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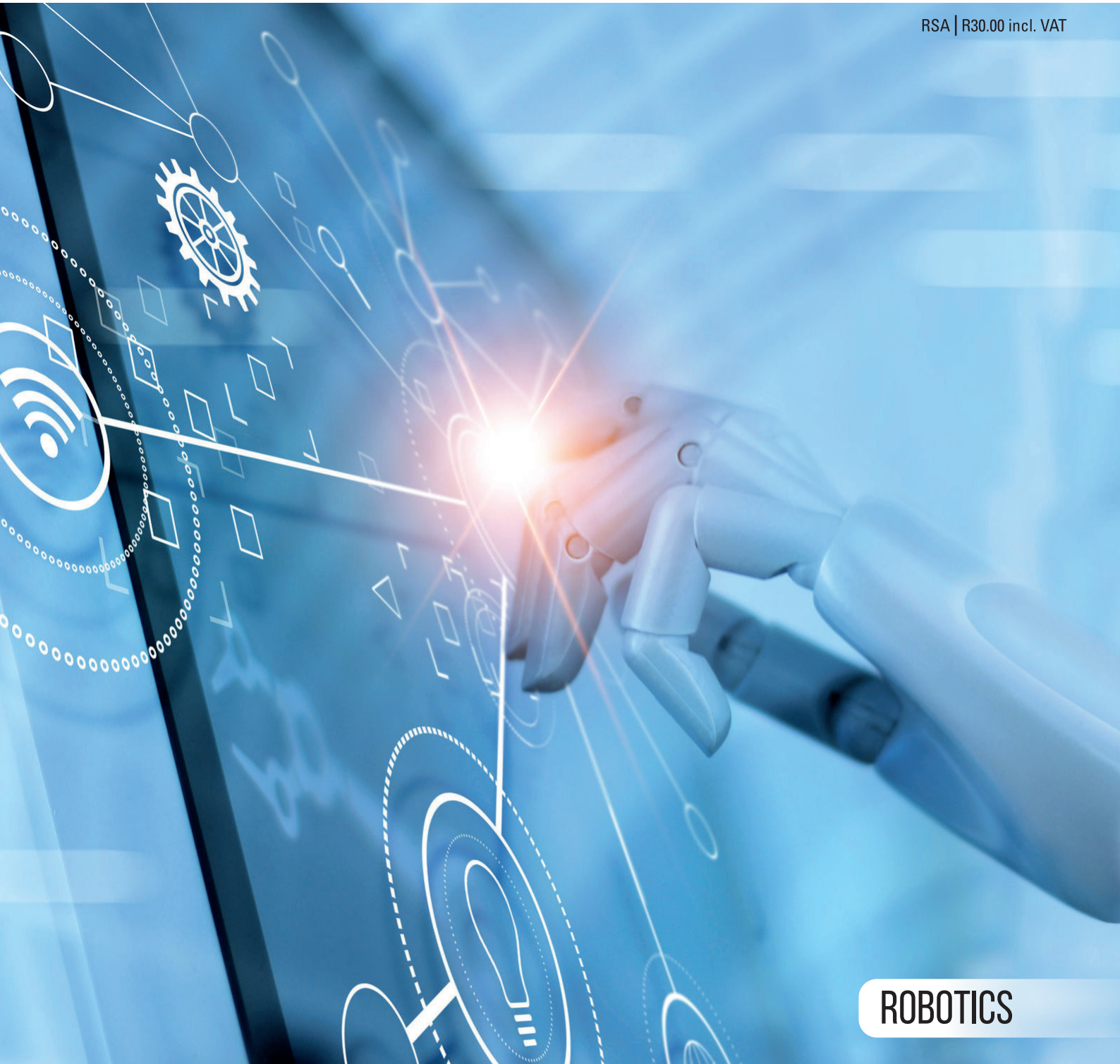

ROBOTICS

SAIEE THE OFFICIAL PUBLICATION OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | SEPTEMBER 2020

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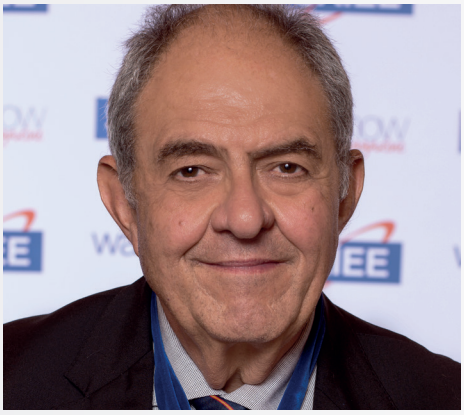

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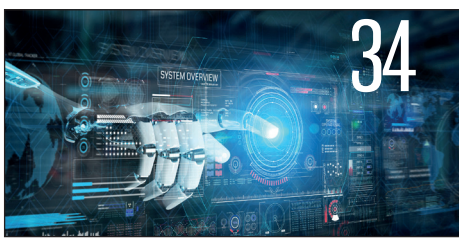

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ISSN: 1991-0452

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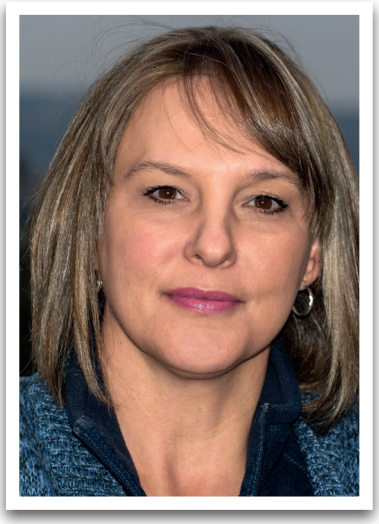

We have all been forced to reinvent ourselves this year, and with that, came automation in some areas. This issue focusses on Robotics.

Our first article, on page 22, "Robotics in times of Covid-19 in South Africa, discusses how the COVID-19 pandemic has highlighted how vulnerable and ill-prepared our healthcare systems are on a global scale. The COVID-19 pandemic has highlighted the need to rapidly develop infrastructures (hospitals) to deal with infectious patients, shifting production lines rapidly to produce medical goods needed to contain the infection and treat infectious patients (including drugs). Add to this, delivering these items to locations that could provide the highest impact on the fight against the pandemic.

Industries today face critical challenges to process operations and a changing workforce. Modern automation systems offer real solutions to these challenges through new functionality that, in essence, can result in a future-proof plant. Read more on page 30, in "Future-proof Plant: Impact of evolving operation, the technology of workforce changes.

After successful limited deployments of Robotic Process Automation (RPA), many organisations struggle to define a path forward to a successful ramp-up and sustained roll-out of an automation program. Read more in "Robotic Process Automation" on page 34.

The SAIEE has been very busy with webinars in the past month, and I urge you to click here to see our upcoming events/webinars or go to page 67 to find a comprehensive calendar which includes our very successful online CPD Training Courses, powered by the SAIEE Academy.

The next **watt**now Tech Talk will take place on the 22 October 2020 at 13h00. Watch out for the announcement.

This online version of wattnow is interactive. So, on the contents page, click on the page number of the article you are interested in, you will be taken directly to the page. When you are finished reading, select the endnote (wn) which will return you to the contents page.

Here's the September issue,
enjoy the read!

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SAIEE - making great strides!

SY GOURRAH
2020 SAIEE PRESIDENT

After 179 days of lockdown, we have finally moved to Level 1 restrictions which will hopefully boost economic activity in South Africa. Even though the rate of infection is trending down I urge all our members to continue to practise the utmost safety and precautions.

Our staff continue to work from home, and we are optimistic that they may be able to return to SAIEE House in the next few months. With this in mind, and that conditions and legislation allow for it, we hope to hold December's Council Meeting in our very own Council Chamber.

Hopefully we will be able to hold The SAIEE Annual Banquet and Awards in February 2021. In the meantime, we look forward to the 2020 Bernard Price Memorial Lecture on the 8th October 2020 which will be delivered by Bernard Price's great-grandson. We encourage you to register and attend this webinar which is a highlight in our annual calendar.

Three CPD online courses and eight webinars have been held during the month of September. Our webinars seem to have sparked a lot of interest and have been well received by our members as well as some 'visitors'.

We look forward to implementing strategies that will add value to your membership. We truly appreciate your support during these times of economic hardship.

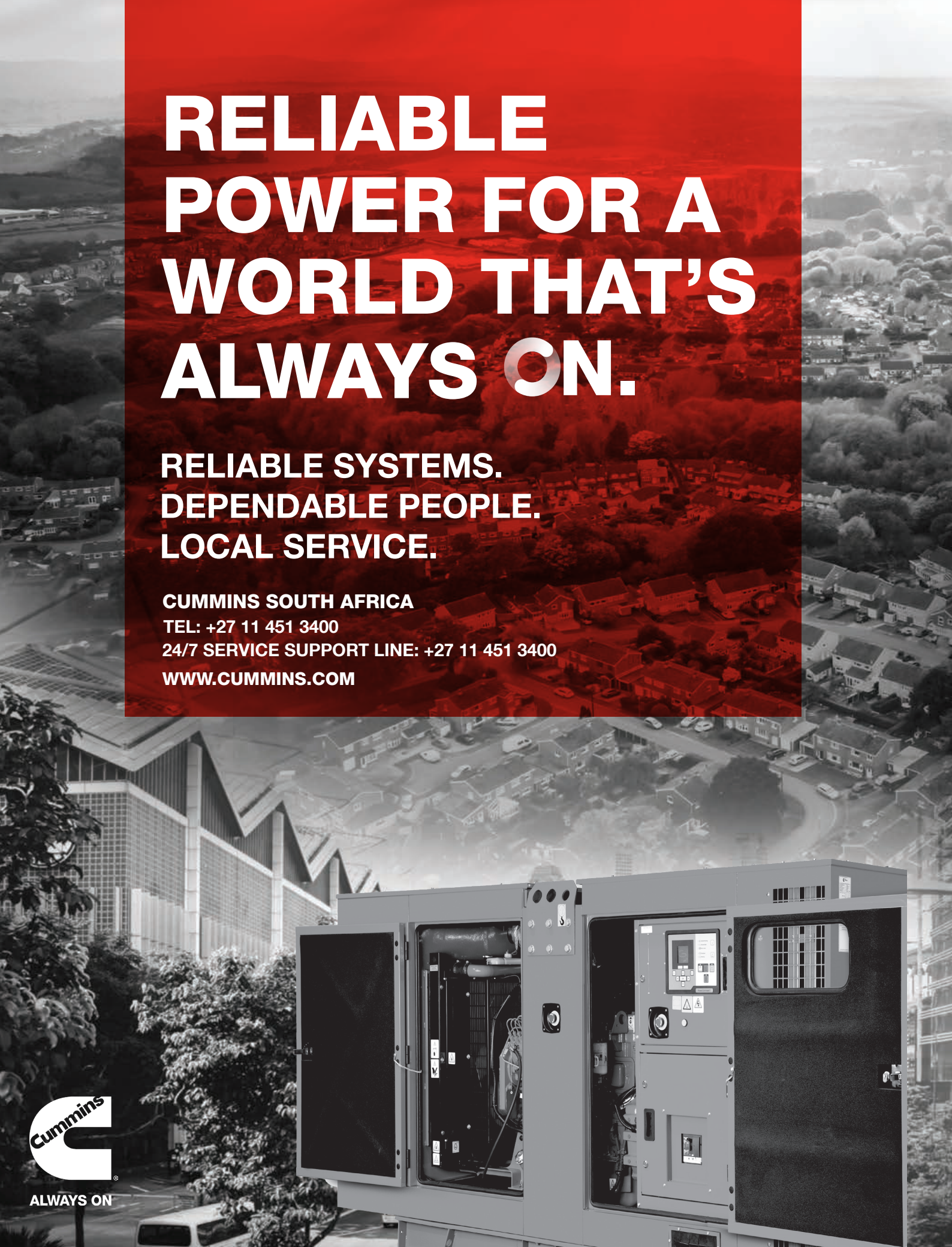
There is a buzz around the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP) for the delivery of 2 000 MW of emergency power.

The subsequent announcement of Round 5 for renewable energy and NERSA's concurrence to a Section 34 Ministerial Determination has opened the way for the procurement of an additional 11 813 MW of new Electrical capacity (6 800 MW renewable + 513 MW storage + 3 000 MW gas + 1 500 MW coal). It is envisaged that all of these will be on-line sometime 2022.

We look forward to interacting with our members' in-person in the foreseeable future with all the necessary precautions in place to stop the spread of the virus.

Until then, stay safe.

S Gourrah I SAIEE President 2020
Pr. Eng I FSAIEE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THERMAL CAMERA GETS THE JOB DONE RIGHT FIRST TIME

COMTEST, local representative of Fluke has the new TiS60+ with patented Fluke IR-Fusion technology that allows users to see things that are invisible to the eye and reveal problems that cannot be detected with other tools. The unit establishes a baseline for equipment, and is simple for the entire team to use to detect temperature differences from further away. Fluke TiS60+ further boosts team performance with an impressive image resolution of 320 x 240. The infrared images taken with the TiS60+ capture smaller temperature differences from further away. So, if users are new to thermal imaging, or if the camera is being used by a team with varying levels of thermal imaging experience, the TiS60+ offers easy-to-use fixed focus. Some of the key features of the TiS60+ are:

- 320 x 240 resolution for clarity and image details that are crucial for a good result
- 9cm (3.5 inch) LCD screen allows for easy 'in-field' issue recognition
- Fixed focus means the Fluke TiS60+ is easy to use, just point and shoot
- Temperature: up to 400 °C can be measured and this covers most application variations
- One-handed image capture, review and 'save' capabilities

See the problem and the location in one image with IR-Fusion™ technology IR-Fusion technology, patented by the Fluke Corporation, automatically captures a digital visible light image at the same time as an infrared image. The camera blends the two images together, pixel for pixel, in a single display. Users can then view the image in full infrared, full visible light or at several degrees of blending in between. The location of an infrared target can be precisely identified even if the infrared contrast is low and there is very little structure in the infrared image.

Fluke's TiS60+ thermal camera is compatible with Fluke Connect with its modern visual design and intuitive navigation, making it easier to learn and easier to work faster. Simplified work flows and reporting as well as better report templates, are all part of Fluke Connect's powerful, easy-to-use software.

Contact COMTEST on 010 595 1821 or sales@comtest.co.za for information on Fluke TiS60+ Thermal Camera, or for upcoming seminars, demos or to locate the nearest dealer. wn

Green Recovery in the Mining Industry Through Energy Efficient Drives Technology

Stephen Brown, Danfoss Drives – Mining Accounts and Business Development Manager, Turkey Middle East & Africa

The mining industry must forgo its traditional energy consumption patterns, in a bid to ensure that the sector de-carbonize towards a greener and sustainable method of exploration. Given the need to increase energy supply in a globally carbon constrained environment, the mining trade needs to improve its energy efficient technologies, such as electrical variable speed drives, which could reduce energy consumption drastically.

The fundamentals of AC Variable Frequency Speed drive technology persist, but many elements are rapidly changing in aid to move towards a more sustainable and environmentally friendly mining future. Increasingly, software is embedded in today's mine processing components, offering new functionalities and enabling the AC drive to play a larger role in the processing plant.

"Conventionally, motors run at a fixed speed, regardless of actual output requirement, wasting a tremendous amount of energy. Energy output use can be reduced by 60%, by controlling motors with electrical Variable Speed Drives." says Stephen Brown, Danfoss Drives – Mining Accounts and Business Development Manager, Turkey Middle East & Africa.

New motor types are appearing, placing additional demands on motor-drive control. This in turn means that the AC drive needs to be able to control an expanding variety of motor types, without burdening the end user with more complexity. In addition, new energy efficiency requirements lead to more variable speed applications. Certain AC Drives are designed for exactly the needs of mining and mineral processing plants, coping with extreme conditions, heavy loading and controlling equipment installed a long distance away.

No matter how well the plant design has been optimised, there is always a way to drive down costs even further. AC Drives are used extensively for this purpose, extending equipment lifetime, optimizing processes, reducing maintenance and saving energy costs. The mining and minerals industry present some of the most challenging environments for production. Mine sites, mineral processing facilities, associated stockyards and ports facilities, are large scale and often in remote locations.

"The mining industry is a major consumer of energy and is responsible for more than 40% of the total industrial energy use. In Sub-Saharan Africa, the energy intensive users group alone consumes over 40% of electricity produced in South Africa. Just less than 50% of the energy intensive users in South Africa, are the mines", according to Energy Minister - Jeff Radebe.

It is with this need for energy efficient technology, that Danfoss South Africa is embarking on a series of informative webinars, geared towards mining engineers, specifiers, buyers, mining houses and investors alike. These interactive webinars will enable mining experts & learners alike, to think differently about their current energy usage and how the right drives are enabling energy costs savings.

