says addressing these challenges requires a comprehensive strategy encompassing increased investment, improved governance, regional cooperation, technological innovation, and strong community participation, all within an integrated water resource management framework.

## CLIMATE MITIGATION MEASURES

"To address these challenges, we need a multi-faceted approach. Firstly, we must prioritise building more resilient infrastructure from the ground up," Abeli says.

"This means utilising stronger, more durable materials, reinforcing structures to withstand extreme weather events, and strategically elevating critical components above potential flood levels. Secondly, diversifying our water resources is key. We need to explore and invest in alternative sources like rainwater harvesting, groundwater recharge, and even desalination where appropriate, reducing our reliance on single, potentially vulnerable sources.

Thirdly, embracing advanced technology for monitoring and prediction is crucial. Implementing early warning systems, utilising remote sensing and GIS mapping, and employing data analytics can provide us with the foresight needed to prepare for and mitigate the impacts of droughts and floods. Also, we can't underestimate the importance of water conservation and efficient use."

Thabo Kabini (Pr. Eng.Tech), Senior Specialist at Industrial Development Corporation, agrees: "To adapt water infrastructure to withstand climate change impacts such as droughts and floods, investment in resilient infrastructure is essential. This includes

expanding storage capacity through reservoirs and aquifer recharge systems, incorporating nature-based solutions such as wetlands for flood control, and using climate-resilient materials in construction. Diversification of water sources, such as desalination, water reuse, and rainwater harvesting, can provide alternative supply options. Climate-smart planning that integrates predictive modeling and early warning systems can also help mitigate extreme weather effects on water supply and distribution networks."

Abeli adds: "We also need to consider ecosystem-based solutions. Protecting and restoring natural systems like wetlands and forests can play a significant role in regulating water flow and enhancing natural water storage. These strategies, combined with adaptive management approaches that allow us to adjust to changing conditions, will be essential in building a water-secure future in the face of climate change. However, all of these measures require funds and partnerships."

## FINANCING, INFRASTRUCTURE AND RIGHTS CHALLENGES

Carl Haycock, CEO of sustainable water and wastewater solutions specialists Talbot, outlines several other challenges impacting water security across Africa.

Haycock says: "Urbanisation is outpacing infrastructure development with an associated lack of planning in many regions. Funding for public sector infrastructure development is a real challenge in a space where water affordability is in itself a challenge. PPPs are the go to political solution, however, the private component of the PPP requires that the investment is repaid."

Another key issue is revenue allocation/ring fencing, he says: "Water infrastructure requires upgrades, operation and maintenance investment over the long term. Few fiscuses ringfence water revenue to re-invest in water: instead water revenue often goes into the general fiscus."

Haycock notes that cross border water rights can also pose a significant challenge with different countries not necessarily coordinating efforts to ensure sustainable use of limited resources.

## REUSE AND RECYCLING FOR WATER SECURITY

Charl McAllister, Head of Department: Marketing at Endress + Hauser, says advanced wastewater treatment and recycling is also crucial for overcoming South Africa's water challenges.

"Well known treatment technologies that can be deployed across the continent include gravity and or membrane filtration, evaporation, biological treatment; combination of chemical reactions and separation technologies, demineralisation, advanced oxidation, and disinfection," he says.

"More advanced technologies include reverse osmosis, ultrafiltration, and ultraviolet systems. However, these require a substantial amount of energy and may not be holistically viable across the continent."

On the issue of improving wastewater treatment to make water safe for reuse in agriculture and industry, McAllister says: "The deployment of advanced treatment technologies at primary, secondary and tertiary treatment stages will enhance removal of contaminants. This may not be enough and should be complemented by improvements in irrigation systems designs, nutrient management and soil quality analysis within the agricultural landscape. When considering industrial applications, each industrial process and their respective contaminants need to be identified and addressed. This approach will ensure that any additional pretreatment stages are identified and implemented to meet specific water quality requirements. Monitoring, traceability, and awareness need to be actively managed to ensure compliance, safety, and benefits of treated wastewater reuse."

## LIMITATIONS IN DESALINATION

WEC Water Managing Director Wayne Taljaard says: "New technologies are being developed continuously to offer more effective treatment to allow recycling and reuse. These include biological and physicochemical processes that can be selected on their applicability to achieve the required objectives. There is no silver bullet or one stop solution but the effective and successful integration of a range of technologies will ensure that users achieve the final treatment objectives."

He notes that seawater desalination is now a very mature technology, and the cost of implementation is continuously reducing as technology advances

 *continues from page 15*

alongside commercial manufacturing and economies of scale. "Desalination can offer a solution at some coastal regions, such as KwaZulu Natal and the Eastern and Western Cape. However, it requires effective planning to avoid inefficient implementation and price gouging in crisis times."

"The need for large scale infrastructure developments is fraught with challenges linked to funding, planning and procurement process timelines. The use of rapidly deployed modular treatment plant solutions and innovative plant upgrades using unique technologies offers an attractive alternative to achieve the required short term capacity upgrades to close the current gaps in infrastructure." Taljaard says.

Digital technologies for water security

Advanced digital technologies can support efforts to manage water more efficiently, say advisory board members.

Terene Govender, Junior Water and Wastewater Industry Developer at Endress + Hauser, says smart water metering helps reduce water wastage and improve efficiency in urban and rural areas. He says: "In far-reaching areas, where manual methods of water readings can prove to be challenging, smart meters for remote monitoring can provide the required information for the usage of water. With the information obtained, trends can be monitored to determine where water usage can be managed more efficiently. Irregular occurrences can also be observed, such as where water leaks may be present and where focus needs to be placed for enhanced management.

Govender notes: "New technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT) have great

potential to contribute towards improving the state of water management and distribution within Africa. IoT devices can be used for monitoring to provide valuable insight with regards to water levels, water quality, and water consumption. AI can also be used for predictive maintenance. With the analysis of historical data and live data, process plants can use this information to manage resources and to improve the overall maintenance practices. These new technologies can help create a more reliable water management system overall for the African continent."

## PPPS TO FOR SHARED RISK AND FINANCING

Kabini says: "Addressing these challenges requires a combination of investment, technological upgrades, and institutional reform."

Public-private collaboration also plays a crucial role in improving water infrastructure and service delivery across Africa, he says.

"The private sector brings in much-needed investment, technology, and operational expertise, which can enhance efficiency and service quality. Public-private partnerships (PPPs) allow for shared risk and financing, enabling large-scale infrastructure projects that governments alone may struggle to fund. Performance-based contracts can ensure accountability in service delivery, while blended finance models can attract additional funding from development finance institutions and climate funds, fostering strong partnerships, governments can leverage private sector strengths while ensuring equitable access to water services.

Gary Brown, Sales Manager: Africa and Sub Sahara at thermal hydrolysis leader Cambi, says: "PPP models play a crucial role in scaling water security projects across Africa by ensuring long-term commitment to skills development, training, and performance validation.

This is particularly important for introducing new technologies that utilities may not yet be familiar with. Without such mechanisms, market entry for proven global solutions can be challenging. By leveraging PPPs, alongside climate funds and other financing mechanisms, African utilities can de-risk innovation, improve operational efficiency, and accelerate the adoption of technologies that enhance water security."

The trends, challenges and solutions for Africa's water, wastewater and refuse management sectors will come under discussion at IFAT Africa 2025, where a forum and exhibition will bring stakeholders from across Africa and the world together to consider solutions.

IFAT Africa and analytica Lab Africa and will be staged at Gallagher Convention Centre in Midrand from 8 - 10 July 2025. To register as a visitor, click here. wn

**14–15 MAY 2025**

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# Festo 100th Anniversary

## - CELEBRATING A CENTURY-LONG LEGACY OF INNOVATION AND COMMITMENT

**Festo has officially begun celebrating 100 years of groundbreaking technology, commitment, and enduring partnerships. To kick off this historic milestone celebration, their Customer Innovation Day and ThankYou Party series began in South Africa, honoured with special events that brought together customers, partners, and employees to reflect on their journey and look ahead to an exciting future.**

The festivities began with an exceptional customer event, where attendees explored Festo's latest electrical, pneumatic, and process automation innovations through interactive product display stands.

Festo South Africa's industry experts led targeted training sessions, providing valuable insights and reaffirming Festo's commitment to keeping customers at the forefront of technological advancements. With almost 100 customers participating, the event highlighted the deep trust and long-standing partnerships that define Festo.

Dr Ulrich Stoll, a member of the founding family and Deputy Chairman of the Supervisory Board reaffirmed Festo's enduring presence and dedication, stating, "I believe long-term relationships and commitment are important, and customers can trust my word that Festo will be in existence for the next 10-plus years."

Mr Frank Notz, a Member of the Management Board, echoed this sentiment, highlighting the power of collaboration: "Festo is the result of the work of many hands, and we have embraced this for the past 100 years, and we will embrace this for the next 100 years."

The second day of celebrations was dedicated to the heart of Festo - their employees. Nearly 100 colleagues from four of Festo South Africa's locations gathered in Johannesburg for a staff Thank You party filled with camaraderie and cultural appreciation. The event honoured the strong German-South African connection with a vibrant program that included traditional cuisine and exciting performances.

Mr Brett Wallace, the Managing Director of Festo South Africa, shared, "We aimed to honour and celebrate our company's German heritage while incorporating local influences to reflect the diverse spirit of Festo South Africa, blending the roots that define us with the vibrant culture and values that make Festo truly unique. "

A key highlight was the ceremonial sharing of Umqombothi, a traditional South African beer which was a powerful symbol of unity, heritage, and gratitude to those who have played a pivotal role in Festo's success. The celebrations continued with an electrifying German line dance, which captivated the audience and filled the room with energy and applause.

Reflecting on this incredible milestone, Festo South Africa takes pride in the past 100 years of innovation and looks forward to the next century of excellence. Here's to another 100 years of shaping the future of automation together!

Cheers to a century of innovation, collaboration, and success!

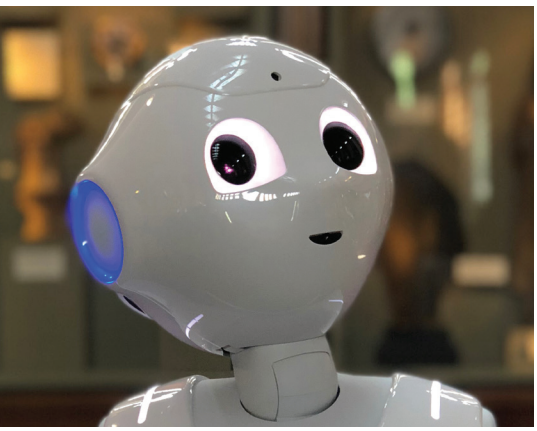
FESTO

# Celebrating 100 Years of Global Excellence!

1925 - 2025

www.festo.co.za

# Africa's Smart AV & Automation Revolution Takes Centre Stage



**As Africa's audiovisual industry evolves at an unprecedented pace, Audiovisual Integrated Systems Africa (AVISA) 2025 emerges as the continent's premier platform to explore the latest innovations, trends, and opportunities in smart automation, AV technology, and digital transformation.**

Taking place on 8 May 2025, as part of Africa Automation Technology Fair, at Gallagher Convention Centre, this high-impact conference will bring together technology leaders, integrators, and industry pioneers to discuss the future of AV, IoT, smart systems, cybersecurity, and industrial automation.

"In today's digital-first world, AV and automation are no longer luxuries but necessities," says Martin Hiller, Portfolio Director: AATF. "From smart control rooms to AI-powered AV solutions, Africa has an opportunity to leapfrog traditional barriers and redefine its technology landscape. AVISA 2025 is the must-attend event for professionals looking to stay ahead, network with the best, and gain actionable insights into Africa's AV future."

WHY AVISA 2025 IS A GAME-CHANGER FOR THE INDUSTRY

With the rapid rise of smart buildings, immersive AV experiences, and automation-driven industries, AVISA 2025 will showcase the latest innovations, provide expert-led insights, and connect attendees with the brightest minds shaping the future of AV and automation.

Key highlights include:

- The Future of AV and Smart Systems – Gain insights into how AI, IoT, and cloud-based AV solutions are shaping Africa's digital landscape.
- Next-Generation Control Rooms and Operations Centres – Discover how data-driven AV integration is transforming industrial operations.
- Cybersecurity & Smart Automation – Learn how to safeguard connected AV systems against cyber threats.
- Best Practices for AV Deployment – Explore strategies for designing cutting-edge AV experiences in corporate, industrial, and smart city environments.
- Case Studies and Interactive Panels – Hear from industry leaders and engage in deep-dive discussions on emerging AV trends.

## A POWERHOUSE LINEUP OF INDUSTRY EXPERTS

AVISA 2025 will feature Africa's leading AV innovators, automation specialists, and cybersecurity experts, including:

- Reghardt Rautenbach – Managing Director, Oculus
- Thabo Wessie – Managing Director, FS Systems
- Johan Pretorius – Business Development Director, VuWall
- Stuart Black – Senior Solutions Architect, AVT Solutions
- Quinton Robbertze – Managing Director, Plan-it Technologies
- Gary Atkins – Director, Digital Fabric

Adding a futuristic touch, the humanoid robot Pepper will serve as the event's host and keynote speaker, offering a glimpse into AI-driven AV integration.

"AV technology is no longer just about screens and sound—it's about creating connected, intelligent environments that enhance collaboration, efficiency, and security," Hiller. "AVISA 2025 is the ultimate platform for professionals

*Reghardt Rautenbach*
*Managing Director, Oculus*

*Quinton Robbertze*
*Managing Director, Plan-it Technologies*

*Thabo Wessie*
*Managing Director, FS Systems*

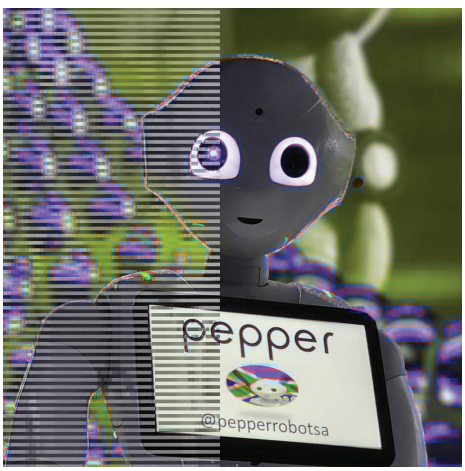
looking to future-proof their business and embrace Africa's AV transformation."

**THE FUTURE OF AV IS HERE – BE PART OF THE MOVEMENT!**

- Date: 8 May 2025
- Venue: Gallagher Convention Centre, Midrand
- Tickets: R1,395
- Register here

With AI-driven AV solutions, cybersecurity advancements, and smart automation shaping Africa's future, AVISA 2025 is your exclusive gateway to the next era of audiovisual excellence. wn

*Gary Atkins*
*Director, Digital Fabric*




*Pepper*

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# Trafo Power Solutions pioneers Dry-Type Transformers for Large intake Substation

*Through a collaborative effort Trafo Power Solutions and TMC Transformers delivered a bespoke transformer solution for a high intake substation for a data center.*

**In a project to supply a large intake substation for a data center in the Netherlands, Johannesburg-based Trafo Power Solutions has taken a leading role in broadening the application of dry-type transformers.**

According to David Claassen, Managing Director of Trafo Power Solutions, the project was conducted in collaboration with Italian transformer specialist TMC Transformers, a key partner in many of Trafo Power Solutions' contracts.

"This application of dry-type transformers in this large substation was very unusual, and we are excited to demonstrate the wider applications of dry-type technology," says Claassen. "Global markets are looking for solutions which are safer and more environmentally friendly while needing less maintenance and these are among the benefits that dry-type transformers bring to this project."

This path-breaking application required TMC Transformers, an established multinational player in the global transformer market, to produce three of its largest dry-type transformers yet.

The scope of supply for the data center includes three 22,5 MVA transformers operating at a voltage level of 50 kV, stepping down to 13,8 kV. Trafo Power Solutions' design team works closely with its engineering counterparts at TMC Transformers to design bespoke solutions for customers around Africa and beyond.

"We have extensive experience in many sectors including the growing data center market and have most often focused on the distribution level – dealing with 3 to 5MVA and below," he explains. "This project involved a power substation with much higher power and voltages, operating as the main intake into the data center."

Traditionally, these applications would use conventional oil-cooled transformers which require their own external infrastructure to ensure safety and to guard against the environmental risk of oil leakage. He notes that the selection of the dry-type option in this project allowed the transformers to be located inside the data center, where it could be built in close proximity to indoor switchgear. "By using the existing footprint and building upwards, the configuration utilised the least amount of space," Claassen says.

One of the primary challenges in implementing this design was managing heat dissipation. Dry-type transformers are predominantly used indoors and their application on such a large scale required innovative cooling strategies. He points out that the larger the installation, the more complex it becomes to have a transformer indoors as there is that much more heat that needs to be ejected. This is where the design ingenuity of Trafo Power Solutions and TMC came to the fore, to plan and implement the appropriate cooling strategies required by the application.

"The final result was achieved through a number of design iterations which we worked through with TMC, the substation provider and the end-client," he says. "The footprint was well defined, so we were required to work within those parameters – and design the necessary cooling facilities."

*Inside the TMC manufacturing facility where the large 22,5 MVA 50 kV cast resin transformers were built for the high performance application at the data center.*

The installation meant that the intake transformer could gain from the established benefits of dry-type transformers.

These include the high levels of fire protection as the transformers are air-cooled and have little risk of fire or explosions. As there is no possibility of oil leakage, there is no requirement for external structures such as dedicated buildings and protective bunds to contain oil and prevent contamination.

The oil in conventional power transformers also needs to be regularly checked and changed, a process that involves manual sampling and testing as well as expenditure on consumables. By comparison, dry-type transformers need minimal maintenance and therefore incur less downtime.

"This makes the use of our dry-type transformers particularly valuable in this application as data centers need to optimise their uptime – and they treat any potential downtime as a strategic risk to the business," he says. "The intake transformer in this case, therefore, is a critical item of equipment that must demonstrate very high levels of reliability and low maintenance time."

Claassen highlights that the selection of the dry-type transformer option was the result of extensive and in-depth discussions between all those involved in this aspect of the project, to evaluate the innovations and the benefits arising from this technology.

"The project was very fulfilling in the sense that stakeholders appreciated our experience in this field and were prepared to embrace an alternative technology that could drive their strategic imperatives," he says.

The project is likely to open doors into a variety of industry sectors, he points out, as every large industrial facility has an intake transformer which could benefit from dry-type transformers. Technological progress is often a slow process, he notes, in which players learn gradually to trust the reliability of innovations through bold applications such as this one.

"It really represents a flagship project for us, adding to the options for customers who are considering the use of dry-type transformers," says Claassen. "It affirms our efforts to expand the application of dry-type technology to projects that demand higher power and voltage, and is a valuable reference for the market to appreciate the potential of these solutions."

Underpinning the success of this project was the synergy with TMC, he says, who are known not only for the manufacturing quality of their standard-type transformers but for their expertise in special designs. This capability includes producing dry-type transformers that need to cater for a high voltage or power range.

"TMC also excels in the quality and range of enclosures, and can produce dry-type transformers with ingress protection up to level IP66," he explains. "This caters for the harshest environmental conditions, such as those that we often encounter in many parts of Africa and in industries such as mining."

In this contract, TMC's willingness to push technological boundaries was instrumental – and indeed highlighted

 *continues from page 23*

*TMC's state-of-the-art facility produces bespoke dry-type transformers, ensuring top-tier quality, reliability and innovation for critical power infrastructure projects.*

a defining aspect of its partnership with Trafo Power Solutions.

"Many companies in Europe tend to be more conservative than we are in South Africa," he argues. "We're always looking for innovative solutions and we often push the established boundaries to achieve the results that customers need."

The collaborative effort involved rapid prototyping, extensive heat load calculations and iterative design refinements to ensure the final product met the operational demands of a high-capacity data center.

"TMC has the capability to design and engineer highly complex transformers in terms of voltage level, power rating and environmental conditions," he says.
Many of Trafo Power Solutions' customers operate in remote locations where high reliability of equipment is critical and this while withstanding high temperatures and risk of water ingress as well as high levels of dust in the air.

"While many of our competitors will avoid venturing beyond their standard off-the-shelf products, we work closely with TMC on bespoke designs that often include unusual applications," says Claassen. "This requires an agile and flexible working culture from both sides to ensure that we can conceptualise, design and manufacture specialised solutions in the tight timeframes that customers expect."

He says that the Trafo Power Solutions has one of the best on-time delivery records in the industry, and this relies on the same dedication to efficiency by its partner TMC.

"We see TMC as the global market leader in dry-type transformer technology, with world class quality processes and operational standards," he says. wn

*Engineered with advanced insulation technology, the MV windings of the cast resin transformer are built for superior protection and efficiency at 22.5 MVA and 50 kV.*

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# Why Engineering Students should join the SAIEE

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## ABOUT THE SAIEE

Formed in 1909, the SAIEE has ±6000 members professionally engaged in various engineering activities, including academic research, manufacturing, electronics, telecommunications, measurement and control, mining, and power infrastructure services. Members make meaningful contributions to the quality of life in communities and the steady advancement of technology. Their efforts are acknowledged in many countries worldwide.

One key advantage of joining the SAIEE is access to a network of experienced professionals in the engineering field.

As members, engineering students have the opportunity to connect with industry experts who can provide valuable mentoring and career guidance. These connections can help students gain insights into the latest trends and developments in the industry, as well as potential job opportunities and internships.

Furthermore, SAIEE membership provides exclusive events, workshops, and seminars tailored to help engineering students enhance their skills and knowledge.

These events offer valuable opportunities for students to learn from experts in the field, collaborate with peers, and stay updated on the latest advancements in engineering.

The SAIEE Student membership is free from 1 December 2024, and with that, the SAIEE Student member (StM) receives the following benefits:

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- **Mentorship**
  The SAIEE has a cohort of mentors who are willing and eager to assist our student members with their studies and career guidance
- **Exclusive Networking Events**
  StMs attend all SAIEE events for free and are exposed to industry decision-makers
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  As a StM, when attending SAIEE events, you earn Charge Reward Points, which can be claimed against paying for training courses, etc.
- **Bursary programme**
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- **Publication access**
  Student members have access to all SAIEE publications since its inception in 1909, which include the monthly online wattnow magazine and the peer-reviewed Africa Research Journal
- **Site visits**
  SAIEE Student members are invited to site visits free of charge, which is CPD accredited, where you can learn hands-on how manufacturing facilities operate
- **SAIEE Centres**
  SAIEE has nine centres nationwide, and we encourage students to get involved at their local SAIEE Centre and represent your student chapter on the Centre EXCO committee.

The South African Institute of Electrical Engineering is a valuable investment for students from all engineering disciplines and tertiary establishments who are serious about advancing their careers in engineering. To learn more about joining the SAIEE, click here. wn

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Formed in 1909, The South African Institute of Electrical Engineers sports ± 6000 engineering professionals.

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Becoming involved in a Student Chapter and participating in meetings can teach a student member valuable business skills. SAIEE offers mentorship, coaching and vacation work.

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## Our Purpose

To enhance the practice of electrical engineering in South Africa and the stature of our members through knowledge, networking, influence, education and communication.

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# SAIEE UKZN Showcases Engineering Innovation at Open Day 2025

*EECE members at the Westville Open Day.*

**The University of KwaZulu-Natal (UKZN) hosted its annual Open Day 2025, welcoming prospective students to explore the diverse academic opportunities available at the institution. Held on 8 March at the Pietermaritzburg Campus and 15 March at the Westville Campus, the event allowed students to engage with various faculties and learn more about their future career paths.**

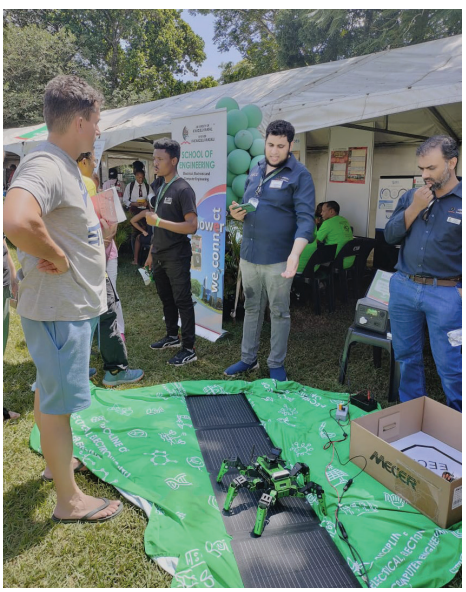
The School of Electrical, Electronic & Computer Engineering (EECE) and SAIEE UKZN presented an exciting glimpse into the engineering world at both events. Visitors to the SAIEE stand could view a range of engineering projects and interactive displays, providing insight into electrical, electronic, and computer engineering.

Attendees had the chance to ask questions about degree programs, career paths, and the practical applications of engineering. The stand served as a platform for meaningful discussions about the opportunities available in this field, giving prospective students a better understanding of what to expect from an engineering degree at UKZN.

Events like these highlight the many possibilities within engineering, and SAIEE UKZN remains committed to fostering interest in the field—a special thank you to everyone who visited the stand. We look forward to seeing some of you join UKZN's engineering community soon! wn

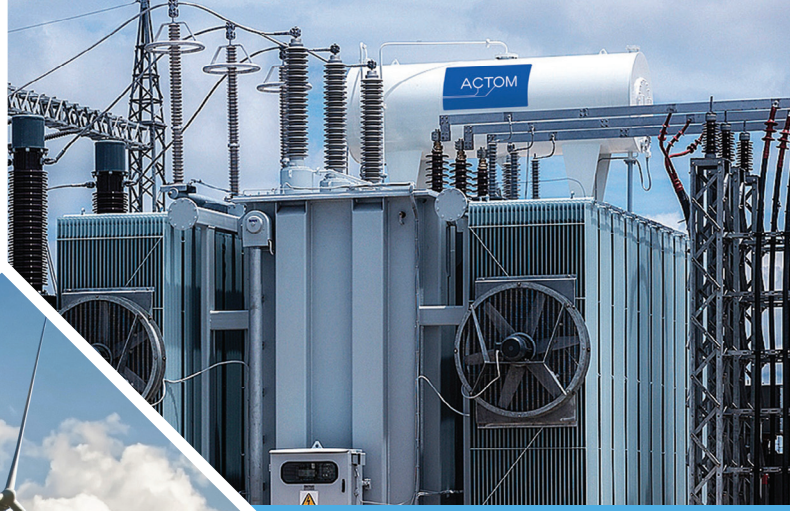
*EECE members at the Pietermaritzburg Open Day*

*Engineering displays at the Westville Open Day, showcasing EECE projects.*

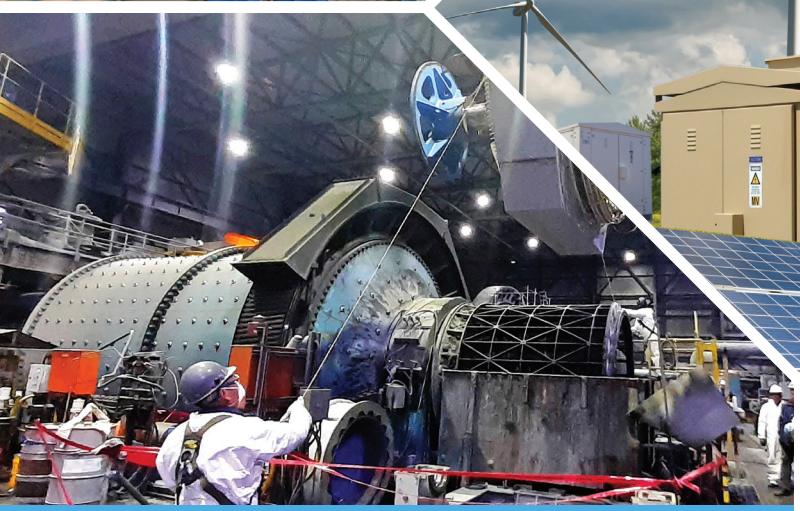


*Interactive engineering displays at the Pietermaritzburg Open Day.*

MANUFACTURING




PROJECTS



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# The SAIEE Unizulu Student Chapter participated in the Bergville Career Guidance Day

**The South African Institute of Electrical Engineers (SAIEE) was invited to participate in the 2025 Career Guidance Day held in Bergville, KwaZulu-Natal.**

Bergville Community Builders (BCB) organised this event to provide career guidance to Grade 11 and 12 learners from 34 local high schools. The goal was to expose students to various professional career paths, their requirements, and real-world applications.

## SAIEE REPRESENTATION

The SAIEE delegation that honoured the invitation comprised:

- Dr. Oni – SAIEE Representative
- Khodani Conjwa– Chairperson, SAIEE UNIZULU Student Chapter
- Vusi Mkhwanazi – Public Relations Officer, SAIEE UNIZULU Student Chapter
- Anelisa Mantshi – Student Member, SAIEE
- Zamaswazi Thwala – Student Member, SAIEE

## EVENT OVERVIEW

During the full-day Career Guidance Day, various professionals, organisations, and institutions engaged with learners in interactive sessions. SAIEE representatives played a crucial role in educating students about career opportunities in engineering, the minimum requirements for learners to receive an offer to study engineering, and the benefits of SAIEE membership.

## SAIEE UNIZULU STUDENT CHAPTER'S CONTRIBUTION

The team focused on:

- Presenting Career Paths in Engineering: Learners were informed about different fields within the engineering field.
- Tertiary Education Requirements: The team outlined the necessary subjects, university admission requirements, and scholarship opportunities for aspiring engineers.
- Practical Examples: Real-life examples of engineering projects were used to engage students.
- Day-to-Day Experiences: We shared personal experiences, discussing academic challenges, career growth, and workplace expectations.
- Motivational Talks: The team emphasised the importance of education, perseverance, and continuous learning in achieving success in engineering.

## LEARNER ENGAGEMENT AND FEEDBACK

The learners showed great enthusiasm, actively participating in discussions and demonstrations. Many students expressed interest in pursuing engineering careers and asked insightful questions regarding university applications, job prospects, and industry challenges. One challenge we faced was that most learners were taking 'Technical Maths' and were unaware that many traditional universities do not consider applications from learners who took Technical Maths instead of Pure Maths when selecting candidates for their engineering programs.

The Career Guidance Day began at 09h30 and continued throughout the day, bringing together professionals, organisations, and institutions to engage with learners through interactive sessions. Representatives from the South African Institute of Electrical Engineers (SAIEE) played a key role

in educating students about various career opportunities in engineering, the academic requirements for university admission, and the benefits of SAIEE membership.

The SAIEE UNIZULU Student Chapter contributed significantly by presenting different career paths in engineering and outlining the necessary subjects, university admission criteria, and available scholarship opportunities.

Learners were captivated by practical examples of real-world engineering projects, which made technical concepts more relatable. Additionally, the team shared personal experiences about academic challenges, career progression, and workplace expectations, providing valuable insight into the engineering profession. Motivational talks were also delivered, emphasising the importance of education, perseverance, and continuous learning in achieving success. The learners responded enthusiastically, actively participating in discussions and demonstrations. Many expressed interest in pursuing engineering careers, asking insightful questions about university applications, job opportunities, and industry challenges.

A primary concern raised was that most students were enrolled in Technical Mathematics and were unaware that many traditional universities do not accept this subject for engineering program admissions, limiting their opportunities. We further proposed that this engagement be initiated at a lower grade to adequately give the learners an informed decision on their career choice.

The University of Zululand is proud to support initiatives like this, which provide crucial outreach to disadvantaged learners.

The event was incredibly impactful because it occurred in a remote and often overlooked location, far from the Bergville highway and main road, making access to career guidance resources scarce.

The SAIEE delegation sincerely appreciated the opportunity to participate in this initiative and thanked Bergville Community Builders for organising the event.

Future collaborations are eagerly anticipated to continue empowering young learners in rural communities. wn

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# Taking Power Conversion to the Next Level

**Multi-level buck conversion is not new and has been applied in higher voltage and power devices for years. The need for high power delivery in small, low-profile applications such as smartphones makes multi-level uses attractive.**

*By: Laurence McGarry*

While multi-level buck conversion has been applied in higher voltage and power devices for many years, the need for high power delivery in small, low-profile applications such as smartphones makes multi-level uses attractive.

Many mobile electronic products require lower-profile form-factor solutions with increasing power requirements. This is especially true for consumer and mobile devices such as low-profile smartphones and tablets—sometimes described as a 3D jigsaw puzzle of PCB boards, antennae, and interconnects. Meanwhile, battery charging speeds are continually increasing, and core processors march toward finer-geometry silicon with low-voltage supply requirements and increasing currents.

Traditionally, power conversion has been based on the step-down buck converter shown in Figure 1 (i). The buck architecture is commonly used and well-understood but has limitations. If we consider the switch node as the midpoint of the buck FETs, this node switches between the entire input voltage and ground. This means that the output filter—the output inductor and capacitance—must be relatively large, which is problematic for low-profile applications.

To solve the issue, we believe that the answer is to take power conversion to the next level and introduce the concept of multilevel power conversion. The multi-level buck converter shown in Figure 1(ii) (in this case, 3-level) is closely related to the traditional buck converter but expands the number of switching levels. Hence, there is a level of familiarity for designers and customers alike. The topology is not new and has traditionally been used in higher input voltage and higher power applications. However, the ability to reduce the size and height of the output inductance and achieve high levels of conversion efficiency makes the topology more attractive to lower-voltage applications with demanding low-profile requirements.

As always, any advanced architecture presents challenges. The increased number of switches increases the complexity of the control and gate drive circuitry. This article addresses some of the advantages and resolutions to some of the challenges before providing some real-product performance measurements and data.

## MULTI-LEVEL BASICS: BUCK VS. MULTI-LEVEL BUCK CONVERSION

The traditional buck converter shown in Figure 1(i) is widely used but carries some limitations. The buck topology can be considered as a 2-level buck converter with the switch node (center point of the switching FET) switching between two levels: input voltage and ground (or approximately one diode drop below). This means that the switch node waveform sees a significant voltage excursion which requires a large

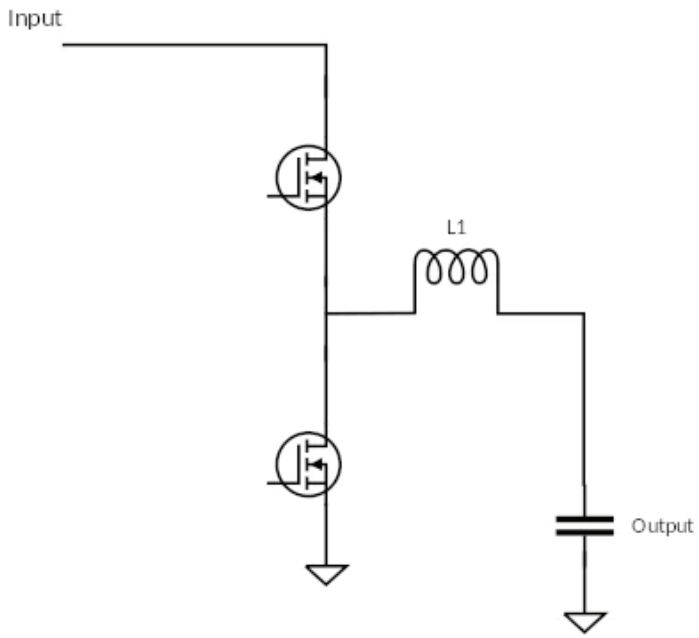


*Figure 1(i). Buck Converter. Image used courtesy of Bodo's Power Systems.*

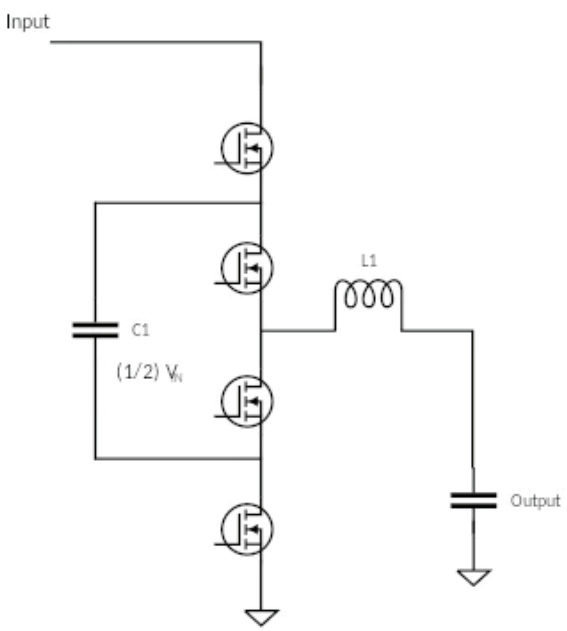


*Figure 1(ii). 3-Level Buck Converter. Image used courtesy of Bodo's Power Systems.*

output filter —output inductor, and output capacitor— to provide a smooth DC voltage to the output load. The voltage stress is further increased by leakage and parasitic inductances as the current reverses in the output inductor. The net result is that the designer must select higher-voltage FETs, reducing the conversion efficiency.

The multi-level buck converter has several benefits over a standard buck converter. Figure 1(ii) shows a 3-level buck converter. The name of the converter derives from the switching node of the inductor switching between three levels. In a buck converter, the inductor switching node switches between input voltage and ground, or two levels. But in the 3-level buck, the inductor's switching node can switch between either the input voltage, ground, or half of the input voltage.

The extra switching states offer some big advantages. The frequency seen across the inductor is twice the frequency of the switching MOSFETs, resulting in a smaller inductor. In a standard buck, the voltage seen across the inductor in the charging state is $V_{IN}$-$V_{OUT}$. But in 3-level, it is ½ $V_{IN}$-$V_{OUT}$, yielding a lower inductor ripple current.

In a typical buck converter, the voltage seen across the MOSFETs is $V_{IN}$. But in a 3-level buck, the voltage is ½ $V_{IN}$. To take advantage of this, lower-rated MOSFETs are used. The Rds_on of the MOSFET roughly scales with the voltage rating squared. The lower voltage rating of the MOSFETs can have ¼ the Rds_on in the case of a 3-level buck.