Register at a date and time that will be convenient to you:

23rd September	09:30 CAT
27th October	08:30 CAT
27th October	18:00 CAT
28th October	11:00 CAT
24th November	09:30 CAT

DATA TRACKING SHOWS MINES WHERE TO IMPROVE

Centralising information from its proximity detection system (PDS) hardware and monitoring devices, Booyco Electronics offers mines a rare opportunity to become both safer and more productive.

According to Anton Lourens, CEO of proximity detection solutions leader Booyco Electronics, a single source of information on the mine's assets is the key to enhancing operations by identifying patterns of unsafe behaviour.

"Our Booyco Electronics Asset Management System (BEAMS) is essentially a central information hub for the mine's PDS assets," says Lourens. *"The software suite is a web-based application used on a robust database, linking the PDS hardware products and the monitoring devices."*

This provides a single source of data that can be leveraged for greater insight into relevant aspects of the mining operation – raising the level of safety and productivity in the workplace.

"The real achievement of BEAMS is that it allows the data from our Booyco CWS, Booyco PDS or Booyco CXS to be analysed for patterns which indicate unsafe behaviour," he says. *"Customers can then design an appropriate intervention to prevent any further occurrences."*

He emphasises that this allows a mine to paint a picture of the complete working environment, shedding new light on operational issues which were previously not visible. Measuring the working environment and interactions in this way then means that risks and bottlenecks can be actively reduced and managed – boosting productivity as a result. This helps to give mines an in-depth view of the operation and the performance of their related assets.

"We have engineered BEAMS for easy implementation," Lourens says. *"It can be used on web browser platforms, and is designed to be adaptable to the information and infrastructure environment."*

BEAMS can also integrate with the lamp room management systems in underground mines, ensuring legal compliance with lamp room requirements. It helps mines locate its safety equipment such as lamps, self-contained self-rescuers and gas instrumentation.

"BEAMS can be set up to suit the needs of each user," says Lourens. *"It can generate a standard set of reports, or be customised to specific requirements."* wn

Global marketplace launched for electricity market

An evolutionary digital marketplace, allsurplus backed by one of the world's largest asset disposal companies, Liquidity Services, is set to change the way local electricity companies can purchase or dispose of assets to a truly national, regional and International buyer base.

Allsurplus.com is an innovation of the global Nasdaq-listed Liquidity Services group, which is best known for its long-running disposal contracts with organisations like USA Department of Defence, Boeing, Mondelez, Chevron and Amazon amongst others. Its new marketplace is therefore well resourced and effectively modelled on an online marketplace where assets in 500 categories are on offer.

GoIndustry DoveBid South Africa who currently represent Liquidity Services in South Africa have been operating in South Africa since 2004 and are excited with the migration of their client sales to www.allsurplus.com platform, calling it a real game changer.

The aggregation of all the groups' seller portals into www.allsurplus.com gives the combined portals a truly global appeal.

Sellers are now able to access over 3.5 million registered global buyers who regularly buy assets across the various online platforms within the Liquidity Services stable.

Private sellers, business corporates, liquidators, lawyers, business rescue practitioners and banks are able to harness this buyer base when selling assets through the allsurplus.com platform. wn

Hitachi ABB Power Grids expands Tropos portfolio with wireless strategy for industrial communications

New future-proof hybrid solution integrates cellular, self-healing broadband mesh technologies and partner sub-GHz technologies to enable a growing number of industrial applications.

Hitachi ABB Power Grids has introduced its new wireless communica-tion solution with the launch of the next generation Tropos TRO600 portfolio. The business entity will introduce a hybrid wireless architecture, seamlessly integrating 2G, 3G and 4G LTE communication technologies, self-healing broadband mesh and select sub-GHz technologies from its eco-system partners into a single device.

The new TRO600 series builds on the Tropos foundation of high availability, proven reliability, IP standards-based security, high throughput and low latency products. The solutions help to future-proof mission critical operations in industrial and utility environments.

"Expanding applications require our customers to change the way they operate their communication networks. With Hitachi ABB Power Grids' new wireless portfolio, we are introducing a comprehensive hybrid network that addresses unique operating challenges of disparate, purpose-built communica-tion networks," said Massimo Danieli, Managing Director, Grid Automation business unit, Hitachi ABB Power Grids.

"TRO600 is backward compatible for legacy investment protection and is future-proof for many years to come. Edge-compute capability will enable our customers' digital transformation jour-ney to an increasing number of Industrial IoT applications," he added.

The new TRO600 portfolio of wireless products offer the optimal combination of technologies to meet multiple use cases in mining, oil and gas, utilities and smart cities, and are configured to customers' specification. The hybrid approach unifies communications to all devices, ensuring fast, secure and reliable connectivity for each operational need. The solutions provide a combination of interoperable technologies on a single communication network, enabling applications for edge devices, mobile de-vices and field networks. This powerful hybrid combination will be fully factory-integrated for increased reliability, ease of deployment and reduced total cost of ownership.

Hitachi ABB Power Grids wireless solutions share Supros, a unified network management platform, enabling simpler and more efficient network deployment and operation. The Supros network man-agement system, with powerful visualisation tools, manages all the radios in the Tropos network from a single console. wn

Calculate, indicate, count: Volume counting for smart savers...

INSTROTECH is offering Kobold's electronic unit ZOE, specifically designed for the calculation and display of flow rates and volume flow of flowmeters. Whether users have external power supply or need a battery powered device, and when a back-lit display is required (or not), the ZOE can be set for an extensive range of applications.

The electronic unit shows flow rate, resettable daily and total counter (mass units can also be set), and all customized programme settings remain saved, ever after a battery exchange. The instruments are suitable for harsh indoor and outdoor environments and comply with EU Electromagnetic Compatibility directives. ZOE's UV-resistant, glass-fibre reinforced nylon housing is weather resistant and has CAT IP66/67 Nema 4X protection.

Electronic flow measurement ZOE's specifications:

- Battery operation or external DC power supply
- Configurable, LCD-display layout with background lighting
- Universal pulse input (NPN, PNP, NAMUR, reed switch)
- Scalable pulse output
- Sensor supply
- Free scaling
- Housing for wall or pipe mounting

The ZOE can be connected with flowmeters with pulse or frequency output.

Users can choose either the compact version, in combination Kobold's DON and DOT flowmeters, or the remote version. Both devices assure users of an outstanding price/performance ratio. wn

Cutting edge virtual conference showcases flexible, smart manufacturing solutions to embrace new business opportunities

In a world reimagined where businesses face new challenges and opportunities, Rockwell Automation has once again set the bar in virtual events to guide customers to prosperity. Nearly 1000 delegates from around the world joined Rockwell Automation and leading industrial organisations on 16 September to experience the latest VirtualConnect event, presenting the Next Horizon for Smart Manufacturing. Delegates considered a variety of options with three action-packed presentations streams designed to help them unlock the digital potential of their manufacturing operations and see their business reach greater efficiency, productivity and – in some cases – new markets.

The pandemic has been hugely disruptive to industries worldwide, and Rockwell Automation has helped many of its customers embrace this journey and respond with agility, according to Susana Gonzalez EMEA President for Rockwell Automation. She was speaking at the exclusive pre-event virtual media conference which hosted top journalists from around the world. "In one case, we partnered with a university in Denmark to design and build a ventilator in just 18 days, making the intellectual property open for use worldwide. In other case, we helped a distillery adapt their operations to manufacture hand sanitiser. This virtual conference will introduce you to the tools and technologies that make this kind of agility possible in your organisation."

Nathan Turner, Director of Integrated Architecture EMEA Rockwell Automation, introduced the three technology streams which ran throughout the day. The digital engineering track featured the latest advances in industrial computing and OT-IT convergence which enables flexible manufacturing at plant and machine levels.

For those who missed this unparalleled learning opportunity, the presentations are available on-demand online here. wn

Hilton Woest
Bearings International Product Manager

I-MAK gearboxes from BI feature a two-year warranty

Bearings International (BI) has been supplying gearboxes from I-MAK, a Turkish OEM based in Istanbul, since 2019 as part of its Bauer range, according to Couplings and Gearboxes Product Manager Hilton Woest.

The I-MAK product range has a Certificate of Conformity from the Turkish Standards Institute, as well as IEP ATEX, ISO 9001 Quality Management, ISO 10002 Customer Satisfaction Management and ISO 45001 Occupational Health and Safety Management certification.

All I-MAK gearboxes are supplied with a two-year warranty, with repairs and technical back-up provided by Bauer through BI's countrywide branch network. The gearboxes are ideal for a range of industries, including food and beverage, refineries, chemicals, cement, packaging, foundries, mining, quarrying and automation.

At present I-MAK exports its products to 30 countries and has a distribution network in 18. Established in 1973, the OEM has grown to include two manufacturing facilities and is a leader in the mechanical power transmission market in Turkey.

BI hosted the I-MAK Academy in South Africa from 9 to 11 September 2019. Attended by over 40 engineers, technical sales representatives and branch managers, it featured product selection and solutions training for specific markets and applications.

I-MAK International Sales and Marketing Director Haffar Salim also unveiled the Turkish OEM's first mounting centre in Sub-Saharan Africa, which now gives it the capability to deliver gearboxes to customers in under five days. With the brand now represented in ten countries in the region, BI is key to its ongoing expansion, adds Woest.

With over a million product references globally, a key focus for I-MAK is the gold and diamond mining sectors, particularly in terms of crushing, scanning, washing and transportation applications. The Turkish gearboxes are ideal for aggressive environments subject to dust, heat, vibration and chemicals, with special configurations and options available.

Connect with BI on Social Media to receive the company's latest news
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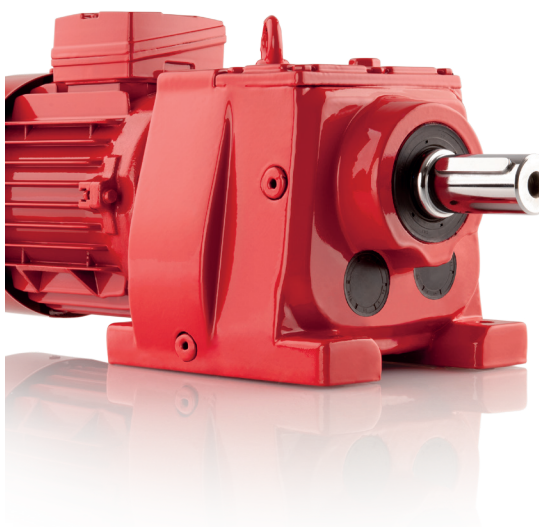


SA'S wind energy market opens up for Zest WEG

Zest WEG has entered South Africa's wind energy industry, combining exciting turbine technology with its established footprint in the local economy.

The development of a direct drive, gearless wind turbine by its parent company WEG is a key factor in Zest WEG's plan to grow a client base among wind farm developers, says Alastair Gerrard, integrated solutions executive at Zest WEG.

"With WEG's latest 4,2 MW wind turbine solution – which augments its initial offering of a 2,1 MW unit – we see considerable scope for broadening our technology offering locally and into the rest of Africa," he says.

With four decades as a local supplier, manufacturer and service provider in South Africa, he says Zest WEG has extensive market presence and knowledge upon which to build. In particular, the company is well-placed to meet the local content requirements for participating in the wind energy segment.

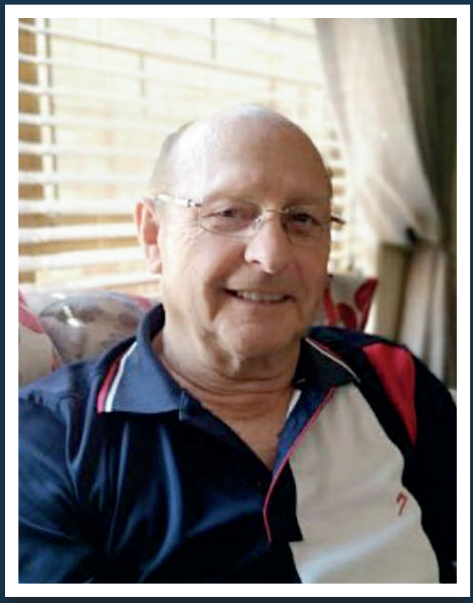
"We have prepared the ground for developing local skills and supply chains in our contribution to wind energy projects," Gerrard says. *"Given our experience in South Africa, our products and solutions also meet the necessary regulations and standards, including grid code compliance, which is vital for projects that will feed power to the national utility."*

The positive take-up of the WEG wind turbine – mainly in South America – is reflected by the 647 MW of capacity that has contributed to the market in recent years; another 181 MW is in the pipeline. He highlights that having no gearbox in the turbine offered a number of benefits.

"There is increased efficiency, less noise and weight, and one less component means less maintenance," he says. *"The whole design is focused on efficiency and reliability, for maximum output and uptime."*

The WEG turbine also includes the transformer in the nacelle, rather than at the tower base. This transformer steps up the 925 volts generated by the alternator to 33 kV, reducing losses through more efficient energy transmission. There is also then no need for a separate transformer and its associated infrastructure at ground level.

"We are looking forward to leveraging WEG's tried-and-tested turbine technology from Brazil, from our established foundation as a well-recognised local player," Gerrard concludes.



MATTHYS M BOTHA

Thys Botha – a giant in the electric motor and related industries in South Africa – sadly left us over the last weekend of August this year.

OBITUARY - THYS BOTHA

Thys had been suffering from two strokes over the last year, so his passing was somewhat of a blessing – as Thys would not be one to rely too much on others to get on with life. One can only imagine Thys reprimanding anyone being too caring over him – adding a few colourful words into the warning!

At the time of his passing – Matthys M. (Thys), Botha was an independent electrical machines consultant with decades of experience as a rotating machines consultant.

He started his career at ISCOR (Vanderbijlpark) in 1957, then joined Dunswart Steel as Electrical Engineering Superintendent in 1977, later moving to GEC Machines (Benoni. Now ACTOM Large Machines) as Divisional Director in 1984. He then joined LH Marthinusen (the largest independent repairer of electrical machines and transformers in South Africa) as Technical Director in 1987 – where he stayed until his partial retirement in 2006.

After his retirement – Thys consulted to LH Marthinusen, Gold Fields Ltd, Pretoria Portland Cement (PPC), SAVCIO (now owned by ACTOM Pty Ltd). He also conducted in-house training for, among others, AngloGold Ashanti, ESKOM and OMNIA.

Those familiar with Thys' career will know that he had an incredibly wide range of experience, including commissioning of plants (ISCOR's North Works at Vanderbijlpark), where he was responsible for the full engineering functions: Projects, procurement, installation, commissioning, maintenance, repair and design. Thys was also not just a rotating machines specialist: His knowledge extended to being a specialist in transformers and switchgear – and he was also widely regarded as the top DC machines' expert in South Africa. The Industry will sorely felt his absence in this field alone!

His qualifications included Matric with University exemption, an Engineering Diploma, Government Certificate of Competency (Electrical Factories), B. Com and B. Com Hons. He also authored numerous papers on electrical machines in local and international publications and conferences. Thys was a Member of the Institution of Certificated Electrical Engineers (ICMEESA), an Associated Member of the SAIEE, and a very active and supportive member of the High Voltage Rotating Machines Working Group – now the Rotating Machines Section – of the SAIEE.

Anybody in our community will know that to appropriately respect Thys' contribution to the Rotating Machines community in South Africa (and further abroad) would require several pages – even a book.

What stands out about "Oom Thys" - as many knew him – is the extensive range of people that he reached in this Industry. Thys shared his knowledge and experience with artisans, technicians, managers, supervisors, engineers and academics – to name just a few.

And he had an extraordinary way of relating his experiences – most often adding an excellent dash of humour making even boring technical material fun to learn, with a laugh and the famous words "do you not know ohms law?" And Thys wasn't just a prodigious contributor to South Africa technically: Many may not know that he played Rugby for Transvaal in his younger years.

Thys – you will be sorely missed by all of us – but we know you are in a better place now, where you can return to your most glorious day.

From your friends and colleagues in the Industry and the SAIEE. wn

Hitachi ABB Power Grids launches open and scalable ecosystem for digitalisation of transformers

The manufacturer-agnostic TXpert™ Ecosystem to enable millions of dollars in savings through greater flexibility, efficiency and resilience in electricity networks

Hitachi ABB Power Grids is delighted to launch the TXpert™ Ecosys-tem for digitalisation of transformers. The ecosystem is designed to drive data-driven intelligence and decision-making in the operations and maintenance of transformers and power grids. It is a complete suite of products, software, services and solutions that work together and have the capability to inte-grate with new and existing digital equipment from other manufacturers.

"Building on deep experience, we have pioneered the scalable TXpert™ Ecosystem to bring together customers, partners and industry peers on an open platform developed on strict cyber-security standards, enabling simple steps in their digitalisation journey," said Bruno Melles, Managing Director, Transformers business unit at Hitachi ABB Power Grids. *"By giving transformers the knowledge and intelligence derived from designing and servicing thousands of transformers it will help to reduce costs and risks, optimize operations, extend life-expectancy and enhance environmental perfor-mance, enabling a sustainable energy future."*

As per a recent CIGRE report, the top three locations of faults in transformers are its windings, tap-changers and bushings. The TXpert™ Ecosystem provides options to mitigate all of these. For example, failure of bushings can lead to transformer tank rupture and explosions, resulting in millions of dollars in repairs and settlement costs for a utility, while the cost of replacing a high-voltage bush-ing would be a few percentage points of this.

Using TXpert™ Ecosystem solutions for digital asset management of bushings, the real-time status of the bushing health can be monitored and corrective action taken before failure probability becomes high. wn

LED dimmer ranges available from Crabtree

Crabtree South Africa's dimmers are available in its legendary Classic range, which is manufactured locally and SABS approved. The Classic steel cover plate range is durable and perfect for any residential or commercial use.

The elegant Diamond range, also manufactured locally and SABS approved, comes in various different colours and is the ideal choice for the discerning homeowner and office.

All dimmers comply with IEC/SANS 60669-1(-2) and have valid NRCS LOA's (Letter of Authority, a Gazetted legal requirement for locally manufactured or imported dimmers). They are also universal: dimmable LED lamp compatible and backwards compatible with halogen and incandescent lamps

Each product is factory default trailing edge (recommended for most dimmable LED lamps and drivers) but automatically sense inductive load and switch to leading edge control if required. The dimmers are short circuit protected with auto reset and can be digitally set to suit the lamp requirements, such as minimum and maximum intensity.

FEATURES OF THE RANGES INCLUDE:

BELL-PRESS (125 W, 500 W)

- Intuitive wiring.
- Two and multiple way switching and dimming possible.
- User presets available.

Turn switched rotary (500 W)

- Classical rotary: turn fully anticlockwise to turn off

Push on/off rotary (225 W, patent pending – coming soon)

- Familiar rotary operation
- Soft push in rotary knob to turn on or off
- Soft push in rotary knob can be used as a bell-press control
- User presets available via integrated soft push switch
- Two and multiple way switching and dimming possible via an optional bell-press switch
- Universal mechanical mounting

DIMMING GENERALLY PROVIDES FOUR TECHNICAL ADVANTAGES

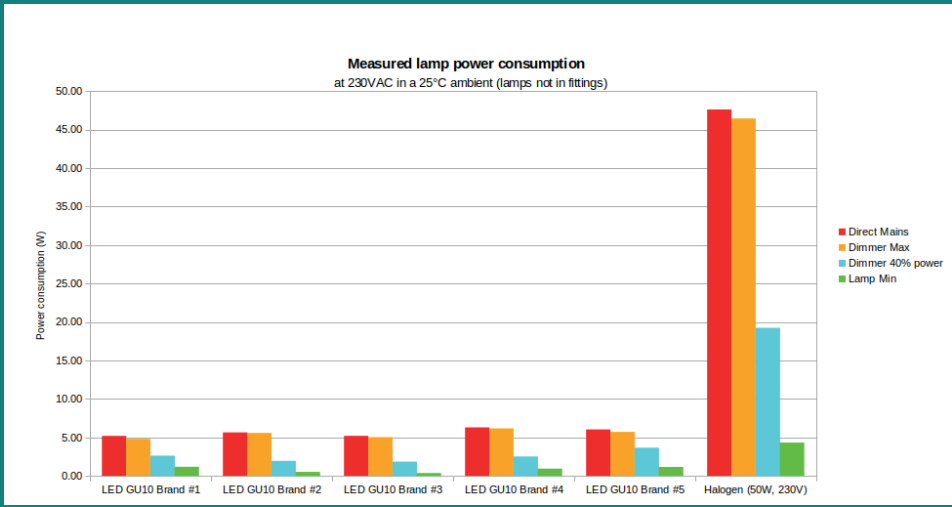
1. Trailing edge dimming provides a natural soft start for a lamp which reduces inrush currents and a positive impact on the lamp lifetime (applies to LED and halogen/ incandescent lamps)

2. Reduced power consumption: Graph 1 (and table 1) shows the measured power consumption of a typical LED lamp when dimming (trailing edge). There is a significant energy saving when dimming (applies to halogen/ incandescent lamps as well).

3. Reduced temperature: Graph 2 (and table 2) shows the measured case/ enclosure temperature of a typical LED lamp when dimming (trailing edge). As the power consumption reduces when dimming, the lamp operates cooler as well. A LED lamp consists of two electronic sections: the physical light emitting diode component which provides the light and the driver which converts the incoming power to a constant current for the LED component. Both these parts of a lamp see a tremendous benefit in operating at a lower temperature which increases the lamp lifetime. Although a halogen/incandescent lamp does not contain any electronic components, the carbon or tungsten filament of the lamp benefits from a lower operating temperature.

Measured lamp power consumption at 230VAC in a 25°C ambient (lamps not in fittings)				
Lamp number	Direct Mains	Dimmer Max	Dimmer 40% power	Lamp Min
LED GU10 Brand #1	5.2	4.8	2.6	1.2
LED GU10 Brand #2	5.6	5.6	1.9	0.5
LED GU10 Brand #3	5.2	5.0	1.8	0.3
LED GU10 Brand #4	6.3	6.2	2.5	0.9
LED GU10 Brand #5	6.0	5.7	3.6	1.2
Halogen (50W, 230V)	47.6	46.4	19.2	4.3

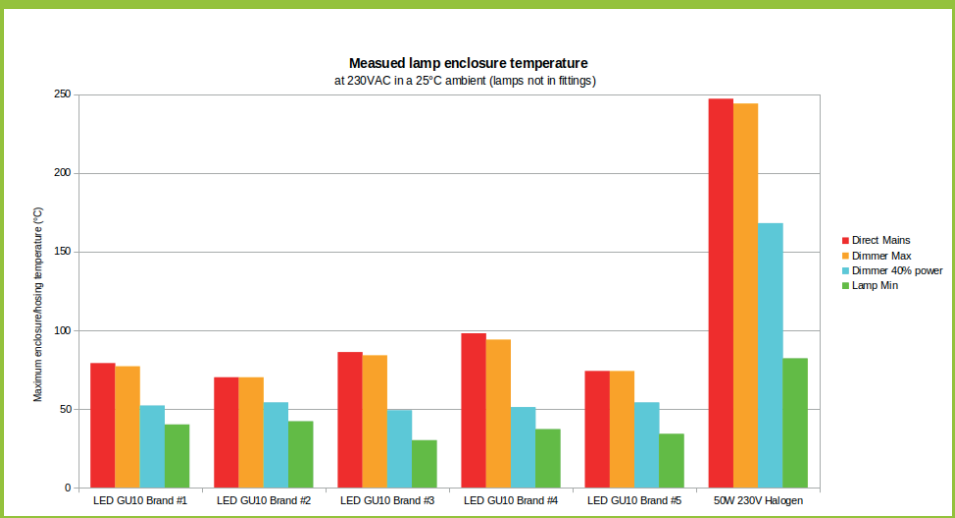
Table 1



Graph 1

Measued lamp enclosure temperature at 230VAC in a 25°C ambient (lamps not in fittings)				
Lamp number	Direct Mains	Dimmer Max	Dimmer 40% power	Lamp Min
LED GU10 Brand #1	79	77	52	40
LED GU10 Brand #2	70	70	54	42
LED GU10 Brand #3	86	84	49	30
LED GU10 Brand #4	98	94	51	37
LED GU10 Brand #5	74	74	54	34
50W 230V Halogen	247	244	168	82

Table 2



Graph 2

4. Increased Lumen-maintenance life (the elapsed operating time over which a LED light source will maintain the percentage of its initial light output). As the light emitting diode component ages when operating, its maximum light output decreases. Data from numerous manufacturers however show that a reduction in operating temperature of the component greatly increases the time before the maximum available light output decreases.

Only qualified and registered electrical contractors are permitted to install dimmers. A certificate of compliance must be issued for the installation which requires that all products used in the installation comply with regulation. Electronic switches, which includes any type of dimmer (manually operated or "automation" types), are NRCS compulsory specification category products (VC8003) which implies that the only proof of compliance with South African regulations is a valid NRCS LOA's (Letter of Authority). wn

Enquiries: www.crabtree.co.za

Smart engineering with digital twin technology

The smart use of data is becoming increasingly pivotal to Babcock's Ntuthuko Engineering business, coupled with deep engineering knowledge and technical expertise to support complex projects. A large part of finding solutions to Babcock's customers' challenges relies on developing a digital twin to improve operations, increase efficiency and provide predictive maintenance alerts before problems occur in real time.

By creating a digital twin, Babcock is able to gain instant insight into how to troubleshoot problems before they arise, using knowledge obtained from a simulated digital model. Solutions can then be safely implementing in real-life systems, while simultaneously reducing risk and improving efficiencies.

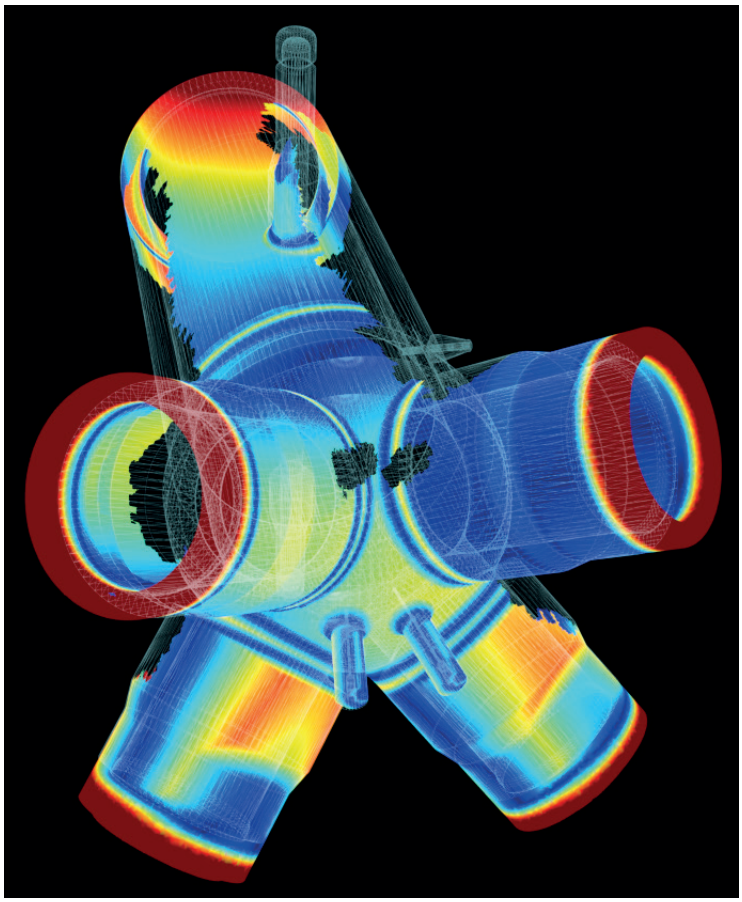
Manager R&D Engineering at Babcock Ntuthuko Engineering, Indrian Govender, says that the technology associated with a digital twin enables its engineers to make faster, better informed decisions while ensuring sound asset management and integrity.

It also opens clear lines of communication and facilitates collaboration between stakeholders by sharing the data on platforms that can be easily accessed by the customer. *"Digital twins bring us closer to our customers as we share our technologically gained input and enable them to make informed decisions,"* says Govender.

He explains that this is particularly true in the power industry where often data is not fully available or of poor quality. Digital models fill the gaps by creating a simulated twin of a physical asset that is continually updated using real-time data. *"Using our deep system engineering understanding of the assets we manage, we are able to extract the precise data to create a digital twin model,"* says Govender.

While digital solutions are increasingly part of Babcock's projects, Govender highlights the ongoing need for skilled engineers who are capable of using digital technology to make the right decisions. To this end, Babcock trains existing engineers in specialised digital technology skills, supported by a research and development division that works on digital twins.

"We leverage Babcock's engineering expertise for specialised capabilities as we all have a deep system engineering understanding of the assets we manage," comments Govender.



Babcock has already successfully utilised digital twinning on a number of critical projects. Most recently, the company relied on 3D scanning and digital twin modelling to implement one of the first nitrogen oxide (NOx) abatement projects in the country. The complex project required a modern approach to engineering that integrated various engineering disciplines. Babcock used its in-house 3D scanning and modelling capabilities to facilitate and optimise the design phase, while all stakeholders, from the customer and engineers through to operators and safety officers, were able to review the process safely, often without requiring on-site presence.

Earlier this year, Babcock applied digital twinning to repair a ruptured mainstream piping system at a major power station. 3D scanning was used to assess the extent of the damage to the piping and associated structure, as well as determine how to safely synchronise it back into the power grid. On this project time was of the essence, and by using specialised software Babcock was able to digitise the real-world architecture by capturing existing plant conditions and complex geometry, quickly identifying large sections of pipework and structures which had been displaced during the rupture.

Another previous project that drew on digital twin technology was the replacement of a vital 1 100 kPa desuperheater at a steam plant, again under intense time constraints.

Two previous attempts by other organisations had been unsuccessful, and Babcock was tasked with completing the project within five months. Installation had to be completed within 11 days. Babcock attributes much of its fast turn-around time to the system design, aided by its in-house 3D scanning and modelling capacity to deliver accurate results.

Babcock's sophisticated digital twin models provide unique opportunities of re-assessing the original line design, using state-of-the-art engineering methods. Any measurable form of data can be extracted and combined with Babcock's 3D scanning technologies, engineering analysis and design software, and electronic, control and instrumentation components to develop a digital twin model. These provide predictive and innovative maintenance solutions leading to improvements in efficiency and maintainability of plant assets, and ultimately improved availability and cost of the assets for the client.

Babcock's Ntuthuko Engineering business has multidisciplinary capability comprising process, mechanical, piping, EC&I, welding and R&D disciplines, supported by project and system engineering, data management and drawing office departments.

These operate individually or as an engineering design group, covering both simple and complex projects. wn

The COVID-19 pandemic has highlighted how vulnerable and ill-prepared our healthcare systems are for dealing with pandemics on a global scale. The COVID-19 pandemic has highlighted the need to rapidly develop infrastructures (hospitals) to deal with infectious patients, shifting production lines rapidly to produce medical goods needed to contain the infection and treat infectious patients (including drugs). Add to this, delivering these items to locations that could provide the highest impact on the fight against the pandemic.

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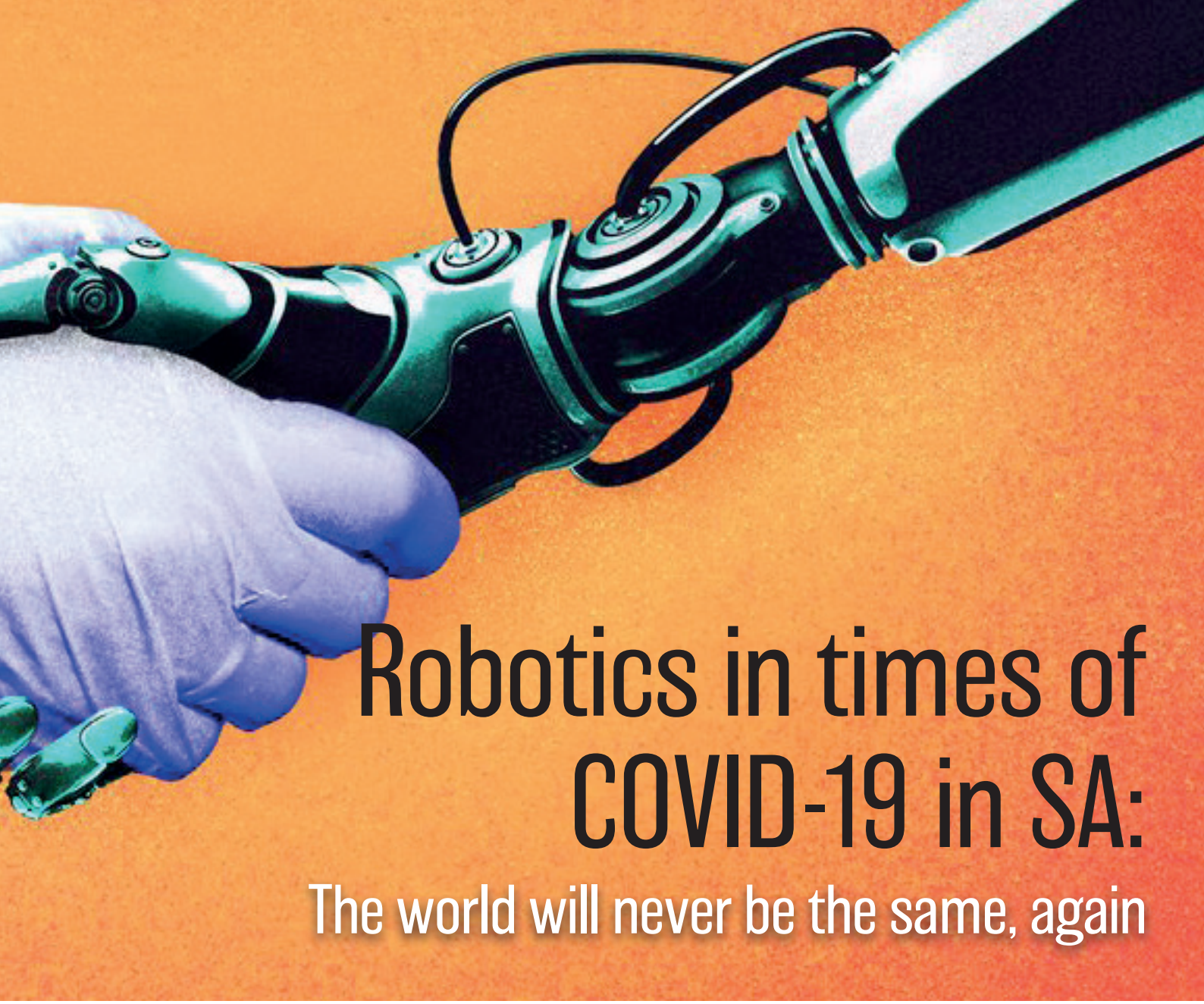
PROF FULUFHELO NELWAMONDO (EXECUTIVE CLUSTER MANAGER: CSIR NEXTGEN ENTERPRISES AND INSTITUTIONS)



Robotics in times of COVID-19 in SA:

The world will never be the same, again

It has highlighted the need for autonomous, intelligent, mobile agents that cannot catch diseases, to support the efforts of humans as they tackle the pandemic. This article explores and highlights the various autonomous agents' technologies and Artificial Intelligence techniques that could be brought to bear rapidly to deal with this, and future pandemics.