Figure 2 shows the four possible switching states of the 3-level buck for continuous conduction mode operation. During steady-state operation, the inductor

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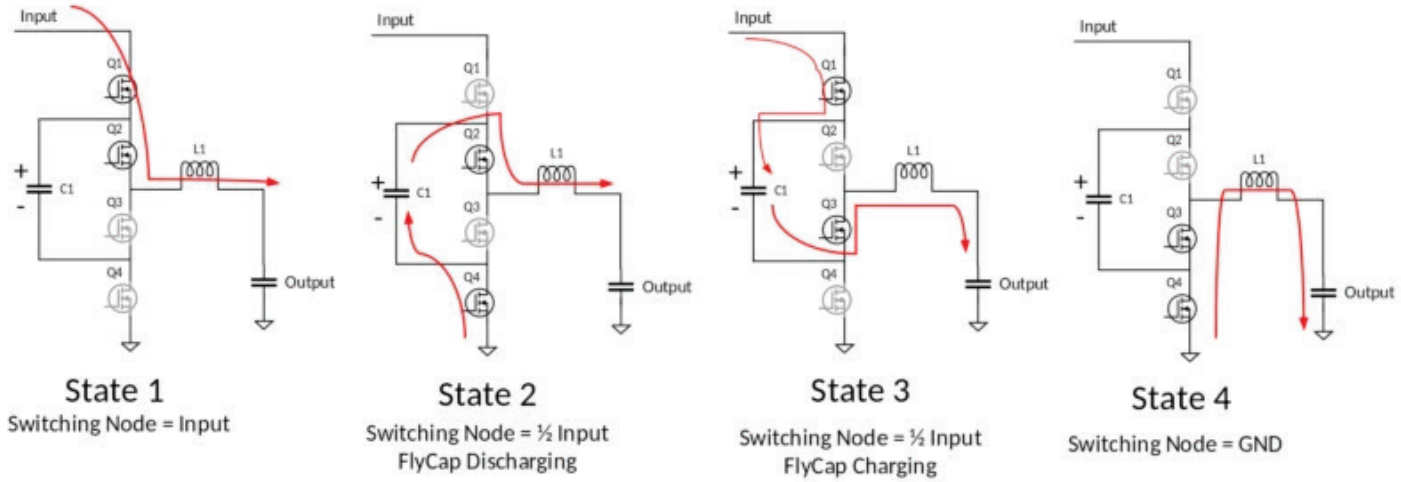


*Figure 2. 3-Level Buck Switching States. Image used courtesy of Bodo's Power Systems.*

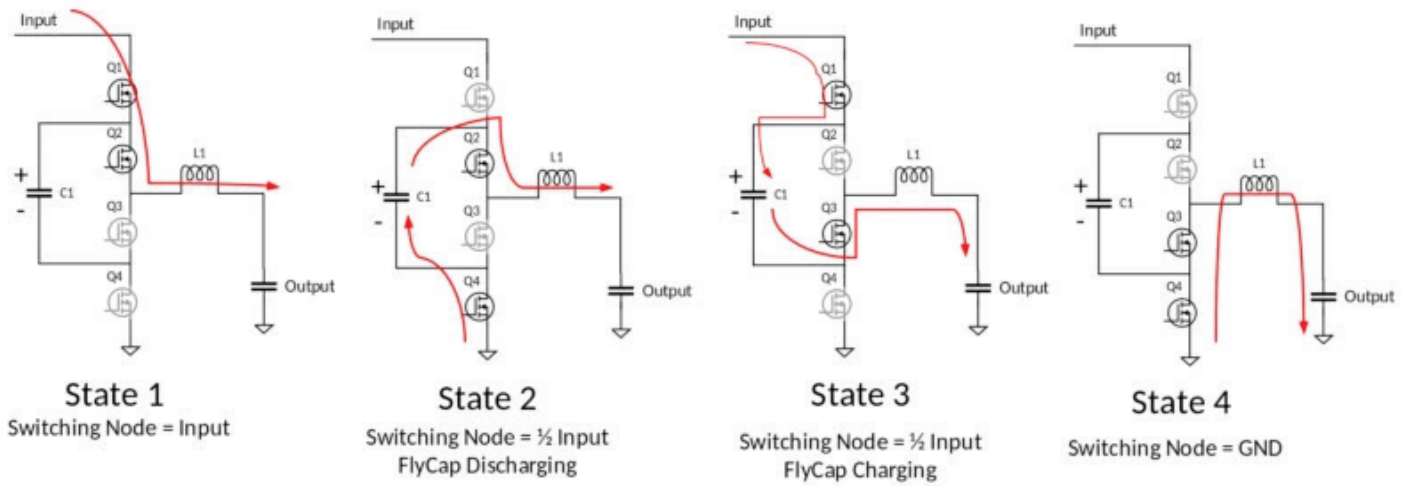


*Figure 3. 3-Level Buck Steady-State Waveforms when $V_{OUT}$ < ½ $V_{IN}$. Image used courtesy of Bodo's Power Systems.*

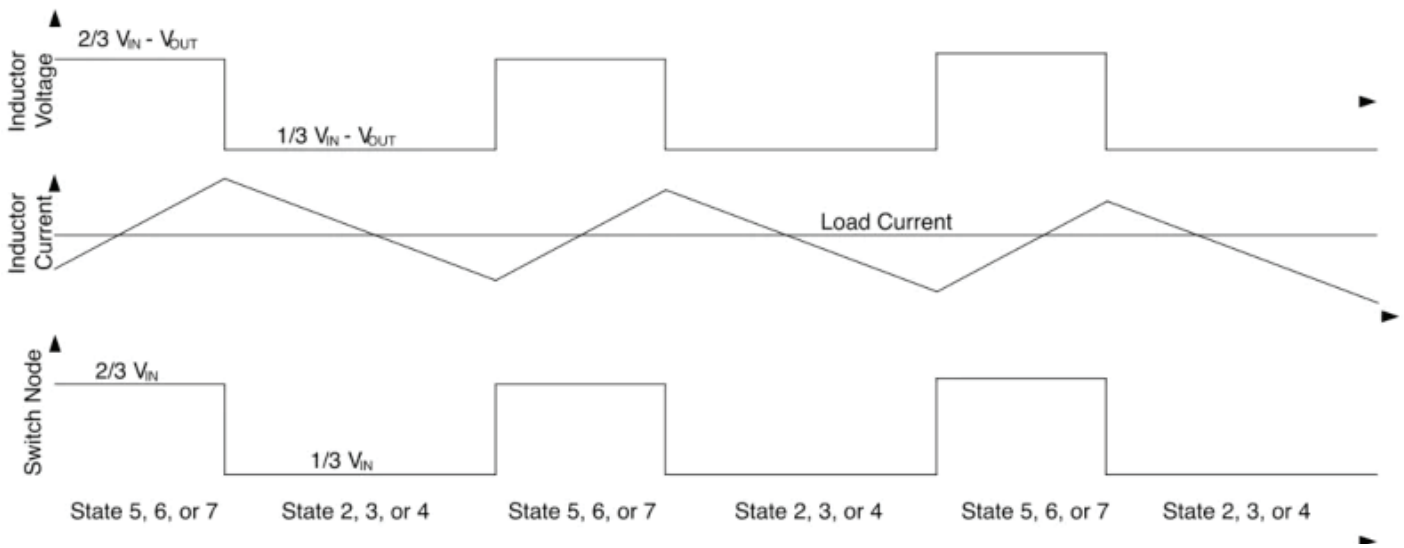


*Figure 4. 3-Level Buck Steady State Waveforms when $V_{OUT}$ > ½ $V_{IN}$. Image used courtesy of Bodo's Power Systems.*

switching node switches between two voltages, like a standard buck. When the output voltage is above ½ the input voltage, states 1, 2, and 3 are used. When the output voltage is below ½ the input voltage, states 2, 3, and 4 are used.

States 2 and 3 keep the voltage balanced on the fly capacitor, C1. To keep the voltage balanced, the voltage across the fly capacitor is monitored. The voltage is actively balanced by the control loop.

Figure 3 shows the 3-level buck inductor current and the inductor switching node voltage in continuous conduction mode and when $V_{OUT}$ < ½ $V_{IN}$. As discussed, in the 3-level buck, the switch node switches between ½ $V_{IN}$ and GND.

During the inductor charging, either state 2 or 3 is used. The PWM controller logic chooses state 2 or 3 depending on the fly capacitor voltage. If the fly capacitor voltage is too low, state 3 is chosen. If the fly capacitor voltage is too high, state 2 is chosen.

This keeps the voltage on the fly capacitor at ½ $V_{IN}$.
Figure 4 shows the 3-level buck inductor current and the inductor switching node voltage in continuous conduction mode and when VOUT > ½ $V_{IN}$. States 2 and 3 are used again to balance the voltage on the fly capacitor.

## MOVING TO THE NEXT LEVEL

By adding more MOSFETs and fly capacitors, the 3-level buck converter can expand to 4 levels or more. A major benefit of adding more levels is to reduce the voltage stress on the MOSFETs. With a 3-level buck, the MOSFETS see one-half the input voltage. With a 4-level buck, the MOSFETs see one-third the input voltage. With a 5-level buck, the MOSFETs see one-quarter the input voltage, and so on. In an N-level buck converter, the MOSFET voltage is reduced to 1/ (N-1). These higher multi-level buck converters, shown in Figure 5, have an advantage in high input voltage applications with lower-rated MOSFETs and lower switching losses.

Figure 5 (ii) illustrates a 4-level buck converter. The 4-level buck converter adds two MOSFETS and one fly capacitor to the 3-level buck. With more MOSFETs and now four levels, the 4-level buck converter has eight different possible switching states.

Again, as in the 3-level buck, the fly capacitor voltages require active balancing. The voltage on each fly capacitor is monitored. When the input is below one-third the output voltage, the inductor switching node switches between 0 and 1/3 $V_{IN}$. To keep the fly capacitors balanced, the PWM controller cycles between states 2, 3, or 4 as shown in Figure 6.

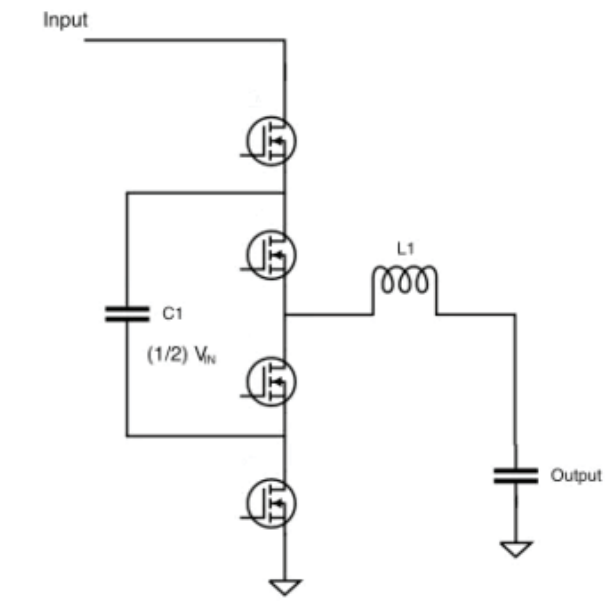


*Figure 5 (i). 3-Level Buck Converter.*
*Image used courtesy of Bodo's Power Systems.*

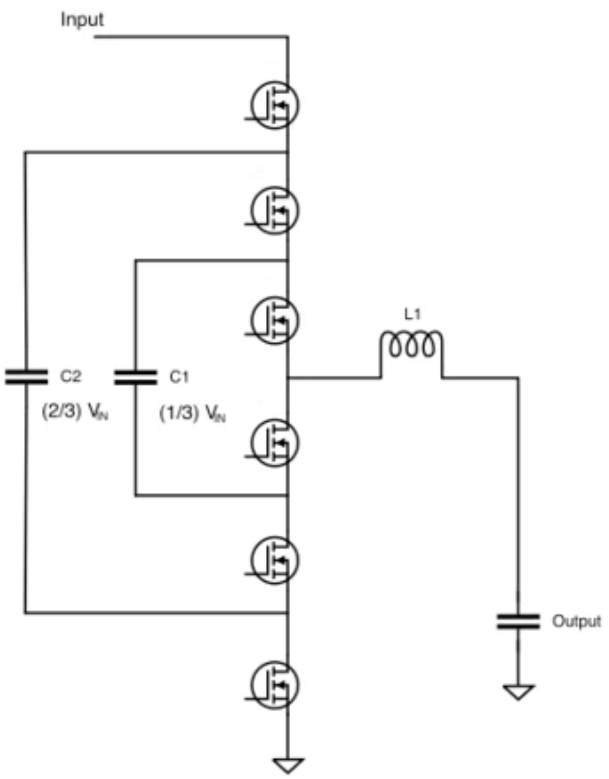


*Figure 5 (ii). 4-Level Buck Converter.*
*Image used courtesy of Bodo's Power Systems.*

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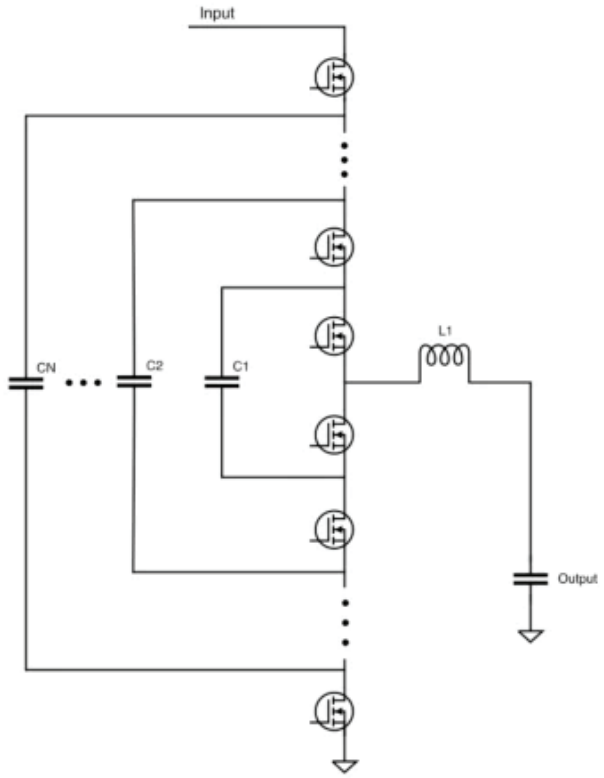


*Figure 5 (iii). N-Level Buck Converter.*
*Image used courtesy of Bodo's Power Systems.*

In applications that require wide-range input voltages, we can run at four levels for high input voltage ranges and switch to three levels for mid-to-low input ranges by shorting out a level of switches and optimizing the conversion efficiency. This can be particularly useful for USB input equipment which can range from 5 V to 20 V. Shorting the fly capacitors together by leaving Q2 and Q5 permanently on turns the 4-level converter into 3-level converter, as shown in Figure 7.

## HYBRID CONVERSION

In general, an unregulated charge pump or switching capacitor converter offers better efficiency than a traditional regulated buck converter. Note that a multi-level converter can be transformed and operated as a charge pump. For example, the 3- level buck converter can be configured to operate as a divide-by-2 charge pump using the same FET structure.

Figure 8 shows a (i) divide-by-2 charge pump compared to a (ii) 3-level buck. The inductor in the 3-level buck converter is required for regulation. Removing the inductor in a 3-level buck converter transforms it into a divide-by-2 charge pump. Charge pumps usually do not require an output inductor to operate.

However, pSemi has developed charge pump architectures that use a small, adiabatic output inductance. Adding an inductor can eliminate the charge redistribution loss in the fly capacitor. In a charge pump, a capacitor is typically switched in parallel or series with other capacitors resulting in charge redistribution loss. An adiabatic inductor allows the current to resonate between capacitors, eliminating the charge redistribution loss and improving charge pump efficiency.

This scheme can be employed if the output inductor is small enough to satisfy the adiabatic performance of the charge pump. The multi-level converter can achieve lower output inductance for the reasons mentioned previously. Hence, the architecture can be switched between multi-level mode and charge pump mode to form an adaptable hybrid converter.
By switching from 3-level buck operation to charge pump operation, we keep the buck inductor in series with the output. The control is changed from a standard PWM control in 3-level buck mode to charge pump control. In charge pump control (see Figure 2), the fly capacitor, C1, voltage is monitored. Switching states 2 and 3 are used. When the fly capacitor voltage is too low, the controller switches to state 3. When the fly capacitor voltage is too high, the controller switches to state 2.

Similarly, the 4-level buck converter can operate as a divide-by-3 charge pump. Figure 9 shows a divide-by-3 charge pump and 4-level buck converter. In charge pump mode, both fly capacitors are monitored to maintain the correct voltages on each capacitor. States 2, 3, and 4 keep C1 charged at one-third of the input voltage and C2 at two-thirds of the input voltage.

When operating in charge pump mode, the 4-level buck inductor is in series with the charge pump output. Because the switching node has small ripple, the inductor ripple current is very small. The inductor performs the adiabatic function in divide-by-3 as in divide-by-2 described earlier.

## FROM THEORY TO PRACTICE

This section shows real waveforms from a multi-level converter capable of operating over a wide input range 4.5V to 18V. The device can operate in 4-level mode buck mode, generally used at higher input voltages, and in 3-level buck mode, generally for mid-to-low input voltages. As described in the previous section, the device can be operated in charge pump, capacitor divider mode with divider ratios 2 and 3. Current delivery is up to 6A in all modes using a 1 mm height inductor.