The outbreak of COVID-19 urges the development of technologies of Artificial Intelligence (AI) and robotics to fight the virus. AI-assisted imaging methods and tools have been investigated and have played an increasingly important role in the detection and diagnosis of the virus. Conversely, Robotic applications are less well understood and integrated.

INTRODUCTION

The advent of the COVID-19 pandemic has forced nations to drastically change how people have been used to viewing/doing things in their daily lives. This phenomenon is now referred to as a "New Normal". The worst part of this is that this new normal is still unfolding, and being defined, and redefined as people learn more about COVID-19 and its impacts. More information comes out daily, calling for more innovations to tackle the challenges brought about by the pandemic. COVID-19, with its high morbidity and mortality rate, has brought devastating effects on the overall wealth and development of societies worldwide, South Africa included.

Artificial Intelligence (AI), and particularly the field of robotics seems poised and well-placed to tackle some of these challenges, thereby enabling the "New Normal". Despite many arguments for and against the use of robots to perform tasks formerly reserved for humans, innovations in the robotics industry can play a significant

Figure 1: Throat swabbing robot: Lifeline Robotics' throat swabbing robot collecting a sample [2]

role in assisting different sectors in tackling the challenges brought about by COVID-19. This article seeks to review and recommend ways in which this can be achieved. The next few sections will highlight some of these applications.

ROBOTS ON THE FRONTLINE WORK AGAINST COVID-19

One way through which the COVID-19 virus spreads is through droplet infection direct from person-to-person or surface infection[1]. We examined over 100 applications of robots around the world, and we found that ground and aerial robots are playing a significant role in almost every aspect of managing the crisis. During the pandemic, the role of robots has been demonstrated through deployment in the deactivation of viruses on surfaces in hospitals and other industries such as factories, hotels, schools, transport, government offices, amongst others applications. By performing laboratory testing, measuring temperature and distributing hand sanitisers, robots reduce the chances of human to human infection. Figure 1 shows a service robot, developed by Lifeline Robotics, taking a throat swap.

The critical need for South Africa to seriously consider the incorporation of robots into its COVID-19 management strategies is made more evident in the scenario described in the Livingston Hospital[3] in the Eastern Cape. Here, incidents of hospital floors littered with blood and waste, patients fighting for oxygen supplies[4], insufficient PPE and doctors cleaning their laundry have been reported, which by the way, is not unique but one that is common in many public hospitals.

The pictures in figures 2 - 4 show examples of these conditions. The dire situation affects the plight of many fellow South Africans.

Addressing similar challenges, ultraviolet-light-disinfection robots have been used to clean the floors, do the laundry and perform other tasks of distributing medications to patients.

Tygerberg Hospital reportedly used robots to monitor patients in ICU, as depicted in figure 5.

Other applications that we have seen include cleaning robots, robots disinfecting areas, thereby minimising human exposure to the risks.

We have also observed several robots being used in taking temperatures of patients, taking blood pressure[9], taking blood samples[10], delivering these samples to laboratories[11], handling materials and samples in hospitals, doctor-patient interaction[12], amongst other applications.

There is also a growing number of robotics applications in surveillance, where such robots are used to monitor compliance with the COVID-19 regulations.

ARTIFICIAL INTELLIGENCE

As a force multiplier right now as we speak, Big tech companies such as Facebook and Google are using AI algorithms to achieve intelligible tasks[13],[14],[15]. AI is employed to remove inappropriate posts from social media platforms which will be seemingly tricky for content moderators to do from their homes in 24-hour cycles.

The far-fetched idea of remote working has since become a reality for many employees during COVID-19 lockdowns. In this case, the AI techniques are being deployed as instructors on computers without the need for face-to-face human contact.

EMERGING AREAS OF ROBOTICS IN THE FIGHT AGAINST THE PANDEMIC

The key areas of robotics that seem to be emerging as critical, in this time of the pandemic are:

- Cognitive robotics – reasoning, decision-making, and perception in initially unknown, dynamic environments.

- Human-robot interaction – safety and social robotics, natural language processing, haptics, intuitive programming paradigms. Applications of robotics in this space include companion robots that kept people company[16], in times where they could not physically have interactions with others.

Figure 2: Bodily fluid waste flowing on the floors [5]

Figure 3: Bags with laundry sacked in plastic containers in the hospital lobby area [6]

Figure 4: Cardboard bins stuffed with rubbish and other medical waste, littered passages as general workers were on a go-slow protest [7]

Figure 5: Robotics application in monitoring COVID-19 patients. [8]

Figure 6: Qisda human-robot collaboration working space [17]

- Multi-robot interaction and cooperation: Some applications have been seen in manufacturing. Due to the social distancing requirements, assembly lines had to be modified, and in some cases, robots filled the gaps. Examples include reprogramming and adaptations of robots to staggered shifts with fewer workers; autonomous disinfecting; ferrying items around factories; picking; packing; handling of products and components; legacy platforms software updates; allowing them to recognise and grasp a new object or retrieve items from new types of bins. The latest robotic technology offers flexibility and possibility to redeploy quickly, as previously typical industrial systems were more rigid and took hours to program[18].

- Service robots: In China, robots were used in the delivery of food parcel earlier during the outbreak of the pandemic. This continues to be a trend worldwide.

- Manufacturing robots: with the following features: Self-organising communications networks, Persistent autonomy – autonomous operation for extended periods (days), Manipulation – mobile, compliant, multi-arm

IMPACT OF ROBOTICS ON JOBS

The employment rate in SA is estimated to be at as high as 31%[20] and worsening since the lockdown. Therefore, the challenge of balancing job creation and the need for the application of AI in the New Normal is an apparent reality.

The use of robots in the manufacturing sector has the potential to increase production levels ten-folds if not a hundred-folds. Unlike humans, robots do not fall sick and need no quarantine, and the chances of them infecting other robots as a human does in the workplace are minimal.

Figure 7: Robots at a Japanese's Factory picking items from bins to assemble order[19]

The only cost associated with robots is their manufacturing as this takes time to design and run. However, once operational, they can be operated with minimum cost.

The design and manufacturing of robots and their components at different tier levels will open up a whole new industry and contribute to various aspects of the inclusive economy in the value chain.

This will allow the country to minimise reliance on other nations and revive the ailing manufacturing sector. It will create an opportunity for reskilling of workers who may be at risk of losing jobs to robots, thereby allowing local municipalities to build enough local engineering capability. Most importantly, robots used in COVID-19 collaborated with human beings and did not necessarily replace human beings. Robots filled a gap that humans had left vacant.

ROBOTICS IN THE WAKE OF DIGITAL TRANSFORMATION

There is absolutely no doubt that robotics will assist in catapulting the digital transformation efforts in many organisations. The world is becoming more automated, and the role of autonomous intelligent mobile systems been steadily growing.

These applications are perhaps similar to those used in other disaster applications, however, which got quickly forgotten as interest and funding disappeared shortly afterwards. In response to the COVID-19 crisis, some companies[21] recently open-sourced some hardware and software designs to encourage other developers to rapidly deploy robots to help reduce the exposure of frontline healthcare workers to COVID-19. The world has learned through this pandemic that robots do not necessarily replace people, but perform tasks that a person could not do or do safely, or take on tasks that free up frontline workers to handle the increased workload.

Our view in is that, there will be no turning back, and collaborative robots may increasingly be part of our lives

Figure 8: Robot delivering salad bar dishes to customers in a restaurant in Tokyo [22].

in the future, and indeed, be part of all the future pandemics and disasters. Robots will be part of our new normal.

Restaurants are finding innovative ways to operate by having robots form part of their staff to create contactless services. Guided by specially-coded stickers mounted on the ceiling that the robot perceives through an upward-pointing camera, the autonomous commercial service robot can deliver salad bar dishes right to the customers. Multi-sensor fusion technology, based on infrared, 3D mapping and machine vision, also enable the robot to avoid people and other obstacles while moving around the space[23]. wn

REFERENCES:

[1] https://www.who.int/publications/i/item/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations

[2] Credit: The Maersk Mc-Kinney Moller Institute at the University of Southern Denmark

[3 https://www.spotlightnsp.co.za/2020/07/23/in-pictures-the-difference-a-ministers-visit-makes-at-livingstone-hospital/

[4] https://www.medicalbrief.co.za/archives/eastern-cape-hospitals-crisis-patients-fight-one-another-for-oxygen/

[5] https://www.mirror.co.uk/news/world-news/hospitals-horrors-patients-fight-over-22361986

[6] https://www.spotlightnsp.co.za/2020/07/23/in-pictures-the-difference-a-ministers-visit-makes-at-livingstone-hospital/

[7] https://ewn.co.za/2020/06/11/livingstone-hospital-doctors-speak-out-on-dangerous-unsanitary-conditions

[8] Credit: Stellenbosch University. https://www.sabcnews.com/sabcnews/tygerberg-hospital-uses-robots-to-monitor-covid-19-patients/

[9] https://www.pri.org/stories/2020-04-08/tommy-robot-nurse-helps-italian-doctors-care-covid-19-patients

[10] https://www.reuters.com/article/us-health-coronavirus-china-robot/robot-designed-in-china-could-help-save-lives-on-medical-frontline-idUSKBN21A0FY

[11] https://www.terra-drone.net/global/2020/02/07/terra-drones-business-partner-antwork-helps-fighting-corona-virus-with-drones/

[12] https://www.pri.org/stories/2020-04-08/tommy-robot-nurse-helps-italian-doctors-care-covid-19-patients

[13] https://fortune.com/longform/ai-artificial-intelligence-big-tech-microsoft-alphabet-openai/

[14] Google Cloud's AI Adoption Framework

[15] https://builtin.com/artificial-intelligence/examples-ai-in-industry

[16] https://www.tribstar.com/news/local_news/union-hospital-deploys-robots-in-fight-against-covid-19/article_0a3a8f23-6cc0-59ca-992b-7275843c4ab9.html

[17] https://ifr.org/case-studies/collaborative-robots/stihl-opens-up-new-

[18] https://www.wired.com/story/workers-spread-halt-virus-robots-fill-gaps/

[19]

[20] http://www.statssa.gov.za/

[21] www.bostondynamics.com

[22] https://english.kyodonews.net/news/2020/09/ce75a6c4c144-feature-robots-filling-the-void-in-post-coronavirus-world.html

[23] https://english.kyodonews.net/news/2020/09/ce75a6c4c144-feature-robots-filling-the-void-in-post-coronavirus-world.html

Modern Industrial automation: Breathing new life into aging assets.

by Elizma van der Walt (Pr. Eng.)

Pick up your mobile phone [if you are not already holding it!]. Access to automation, data and human machine interfacing has become rooted in our daily existence. You are also most likely holding space exploration equivalent processing power in your hand, at a fraction of the price.

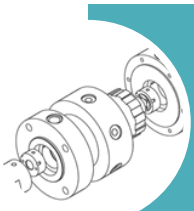
An exponential increase in appetite for data and savvy human-machine interfacing coupled with the comparative ever decreasing cost of tech is making automation matter and making it accessible. Combine this with an economic climate in which the cost of full mechanical asset replacement is just too high for existing operational budgets and an ecosystem is created in which thebusiness case for automation becomes the smart choice for all critical industries. You can make your equipment safer, smarter, more efficient, and more environmentally friendly by adding automation solutions instead of substituting mechanical and structural elements (where costs are high and less technological advancement has occurred over the past decade). Automation also breathes new life into aging industries where a lower carbon future necessitates stricter environmental compliance.

What drives myself and my team's passion and energy is that these are not theories but implemented realities. Proconics has completed and are involved in various rotating and other equipment projects where existing equipment is revamped with modern automation systems to enable compliance to latest regulatory requirements and international best practices. The relationship between electronics and mechanical design on rotating equipment is an intricate and interdependent one, but with a multitude of opportunities.

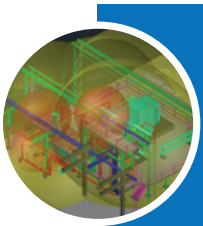
Automation renewal requirements on rotating equipment will vary according to the client's unique challenges, constraints, and requirements. With a 25-year brownfields integration history, Proconics believes in joint value creation. Drawing on industry literacy, operation understanding and technology provider relationships, a solution can be tailored that supports shared priority, strategic business drivers and financial constraints whilst meeting regulatory and legislative requirements.

Legacy rotating equipment are often still equipment with mechanical and hydraulic or pneumatic governors & interlock systems. Modern electro – pneumatic orelectrohydraulic equivalents canachieve much tighter control optimising on energyusage, safety, critical start-up curves and bestefficiency point operation

Seal system and oil systems upgrades can include mechanical modification for increased environmental safety and loss of containment prevention as well as increase automation diagnostic measurements on these systems. In the above project automation solutions even played a pivotal role in mechanical modifications where 3d printed parts where utilized to complete fast mechanical brownfield fit-up prototyping



Industrial automation solutions in this space include speed control, antisurge control, overspeed protection, vibration and bearing condition monitoring and predictive maintenance automationsystems. All of which as supported by enough science to warrant individual articles! Modern functional analysis standards and techniques such as functional safety (SIL) assessment combined with HAZOPs ensure tailored protection suitable for each industrial application.



Another aspect of rotating equipment safety related to industrial automation is hazardous area. Compliance, explosion preventions and fire and gas detection. Various risk assessment techniques (for example gas dispersion) exist and well as the selection and implementation of suitable mitigation measures (fire detection, gas detection or deluge system)

Often at the heart of manufacturing and production facilities rotating equipment offers a critical application with a myriad of automation opportunities. But Rotating equipment renewal is but one example of how modern industrial automation system is breathing life into legacy mechanical equipment.

The Future-proof Plant:

Impact of Evolving Operations, Technology, and Workforce Changes

Industries today face critical challenges to process operations: operational acceleration; evolving technologies; and a changing workforce. Modern automation systems offer real solutions to these challenges through new functionality that, in essence, can result in a future-proof plant. This paper explores these challenges and explains how process automation systems can address them.

BY PETER G. MARTIN

VP OF STRATEGIC VENTURES AND MARKETING AND AN INVENSYS FELLOW WITHIN SCHNEIDER ELECTRIC'S PROCESS AUTOMATION INDUSTRY BUSINESS

Globalisation; energy markets that change in real-time; variations in materials and prices; ageing of the industrial workforce; inability to attract the next generation of talent; and difficult regulatory pressures are all challenges that face industrial companies. These trends contribute significantly to the high level of stress present within today's industrial business environment.

New tools and updated automation systems help address these challenges by enabling organisations to keep pace with accelerating operational and market requirements. The benefits of evolving the business through the use of these tools include enhanced productivity derived from the new technologies, attraction to the firm of qualified new employees, and the ability to support these employees with the required knowledge then.

THE SPEED CHALLENGE

Only a decade ago, primary manufacturing processes operated with what was then an acceptable production pace: within the limits and constraints of their material and energy storage boundaries. This storage capacity was viewed as a necessary aspect of production value chains, ensuring that materials and energy would be readily available when required. But storage-based value chains also added cost to the business and removed agility from the operation.

Over time, critical business variables associated with industrial production have begun to fluctuate with more frequency. For example, today, the price that an industrial firm pays for

electricity might change every 15 minutes. This increase in speed has also impacted the frequency in the variation of the production value and material costs of operation.

Now the rate of the business is so fast that industrial processes must be able to respond to market changes in real-time. Unfortunately, the energy and materials storage points in the storage-based value chains of a decade ago are becoming the limiting factor in these operations.

THE TECHNOLOGY CHALLENGE

Several industrial businesses are working to change their process designs by improving their agility. Automation systems must be designed from inception to be extremely agile, adapting to process changes quickly and easily. As these process changes are implemented, object-based industrial service-oriented architecture (SOA) can help industrial companies to adapt flexibly – therefore future-proofing the operation while maintaining the operational integrity of the plant.

As the speed of business continues to accelerate, many traditional functions that industrial operations have performed in transactional business systems will require execution in real-time. Therefore, business functions such as real-time performance measures, real-time activity-based accounting, and profitable safety and asset performance management will need to operate in a real-time system.

As well as helping companies meet business challenges by future-proofing their operations, modern

process automation systems also future-proof their technology. Control room components such as operator consoles and engineering tools have much shorter lifecycles than process-connected components such as transmitters and control software. Process manufacturers need the flexibility to upgrade all components to meet emerging business requirements, without having to upgrade everything at once.

To accomplish this goal, the most effective automation systems embody a "continuously current" approach, which allows a plant to evolve to the latest state-of-the-art technology while preserving existing hardware, software, and applications. Indus- trial businesses can therefore protect their engineering investments, and in many cases, use emerging technology to drive more value from their automation solutions.

From an architectural perspective, three key features of such an automation system are:

- Providing a distributed software architecture that operates in standard operating system environments such as UNIX and Windows NT
- Utilising industry standards where available
- Building a distributed object-based communication infrastructure

In recent years, the concept of continuously current technology has been taken to a new level by extending the basic system design to become an industrial service-oriented architecture (SOA). Incorporated into the process automation system, the SOA design is based on a two-layer set of services that wraps around Microsoft's Windows NT kernel and utilises open web technologies.

The first layer consists of operating system services that extend Windows NT for highly distributed and secure industrial usage (see). These services include distributed object management, common namespace, inter-process communications and security services, among others. Adding these extended operating system services to the Windows NT kernel means that users experience the full benefit of the Windows NT system services as well as of the industrial context provided by these extensions.

Figure 1
Industrial service-oriented architecture (SOA) – layered system design

THE PEOPLE CHALLENGE

The second layer provides a set of application services that are common across all industrial systems. These services include standard human-machine interfacing, historical data management, and a real-time workflow engine. (See the Schneider Electric white papers Considerations for Integrating Historian Tools and Industrial Human Machine Interface (HMI) and How Human Machine Interface (HMI) Impacts Business Performance in Industrial Sites).

This application layer of services is based on the desire among industrial companies to have common approaches across their systems to simplify system design, implementation, and operation, as well as to offer operational insight and encourage collaboration across their operations.

An ageing workforce is also an essential issue to (see Figure 2). This will impact industrial companies in three ways. First, critical expertise and experience will be displaced from the workforce. Second, new, younger workers must be readied to replace the talent that is leaving. Third, industrial companies will need to develop plant environments that attract younger talent. Automation technology can help future-proof industrial operations within each of these three areas in many ways.

Properly designed automation software can help capture the intellectual property of both engineers and operators before they depart. On the engineering side, apply- ing an advanced object infrastructure and taking full advantage of the technology-independent characteristics of modern applications can enable these applications to migrate forward easily on new technology platforms, effectively preserving their design intelligence over time.

Software workflow engines at the system platform layer allow intellectual property originating with engineering, operator, and maintenance veterans to be embedded into the system environment. These assets can be accessed on-demand. Thus these workflows can offer to new hires operational insights from more experienced contributors who may have left the organisation. Highly complex and error-prone operations such as plant and unit startup and shutdown can be directed down optimal operational paths. Also,

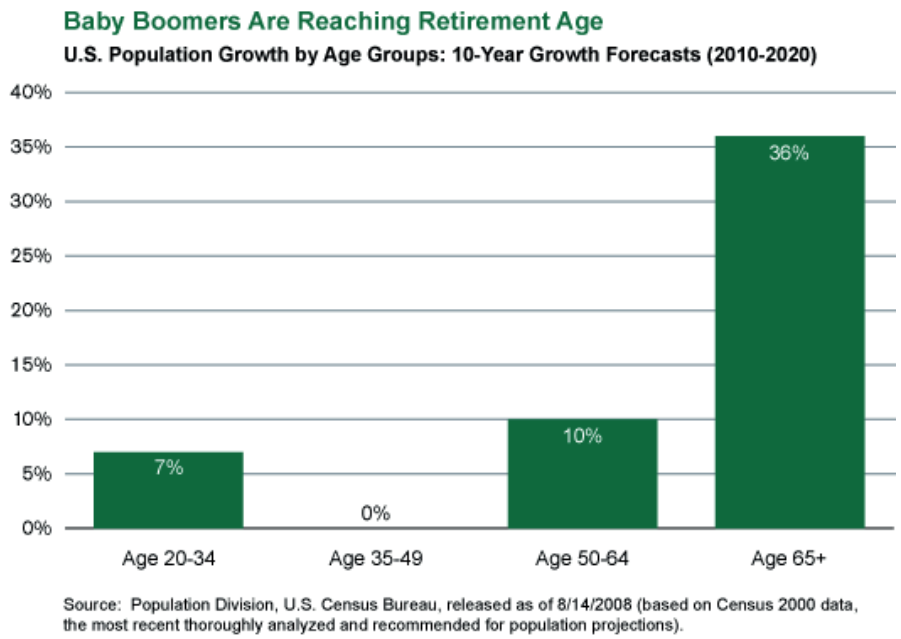


Figure 2

On average, today's most experienced workers will retire at an average rate of 10,000 per day in the USA alone.

operators and maintenance workers can be guided through unexpected and perhaps unsafe events via intellectual property embedded in automatically triggered workflows.

An adequately designed automation system can also address bringing new and younger employees up to an acceptable level of effectiveness in the shortest time possible so that they can replace retiring personnel. Tightly coupled, first-principle- based operator training simulators used in conjunction with contextualised virtual reality training systems can help new operators achieve certification levels in less than half the time of traditional methods.

Experience demonstrates that operators can become proficient in short order on the day-to-day, repeatable functions they are expected to perform. The challenge has been to train for infrequent and unexpected events. Now, these can be programmed into a simulation and virtual reality software, enabling operators to practice repetitively responding to these events and getting them to proficiency very quickly. But reaching proficiency is only the first step. Once operators reach certification levels, they must continue to build on their performance. The advanced automation answer is to embed lifetime training capability into the online environment through performance feedback mechanisms and performance prediction software. Since people learn by feedback control, providing these capabilities within the operational insight environment drives them to even higher levels of performance than that of their predecessors.

In the final component of the people challenge, potential employees from the X, Y and millennial generations may not be attracted to industrial careers because they view them as "old and dirty." But the industrial environment can be made more appealing by system features such as visualisation software that can run on a traditional CRT console, a display wall. A smartphone and that can be adapted to operate in new human interfacing technologies as they are introduced. Coupling such user-friendly high-technology environments with advanced learning environments based on a deeper understanding of how people learn could be a significant attractor of new talent into the operation.

CONCLUSION

Future-proofing automation technology is only one of the issues industrial companies face as they move forward. Many critical challenges and changes that are expected to impact industrial operations will require similar efforts.

Automation system technologies cannot address every aspect of future-proofing industrial plants. Still, they can help in three critical areas: protecting the operational integrity of plants, enhancing the operational insight of people, and enabling plants to adapt quickly and affordably to change. Companies that deploy object-based industrial SOA will gain significant capabilities for addressing all of those objectives. wn

BY: VARGHA MOAYED | CHIEF STRATEGY OFFICER, UIPATH

THE PHASES OF AN RPA JOURNEY

Most organisations will go through three phases in their RPA program deployment before being fully prepared to scale.

They start their journey with what we may call the "appropriation phase".

This is the phase whereby they test the technology to ensure that it "works" in their specific environment, build the first group of people familiar with the technology, and see some early results.

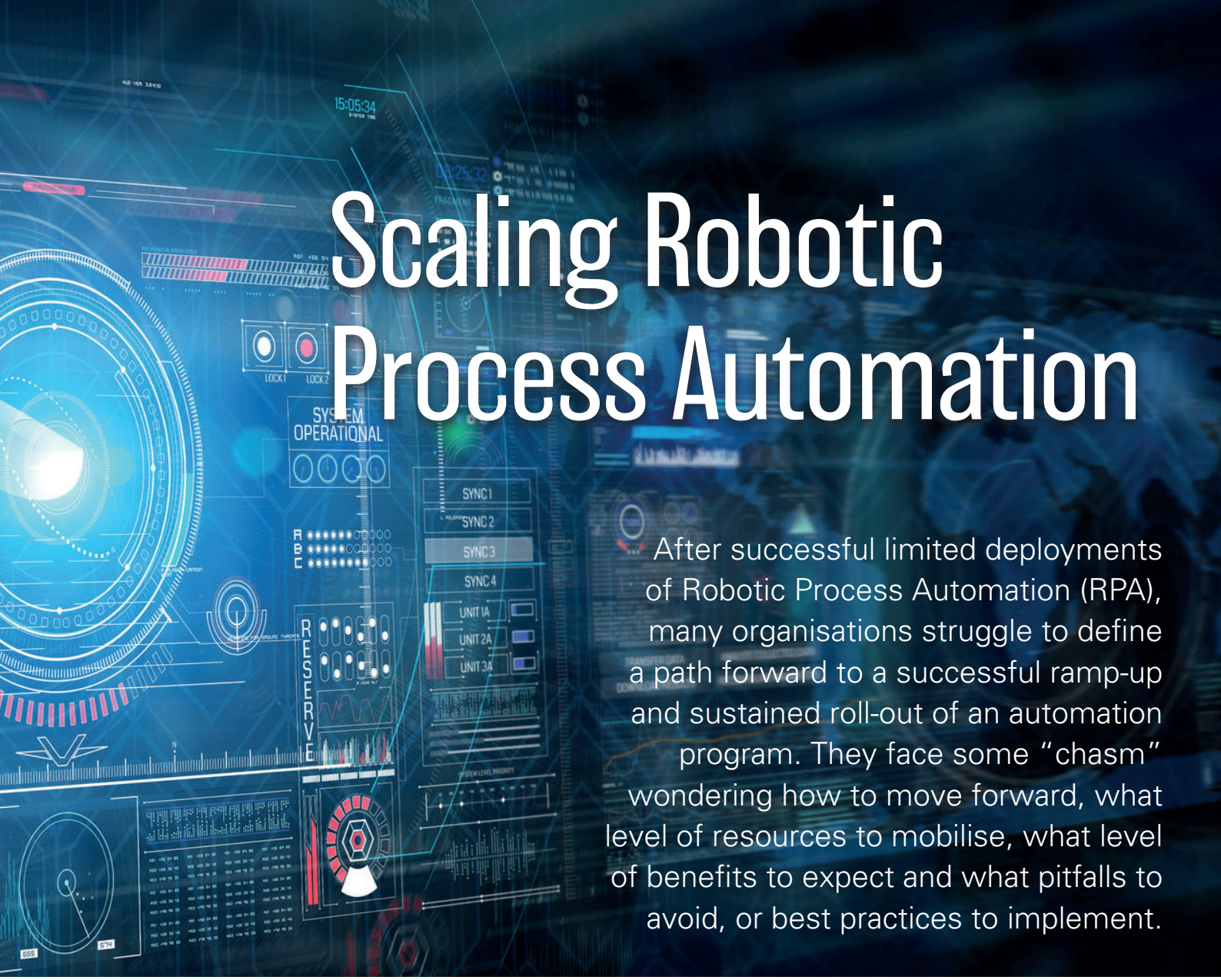
This phase tends to last between three to six months and is often, but not

For organizations to be able to truly scale their RPA program, they need to mature along six dimensions:

1. Upper management alignment and support
2. Quantity and quality of talent
3. Methods for discovering and prioritizing automation candidates
4. Levels and sources of funding
5. The scope and approach of the automation program
6. The automation operating model

After reviewing all these dimensions and how they can and should evolve, we will also share what an ideal preparation phase for scaling looks like.

Figure 1



Scaling Robotic Process Automation

After successful limited deployments of Robotic Process Automation (RPA), many organisations struggle to define a path forward to a successful ramp-up and sustained roll-out of an automation program. They face some "chasm" wondering how to move forward, what level of resources to mobilise, what level of benefits to expect and what pitfalls to avoid, or best practices to implement.

always, initiated in a single department/ location.

In most organisations, the appropriation phase is followed by a period of multiple deployments whereby organisations, on their own or with outside help, automate several "batches of processes" either in the same department as the initial deployment or into new departments/ locations.

Ideally, this phase should last an additional 9 to 12 months. However, many organisations struggle then to move beyond this phase, not knowing how to prepare for large-scale deployment and consequently, their RPA deployment may stagnate robbing them of the benefits that full automation could be providing.

DIFFERENT LEVELS OF AUTOMATION

Before diving into how to mature and tackle the different dimensions, it is essential to understand the different levels of processes. For automation purposes, we have simplified them into three main categories.

At the highest level, there are the inter-departmental processes that cut across multiple departments and engage various people, such for instance employee onboarding. These processes are often (not always) complex, requiring re-engineering while being automated and are often using multiple automation technologies (e.g. Intelligent OCR, AI, chatbots). Their automation entirely yields impressive results as not only does it eliminate any human errors, but it also reduces execution time considerably. As a result of being treated as a single continuous process, it eliminates "hand-over" time between departments.

Further down, there are departmental level processes. These are processes that are contained within a single department (e.g. end of month closing

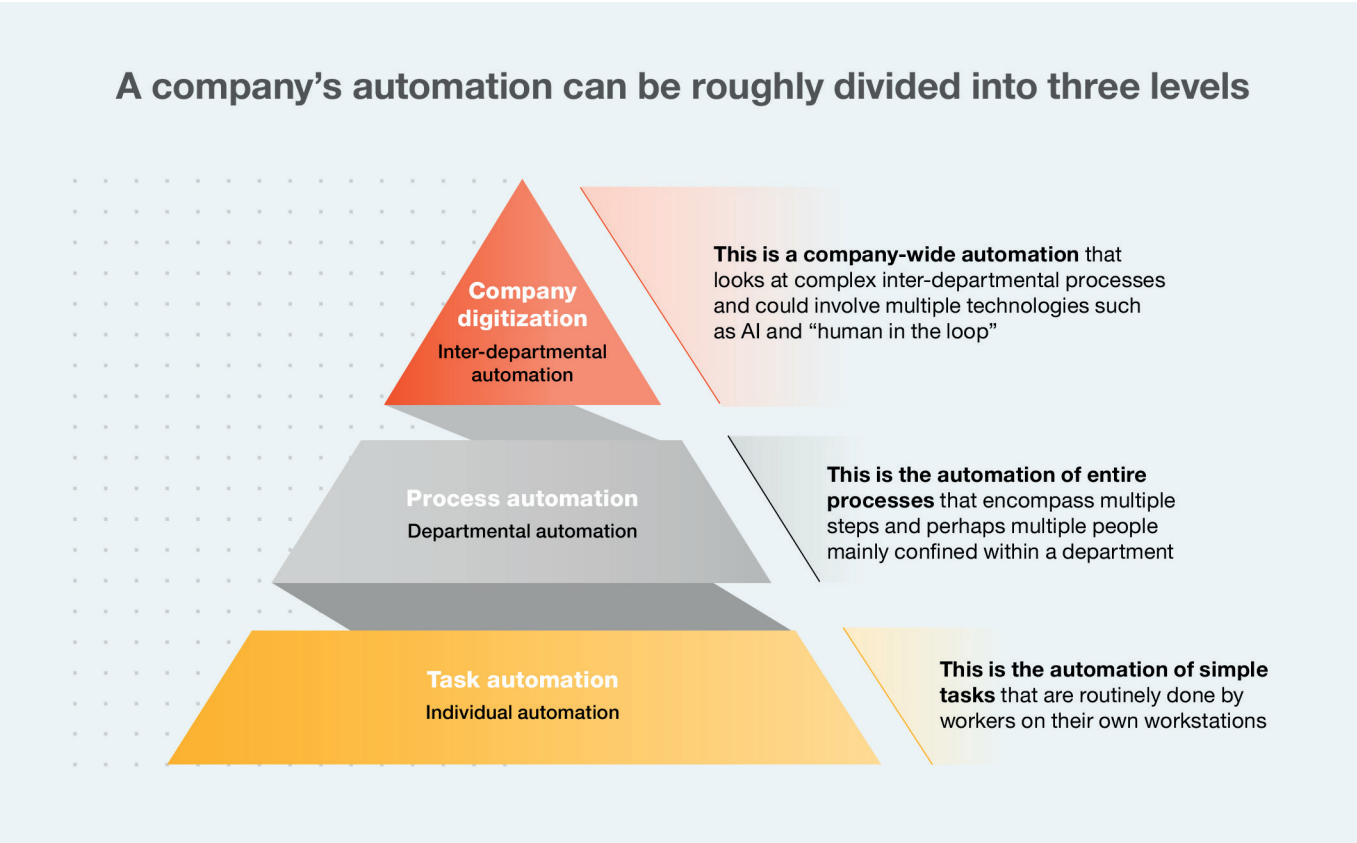


Figure 2: These distinctions play a significant role in the RPA journey of organisations. The ultimate goal of an organisation should be to efficiently automate all the processes and tasks across all departments, business units, and geographies. Doing so will provide a step function difference in productivity.

in finance); they involve multiple people within the same department, and they run the spectrum of relatively simple to relatively complex.