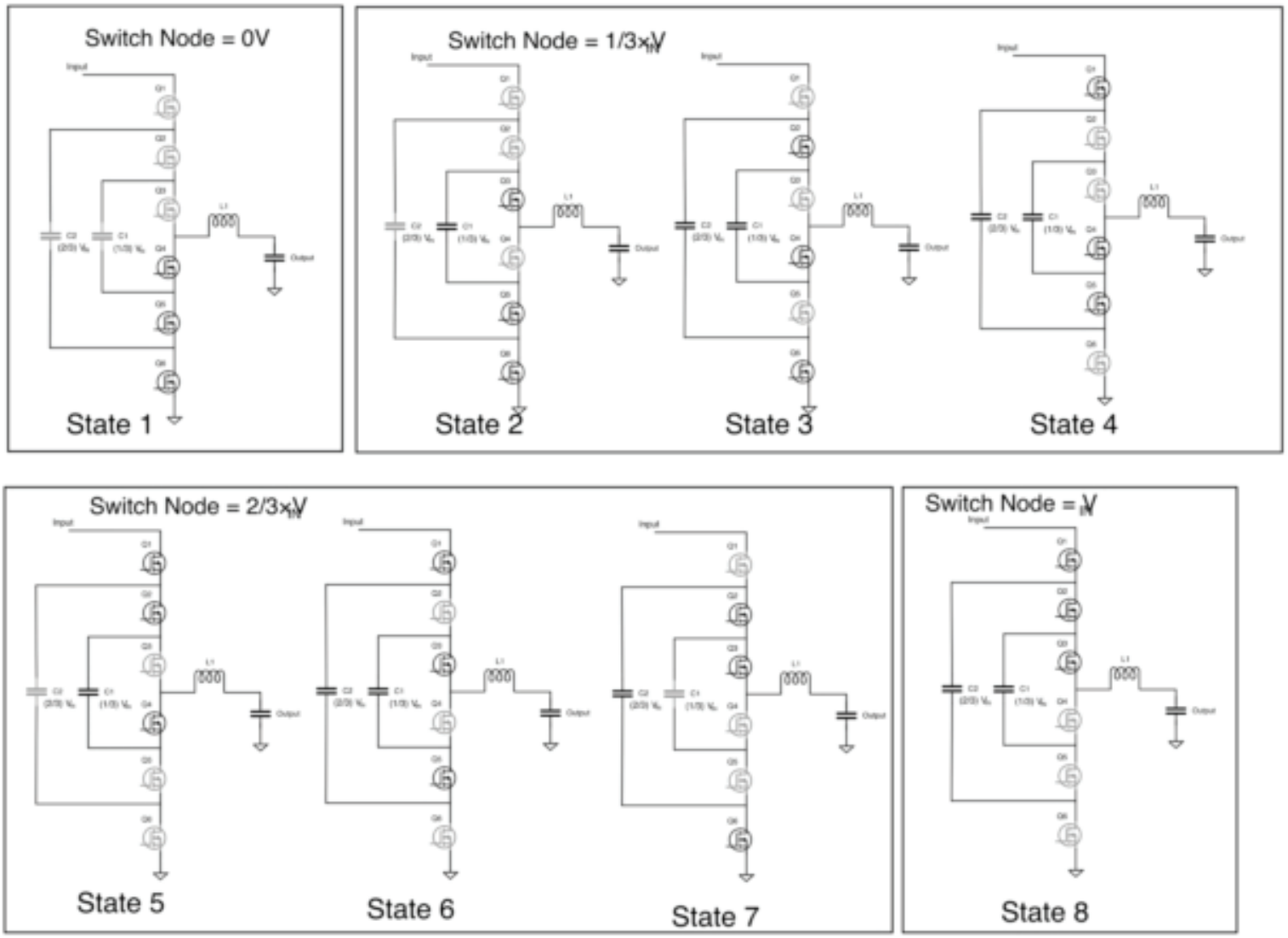


*Figure 6. 4-Level Buck Switching States. Image used courtesy of Bodo's Power Systems.*

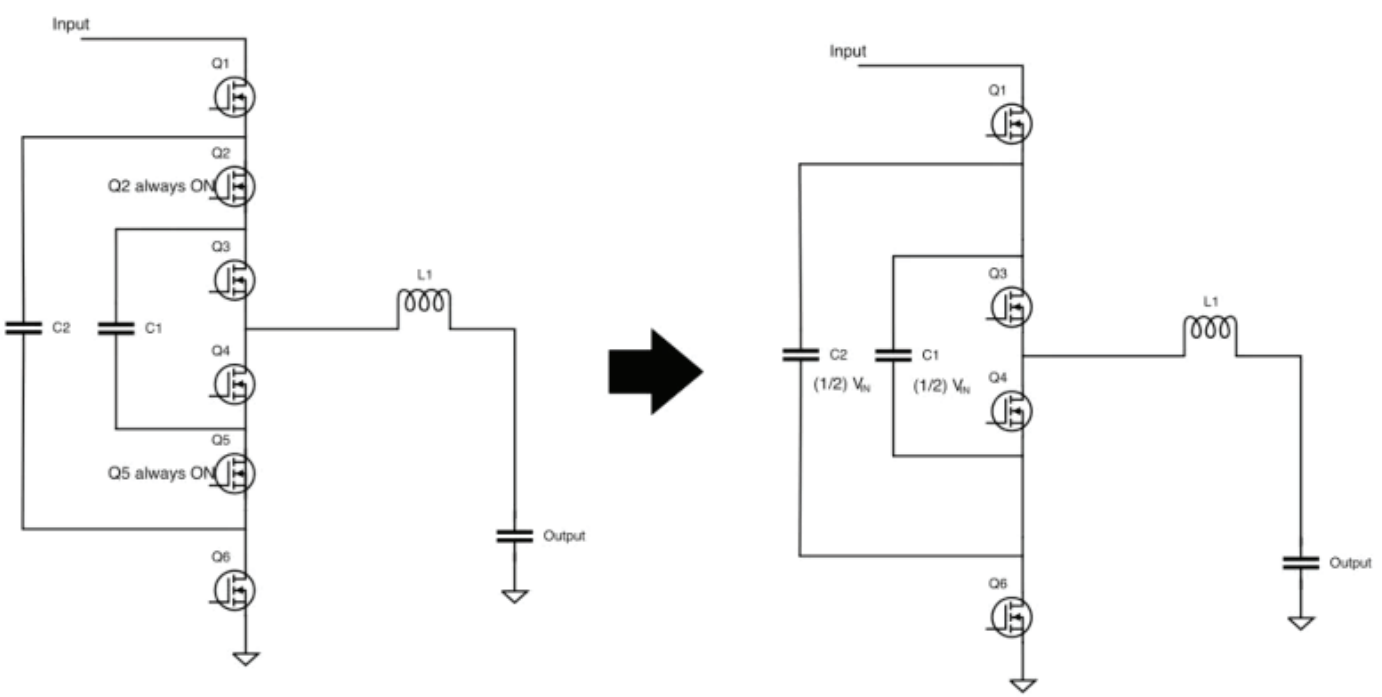


*Figure 7. 4-Level Buck Transition to 3-Level Buck. Image used courtesy of Bodo's Power Systems.*

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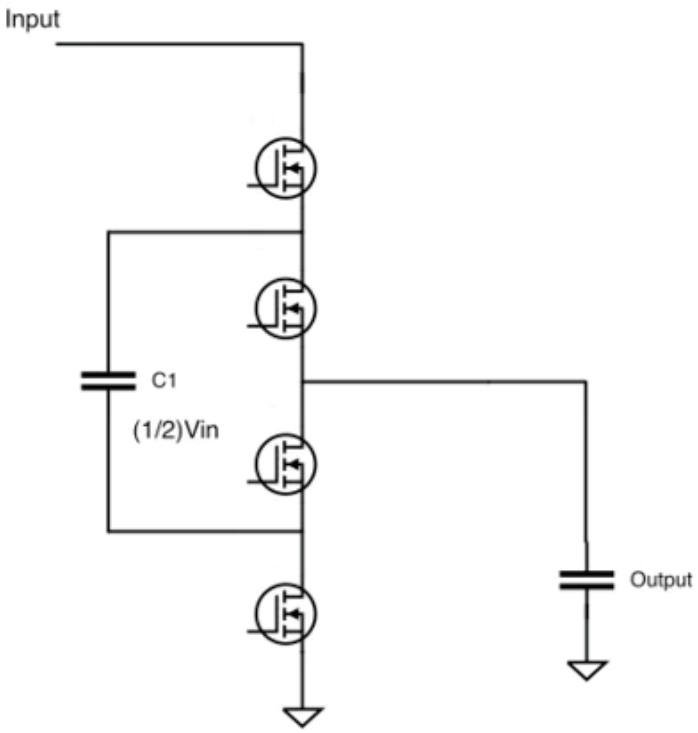


*Figure 8 (i). Divide-by-2 Charge Pump.*
*Image used courtesy of Bodo's Power Systems.*

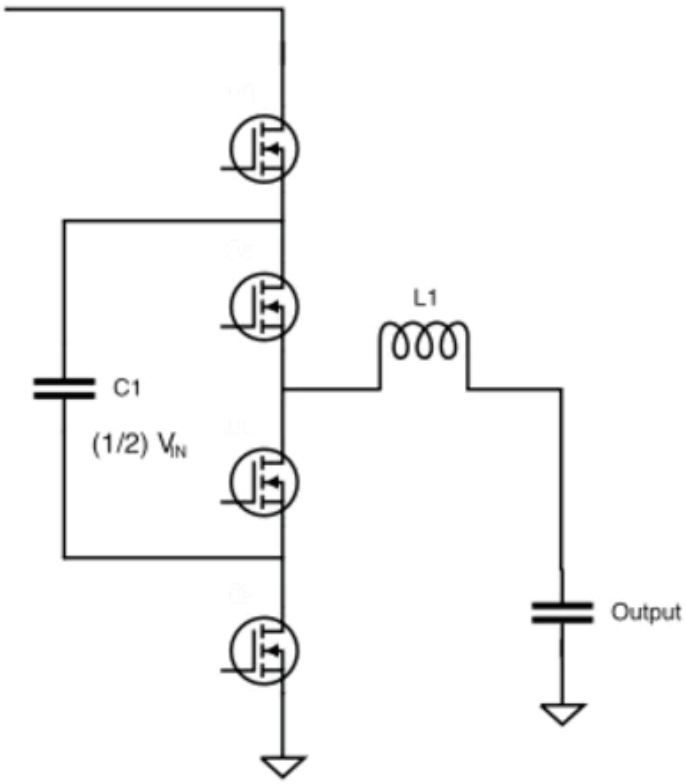


*Figure 8 (ii). 3-Level Buck Converter.*
*Image used courtesy of Bodo's Power Systems.*

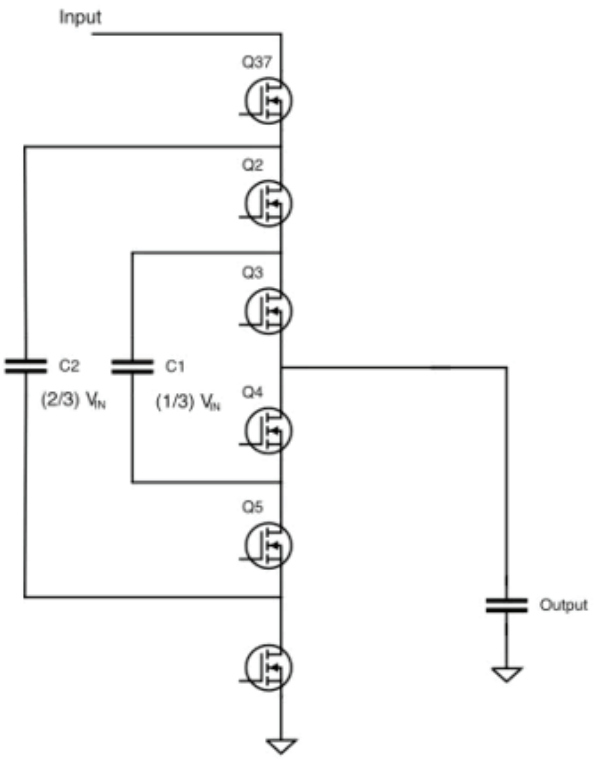


*Figure 9 (i). Divide-by-3 Charge Pump.*
*Image used courtesy of Bodo's Power Systems.*

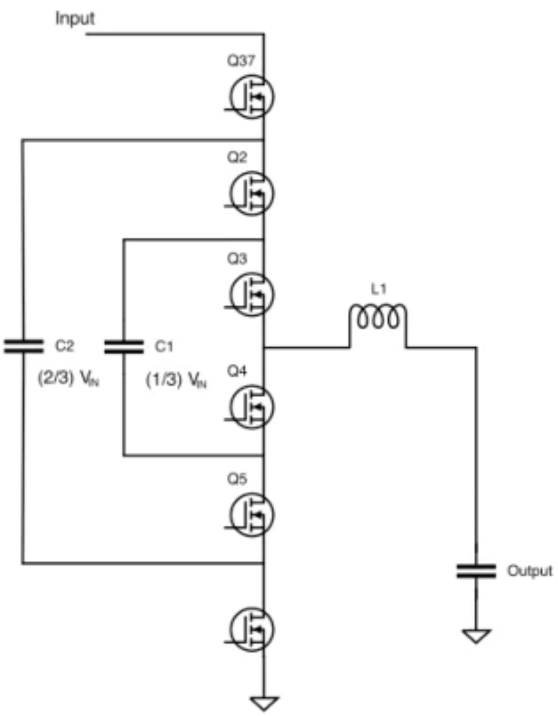


*Figure 9 (ii). 4-Level Buck Converter.*
*Image used courtesy of Bodo's Power Systems.*

Figure 10 shows operation in 3-level mode. In Figure 10 (i), the $V_{IN}$ to $V_{OUT}$ ratio is less than 0.5. Hence, the FET/inductor node switches between 0 and ½ * $V_{IN}$. In Figure 10 (ii), $V_{IN}$ is reduced to 6V. Now the $V_{IN}$ to $V_{OUT}$ ratio is greater than 0.5. So, the device switches between ½* $V_{IN}$ and $V_{IN}$.

Figure 11 shows the device operating in 4-level mode with the input voltage changing from (i)18V to (ii) 12V and then to (iii) $6V_{IN}$ input. This exercises the converter at each level, but in all instances, we can see that the voltage excursion on the switch node is always one-third of the input voltage.

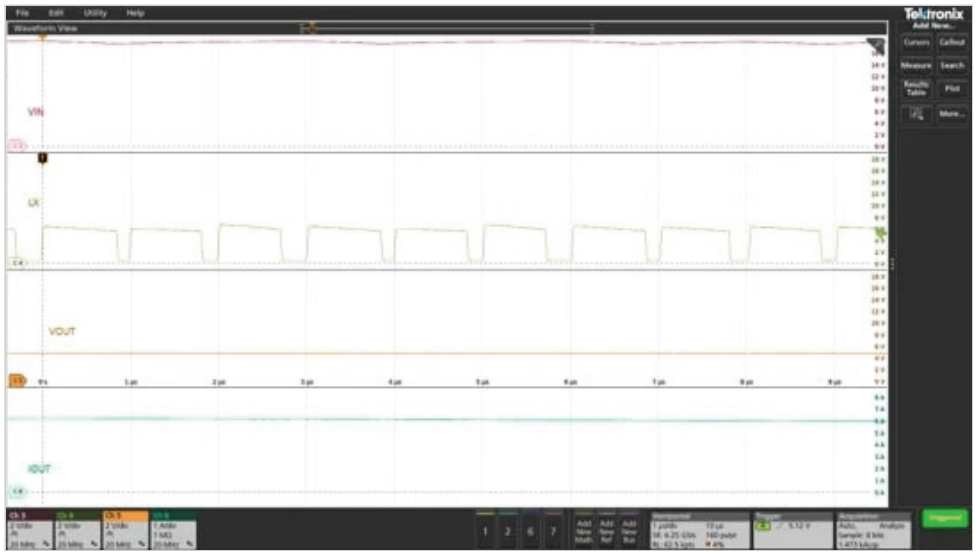


*Figure 10 (i). 3-Level -lower half: $12V_{IN}$ with $4.5V_{OUT}$ Switching node moves between 0 to ½*$V_{IN}$*
*Image used courtesy of Bodo's Power Systems.*

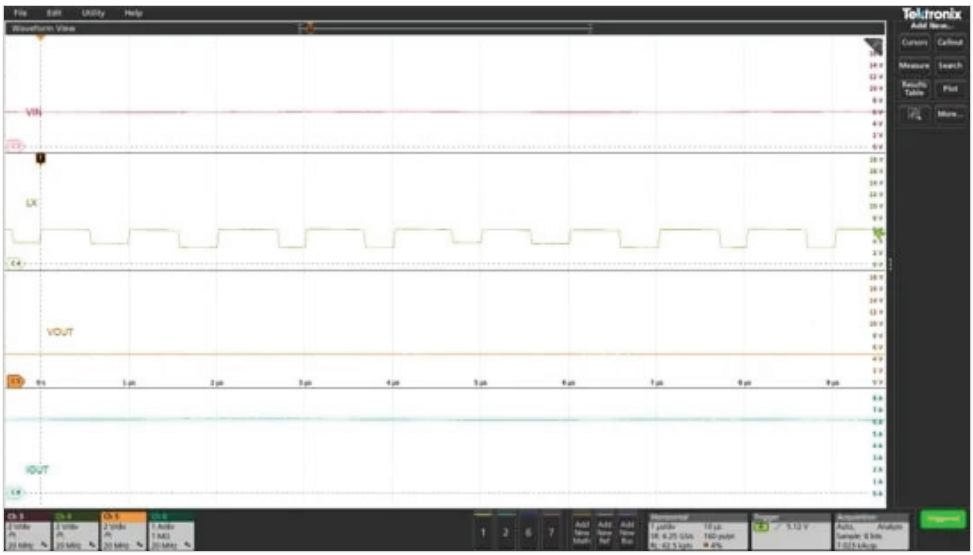


*Figure 10 (ii). 3-Level -Upper half: $6V_{IN}$ with $4.5V_{OUT}$ Switching node moves between ½*$V_{IN}$ to $V_{IN}$*
*Image used courtesy of Bodo's Power Systems.*

## CONCLUSIONS

The concept of multi-level buck conversion is not new and has been applied in higher voltage and power devices for many years. However, the need for high power delivery in small, low-profile applications such as smartphones makes multi-level uses more attractive. The topology provides many advantages, resulting in smaller, lower-profile output inductors and the use of lower voltage FETs for higher efficiency. As with all advanced power architectures, there are added complexity and control techniques that must be applied, but problems such as dead-zone operation and fly-capacitor balancing are solvable.