And finally, at the bottom, there is task automation. We define a task as a relatively simple process that involves only one person on her workstation.

UPPER MANAGEMENT ALIGNMENT AND SUPPORT

To be able to scale RPA, it is crucial to have upper management understanding, alignment, and support of the program.

A proper RPA program requires the support of many stakeholders eventually. First and foremost, you will need the help of the heads of central departments and business units as they are the ultimate beneficiaries of automation. Often, the most accessible upper managers to onboard are the heads of support services or Shared Services Centers for companies that have consolidated the bulk of their clerical work in such units. They tend to see the benefits of RPA quickly and can act as early champions. However, several other stakeholders (as per figure 3) need also to understand what RPA is about so that they can at best-become winners, or a minimum not be an obstacle.

However, for an organisation to truly embrace RPA at scale, two specific events need to happen: all heads of business units need to have automation-specific goals and RPA technologies need to be an integrated part of the overall IT architecture of the organisation.

This, in turn, requires the full backing of the CFO in establishing automation-specific goals for each business unit related to the total number of hours saved via automation for a given period, as well as the CIO's blessing for RPA to be fully integrated into the overall Information System Architecture and Roadmap of the organisation. Finally, having a C-level manager officially designated as a sponsor of the automation program act as a real catalyst for scaling.

QUANTITY AND QUALITY OF TALENT

Access to talent is among the most

Engaging key stakeholders

CFO
It will become crucial to have CFO support to be able to properly fund the RPA roll-out program

Heads of major business units and departments
These are the ultimate beneficiaries of RPA, and their consent and support will be required to deploy RPA

Head of support services
Typically the head of support services (GBS) tends to be the early sponsor of an RPA initiative as quite often RPA is first deployed in back office functions

CIO
While RPA tends to be more business led, CIO and IT should not be ignored as IT's full backing is a pre-requisite to a successful RPA program

Chief Personnel Officer
The deployment of RPA will be a source of anxiety among staff and it is important to enroll the help of the HR department to create a communication and change program accordingly

IT Security
IT security specialists need to feel reassured that RPA will not be breaking any security rules and that it is in full accordance with the organization's security protocol

Chief Compliance Officer & Internal audit
As RPA will modify some processes and alter issues such as segregation of duties, it is important that an organization's chief compliance officer and the internal audit team address any concerns upfront and that an ongoing collaboration is established with them

Figure 3

cited reasons why organisations have difficulties scaling their RPA program.

To assess the required talent for automation, it is good to first understand the eight steps of a process automation (see figure 3) that starts with process identification and ends with automation being monitored in production. The first four steps are business in nature, while the last four ones are more technical.

Overall, three categories of talent are required: business, technical RPA, and general IT.

REQUIRED BUSINESS TALENT

- A process Subject Matter Expert who will provide his/her input in steps 1 and 2 to identify the best processes to automate.
- An RPA business analyst who is capable of dialoguing with the process subject matter expert and can understand in detail the process, its business, as well as some technical requirements (supported by the solution architect). Having a good knowledge of RPA, she can spot what can be automated, and if necessary, can redesign the process to best fit automation.
- A scrum master, in effect an automation project manager who, according to the agile terminology will supervise the overall implementation from steps 1 to 7, combining both good technical knowledge, business understanding as well as project management skills.

REQUIRED TECHNICAL RPA TALENT

- A solution architect with an in-depth automation knowledge who works hand-in-hand with the business analyst and RPA developer to ensure the design of the RPA workflows are solid and incorporate all technical constraints.
- An RPA developer who, based on the chosen technology, develops the workflows under the supervision of a solution architect, participates in the user acceptance testing step and is in charge of the hyper care.
- Process controller, whose role is to monitor the robots, to alert for problems, to perform root-cause problem analysis with the help of solution architects, to perform capacity management actively and to provide ad hoc reports. The skillset required is similar to the one of a senior RPA developer.

REQUIRED GENERAL IT TALENT

- An IT infrastructure specialist dedicated to RPA is necessary to interface with the organisation's IT function to establish and maintain the environment required for testing and developing robots. He also needs to be the prime liaison person with the IT department to stay informed about changes in underlying applications and future releases.
- A security specialist (depending on the size of the virtual

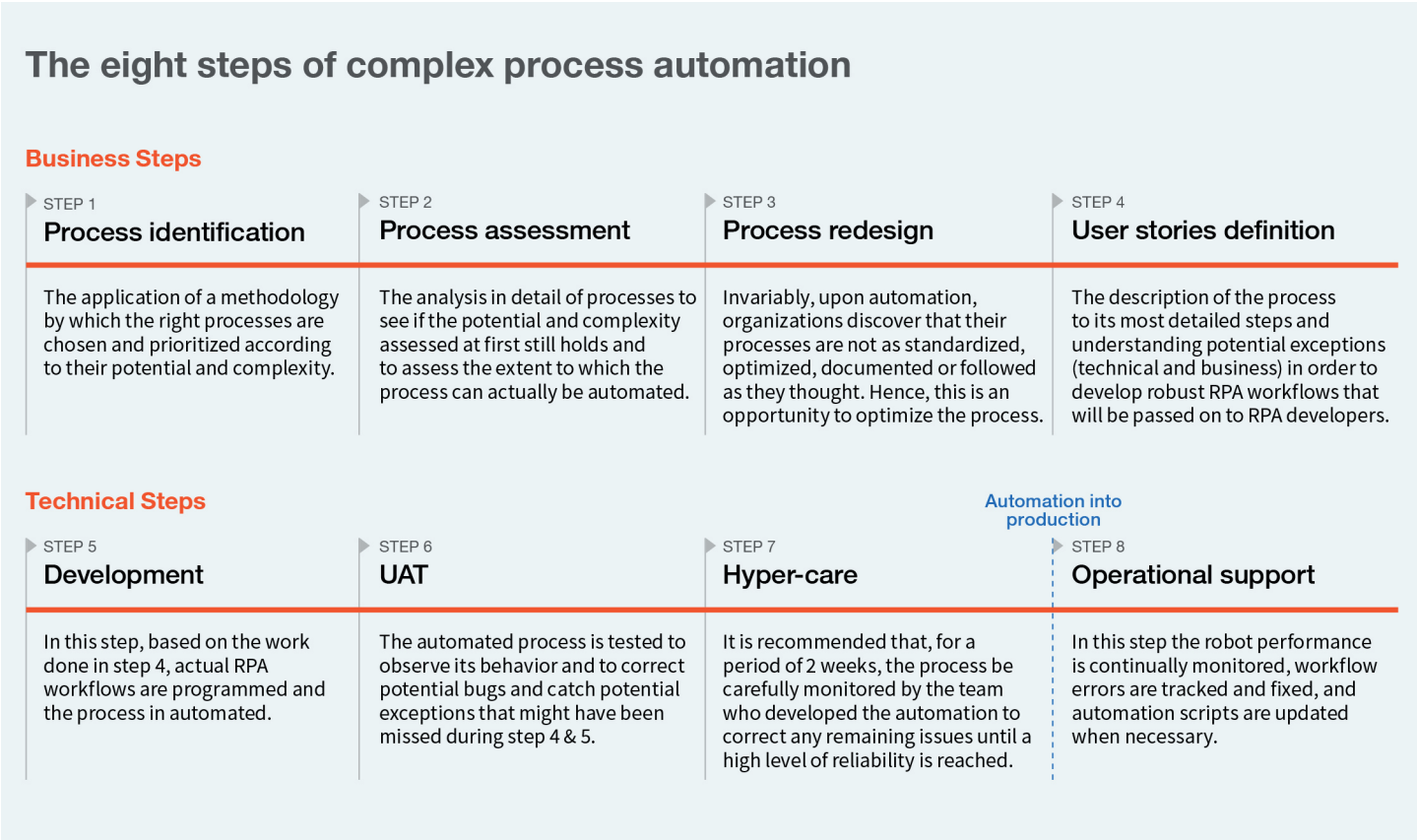


Figure 4: The eight steps of complex process automation

workforce) needs to be assigned to the RPA team to make sure that all of the organisation's security requirements are followed, and any future security breaches are prevented.

In practice, some of these roles, especially in the early days, can be embodied by the same individuals. However, these distinct roles will be needed when the RPA program scales.

On the other hand, bottom-up, citizen-led automation of tasks, and simpler processes are much less skill-intensive.

The end-users of an automated job can themselves identify and describe the functions/processes they wish to automate, citizen-developers can develop them, and finally, the code/ script could be curated by a specialised RPA developer situated in the RPA COE. More on this in the "scope and approach of automation program" section.

Given that depending on the complexity of automation, an RPA developer can only develop between 10 to 15 automation per year, it becomes clear that to scale up, organisations need to have a deliberate plan to scale their access to talent.

As part of this deliberate approach to scaling talent, organisations need to ask themselves how much outside help they are willing to use.

Usually, the help is used in two different stages of development. In the early days, many clients use outside help to kick-start their effort. They mix an internal team with an external team to be able to benefit from skill transfer and learn how to identify the processes appropriately to be automated.

Later on, clients that have established a systematic RPA program maintain a vendor relationship to outsource part of the RPA development to a lower cost, often offshore, professional firm. However, to do so effectively, they must establish a stringent standard methodology with their outside partners.

RPA developers are usually recruited among a mix of tech-savvy business users and IT talent. As for the RPA business analyst, a good source of talent is the lean practitioners, for organisations that have a continuous improvement/ lean group, that can be trained to make very useful RPA business analysts.

METHODS FOR DISCOVERING AND PRIORITISING AUTOMATION CANDIDATES

Many organisations struggle with establishing a unified approach to discovering and prioritising automation candidates. At first, it is relatively intuitive, as everyone seems to know those pesky processes/tasks that are labour intensive, error-prone, repetitive, not requiring much thinking and ideally not too complex to automate.

However, once these obvious low hanging fruit candidates have been automated, many organisations wonder how to discover and choose the next automation candidates.

To make things even more difficult in some organisations, the RPA champions may also encounter resistance from people willing to volunteer automation candidates in the fear that robots may make them redundant. To unlock this situation, we suggest a stepwise approach.

At first, organisations should entrust the discovery of automation candidates to a team of RPA analysts. They should use the momentum and "wow effect" of the first automation, that would have hopefully shown spectacular results in terms of increased productivity and customer satisfaction, to entice process subject matter experts and business users to work with them to unearth further automation candidates.

They will then use a standard methodology to assess and prioritise these automation candidates. There are variations in the methods used. However, most take into consideration, on the one hand, the potential benefits and on the other hand, the feasibility and complexity of the automation itself. The time saved is itself driven by volume, frequency of use and the time-saving potential for the process itself. On the feasibility/complexity side of things, RPA practitioners look for parameters such as number of underlying applications being used by the process, number of steps in the process, number of exceptions to the process, whether the operation uses digitised and structure data etc.

The combination of these two dimensions allows us to find the best automation candidates. We call this approach of finding and prioritising automation candidates the centralised or "Top-down" approach. It is a necessary and tangible first step.

However, it is not enough to scale. A centralised RPA group, no matter how talented, cannot by itself discover, assess, let alone develop all the required automation for an organisation to scale.

A second step consists thus to complement this top-down and bottom-up approach whereby every clerical worker can submit and self-assess automation ideas. Of course, to enable such a policy, organisations need to have at their disposal tools to allow it. UiPath Automation Hub is one of such tools that allows everyone to submit and self-assess the potential of automation candidates. Furthermore, a technology, such as UiPath Task Capture, makes it easier for individuals to submit to RPA developers the way they accomplish a specific task that they wish to see automated.

In a combined bottom-up and top-down approach to automation discovery, the specialised RPA COE(s) covers mostly the top of the process pyramid while empowered workers using the bottom-up approach discover the countless number of opportunities at the task and simple process levels.

In parallel to launching a bottom-up approach to automation discovery, the specialised teams can also deploy more sophisticated tools for automation discovery.

The final and ultimate stage of process discovery consists of being able to develop multi-month automation roadmaps for most departments. Such roadmap prioritises what will be created when it will be made, by whom, using which automation technologies and further identifies processes that may require a re-engineering before being automated.

These top-down roadmaps will guide the priorities of the specialised teams and provide visibility to business units managers. At the same time, the bottom-up discovery will continue to supply countless opportunities at the bottom of the process pyramid.

LEVELS AND SOURCES OF FUNDING

Approaches to funding RPA deployment play a crucial role in the further development of the program. Most organisations start, understandably so, with a process-by-process approach to funding. In this approach, they try to establish an ROI and business case for every process they wish to automate and also sometimes use this information to prioritise the automation candidates.

The business case and ROI is most often based on the time that can be saved through automation and the volume of transactions related to the specific process being automated—the combination of both providing enough benefits to justify the cost of development and technology.

However, to scale, it is paramount that organisations evolve from a process-by-process business case into a departmental business case for automation; otherwise, they risk running out of processes to automate. They will miss out on the portfolio effect of automation and never actually accomplish the step-up in productivity that CFOs are looking for.

Let us review what we mean by "portfolio effect" of automation and why a departmental approach is crucial.

Except for highly specialised departments such as call centres, in most departments, most people are involved in multiple processes during a day, week or month. Let us assume that Susan in the HR department is involved in 10 operations and that only two of the methods on which she works have been automated because they met the threshold of time saved that was set at more than 50% per cent in the "process by process business case" approach.

So, by automating the first process, 70% of the time Susan spent on that process was saved and by automating the second process, 50% of the time spent by Susan on that process was saved. However, approach one and two represented respectively 10% and 15% of Susan's workload, so in essence, only 14.5% of Suzie's time was saved. With this approach, we may have hundreds of "Susans" for which we have saved, in most cases, between 0 to 18% of their time.

On the other hand, if we had automated almost all the processes and tasks that Susan was involved in, down to the ones where we could only reduce by 10% the time, we would be reducing in total 20% to 30% of people's time in a department. Enough to re-organise work and have an impact on the bottom-line. This approach of "full automation" is the holy grail that organisations should aspire to if they wish to harness the power of automation and realise an actual step in terms of productivity.

Hence, business cases for automation are no longer developed process by process but instead for an entire department by setting overall goals for time reductions as well as deploying multiple approaches to RPA deployment which we will cover under the "approach" section of this paper.

The final step of funding is company-wide funding with a global RPA/automation budget and business case that span at least two years. Within that overall budget, some elements of RPA funding are delegated down to the business units/departments and others such as skill development, and intra-departmental automation is financed at the corporate level.

THE APPROACH OF THE AUTOMATION PROGRAM

As mentioned earlier, most organisations start their automation journey in one or two business units/geographies and start with "low hanging fruit" processes. In other words, not too complex processes/tasks that come readily to mind and which benefits are easy to demonstrate.

This is a logical and standard approach to familiarise oneself with the technology and start building some minimum in-house knowledge and momentum. The method is still mainly driven by a small group of specialists grouped in an RPA Center of Excellence (COE) that can serve one or several business units.

However, continuing with this approach will not allow an organisation to scale because it will eventually run out of opportunities. An organisation will not be able to justify the business case for automating tasks and simple processes by highly paid specialised

resources. It will not have enough resources to sustain its program.

As described for the process discovery method, in addition to a top-down, centralised approach to automation that is driven by a specialised team of RPA developers, organisations that wish to scale their automation need to embrace as well a bottom-up approach: citizen developer-led approach to automation.

This approach consists, at first, to allow a set of tech-savvy business users (a.k.a. citizen developers) to develop task and simple process automation for themselves and their colleagues. The ratio of citizen developer to the employee will vary department by department depending on their automation potential; it could be as low as 1 to 20 or as high as 1 to 100. Ultimately, the goal is that all clerical employees will have their tasks and processes automated. Some would have been developed by themselves; some would have been developed by their citizen developer colleagues and some finally by specialised resources belonging to the RPA COE.

This approach not only unearths many more automation ideas, but it is cost-effective and removes the bottleneck of limited specialised resources. Indeed, to achieve full department automation as described in the funding section and justify the business case, complex processes can be developed by expensive technical resources. In contrast, more straightforward methods should be developed by part-time citizen developers.

Finally, some task automation that has been deployed in one department can be shared across the organisation.

Finally, the bottom-up automation approach is a suitable catalyst for change management as employees feel empowered to create their automation opportunities and become actors of the change. It does require, a technology that enables such an approach in terms of simplicity of development and overall governance (i.e. control and curation) of the automation program to avoid the creation of "shadow IT" and meet the security and compliance requirements of most large organisations.

THE OPERATING MODEL

There is not a "one size fit all" most effective RPA operating model. The operating model itself will need to evolve as the RPA program expands. The operating model will be further influenced by the size and geographical spread of an organisation, by the role that will be taken on by the RPA Center Of Excellence(s) (COE) and, last but

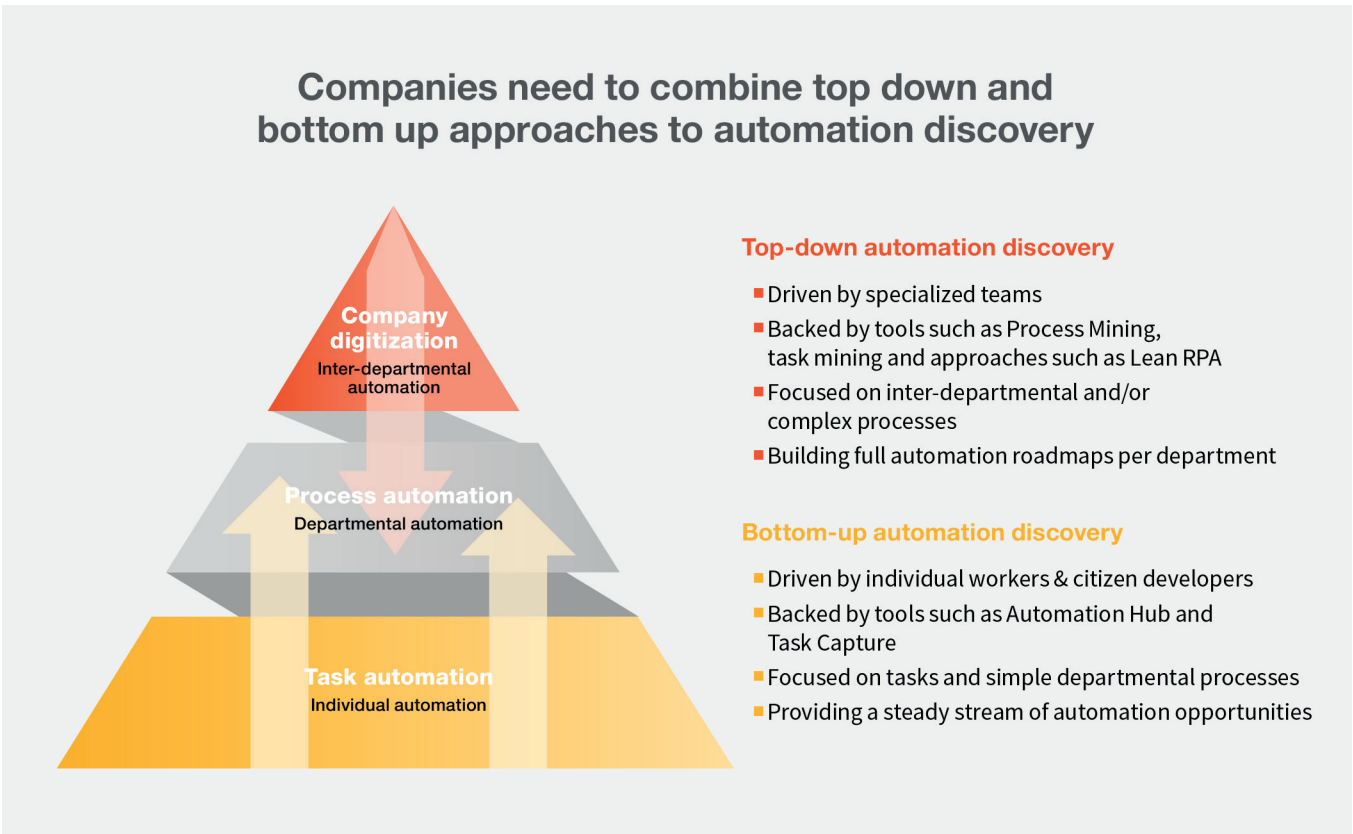


Figure 5: Sources out automation per type of processes

not least, by the organisational culture of a company.

Clearly, at the beginning of the RPA program, it does make sense to have a small, agile RPA COE that serves the entire organisation because the resources are scarce and centralising them allows for faster learning and better workload balancing.

Also, in the early days, the role of the RPA COE tends to be entirely operational as there are few resources. The COE is called upon to not only train new resources, deal with RPA vendors, manage the relationship with IT but also develop most of the automation on behalf of business units.
As the RPA program expands both geographically and within multiple business units, the structure and role of the early RPA COE need to evolve and be clarified.

Often, people confuse role and structure. Roles refers to how operational the RPA COE would be. At one end of the spectrum, the RPA COE can have a purely advisory role, at the other end, a fully operational role with operational SLA towards its internal clients. Structure, on the other hand, refers to whether the RPA COE(s) will be one and centralised or several and decentralised. The two notions are not the same; it is possible to have a centralised or decentralised advisory type of RPA COE. Likewise, it is possible to have a decentralised strongly operational type of RPA unit or a centralised one. And anything in between. Some organisations are very centralised in their governance model, while others are decentralised.

RPA COEs usually adapt to and follow the overall enterprise organisational culture. It is, however, crucial to clarify the roles that everyone will be playing along with the eight steps of process automation as defined in the talent section and ensure that the adequate talent resides in the proper organisation.

Clarifying the RPA operating model comes down to describing what roles will be played by the RPA COE(s), the business units and the IT department.

For instance, as illustrated in figure 7, in the case of an advisory type of RPA COE, the business steps of process automation will be under the responsibilities of the business entities themselves. The technical measures provided by the IT department while the RPA COE itself will be only giving training, overall RPA methodology and guidelines, maintaining the RPA vendor management and perhaps designing the overall RPA program strategy and cadence.

In contrast, with a strong operational RPA COE, most functions and talent related to process automation reside within the COE; the business entities are treated as "internal" clients, and the IT department plays simply a support role.

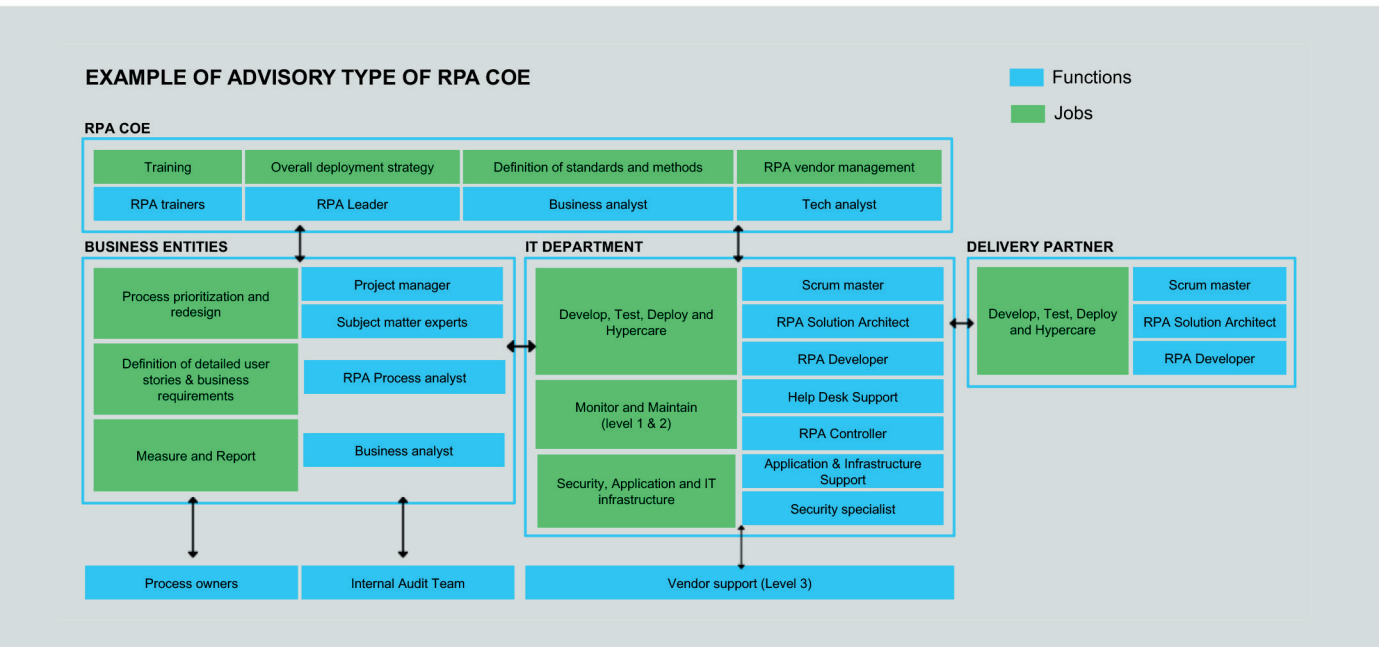


Figure 6: Example of Advisory Type of RPA COE.

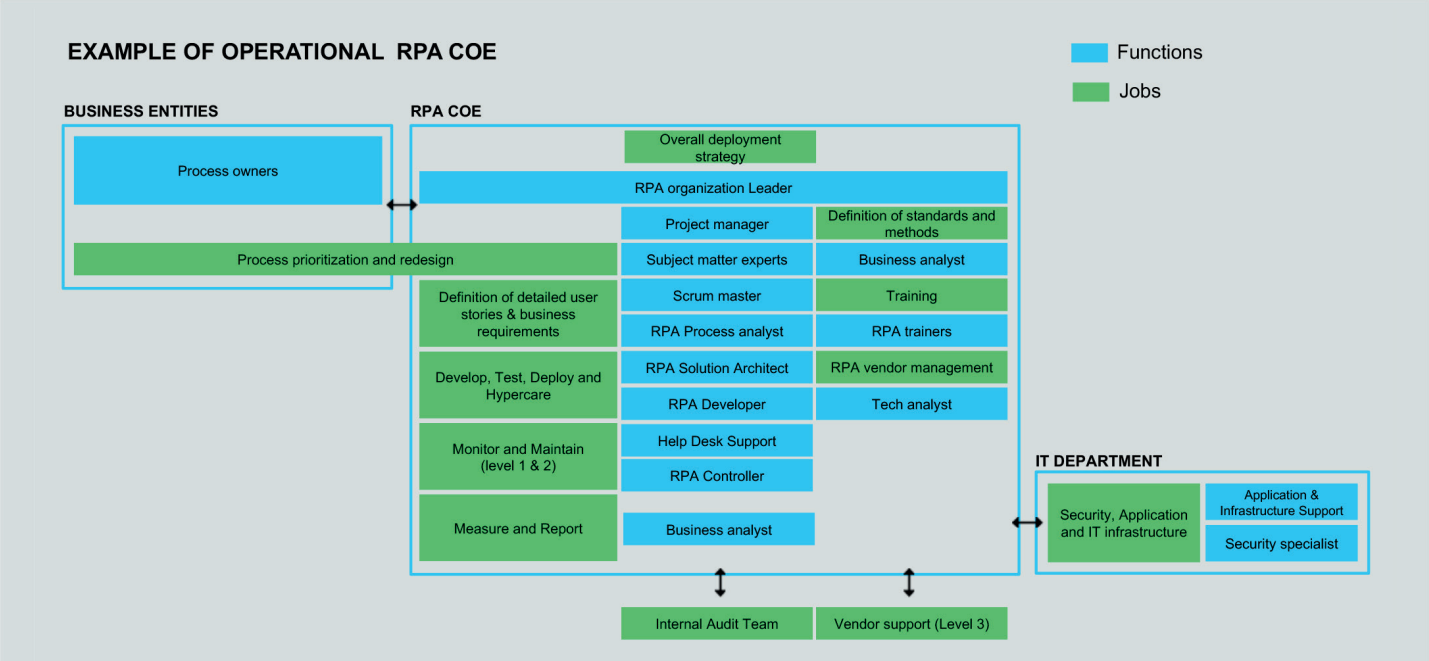


Figure 7: Example of Operational RPA COE

Again, there are almost endless variations on these constructs, and none are inferior or superior to the others. What matters is to clarify and formalise the roles and responsibilities as the RPA program expands. Failing to do so is a significant barrier to scaling as budget and talent do not get adequately allocated, and reliable processes for the process automation method do not get established.

As an organisation continues to mature on its RPA journey, it will need to refine its operating model once more to properly govern simultaneously the top-down as well as the bottom-up approaches to automation. RPA COE(s) can and should play a significant role in deploying and ensuring the success of a bottom-up approach to automation.

Indeed, a bottom-up approach is not a free for all; it requires that people are adequately trained to use automation. It also requires a central role for curation, certification and deployment of automation created by citizen developers. In the most advanced phase of RPA deployment when combining both top-down and bottom-up approaches, a central RPA COE will, in all likelihood, play simultaneously an advisory type of role as defined earlier. A central curation role for citizen-led development, as well as an active role for the automation of the most complex inter-departmental processes and the deployments of complementary technologies to RPA such as AI and process mining.

THE IDEAL PREPARATION PHASE

Now that we have reviewed all the dimensions involved in successfully scaling of an automation program and how they should mature, we will try to shed some light on what an ideal preparation phase before real scaling could look like. Such preparation can last anywhere between 12 to 18 months.

Let us imagine that it has been 12 to 18 months since you have started your RPA journey. You have built a first group RPA specialist in a central COE. You have done multiple deployments primarily in one or two business units/ locations and "peppered" some more automation in other departments. You have had good results so far in terms of ROI and customers experience. You are still funding the automation process by process. You have established a methodology to discover, assess, and prioritise functions to automate.

You are receiving good support from the IT department, and the roles and responsibilities between IT and the RPA COE have been clarified.

Most stakeholders have heard of RPA, and you have a knowledgeable and credible (with upper management) RPA champion. You are ready to prepare for actual scaling.

To do so, you will need to embark on three significant initiatives simultaneously:

1. Starting a project to automate an entire department
2. Tackling several complex inter-departmental processes
3. Training hundreds of RPA developers and analysts

STARTING A PROJECT TO AUTOMATE AN ENTIRE DEPARTMENT FULLY

As discussed in the approach to automation section, to truly show the transformative power of automation, you need to capture the "portfolio effect" of automation and have a real impact in the organisation of work and productivity of a group of workers.

For this, you are going to need one business unit head that is willing to transform her department and work hand-in-hand with the RPA champion first to deliver a complete automation roadmap. Then start fully automating all of the processes and tasks in that department that can be automated.

The benefits of concentrating the efforts on a single department are multiple. You will be able to show the type of results CFOs care about. You will learn how to deploy a combination of top-down and bottom-up approaches to automation.

You will be able to develop and transfer skills at the business unit level, thus enabling the business unit to continue its automation journey semi-autonomously. Last but not least, thanks to your results, you will now have a strong business champion that will entice other business leaders to want to follow her lead. At that point, with the backing of the CFO, automation KPIs can be implemented for each department.

TACKLING SEVERAL COMPLEX INTER-DEPARTMENTAL PROCESSES

This is also necessary to show the power of automation because they are usually high ROI cases that allow keeping the momentum for the RPA program. Furthermore, these often complex processes require process redesign, inter-departmental collaboration and the use of multiple technologies. Consequently, there are good projects to have to strengthen further the position of a common RPA COE where more specialised skills can be honed. They also provide high visibility to the RPA organisation and encourage inter-departmental collaboration necessary for company digitisation.

TRAINING HUNDREDS OF RPA DEVELOPERS AND ANALYSTS

As we have seen, a critical barrier to scaling is access to talent. The use of external providers can partially offset it. However, to truly scale RPA, and more importantly, to prepare for a bottom-up approach to automation, it is crucial to launch an effective internal training program. The idea is to allow hundreds of employees to be trained as RPA developers and analysts.

RPA is a low/no-code technology that presents relatively low barriers to entry. Organisations should take advantage of these to sponsor an internal training program whereby hundreds of employees voluntarily will get themselves trained.

The first wave of training should be launched, targeting mainly the department that would have signed up for full automation but also include employees from other departments.

The purpose and benefits of such a training program are multiple:

- It will provide the needed citizen developers required to augment the RPA COE talent pool to automate the chosen department fully, some of the workers being trained may turn out to be so talented that some may integrate the RPA COE.
- It will create a group of enthusiastic ambassadors of the technology in other departments preparing the terrain for the following department's automation program.
- And, finally, by doing so, you will be signalling your organisation's commitment to re-skilling employees and assuage their fear of automation.

It is important to note that once scaling starts, "full automation" will no longer be driven solely by the COE resources but rather by a combination of COE talent and the trained employees imbedded in each department that will act as citizen developers hence bringing down the cost of development and deployment.