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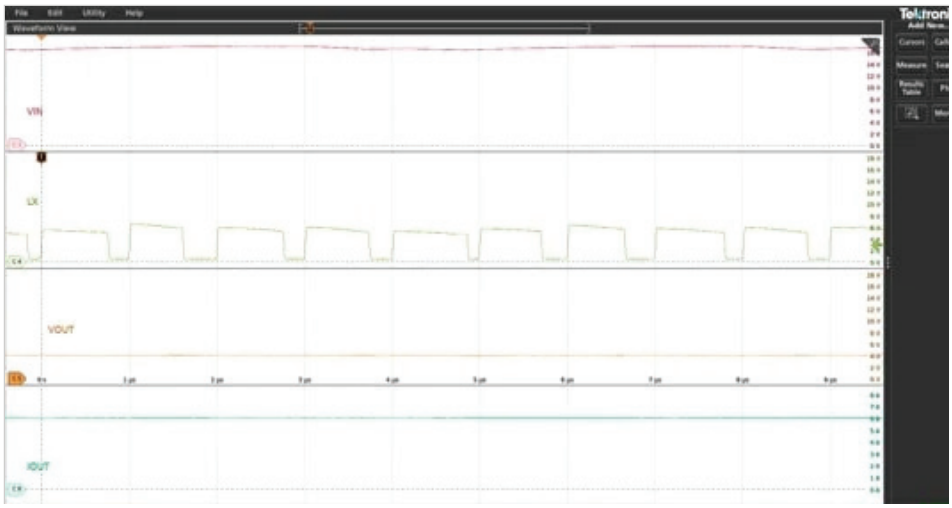


*Figure 11 (i). 4-Level - lower third: 18$V_{IN}$ with 4.5$V_{OUT}$ Switch node moves between 0 to 1/3* $V_{IN}$*
*Image used courtesy of Bodo's Power Systems.*

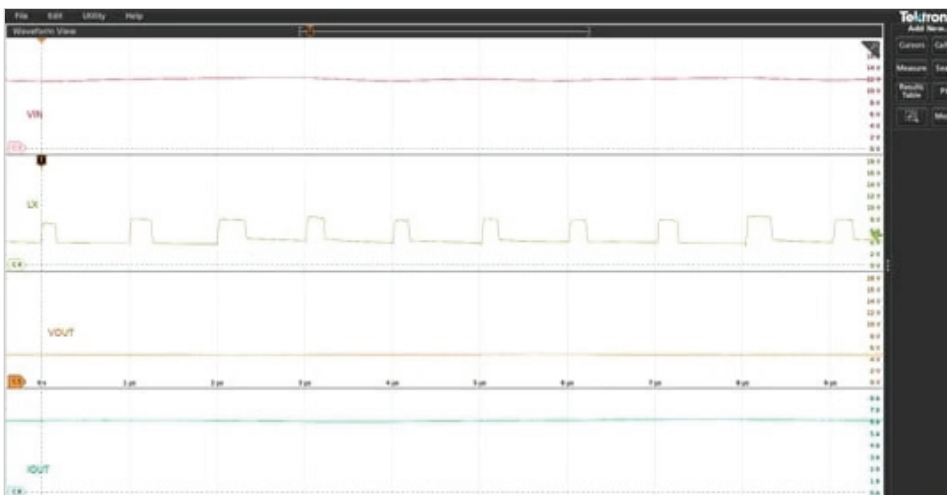


*Figure 11 (ii). 4-Level – middle third: 12$V_{IN}$ with 4.5$V_{OUT}$ Switch node moves between 1/3* VIN to 2/3 *$V_{IN}$*
*Image used courtesy of Bodo's Power Systems.*

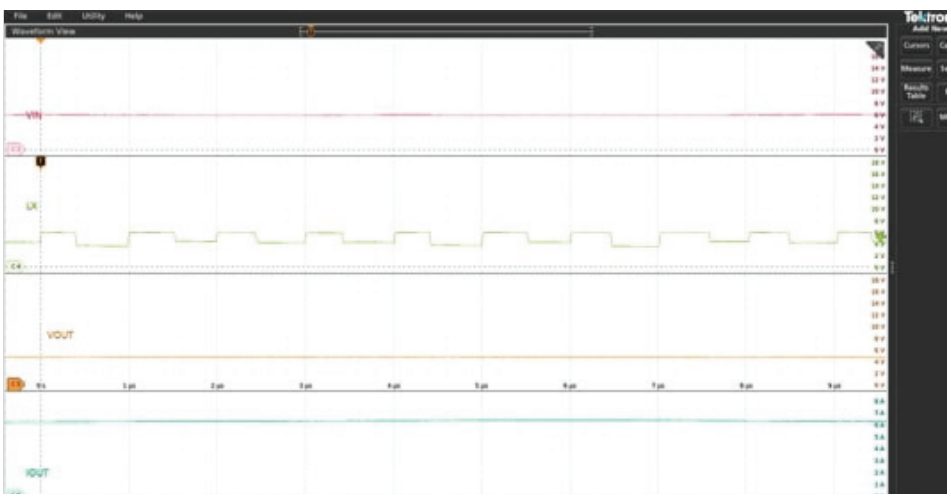


*Figure 11 (iii). 4-Level -Upper third: 6$V_{IN}$ with 4.5$V_{OUT}$ Switching node moves between 2/3*$V_{IN}$ to $V_{IN}$*
*Image used courtesy of Bodo's Power Systems.*

The multi-level approach is particularly appealing in smartphone applications where solutions are expected to be <1 mm in height. The topology can provide high efficiency and high-power delivery to increase battery charging speeds and provide high current supply to sub-10 nm processor ASICs that demand higher currents at lower supply voltages.

One key challenge facing the smartphone industry is supporting a plethora of new and legacy 'wired' and 'wireless' charging voltage requirements. The multi-level approach can adapt and transform depending on the type of input voltage presented. If the input adapter is fixed to USB_PD (power delivery), it is enabled as a multi-level buck converter.

Depending on the input voltage magnitude, this could be implemented as a 4-level, 3-level, or 2-level. If the adapter type is PPS and presents a variable input voltage, the multi-level converter can act as a capacitor divider charge pump. Truly, this is an intelligent hybrid architecture.

pSemi-Murata has developed the industry's first multi-level converter capable of operating to four levels and as a charge pump capacitor divider capable of delivering high current. pSemi will showcase a hybrid 4-level buck and charge pump converter for power conversion in mobile platforms for the first time at APEC 2025 this week.

Based on a substantial body of IP developed over the last 13 years and originating from patents from MIT, pSemi is now able to demonstrate products that take power conversion to the next level. wn

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FEATURE

# Fundamentals of Electromagnetic Compliance

**Everyone enjoys the advantages of electronic devices and gadgets becoming smaller, lighter, and faster, while providing longer battery life and ever-improving processing ability. Smaller devices require smaller electronic components — an advantage in reducing electromagnetic interference (EMI).**

However, a compact design also means smaller spacing between components, circuit traces, and enclosures, which can lead to increased field interactions, current loops, ground loops, cross-talk, and other potential sources of EMI.

We benefit from the convenience of televisions, cell phones, digital tablets, notebook computers, and IoT devices, all operating at the same time while appliance motors, lights, fans, and HVAC units are operating in the background to keep us comfortable. With multiple electrical and wireless electronic devices operating at the same time, signals must remain reliable in electro-magnetically-noisy environments.

The rapid growth of the electric vehicle (EV) and hybrid electric vehicle (HEV) market raises new electromagnetic compatibility (EMC) concerns as high-voltage batteries and chargers see increased use. High-voltage and high-frequency automotive electronics, if not prop- erly designed, can lead to EMC compliance headaches. Focusing on design techniques that mitigate EMI will help ensure a low-emissions outcome.

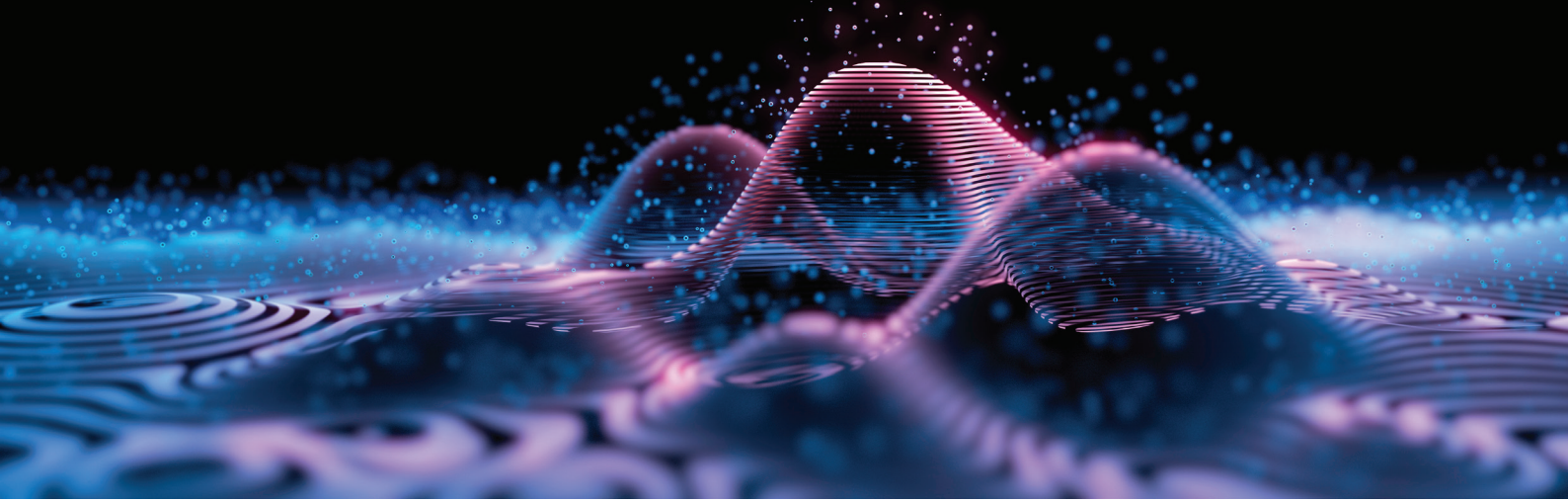
High levels of electromagnetic (EM) noise leads to EMI, which is any undesired electrical disturbance (noise) that interferes with other circuits. Electromagnetic emissions occur when electrical or electronic equipment radiates or conducts EM noise that interferes with other devices. Electromagnetic compatibility is the ability of electronic equipment to function properly without interference from noise sources (immunity / susceptibility) and with- out causing disturbances to other electronic equipment (emissions).

EMC isverified bytesting toindustry standards developed by regulating agencies described later in this discussion. These standards define specific test conditions and limits of noise emissions that may vary by location, application, and operating environment.

## NOISE SOURCES

Noise might be of a transient or discontinuous nature, or it might be generated continuously. Potential sources of transient or discontinuous conducted emissions include automatic switches, temperature controllers, appliance controllers and other automatic controllers, motor controllers and any other non-constant or event-driven on/off switching of voltage.

Potential sources of continuously conducted emissions include electric motors, unshielded or poorly-shielded data lines, switch-mode power converters, and any other constant steady-state switching of voltage. Improperly designed PCBs with power and signal areas too close together or having insufficient filtering can result in transient or steady state conducted emissions.



## MODES OF ELECTRICAL NOISE PROPAGATION

Noise is generally discussed as being either radiated or conducted. The solution to any noise problem requires identifying and understanding the nature of the noise. This can be complicated by interaction between radiating and conducting modes. After all, any conducted electricity has the potential to generate radiating fields, and likewise fields can cause electrical signals.

Designing and testing for EMC involves understanding how electric fields (E-fields) and magnetic fields (B-fields) propagate and interact. A fundamental understanding of antenna theory provides insights into how the size and design of electronic components, PCB traces, pads, and grounds relate to various frequencies and their associated wavelengths. Understanding the modes of electrical noise propagation and the methods of testing for EMC leads to design solutions that greatly improve the probability of passing EMC compliance tests in the earliest stages. Failing to design for EMC often results in expensive redesigns and PCB re-spins by field-coupling from source "aggressor" equipment through conducting input lines, cables, connectors, or traces to the equipment circuits. This mode of noise propagation and its effects on power quality are referred to as conducted emissions. Conducted emissions can be conducted directly into the circuit on the input lines or they can be near-field energy that is capacitively- coupled (E-field) or magnetically-coupled (B-field) to a circuit unintentionally. Because conducted emissions may involve capacitively- or magnetically-coupled fields, they are essentially reactive (non-radiative) near-field effects that can generally be modeled using lumped resistive, inductive, and capacitive (RLC) elements. Conducted emissions are typically measured in the 150 kHz to 30 MHz frequency range.

## DIFFERENTIAL AND COMMON MODE NOISE

Conducted emissions consist of differential mode (DM) currents and common mode (CM) currents. The dominant mode depends on the source of the noise. Differential mode noise currents are superimposed on the intended current that powers the circuit, traveling in a loop from the power source, through the circuit, and returning to ground or the intended source return node for non-grounded circuits.

DM currents include the typically lower-frequency desired fundamental signal and any higher-frequency harmonics. In some circuits, the fundamental frequency plus harmonics make up the desired waveform (AC), such as sine waves, square waves, or triangular waves. In others, the main current is DC and the AC portion is noise to be filtered out. The cutoff frequency of a low-pass filter inductor, choke, or LC filter must be designed to filter out the high-frequency noise without significantly attenuating the intended signal.

CM currents travel in the same direction through one or more conductors toward a common return point that closes the current loop (e.g. ground). When the return path is not intentional, the CM current may be the result of energy capacitively- or magnetically-coupled to the common point. Common mode chokes are designed to create high impedance to such CM noise (Figure 1) while presenting low impedance to the desired differential signal.

## RADIATED EMISSIONS

Near-field and far-field are terms associated with antennas. Why mention antennas in an EMC discussion? Unintentional transmitters are circuit elements that unintentionally radiate or scatter radiation. These are in effect "antennas" that were not intentionally designed to transmit energy. Unintentional transmitters cause radiated emissions, that is, electromagnetic noise propagated through the air that is received by other parts of the circuit or other devices.

Radiated emissions are essentially far-field at approximately two or more wavelengths distance from the source. The maximum dimension of an optimized antenna is about 1/4 wavelength of the intended signal being transmitted or received. When the size of an unintentional circuit transmitter, such

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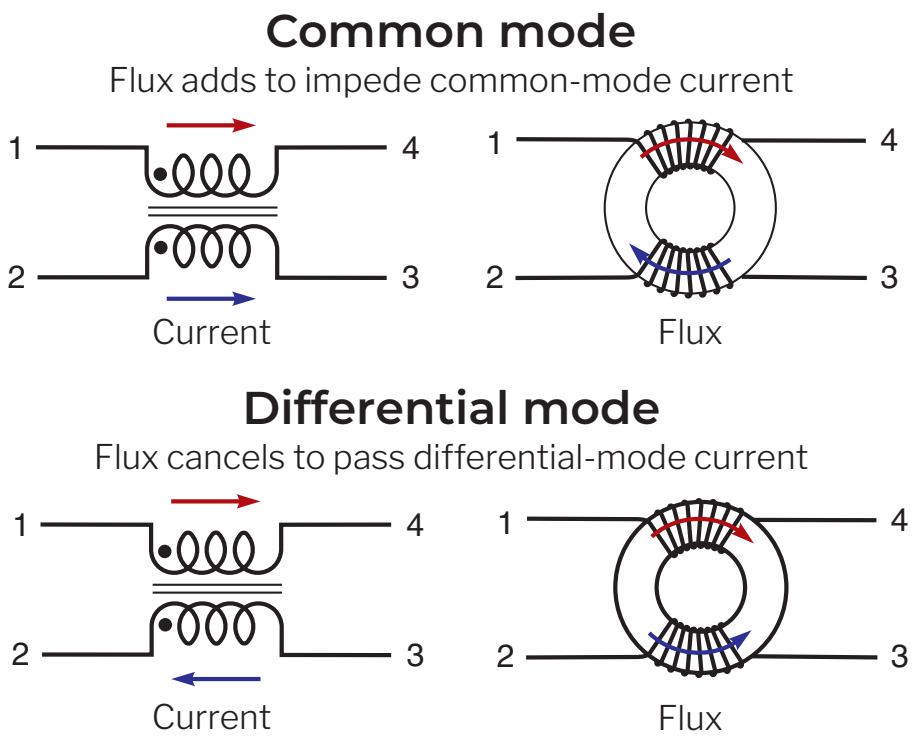



*Figure 1.*

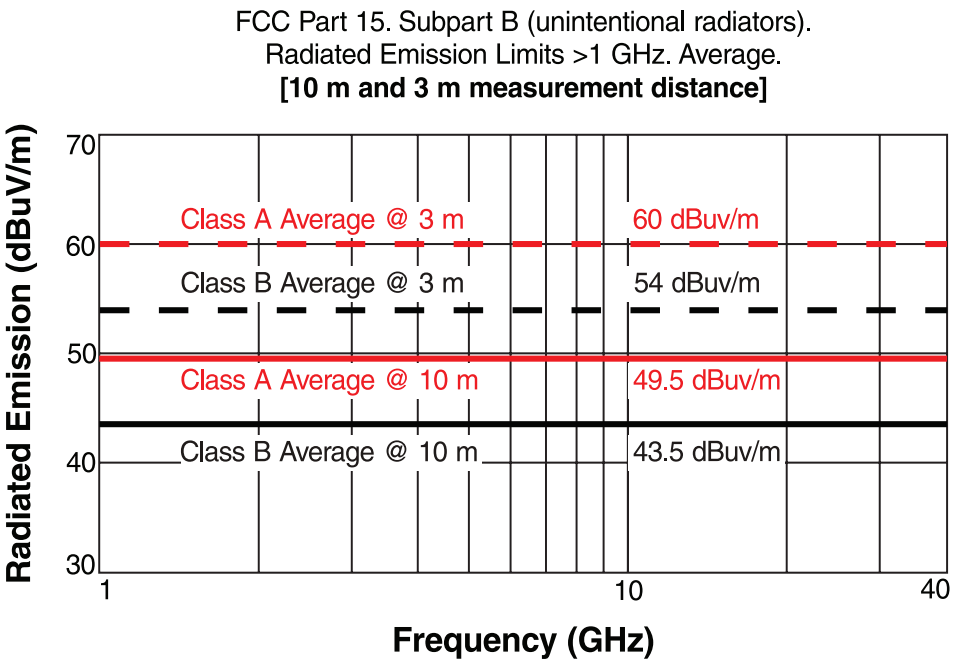



*Figure 2. FCC Part 15. Subpart B Radiated Emissions Limits > 1 GHz - Average*

as a PCB trace cable or slot behaving as an antenna, approaches about 4x the wavelength the transmitted high-frequency energy can be modeled by distributed (transmission line) elements.

Wavelength and frequency have an inverse relationship, therefore at higher frequencies in which the corresponding wavelength approaches about 1/4 of the size of the unintended antenna or smaller, radiated emissions can be expected. Consequently, radiated emissions are tested at higher frequencies than conducted emissions, typically in the 30 MHz to 1 GHz range.

Potential sources ofradiated emissions include switched wireless devices, iOT devices, radios, switching power supplies, electric motors, digital signal data lines, communications devices, motor drives, and any unshielded or radiating source with ineffective shielding. Some of these are also included as sources of conducted emissions, because they can interact both on power cables and data lines as well as via radiation over the air.

## EMC COMPLIANCE AGENCIES AND TEST METHODS

Following is a brief overview of EMC compliance agencies, test setups, methods, and standards. It also includes design hints for mitigating EMI and tips for EMC test troubleshooting.

EMC standards define specific test equipment, test set-ups, and pass/fail limits. EMC standards generally set limits on both peak (or quasi-peak) and average emissions levels vs. frequency range for the appropriate classification of the measured device. The equipment designed for measuring these levels is defined within the applicable product standard or within the referenced basic

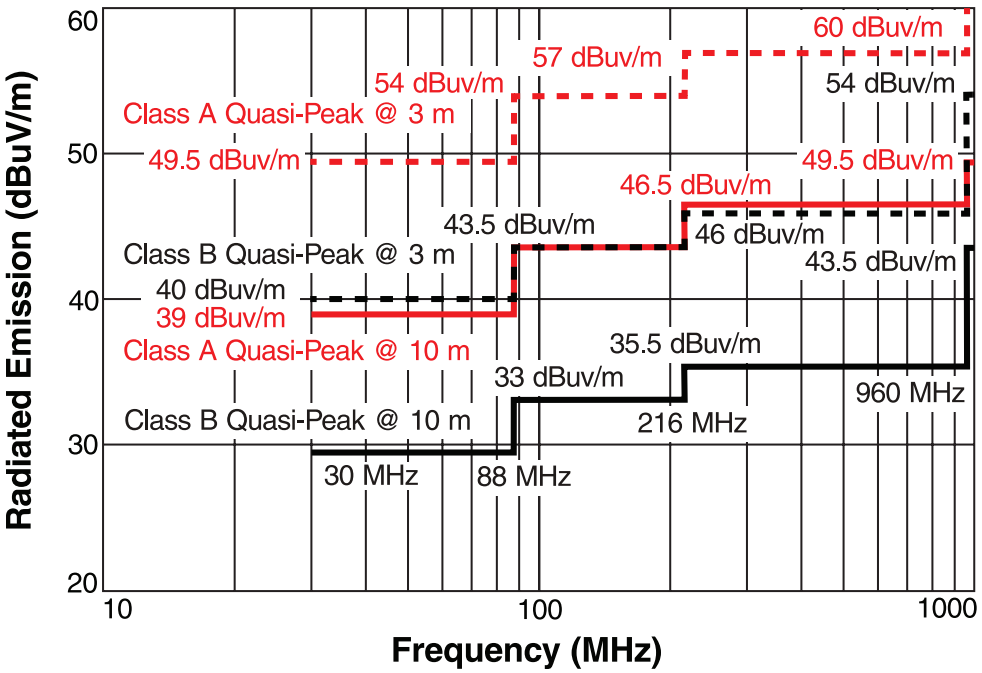



*Figure 3. FCC Part 15. Subpart B Radiated Emissions Limits 30 – 1000 MHz - Quasi-Peak*

standard. EMC standards are continually under review due to new product types and applications. Therefore, the latest approved standard should be ap- plied in any EMC test plan.

Figure 2 shows the test limits for FCC Part 15 (radio fre- quency devices) Subpart B radiated emissions limits for frequencies greater than 1 GHz for average measured values at 3 m and 10 m distance. Figure 3 shows the same for measured quasi-peak values.

Quasi-peak measurements apply a weighting fac- tor based on the repetition frequency of the spectral components of the signal. Even if the emission is over a test limit when measured with peak detection, it can pass if the quasi-peak level is below the limit. For this standard, one must meet the limits for both average and quasi-peak measurements. Quasi-peak measurements require more time than peak measurements. If initial (faster) peak measurements pass, they will pass quasi-peak testing and the slower quasi-peak test is not needed.

Basic EMC publications include definitions of terms and specific test setups and equipment requirements, such as those for line impedance stabilization networks (LISN) that stabilize the impedance of the source and provide isolation of the test equipment and circuit under test. EMC product standards and EMC product family standards refer to specific products and categories of products, while generic EMC standards apply where specific product or family categories do not exist. Product, product family, and generic EMC standards reference the more fundamental basic EMC standards.

Selecting appropriate EMC standards can be confusing, requiring a clear indication of the product category and markets, whether local, international, or both. Consulting an accredited EMC test laboratory can save much time and effort in determining the appropriate test standards and requirements for general or specific products and applications.

The following are the major EMC regulation agencies and examples of some of their basic, product, product family, and generic standards currently in effect.

## MAJOR US AND GLOBAL EMC REGULATING AGENCIES

The major regulating agencies that publish EMC standards include:

**FCC:** Federal Communications Commission (USA/North America)
Products designed for North American markets are generally tested to the basic compliance limits of the Federal Communications Commission (FCC) Part 15.

**IEC**: International Electrotechnical Commission (International)

**CISPR**: Comité International Spécial des Perturbations Radioélectriques (International) CISPR is part of the IEC.

### BASIC EMC STANDARDS

The major basic EMC standards cover a wide range of devices and include:

**FCC Title 47 Part 15**: Radio Frequency Devices is a basic standard in the USA. Under this standard:

- Class A digital devices are generally marketed for use in commercial, industrial, or business environments.
- Class B digital devices are generally marketed for residential, but can include commercial, industrial, or business environments. Class B requirements are more stringent, therefore Class B devices can be used in Class A environments.
- IEC 61000 Series Parts 1, 2, 4, 5, 6, and 9 define basic terminology, test and measurement methods, and installation and EMI mitigation guidelines.

*continues from page 47*

- IEC 61000-3 European (international) Standard for all electrical and electronic equipment that is connected to the public mains up to and including 16 A max.

**CISPR 16:** Defines measuring apparatus and methods for radio disturbance and immunity testing from 9 kHz to 1 GHz.

### PRODUCT EMC STANDARDS

Product EMC standards apply to specific products, such as electric vehicle conductive charging systems, power electronic converter systems, cables and connectors, or medical electrical equipment.

Examples of product-specific EMC standards include:

**IEC 61851-21:** Electric vehicle conductive charging system - Part 21: Electric vehicle requirements for con- ductive connection to an a.c./d.c. supply

**IEC 62477-1:** Safety requirements for power electronic converter systems and equipment - Part 1: General

**IEC 61726:** Cable assemblies, cables, connectors and passive microwave components - Screening attenuation measurement by the reverberation chamber method

**IEC 60601-1-2:** Medical electrical equipment - Part 1-2: General requirements for basic safety and essen- tial performance - Collateral standard: Electromagnetic compatibility - Requirements and tests

### PRODUCT FAMILY EMC STANDARDS

Product family EMC standards apply to wider general product categories, such as vehicles, information technology equipment, industrial, scientific, and medical equipment.

Examples of product CISPR EMC standards include:

**CISPR 25:** Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers. This is the go-to standard for automotive applications.

**CISPR 22:** Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement - High frequency conducted emissions standard

**CISPR 11:** Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement - High frequency conducted emissions standard.

**CISPR 15:** Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment.

### GENERIC EMC STANDARDS

Generic EMC standards are grouped as either residential, commercial, and light industrial, or as industrial. Industrial includes higher-power industrial, and scientific and medical equipment.

When a specific EMC standard does not exist for new products, a simplified generic EMC standard may be invoked. As with other product standards, they may refer to basic EMC standards for specific test methods.

Generic EMC standards examples include:

**IEC 61000-6-3:** Emission standard for equipment in residential environments

**IEC 61000-6-4:** Emission standard for industrial environment

**IEC 61000-6-8:** Emission standard for professional equipment in commercial and light-industrial locations

### DESIGNING TO MITIGATE EMI

Because higher-frequency harmonics are considered noise in conducted emissions testing, low-pass filters are purposely designed into electronic equipment to reduce this high-frequency noise to below the defined limits of the conducted emissions test. Series inductors, and capacitors between line and neutral lines, such as X-caps between the power and neutral lines, are employed to reduce the high-frequency DM currents. Common mode chokes and Y-caps between the lines and chassis ground are used to reduce the CM noise.

When the source includes significant conducted noise as with switching power supplies, additional elements may be needed to create higher-order LC filters that further reduce the DM and CM noise. Some good news is that the use of small surface mount (leadless) components reduces connection inductance and the length of traces that may contribute to higher EMI.

## DESIGN HINTS FOR PASSING EMC

### PRE-COMPLIANCE AND COMPLIANCE TESTS

These design hints for passing EMC pre-compliance and compliance testing do not comprise an exhaustive list, however following these guidelines will help assure minimal generation of EMI.

1. Minimize the length of circuit traces to avoid making unintentional emitters / antennas. This is listed as #1 because it is most critical in preventing EMI. Minimizing trace length decreases the total stored reactive energy of the trace and reduces ringing due to para- sitic inductance. This is especially critical in switched power converters.
2. Consider EMC in the earliest stages of the design process. It can save considerable time and help prevent time-consuming PCB redesigns.
3. Use simulation programs to design and simulate noise filters, and use real measurements to verify them.

Even accurate models may not fully capture some important parasitic interactions.

4. Use magnetically shielded inductors to minimize B field coupling, unless your design requires purposeful interaction with the inductor field (e.g. NFMI or RFID). Magnetic shielding is created by surrounding the inductor with a high-permeability, low-reluctance material (e.g. ferrite) creating a "closed" magnetic path. The purpose of magnetic shielding is to reduce the amount of magnetic flux generated outside the inductor, in turn reducing the likelihood of radiating energy to nearby components or circuit board traces causing electro-magnetic interference (EMI).
5. Avoid electrically-conducting (metal) materials directly above, next to, or below inductors or high-frequency switches (e.g. switched power converters). When this can't be avoided, use raised inductors to increase the distance between inductor and conductors below.
6. Place the start winding of inductors closest to the high dv/dt side of switches.
7. Maintain spacing between components, generally 1.5x the largest x-y dimension.
8. Avoid or slow down sharp rising-edge and falling-edge waveforms (slew rate control). This can lead to reduced efficiency, so there are trade-offs and a balance must be struck.
9. Route clock lines and other high-speed traces away from power sources.
10. Avoid running high-speed lines across gaps in return lines.
11. Consider ground loops or return paths of reference planes as potential EMI sources.
12. Avoid discontinuous signal return paths e.g. gaps in ground planes.
13. Utilize filtering or shielding to block coupling paths from energy sources.
14. Engage filter reference designs with proven performance and to save design time.
15. A single pole (L or C) filter provides -20 dB/decade of frequency filtering. A two-pole (LC) filter has a more rapid attenuation rate of -40 dB/decade. A three-pole filter (e.g. LCL) gives -60 dB/decade attenuation. Therefore, a sharp cutoff frequency requires a high order filter.
16. Consider spread-spectrum control methods to spread noise energy to lower levels over a range of frequencies.
17. Slope compensation requires a certain level of ripple current to maintain stability. If the ripple is too high, it can cause EMI. When using slope compensation, check that the ripple current is not a source of EMI.

## EMC FILTER SIMULATIONS

Computer programs for designing noise filters speed up the design and analysis phase of electronic product development. Free programs are useful for designing and verifying the performance of LC filters. Physics-based three-dimensional EM (3D EM) simulation programs that use more advanced computational solver methods, such as FEM, FDTD, MoM are higher-priced and require more advanced knowledge, however, these advanced solver programs provide more geometry- and materials-related insights when attempting to understand EM field interactions.

## COST FREE PASSIVE COMPONENT FILTER SIMULATION PROGRAMS

These no-cost programs help engineers design and simulate lumped-element filters and their effects on circuit behavior. It typically takes much less time to model and simulate a proposed circuit than to build and test the physical circuit, especially when performing "What-if?" analyses that involve many iterations.

Thus, SPICE-based and other circuit design and synthesis simulation programs provide fast insights while saving time in the initial stages of design and analysis.

ANALOG DEVICES LTSPICE

LTspice

LTpowerCAD (Includes EMI Filter Design Module)

Coilcraft

Coilcraft LC Filter Designer Software: Create elliptic low pass filters using actual Coilcraft inductor values, not just ideal components.

Coilcraft LC Filter Reference Designs

WA4DSY.NET

Design LC Filters: Filter design calculations for designing multi-pole filters

## 3D ELECTROMAGNETIC SIMULATIONS

The major advanced 3-dimensional electromagnetic (3D EM) programs for simulating printed circuit boards (PCBs), electronic components, and circuits include Ansys - HFSS, AWR Axiem / Analyst, CST Studio Simulia, and Cadence Clarity. These programs use physical models that include materials and geometry details and advanced computational techniques for a better understanding of the effects of materials and spacings at various operating conditions.

## PRE-COMPLIANCE TESTING

Even the best design simulations can miss unanticipated field or wave interactions. Intertek Testing Services NA, Inc, an accredited EMC test lab has

*continues from page 49*

found that about 50% of EMC tests fail on the first try.

Some failures may be unavoidable, but many are due to preventable design oversights, such as failure to apply EMC principles or to simulate predictable interactions between circuit components.

Pre-compliance testing allows engineers topre-verify EMC standard compliance so that no such surprises delay release of a product due to necessary re-designs. When un-predicted EM noise is made visible by pre-compliance testing, there are methods that can be employed to identify the source and remediate the problem.

Tips for EMC Test Troubleshooting

1. Use E-field and B-field probes to locate sources of EMI on a PCB.
2. If inductors or capacitors are suspected, rotate inductors by 180 degrees, and place nearby inductors and capacitors 90 degrees to each other. If available, replace inductors having side terminations with bottom-terminated inductors.
3. Use a spectrum analyzer to determine the frequency range and amplitude of noise sources.
4. Set the resolution bandwidth of the spectrum analyzer to that specified in the applicable emission standard.
5. Slower voltage rise times create higher-order harmonics of lower magnitude and faster rise times lead to higher-magnitude, higher-order harmonics.
6. Lower duty cycle leads to lower-magnitude, higher-order harmonics and higher duty cycle leads to higher-magnitude, higher-order harmonics.
7. Determine whether the noise is DM or CM. If the noise is suspected to be CM, select a CM choke for the offending frequencies. If the noise is reduced, the noise was CM (unless the choke is a combination choke). If the noise is not reduced, it is more likely DM noise.
8. If changing EMI filter components does not change the EMC test results, this points to a possible PCB layout issue.
9. A combination of too many circuit elements can lead to resonances that amplify unwanted harmonics. In such cases, removing a component, such as a capacitor, may improve EMC test results. This may seem counter-intuitive, however, sometimes more is not better.
10. Is ringing in your switched mode power supply switching edges causing EMI? Use a simulation pro- gram to design an RC snubber circuit to reduce the ringing. Higher resistance dampens the ringing but can affect efficiency, so use simulation to optimize the trade-offs.
11. If the source issue is a strong E-field, a metal "Faraday cage" shield connected to ground provides a closed field path that shunts noise to ground.
12. Wrap thin copper completely around a noisy trans- former and connect the copper to ground to create a Faraday cage shield.
13. Use copper tape in closed loops to create prototype shielding. Test with and without the shielding to determine whether it is needed.
14. Review the design hints above for additional insights into possible solutions.

## CONCLUSION

The continual increased use of electronics and electrical products has led to an environment filled with many signal and noise sources over a wide range of frequencies. Understanding how fields interact to create intentional and unintended transmitters and receivers, and applying EMI mitigation techniques when designing and testing, can lead to positive outcomes in electromagnetic compliance testing.

## DEFINITIONS

**CISPR**—Comité International Spécial des Perturbations Radioélectriques

**Common mode current** (noise) involves currents flowing in the same direction to circuit ground at higher frequencies. It is also called asymmetrical or longitudinal current.

**Conducted emissions** are unintentionally conducted, capacitively coupled (E-field), or magnetically coupled (B-field), to the circuit. They are typically measured in the 150 kHz to 30 MHz frequency range.

**Crosstalk** occurs when a high-frequency (e.g. clock) signal couples into nearby analog circuits.

**Differential mode** (normal) noise involves currents flowing in opposite directions at lower frequencies, also called symmetrical or transverse current.

**Electromagnetic (EM) field** — A field of force that consists of both electric and magnetic components, resulting from the motion of an electric charge and containing a definite amount of electromagnetic energy.

**Electromagnetic (EM) noise** a.k.a. electrical noise is any unwanted electrical disturbance, not necessarily in the audible frequency range (audible noise).

**EM Emissions** occur when equipment radiates or con- ducts electromagnetic noise.

**EM Immunity** is the ability of the equipment to with- stand outside sources of EM noise without adversely affecting functionality.

**EM Susceptibility** is the sensitivity of equipment to function within an environment of EM noise.

- An aggressor is equipment that emits EM noise. Ag- gressors conduct or radiate EM emissions.
- A victim is equipment that is adversely affected by EM noise. Victims are susceptible to EM emissions.

**EMC** is electromagnetic compatibility. EMC is verified by testing to industry global and local standards.

**EMI** is electromagnetic interference. If EMI exists at a level that exceeds the applicable EMC testing standards, the equipment is not EMC-compliant.

**Far-field** — Involving a distance from the source in which the distributed element models are needed for high-accuracy far-field simulations. The transition from near-field to far-field exists at about 1/6 the wavelength of the signal (or noise).

**FCC**: Federal Communications Commission (USA)

**FCC Title 47 Part 15**: Radio Frequency Devices is a basic EMC standard in the USA applicable to electro-magnetic energy at any frequency in the radio frequency (RF) spectrum between 9 kHz and 3 GHz.

**FDTD:** Finite Difference Time Domain - A powerful method of solving Maxwell's equations directly without requiring physical approximations.

**FEM**: Finite Element Method - An advanced method of numerically solving differential equations that, for example, define physical relationships over a geometric space.

**IEC**: International Electrotechnical Commission

**Intentional transmitters** (antennas) purposely transmit EM waves for wireless charging and communications.

**LISN**: Line Impedance Stabilization Network - Pi filter networks that stabilize the impedance of the test source and provide isolation of the test equipment and circuit under test.

**MoM**: Method of Moments - Efficient full-wave numerical technique for solving open-boundary electromagnetic problems.

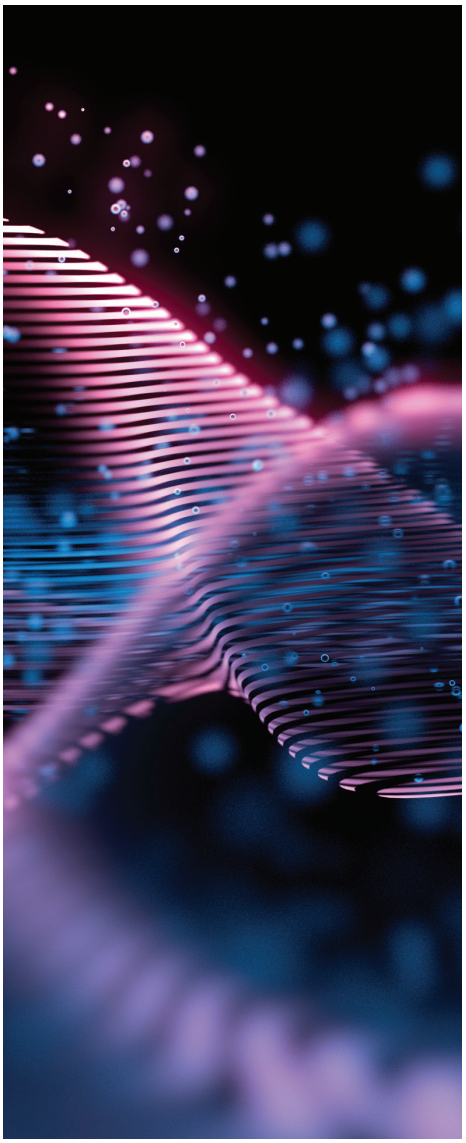
**Near-field**: Involving capacitively-coupled E fields or magnetically-coupled B fields. Lumped element models can be sufficient for near-field simulations.

**Radiated emissions** are the result of unintentional current loop paths that radiate EM noise from the circuit. They are typically measured in the 30 MHz to 1 GHz frequency range.

**SMPS**: Switched Mode Power Supply (switching converter).

**Unintentional radiator:** A device that intentionally generates radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

**Unintentional transmitters** transmit EM waves unintentionally as noise. The FCC defines this as an "incidental radiator" - A device that generated radio frequency energy during the course of its operation although the device is not intentionally designed to generate or emit radio frequency energy. wn



# Cyber resilience

## - A BOARDROOM IMPERATIVE

**Cyber threats, particularly ransomware, represent one of the most significant risks to enterprises today. Ransomware attacks are no longer just an IT issue; they have become full-blown business crises with financial, legal, and reputational consequences. Boards and executive committees must take ownership of cyber resilience, recognising that paying a ransom does not guarantee full data recovery—only 57% of compromised data is ever recovered. The question is not if your organisation will be targeted, but when.**

*By: Neda Smith*
*CEO and founder of Agile Advisory Services*

Cybersecurity is a board-level issue, and the level of preparedness today will determine whether an organisation survives tomorrow's cyber threats.

### UNDERSTANDING THE THREAT LANDSCAPE

Recent cyber-attacks in South Africa underscore the increasing sophistication and frequency of these threats. The South African Weather Service (SAWS) suffered a cyberattack in January 2025, disrupting critical forecasting services. The South African Bureau of Standards (SABS) was hit by ransomware in December 2024, halting certification services and affecting businesses reliant on regulatory approvals. In June 2024, the National Health Laboratory Service (NHLS) faced a cyberattack that delayed medical test results and impacted patient care. The Companies and Intellectual Property Commission (CIPC) experienced a breach in February 2024, compromising corporate registration data and raising concerns about identity theft.

Beyond external threats, organisations must acknowledge the risks posed by insiders. Many boards assume that ransomware attacks originate solely from external cybercriminals, but insider threats are just as dangerous. Negligent employees may click on phishing links, use weak passwords, or share credentials unknowingly. Disgruntled employees can sabotage systems or leak sensitive data, while compromised employee accounts provide attackers with unauthorized access. Organisations must proactively monitor unusual internal activity, restrict administrative privileges, and implement logging and alerts to detect suspicious behaviour early.

### THE SUPPLY CHAIN RISK

Cyber threats do not stop at an organisation's perimeter. Third-party vendors and suppliers with access to critical infrastructure and data can serve as entry points for attackers. Some of the biggest cyberattacks globally, such as SolarWinds and MOVEit, were supply chain attacks where hackers breached a third-party provider to gain access to multiple companies. Many smaller vendors lack strong cybersecurity measures, making them prime targets. Organisations must rigorously vet third-party vendors before granting access, enforce multi-factor authentication (MFA) for external partners, and limit third-party access to the bare minimum necessary.

### THE ROLE OF AI IN RANSOMWARE

Artificial Intelligence (AI) is transforming the ransomware landscape for both attackers and defenders. Cybercriminals leverage AI to craft highly convincing phishing emails, deploy adaptive malware that evades detection, and automate hacking tools that rapidly exploit vulnerabilities. As these threats evolve, organisations must adopt AI-driven security solutions that identify ransomware activity before execution, automate threat responses to contain infections, and enhance phishing detection through machine learning. The

growing ransomware threat demands that boards assess risks stemming from internal staff, third parties, and AI-driven attacks proactively.

## WHY BOARDS MUST TREAT RANSOMWARE AS A BUSINESS RISK

Ransomware attacks can bring operations to a halt for days or weeks, expose sensitive corporate and customer data, result in regulatory fines and legal liabilities, and inflict severe reputational damage. While board members are not responsible for configuring firewalls or selecting IT security tools, they must lead the organisation's response strategy and ensure business continuity. The financial impact of ransomware extends beyond ransom demands—operational downtime results in lost revenue, compliance violations can lead to hefty penalties under regulations like South Africa's Protection of Personal Information Act (POPIA) and Europe's General Data Protection Regulation (GDPR), and customer trust may be irreparably damaged. Investing in prevention is always more cost-effective than managing the aftermath of an attack.

## THE BOARD'S ROLE IN CYBER RESILIENCE

Cybersecurity must be embedded in corporate culture, and leadership plays a critical role in setting the tone. Boards should assess whether executives take cybersecurity seriously, ensure employees feel empowered to report suspicious activity, and integrate cybersecurity goals into performance metrics. Strong leadership involves active participation in cybersecurity simulations, integrating cyber awareness into onboarding and training, and rewarding employees for identifying threats. A robust security culture is far more effective at mitigating risk than relying solely on expensive software solutions.

Boards must ensure that their organisations have comprehensive cyber resilience plans in place. These plans should extend beyond IT recovery to include business continuity, legal considerations, and public trust management. Key pillars of a resilient organisation include:

**Immutable backups and clean room recovery:** Backups must be protected from modification by hackers, with regular restoration testing. Disaster recovery environments should be isolated from the primary IT infrastructure to ensure recovery remains unaffected by an attack.

**Incident response planning:** A response plan should cover various outage scenarios and involve key business units, including HR, operations, legal, PR, and IT. Crisis communication strategies must be developed to protect brand reputation, and critical response documents should be stored offline for accessibility in an emergency.

**Table-top simulations:** Regular executive-led cyber crisis drills, and annual IT recovery testing are essential to validate system restoration processes. Lessons learned from past incidents should inform continuous improvements to cybersecurity strategies.

## TO PAY OR NOT TO PAY?

Boards should determine in advance whether they will pay a ransom in the event of an attack. This decision must weigh the risks and ethical considerations, acknowledging that ransom payments do not guarantee full data recovery and may inadvertently fund further cybercrime. If a company decides to pay, it must ensure compliance with legal requirements, as ransomware payments often involve international transactions and cryptocurrency. Engaging a ransomware negotiator can help assess options, delay payment while recovery efforts proceed, and explore alternative decryption keys.

## ORGANISATIONAL PREPAREDNESS AND CYBER INSURANCE

Cyber insurance can provide financial relief during a ransomware attack, covering ransom payments, forensic investigations, regulatory fines, and public relations damage control. However, businesses that cannot afford cyber insurance must establish external partnerships in advance, including ransomware negotiators, legal firms with cyber expertise, technical response teams, forensic auditors, and PR firms. Pre-negotiating contracts with these vendors ensures that an organisation is not left scrambling for help during an attack.

## CYBER RESILIENCE ON A BUDGET

Not all cybersecurity measures require substantial investment. Cost-effective yet impactful strategies include implementing least privilege access,

*continues from page 53*

disabling unused service accounts, enforcing strict patch management, segmenting networks to prevent ransomware spread, mandating multi-factor authentication and strong passwords, and conducting regular cybersecurity awareness campaigns.

## MEASURING CYBERSECURITY ROI

Boards often struggle to justify cybersecurity spending because it does not provide immediate returns. Instead of framing cybersecurity as an expense, organisations should highlight the financial exposure it mitigates. For example, presenting security investments as reducing potential ransomware damages by tens or hundreds of millions can help secure board approval. Every currency unit spent on prevention saves significantly more in recovery costs.

## POST-ATTACK REPUTATION MANAGEMENT

A well-managed response can prevent customer churn and protect shareholder confidence. Transparency, proactive regulatory engagement, and clear internal communication are essential. Case studies illustrate the consequences of poor responses, such as Equifax's delayed breach disclosures in 2017, versus strong crisis management strategies like Maersk's rapid recovery and transparent updates following the NotPetya attack.

## CONCLUSION

Cyber threats are an enterprise risk, not just an IT problem. Boards and executive committees must take ownership of cyber resilience, ensuring their organisations are prepared to respond effectively to ransomware attacks.

The time to establish cybersecurity strategies, incident response plans, and leadership engagement is now—not when an attack is already underway. The question remains: is your organisation truly prepared? If not, the time to act is today. wn

# RETIREMENT SAVINGS

## INVEST IN YOUR FUTURE AND GET TAX BACK SOON

For many South Africans, saving for retirement feels like a luxury – something to worry about later. Between home loans, school fees, groceries, and everyday expenses, long-term planning often takes a backseat.

Yet, saving for your retirement can put money back in your pocket sooner than you might think. Thanks to tax benefits offered by the South African Revenue Service (SARS), investing in a Retirement Annuity (RA) could reduce your taxable income and result in a tax refund – giving you extra cash as soon as it's tax season while helping you secure the retirement you deserve.

### HOW THE TAX BENEFIT WORKS

SARS offers tax incentives to encourage retirement savings. If you contribute to a pension fund, provident fund, or Retirement Annuity, you can deduct up to 27.5% of your taxable income (capped at R350 000 per year) from your annual taxable income.
This means that:

- You pay less tax because SARS calculates your tax based on a lower income figure.
- You could receive a tax refund when you submit your annual tax return.
- Your savings grow tax-free in your retirement account, maximising your long-term investment.
- Depending on your tax bracket and deductions, you could be eligible for a sizable tax back from SARS, giving you extra cash in hand that you can put towards your financial goals.

### A SMARTER WAY TO SAVE FOR RETIREMENT

Many people put off saving for retirement because they worry it will stretch their budget too thin. In reality, though, thanks to SARS' tax benefits, your retirement contributions won't impact on your budget as much as you might think, making it more affordable to secure your retirement goals.

**Let's look at an example:**
Sarah is 30 years old and earns R30 000 per month. She decides to invest R1 000 per month into a retirement annuity, bringing her total annual contribution to R12 000.

Because RA contributions are tax-deductible, she qualifies for a tax refund of R3 120 from SARS at the end of the tax year. This means that while R12 000 is now invested into her retirement savings and will now start earning compound interest, her actual out-of-pocket expense is only R8 880 after the tax benefit.

**By making this small, manageable contribution every month, Sarah is growing her long-term wealth while reducing her immediate tax burden – helping her plan for retirement without putting extra strain on her finances today.**

**Maximise your tax savings. Use our free Tax Back calculator or talk to your financial adviser today.**

### ADDRESSING OTHER COMMON CONCERNS

Affordability is not the only reason why some might be hesitant to start saving towards their retirement. Many South Africans share other similar concerns:

**"Retirement feels too far away to worry about now."**
The earlier you start, the more time your money has to grow, thanks to the power of compound interest. That means you'll have to invest less money in the long run to reach your retirement goals, because you'll earn more interest.

**"I don't know where to start."**
With so many financial options, it can feel overwhelming. That's why partnering with a financial adviser can make all the difference.

### FREE ONLINE TOOLS TO HELP YOU GET STARTED

To make retirement planning easier to understand and more accessible, Old Mutual has created a range of free digital tools to help you get started:

- A **Tax Back calculator** – See how much you can get back when you invest in a retirement annuity. Just like Sarah's example earlier, you can easily work out how much tax you'll get back during tax season.
- A **Retirement Annuity calculator** – Understand how your savings will grow over time with the power of compound interest.
- These tools provide a **practical starting point**, helping you understand the financial benefits of saving for retirement and giving you the insights needed to make informed decisions.

### EXPERT FINANCIAL ADVICE TO TAKE THE NEXT STEP

While digital tools give you valuable insights, a financial adviser can help to turn those insights into a personalised plan of action.
A qualified financial adviser can:

- Help you maximise your tax savings while building a sustainable retirement plan.
- Guide you in choosing the right annuity options that fit your budget and future needs.
- Review your retirement planning annually to help ensure you remain on track to reach your goals.
- Ensure your retirement strategy aligns with your family's financial security.

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**Disclaimer**
The tax benefits and refunds referenced in this article are based on current South African Revenue Service (SARS) tax regulations and are subject to change. The potential tax refund from retirement annuity contributions depends on individual tax circumstances, including total taxable income, other deductions, and SARS assessment.

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# A Blueprint for Sustainable Organisational Growth

**As organisations enter the new year, many are refreshing strategies and refining goals amidst a rapidly changing landscape. About 80% of companies consider change part of their long-term vision and 100% of C-suite executives anticipate workforce transformation – yet only 30% feel confident in their ability to manage change.**

*By Vanisha Balgobind*
*Talent & Organisation lead for Accenture, Africa*

African organisations have faced an increasingly volatile political, economic, and social landscape for the past decade. This environment will become more turbulent, requiring more sophisticated tools to turn the fear of change into growth opportunities for organisations and their people.

Individually we often enter a new year with a new mindset, setting intentions and resolutions for personal growth. The familiar fizzle of these resolutions leads to disappointment and, over time, a defeated return to square one. This cycle repeats until we grasp the importance of concrete, measurable steps to see our plans through and ensure change sticks. The same lesson is true for your business. Accenture's latest report titled "Change Reinvented" provides a blueprint for lasting change with actionable steps and innovative approaches detailed in the Change Capability Quotient (CCQ).

The CCQ enables organisations to embrace change as a core capability, transforming them into agile, resilient entities. By embedding change into their culture and aligning it with purpose and values, leaders can inspire their teams and drive meaningful transformation. It applies a goal-oriented approach to organisational transformation, making change more measurable, actionable, and aligned with outcomes. Most importantly, it's people-centric, informed by the understanding that talent is the backbone of your organisation and a valuable source of insight into its operations. Organisations with a high CCQ consistently outperform their competitors, achieving stronger financial performance, better employee outcomes, and faster, more successful transformations. So how do they do it? They've laid a solid foundation for success across all six capabilities outlined in the CCQ.

Effective change efforts are built on two core pillars, each detailing key capabilities. The first pillar focuses on foundational capabilities that drive success. The second pillar, Innovations, builds on these foundations, offering a comprehensive strategy to guide organisations toward successful transformation.

First, let's tackle the foundations: linking change to purpose, clearly defining value, and creating new experiences. Leading organisations inspire employees by communicating a clear purpose and vision for change, fostering open dialogue with two-way communication, and addressing concerns to build an inclusive culture. They set clear goals and align them with individual growth aspirations, measuring progress, and prioritising investments in people and technology to drive value.

By embracing modern technologies and fostering continuous learning through upskilling and mentorship, these organisations enhance employee experiences, encourage ownership of change, and create a culture of growth where individuals feel supported and empowered to drive transformation.

The second pillar, Innovations, unpacks how behavioural science and AI, data-driven insights, and growing networks of influencers transform how organisations manage change. Generative AI and advanced analytics enable organisations to measure outcomes like engagement and program effectiveness, fostering psychological safety, resilience, and continuous improvement. By leveraging these tools, leaders can better understand people's motivations, identify barriers, and create personalised strategies that guide individuals toward positive actions. These innovations move beyond collecting data to driving meaningful, outcome-focused transformation. Building networks of trusted influencers—both internal and external—amplifies the impact of change initiatives. Respected employees can function as champions, fostering collaboration and inspiring trust, while external partnerships with stakeholders like customers and suppliers encourage innovation and break down silos.

Foundations and innovations work together to form an ecosystem that fosters growth and positive change in the workforce. Strong leadership is crucial to ensure that this ecosystem thrives. Executives must have a sharp vision for the future and ensure that this shapes their strategy.

They must serve as role models, foster the right mindsets, embrace new behaviours, and leverage formal and informal networks to drive cultural alignment. Success lies in building the capabilities and characteristics needed to navigate barriers and articulate an unobstructed vision for the future.

Change is not just about streamlining organisational processes and leveraging innovative technologies to increase profit. Lasting change comes from using real-time data to drive a holistic approach, centring employees in these processes and supporting their individual growth, learning and overall well-being.

It means unlocking new ways of creating better employee experiences and integrating these into the fabric of your organisational structure. A new year means embracing the possibility of continuous change.

The CCQ takes your organisation from insight to action, equipping your organisation with the tools to successfully navigate a rapidly changing world. wn


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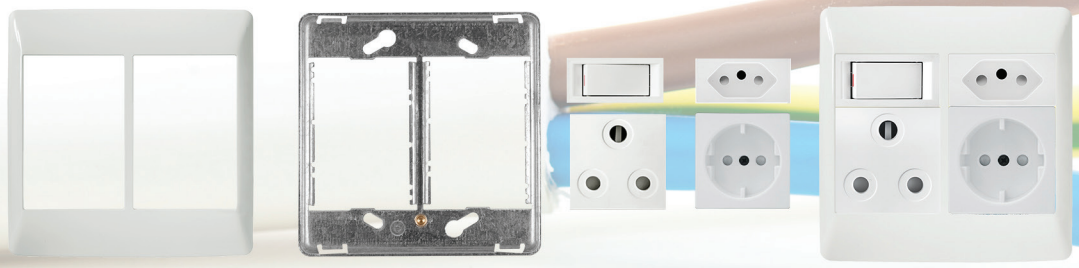

The Diamond range has a modular design which allows you to interchange switch modules and coverplates to suite your electrical installation requirements.

Coverplate | Yoke | Modules | Complete Unit

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# A passwordless future?

## HOW SOUTH AFRICAN COMPANIES CAN THRIVE WITHOUT PASSWORDS

**The digital landscape is evolving rapidly, and with it comes the urgent need for more secure authentication methods. Passwords, once the cornerstone of online security, are now easy targets for cybercriminals. With these cyber threats on the rise, businesses must adapt more sophisticated security solutions, that are passwordless and hassle-free at the same time.**

*By: Kumar Vaibhav*
*Lead Senior Solution Architect*
*Cyber Security at In2IT*

### THE LIMITATIONS OF PASSWORDS

Passwords have long been the standard for securing online accounts. However, they come with significant drawbacks. Passwords work on the principle of user memory, and most of them, therefore resort to passwords that are easy to remember, that may be weak, and reuse them across different online platforms, making them soft targets for cybercriminals. Statistics reveal that over 80% of hacking incidents are password-related, underscoring its vulnerability. In South Africa, where digital banking and e-commerce are rapidly expanding, the implications of these vulnerabilities are particularly concerning.

Moreover, managing numerous passwords leads to user frustration and increased operational costs for businesses. Users who set complex combinations as passwords tend to forget it more often, resulting in frequent password resets and helpdesk calls. This significantly affects the user experience and strains the business's IT resources. As organisations seek to enhance security while improving user satisfaction, the shift towards passwordless authentication presents a viable solution.

### UNDERSTANDING PASSWORDLESS AUTHENTICATION

Passwordless authentication eliminates the need for traditional passwords by utilising alternative methods such as biometrics (fingerprints or facial recognition), hardware tokens (like YubiKeys), or mobile devices for verification. These methods rely on two primary factors: possession (something the user has) and inherence (something the user is), which provide a more secure and user-friendly experience compared to traditional passwords.

The adoption of passwordless solutions is gaining momentum globally, driven by advancements in technology and increasing awareness of cybersecurity risks. In South Africa, there are companies leading the charge by implementing Fast Identity Online (FIDO2) standards to enable secure transactions without passwords. This approach not only enhances security but also streamlines user access across various platforms.

### BENEFITS OF PASSWORDLESS SECURITY

Transitioning to passwordless security offers numerous advantages. Firstly, it significantly reduces the risk of data breaches associated with stolen or weak passwords. By eliminating passwords from the equation, businesses can mitigate one of the most common attack vectors exploited by cybercriminals.

Secondly, passwordless systems improve the overall user experience. Users no longer need to remember complex passwords or undergo tedious reset processes. Instead, they can authenticate quickly using biometrics or hardware tokens, leading to better satisfaction and productivity levels. This is particularly relevant in sectors like banking and e-commerce in South Africa, where customer trust is paramount.

Additionally, implementing passwordless authentication can enhance compliance with regulations aimed at protecting personal data. As legislation around data privacy tightens globally, organisations that adopt robust security measures will find it easier to meet compliance requirements and avoid costly penalties.

## HOW IT EXPERTS FACILITATE PASSWORDLESS TRANSFORMATION

While the benefits of passwordless authentication are clear, many organisations may lack the expertise or resources to implement these solutions effectively.

This is where expert third-party IT companies come into play; they offer tailored cybersecurity solutions that address unique business needs while ensuring a smooth transition to passwordless systems.

These providers can conduct comprehensive assessments of existing security frameworks, identify vulnerabilities, and recommend appropriate passwordless solutions tailored to specific industry requirements. Their expertise ensures that organisations implement effective security measures and maintain ongoing support and monitoring to adapt to evolving threats.

Moreover, third-party IT companies can facilitate employee training programmes focused on new authentication methods. By educating staff about biometric security protocols or hardware token usage, businesses can foster a culture of cybersecurity awareness that extends beyond mere compliance.

As businesses navigate an increasingly complex digital landscape fraught with cyber threats, transitioning to passwordless authentication emerges as a critical strategy for enhancing security and improving user experience. The limitations of traditional passwords are becoming more apparent, prompting organisations to seek innovative solutions that leverage advanced technologies.

By partnering with expert third-party IT companies, businesses can effectively implement passwordless systems tailored to their unique needs while ensuring robust protection against cyber threats. Embracing this shift not only safeguards sensitive information but also positions organisations at the forefront of a more secure digital future. As we move towards an era where passwords may become obsolete, those who adapt early will reap significant rewards in security resilience and customer trust. wn

# From cost-cutting to revenue-generating

## - THE STRATEGIC ROLE OF TECHNOLOGY IN TODAY'S ECONOMY

**In an era of economic uncertainty and persistent market volatility, businesses are under immense pressure to manage costs while maintaining operational effectiveness.**

*By: CG Selva Ganesh*
*VP, CEO South Africa at In2IT Technologies*

The role of Chief Information Officers (CIOs) and Chief Technology Officers (CTOs) has never been more critical, as they are tasked with leveraging technology not just as a tool for efficiency but as a strategic asset in navigating these turbulent times. The challenge lies in finding innovative solutions that optimise expenditures without sacrificing the quality of products and services.

### LEVERAGING CLOUD COMPUTING FOR COST EFFICIENCY

One of the most effective strategies for cost optimisation is the adoption of cloud computing. By transitioning to cloud-based solutions, organisations can significantly reduce their infrastructure costs. Unlike traditional hardware setups that require substantial capital investment, cloud services offer scalability and flexibility, allowing companies to pay only for the resources they use. This shift alleviates financial burdens and enhances agility, enabling organisations to adapt to changing market conditions, and customer demands swiftly.

### THE POWER OF AUTOMATION AND AI

In addition to cloud solutions, automation and Artificial Intelligence (AI) are transforming businesses' operations. These technologies streamline routine processes, reducing the need for manual intervention and minimising human error. For instance, Robotic Process Automation (RPA) can take over repetitive tasks, freeing employees to focus on more strategic initiatives that drive growth. Furthermore, data analytics and business intelligence tools empower organisations to monitor performance closely, identifying inefficiencies and areas where costs can be trimmed without compromising service quality.

Balancing innovation with cost control

As companies embark on their digital transformation journeys, balancing innovation and cost control is essential. A strategic, phased approach can be particularly effective; organisations should prioritise initiatives that promise immediate returns or significant operational efficiencies.

By modernising core systems and automating critical processes, businesses can build a solid foundation before investing in larger-scale innovations. Collaboration between CIOs and CFOs is crucial in this context, ensuring that technology investments align with overall business goals and deliver a clear return on investment.

### DIGITAL TRANSFORMATION AS A REVENUE CATALYST

Digital transformation is not merely a means of cutting costs; it serves as a powerful catalyst for revenue generation. Companies can unlock new revenue streams by enhancing operational efficiencies and improving customer experiences through technology. For

example, implementing e-commerce platforms allows businesses to reach broader markets, while AI-driven personalisation enhances customer engagement by tailoring interactions based on individual preferences. This ability to pivot quickly in response to market shifts positions organisations ahead of their competitors.

Various technologies can be employed to drive revenue growth through digital transformation. AI and Machine Learning (ML) enable businesses to predict customer behaviour and develop hyper-personalised marketing strategies that boost sales. Customer Relationship Management (CRM) systems enhance engagement by improving sales funnel management and customer support services.

Additionally, predictive analytics tools help organisations anticipate market demands and optimise inventory management, ultimately leading to improved service delivery and better revenue outcomes.

## EMPHASISING AGILITY AND CYBERSECURITY

Agility becomes a vital asset for organisations in navigating economic volatility. Businesses must remain responsive to market changes while continuously evaluating emerging technologies such as blockchain or edge computing. Adopting an innovation mindset fosters a culture of adaptability that enables companies to thrive amidst uncertainty. As organisations pursue digitalisation efforts, they must also prioritise cybersecurity; protecting digital assets and customer data is essential in today's landscape of increasing cyber threats.

## THE ROLE OF IT PROVIDERS

In this complex environment, partnering with third-party IT service providers can significantly enhance a company's ability to manage costs while accessing specialised expertise. These providers offer a range of benefits that can help businesses focus on their core competencies while optimising their IT operations.

By outsourcing certain IT functions, companies can reduce overhead costs associated with hiring full-time staff while gaining access to advanced technologies and skills that may not be available in-house.

IT firms bring fresh perspectives and innovative solutions that can help organisations navigate the changing technological landscape. They provide ongoing support and monitoring services that ensure systems remain secure and efficient without the burden of constant internal management. This partnership allows companies to scale their IT resources flexibly according to business needs without incurring the fixed costs of maintaining an extensive internal team.

Ultimately, CIOs and CTOs have the opportunity—and responsibility—to lead their organisations through these challenging times by strategically leveraging technology for both cost optimisation and revenue growth.

By embracing cloud solutions, automation tools, and data analytics while fostering agility and maintaining a strong focus on cybersecurity, businesses can successfully navigate the complexities of the current economic environment.

In doing so, they not only safeguard their operations but also position themselves for sustainable growth in an ever-evolving marketplace.

Partnering with third-party IT providers further amplifies these efforts by delivering essential expertise and support that enhances overall operational efficiency while minimising costs. wn

# How Ignoring POPIA Could Land You Behind Bars

## - IS YOUR ENGINEERING FIRM NEXT ON THE INFORMATION REGULATOR'S RADAR?

**If you believe POPIA (the Protection of Personal Information Act, Act 4 of 2013) is just another piece of red tape that only matters to banks or online retailers, think again. Engineering professionals and businesses across South Africa, including SAIEE members, are now squarely in the crosshairs. With the Information Regulator empowered to mete out stiff penalties - even jail time - no one can afford to ignore the serious consequences of non-compliance any longer.**

*By: Jodi Poswelletski*
*Fairbridges Wertheim Becker*

### THE VERY REAL THREAT OF PRISON

You read that correctly: prison. POPIA isn't just about paying a fine (though that can run as high as ZAR 10 million). In extreme cases of reckless or intentional data misuse, penalties can include criminal charges. For smaller engineering firms, a blow like this could be catastrophic. And if you think it could never happen to you, remember that data breaches and unauthorised data sharing can happen with just a careless email, an unsecured server, or a rushed IT fix.

### WHY ENGINEERING FIRMS ARE ESPECIALLY VULNERABLE

1. **Client & Project Personal Information**
   Engineers collect, process and store client personal information- often including sensitive information about project sites, personnel, proprietary technology, and more. Any breach here doesn't just expose personal details but potentially trade secrets and safety risks.
2. **Supplier & Partner Details**
   In the course of managing contracts, supply chains, and professional collaborations, personal and financial information often flies around via email or shared drives. Without proper protocols, it's easy to violate POPIA's requirements.
3. **Employee Records**
   A firm's own workforce of personal information ranging from CVs and ID numbers to payroll details - must be handled with scrupulous care under POPIA. Many companies fail to realise the scale of personal information they hold internally.
4. **Cyber & Physical Security Risks**
   With digital transformation in full swing, engineering professionals regularly interface with cloud services, IoT solutions, and big data analytics. If these systems aren't properly secured, breaches can happen fast - and the Information Regulator could consider it a direct failure in your firm's duty to protect its personal information.

### SETTING THE TONE FOR PROFESSIONAL ETHICS

For members of the South African Institute of Electrical Engineers (SAIEE), data privacy isn't just a nice-to-have. It dovetails with engineering ethics - doing no harm, safeguarding the public interest, and maintaining professional integrity. When personal information is compromised, trust erodes quickly. That tarnishes not only your firm's reputation but also the broader reputation of professional engineers.

### A HYPOTHETICAL HORROR STORY - CLOSER THAN YOU THINK

Picture this: An engineering consultancy juggling multiple large-scale projects. An internal oversight leads to a spreadsheet with detailed staff and client personal information being shared publicly online. A concerned individual files a complaint with the Information Regulator. Before you know it:

# A single flaw can break an entire system

## IN ENGINEERING, PRECISION IS NON-NEGOTIABLE.

## THE SAME PRINCIPLE SHOULD APPLY TO YOUR DATA SECURITY AND PRIVACY PROTOCOLS.

Don't let a compliance gap put your business at risk. As an official legal panel member for the SAIEE, Fairbridges Wertheim Becker, provides expert legal services to ensure your business stays compliant.

POPIA Compliance: Expert guidance to ensure your business meets the requirements of the Protection of Personal Information Act.

Data Privacy Reviews: Thorough assessments to identify gaps and mitigate risks.

Training & Workshops: Tailored training to equip your team with the knowledge to manage data privacy effectively.

CONTACT US FOR A DISCUSSION REGARDING YOUR NEEDS TODAY

**Jodi Poswelletski**
DIRECTOR
SPECIALIST IN DATA PRIVACY AND POPIA

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 *continues from page 62*

1. Investigation and Audits: The Information Regulator demands a deep-dive into your data and personal information governance processes.
2. Mounting Legal Fees: You scramble for a defence, racking up bills that could've easily been avoided by basic POPIA compliance steps from the start.
3. Potential Civil Suits: Impacted individuals may sue for damages, compounding your firm's legal woes.
4. Criminal Consequences: In cases of egregious misconduct, responsible parties could face hefty fines and penalties ranging from between ZAR1 000 000 to ZAR10 000 000 - or, in the worst case, imprisonment.

Sound far-fetched? It's not. The Information Regulator has explicitly stated its intent to apply meaningful enforcement against organisations that disregard POPIA.

## WHAT YOU MUST DO - RIGHT NOW

1. **Appoint an Information Officer:** POPIA requires every business or organisation to assign someone to oversee compliance. This person ensures everyone else stays in line with data protection and POPIA requirements.
2. **Conduct a Risk Assessment:** Identify every point at which you collect, store, or process personal information. Determine vulnerabilities - from cybersecurity gaps to inadequate policies.
3. **Train Your Staff:** POPIA compliance is a team sport; if employees aren't fully aware of the do's and don'ts, even the tightest policies will fail.
4. **Review Contracts & Policies:** Align your vendor agreements, third-party collaborations, and employee contracts with POPIA requirements and draft a privacy policy and Security incident breach policy
5. **Enforce Data Security:** Institute rigorous data security protocols, from password management to encryption and secure backup routines.

## DON'T DELAY: THE CLOCK IS TICKING

The longer your business waits, the more you risk a catastrophic incident.

Even if you dodge the maximum fines, any formal investigation or censure by the Information Regulator will drain time, money, and goodwill. In a hyper-competitive industry like engineering, you can't afford to have your name associated with a data-breach scandal or criminal liability.

## READY TO SAFEGUARD YOUR BUSINESS (AND YOURSELF)?

As a partner at Fairbridges Wertheim Becker, I've seen firsthand how quickly data issues can spiral out of control. My team specialises in POPIA compliance, risk assessment, and training tailored for engineering and technical firms - especially those in the SAIEE community.

- Comprehensive Compliance Roadmaps: We'll guide you step-by-step, from gap analysis to policy implementation.
- Staff Training & Workshops: Customized sessions to ensure every level of your organisation fully grasps their role in data protection and fully understands the POPIA Act.
- Ongoing Legal & Regulatory Support: As regulations evolve, we stay ahead of the curve - so you don't have to.

## ACT NOW TO AVOID BEING AN EXAMPLE

The message is clear: with data privacy, you're either fully committed or you're gambling with your company's future - and possibly your personal freedom. Don't be the next headline, the next cautionary tale, or the next engineering firm to pay a steep price for ignoring POPIA.

For a confidential consultation or to discuss your organisation's compliance needs, reach out to Jodi Poswelletski at Fairbridges Wertheim Becker.

Let's ensure your company, and your career, stays on the right side of the law. wn

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## MEMBERSHIP FEES EFFECTIVE 1 DECEMBER 2024

The Council meeting held on 6 September 2024 approved subscription & entrance fees as from 01 December 2024 as per schedule indicated below.

**PLEASE NOTE: In terms of Bylaw 3.2 annual subscriptions are due on 1st December 2024**

**MEMBERSHIP FEES CAN BE PAID IN MONTHLY RECURRING PAYMENTS**

Council agreed to a discount for fees paid before 31 March 2025. Members are therefore encouraged to pay promptly to minimize increase impact.

| Grade of Membership | Annual Subscriptions paid before 31 March 2025 | | Annual Subscriptions paid after 31 March 2025 | | New Members FEES * see Notes 1 & 4 below. | |
|---|---|---|---|---|---|---|
| | RSA incl VAT (R) | Outside RSA excl VAT (R) | RSA incl VAT (R) | Outside RSA excl VAT ( R ) | RSA incl VAT (R) | Outside RSA excl VAT (R) |
| **Student** | nil | nil | nil | nil | nil | nil |
| After 6 yrs study | 1 890 | 1 644 | 2 268 | 1 972 | 2 268 | 1 972 |
| **Associate** | 1 890 | 1 643 | 2 268 | 1 972 | 2 268 | 1 972 |
| **Member** | 2 089 | 1 816 | 2 507 | 2 180 | 2 507 | 2 180 |
| after 6 years | 2 441 | 2 122 | 2 929 | 2 547 | 2 929 | 2 547 |
| after 10 years | 2 555 | 2 221 | 3 065 | 2 666 | 3 065 | 2 666 |
| **Senior Member** | 2 555 | 2 221 | 3 065 | 2 666 | 3 065 | 2 666 |
| after 6yrs/age 40 | 2 768 | 2 407 | 3 322 | 2 889 | 3 322 | 2 889 |
| **Fellow** | 2 768 | 2 407 | 3 322 | 2 889 | 3 322 | 2 889 |
| **Retired Member (By-law B3.7.1)** | 1 174 | 1 021 | 1 409 | 1 225 | n/a | n/a |
| **Retired Member (By-law B3.7.3)** | nil | nil | nil | nil | n/a | n/a |

1. The fee for all new applications is R3457.00 which includes an entrance fee of R950.00. On election to the applicable grade of membership the new member's account will be adjusted accordingly and refunds/additional payment made on request.

2. Transfer fee to a higher grade is free for all grades of membership.

3. Members are encouraged to transfer to a higher grade when they qualify. It will be noted that the fees of Member and Senior Member grades after 10 and 6 years respectively are equal to the fees at the next higher grade.

4. Members elected after May 2025 pay a reduced subscription fee.

5. By-law B3.7.1 reads “Where a member in the age group of 55 to 70 years has retired from substantive employment in the engineering profession, such member may make written application to Council for recognition as a retired person and a reduced membership fee".

6. By-law B3.7.3 reads “any member complying with the conditions of B3.7.1 but who has been a member of the Institute for not less than 25 consecutive years, shall be exempt from the payment of further subscriptions.” Members who comply with the requirements of By-Law B3.7.3 may make written application to Council for exemption from paying subscriptions".

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

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

9. Members in good standing and no longer in substantive employment and do not receive payment or salary for work done may apply to Council for a reduction in their annual subscriptions.

10. The members monthly magazine ("wattnow") is available on line and members who require a hard copy may acquire same on request and for a nominal fee subject to minimum uptake numbers.

11. Members who wish to pay their membership fees in recurring payments should activate the payments on their banking portal. Members will receive the early bird discount only if their fees are fully paid by 31 March 2025.

# 2025 SAIEE MEMBER BENEFITS

| STUDENT MEMBER | ASSOCIATE MEMBER | MEMBER | SENIOR MEMBER | FELLOW |
|---|---|---|---|---|
| Jobs portal for WIL | Jobs portal access | Jobs portal access | Jobs portal access | Jobs portal access |
| Mentorship | Mentorship | Mentorship | Services Directory | Services Directory |
| Exclusive Networking Events | Exclusive Networking Events | Exclusive Networking Events | Mentorship | Mentorship |
| CPD training discounts | CPD training discounts | CPD training discounts | Exclusive Networking Events | Exclusive Networking Events |
| Charge Reward Programme earnings | Charge Reward Programme earnings | Charge Reward Programme earnings | CPD training discounts | CPD training discounts |
| Bursary programme | Bursary programme | Long standing member gifts | Charge Reward Programme earnings | Charge Reward Programme earnings |
| Publication access (**watt**now & ARJ) | Publication access (**watt**now & ARJ) | Bursary programme | Long standing member gifts | Long standing member gifts |
| Site visits | Site visits | Publication access (**watt**now & ARJ) | Bursary programme | Bursary programme |
| SAIEE Centres | SAIEE Centres | Site visits | Publication access (**watt**now & ARJ) | Publication access (**watt**now & ARJ) |
| | | SAIEE Centres | Site visits | Site visits |
| | | | SAIEE Centres | SAIEE Centres |
| | | | Eligibility for nomination as Center Chair | Eligibility for nomination as Center Chair |
| | | | | Eligibility for nomination as an Office Bearer |

## MEMBERSHIP UPGRADE DISCOUNT STRUCTURE

| LENGTH OF MEMBERSHIP | DISCOUNT UPON UPGRADE |
|---|---|
| 10 - 19 years | 5% |
| 20 -39 years | 10% |
| 40+ years | 15% |

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## APRIL 2025

| | |
|---|---|
| 09/04/2025 | Power Systems Protection |
| 10/04/2025 | KZN Centre AGM & Webinar |
| 15/04/2025 | Substation Design & Equipment Selection |
| 15/04/2025 | Power Transformers: Fundamentals and Life Cycle Management Principles Course |
| 17/04/2025 | 5G Radiation effect on the Human Body |
| 28/04/2025 | Project Management for Engineers |
| 29/04/2025 | Incident Investigation and Management (Root Cause Analysis) |

## MAY 2025

| | |
|---|---|
| 06/05/2025 | Power Transformers: Fundamentals and Life Cycle Management Principles |
| 07/05/2025 | Hack Lab |
| 07/05/2025 | WW4: Passive Houses in Southern Africa |
| 08/05/2025 | Understanding long-duration storage |
| 09/05/2025 | Road to Registration for Engineering Candidates |
| 13/05/2025 | Cable Jointing, Termination and Testing |
| 15/05/2025 | Writing Good Technical Specification |
| 19/05/2025 | New Engineering & Construction Contract |
| 20/05/2025 | Planning Feasibility Studies in IR 4.0: An Engineer's Perspective |
| 20/05/2025 | Incident Investigation and Management (Root Cause Analysis) |
| 22/05/2025 | LV/MV/HV Switch gear Operation, Safety, Maintenance and Management |
| 27/05/2025 | Lightning Protection of Structures, Low Voltage and Signal Systems |

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