Twelve to 18 months after having been on this path, an organisation will have:

- Strengthened its central RPA COE with adequate skills
- Created one enthusiastic department leader that would have seen RPA considerably improve the productivity of his teams hence encouraging others to follow suit
- Learned how to approach "full automation"
- Automated several inter-departmental processes with high results and visibility
- Created a pool of RPA talent imbedded in business units that will play a vital role in the subsequent years of RPA deployment

In other words, the organisation will be poised for real RPA scale-up. wn

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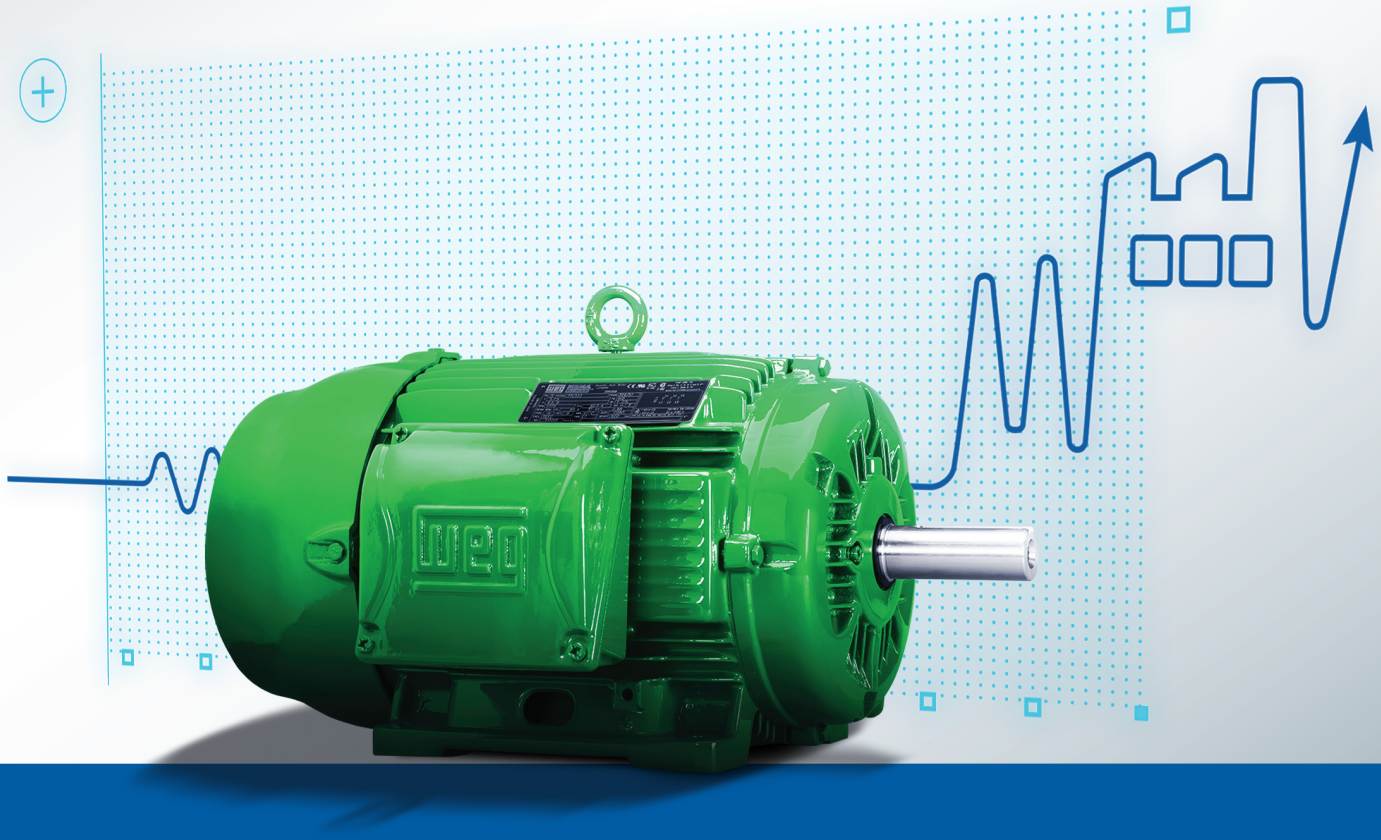

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Is Working Overtime Worth it in Your Country?

We've all likely stayed later at work when we've been super busy or had to catch up on work, however sadly, in recent years, long working days and taking work home has become the norm for many employees. Not only is this causing employees to miss out on enjoying the pleasures of life and spending quality time with family and friends, it might not be worth the hassle.

BY: LUCY DESAI

On average, in South Africa, workers work some of the longest work weeks at around 2,209 hours a year. 18.1% of workers worked very long work weeks of 50 hours or more, which is significantly more than the Organisation for Economic Co-operation and Development's (OECD) average of 13%.

Last year, Microsoft trialled a four-day work week, resulting in a 40% boost in productivity, suggesting that perhaps it isn't necessary for employees to be putting their life and soul into their job when the same amount of work can be done in a considerably shorter amount of time. Productivity can be enhanced through industry software, such as accounting software for small businesses, which can help financial and accounting professionals to evolve business productivity. Some businesses may discover that the path to increasing productivity isn't working hard but working smart.

Here, we'll look at different countries' overtime and compare it to how well a company's economy is performing to see if there's a correlation. Will it be more favourable to work overtime in certain countries based on the hours they work a week?

THE COUNTRIES THAT WORK THE MOST

From the data, as mentioned before, South Africa's work week is the longest at 2,209 hours a year. Considering the overtime workers are putting in, their economy is worth $349.4 billion, the 10th smallest of the countries analysed. South Africans have been hailed as some of the hardest working across the world, with research reporting they are three times more likely to work a 60-hour work week than their American counterparts, despite labour laws forbidding being asked to work over 45 hours a week. However, South Africa's economy has experienced an upward trend over the last ten years — is this boost from the hard-working nation, and would it be significantly worse off without overtime?

Mexico worked the second longest work week (2,148) with 28.7% working 50 hours or more; third came Costa Rica (2,121) however data wasn't available for the percentage of

employees working 50 hours or more. Fourth was Korea (1,993) at 25.2%, and fifth was Russia (1,972) with 0.1%. Mexico's economy is worth $1.27 trillion, Costa Rica $57.06 billion, Korea $1.63 trillion, and Russia $1.64 trillion. Although Costa Rica's GDP is relatively small in comparison to other countries, it is a small but stable country which wouldn't generate trillions of dollars. In June of 2018, South Koreans were forced to cut down on the hours they were working to introduce a better work-life balance and help boost the falling birth rate. With so many more Koreans previously working 50 hours or more a week than other countries, the GDP doesn't outrank many others.

THE COUNTRY THAT WORKS THE LEAST

Germany works the fewest hours per week at 1,362 a year, with 4.3% of the population working 50 hours or more. Considering a significantly lower work week than other countries, Germany's economy is the third largest at $3.86 trillion. At the start of 2018, millions of Germans won the right to reduce their work week to 28-hours to help them achieve a good work life balance and spend more time with their loved ones and doing things they enjoy. It seems that countries don't need to work long hours to get more work done — Germany has been recognised as one of the most productive countries with a booming economy despite a cut in hours, striking the ideal work life balance while being 27% more productive than the UK.

The second country to work the fewest hours was Denmark (1,392) with 2.3% working 50 hours or more. Third was Norway (1,416) with 2.9%, fourth was Netherlands (1,433) at 0.4%, and fifth was Iceland (1,469) at a higher 15.1%. Iceland has the smallest economy at $23.91 billion, followed by Finland at $251.9 billion, Denmark at $324.9 billion, and the Netherlands at $902.36 billion. A 2017 report found that Norway is one of the most productive countries despite having one of the shortest working weeks.

Lead researcher of Expert Market, Adelle Kehoe, said: "Our data has shown, both this year and last year when we first ran the study, that there is a definite correlation between a shorter working week and productivity. "Countries that have shorter working weeks in general are more productive, whereas countries which have a culture of presenteeism and long desk hours actually get less out of their teams."

There's more to life than work — hopefully more countries will realise that long hours doesn't necessarily mean productivity. wn

COUNTRY	HOURS WORKED	EMPLOYEES WORKING VERY LONG HOURS	GDP
Iceland	1,469	15.1%	$23.91 billion
Latvia	1,699	1.3%	$30.26 billion
Costa Rica	2,121	(N/A)	$57.06 billion
Luxembourg	1,506	3.8%	$62.4 billion
Slovak Republic	1,698	4.1%	$95.77 billion
Hungary	1,741	3.0%	$139.1 billion
New Zealand	1,756	15.1%	$205.9 billion
Finland	1,555	3.8%	$251.9 billion
Denmark	1,392	2.3%	$324.9 billion
South Africa	2,209	18.1%	$349.4 billion
Norway	1,416	2.9%	$398.8 billion
Belgium	1,545	4.8%	$492.7 billion
Poland	1,792	6.0%	$524.5 billion
Sweden	1,474	1.1%	$538 billion
Switzerland	1,561	0.4%	$715.36 billion
Turkey	1,832	32.6%	$743.71 billion
Netherlands	1,433	0.4%	$902.36 billion
Mexico	2,148	28.7%	$1.27 trillion
Australia	1,665	13.0%	$1.38 trillion
Spain	1,701	4.0%	$1.4 trillion
Korea	1,993	25.2%	$1.63 trillion
Russia	1,972	0.1%	$1.64 trillion
Canada	1,708	3.7%	$1.73 trillion
Italy	1,722	4.1%	$1.99 trillion
France	1,520	7.7%	$2.71 trillion
United King-dom	1,538	12.2%	$2.74 trillion
Germany	1,362	4.3%	$3.86 trillion
Japan	1,680	17.9%	$5.15 trillion
United States	1,786	11.1%	$20.58 trillion

ARTICLE COMMENT - WATTNOW AUGUST ISSUE

Lightning Protection of Structures:

How to do it wrong

As Prof Gomes explained, the height advantage claimed by ESE vendors is dependent on the speed of the upward streamer or leader (assumed to be 1X106 m/s). In point 2 of the article, he notes why this value is one of the key reasons why ESE technology is rejected by standards stating: "There is no scientific evidence to prove that the upward streamer speed is 1X106 m/s. In reality, it may be a couple of magnitudes less. The recent experiments done with fast video camcorders will soon reveal the validity of this assumption." This comment aims to draw attention to research performed by the authors led by Dr Marcelo Saba in São Paulo, Brazil, where downward lightning events to two common apartment buildings were filmed using high-speed video cameras [2].

BY | C. SCHUMANN, M.M.F. SABA, J.C.O. SILVA, H.G.P. HUNT

The interest in common buildings (under 60 m) is because of the type of lightning events such buildings are exposed to - downward negative lightning, the most frequently (more than 80%) occurring cloud-to-ground lightning events. This kind of study is rare (if compared to studies of lightning flashes to tall towers). Even though the frequency of negative cloud-to-ground flashes is high, studying their connection to a specific building is very difficult, and data collection may require many years of observation. The project in São Paulo consisted of a high-speed camera (recording more than 10,000 frames per second) looking at twin side by side apartment buildings, each with its own Franklin rod and down conductors installed. With this setup, it was possible to observe the propagation of the downward leader as well as the propagation of the upward connecting leader (or streamer) before attachment occurred in three different

lightning events. The high frame rate of the cameras (each frame with accurate GPS time-stamping) meant the speed of any propagated leaders could be estimated (as well as the ratio of these speeds and striking distance) [2].

Figure 1 shows a sequence of frames from one of the lightning events to the buildings occurring on the 1 March 2014. As can be seen, a downward leader approaches the buildings and an upward leader begins propagating from the Franklin rod of the building on the right. In the third frame, a second upward leader begins from the building on the left. All three leaders continue to propagate until attachment occurs to the building on the right. Note the time difference between frames is 100 microseconds.

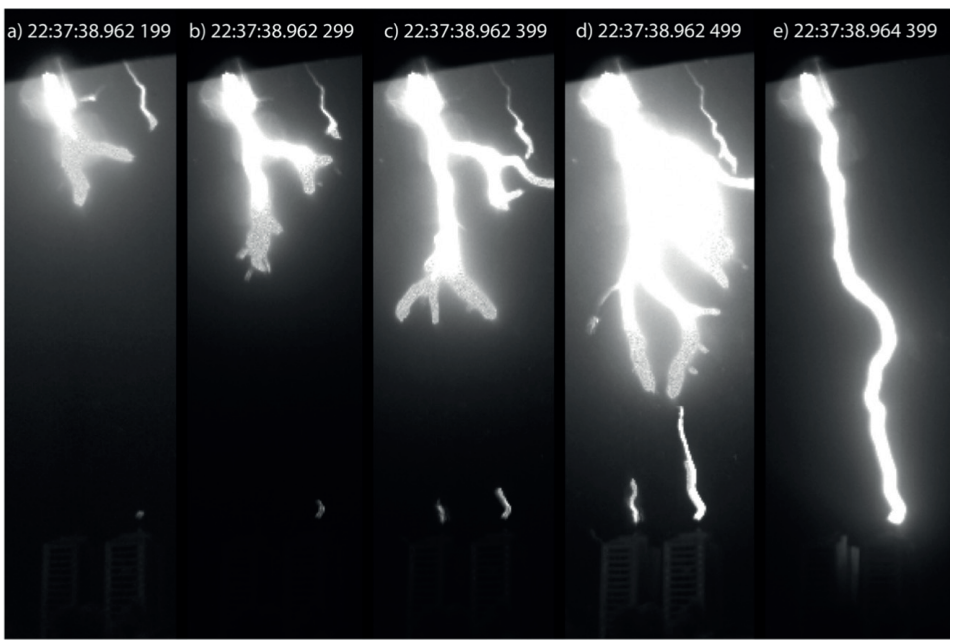

Figure 1: A sequence of frames from one of the high-speed captures of a lightning attachment to the apartment building on the left.
The downward leader propagation can be seen as can two upward leaders - an upward unconnected leader (left) and the upward connecting leader (right) [2].

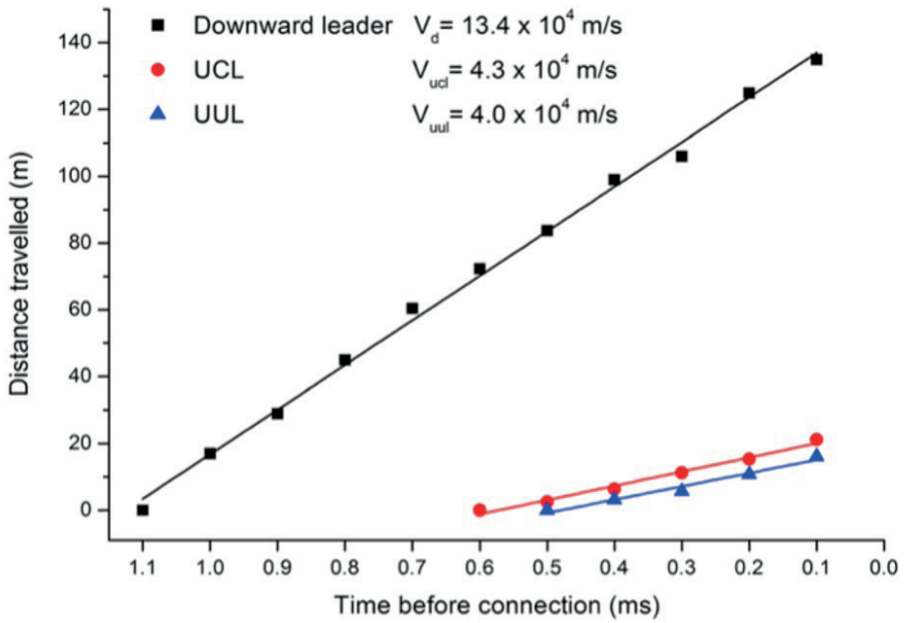

Figure 2: Distance versus time plot and linear regression fits for the downward leader and the upward connecting leader (UCL) and upward unconnecting leader (UUL). The gradient of the linear fits gives an indication of the average speed of propagation [2].

Figure 2 shows a plot of propagation distance versus time measured from the videos for one of the three flashes to the buildings. The plot shows the propagation of the downward leader as well as the upward connecting leader and the upward unconnecting leader. For each leader propagation, a linear regression fit is done, with the gradient giving an indication of the average speed of propagation. As can be seen, the average upward leader speeds in this case were 4.0 and 4.3 X 104 m/s. Similar average speeds were obtained for the two other lightning events that were filmed: 3.9 and 5.9 x 104 m/s; and 6.2 and 7.1 X 104 m/s for upward connecting and upward unconnecting leaders respectively.

This is a significant result and has important implications for ESE technologies - as mentioned by Prof Gomes, the propagation speed of upward leaders (or streamers) appears to be orders of magnitude less than the assumed speed of U = 1X106 m/s [3]. This means that the height advantage (100-200 times greater than the physical height of the ESE rod) claimed by ESE technology is not nearly as great as assumed and the volume of protection significantly less.

About the authors: Dr Carina Schumann is currently a member of Johannesburg Lightning Research Laboratory at WITS in the Center of Excellence on High Voltage. She completed her PhD at the National Institute for Space Research in Brazil with Dr Marcelo Saba and has now brought her high-speed lightning expertise to South Africa.

Dr Marcelo Saba is a researcher at the National Institute for Space Research in Brazil. Dr. Marcelo is a pioneer on lightning high speed studies. Since 2001 he has been characterizing all types of flashes: negative, positive and bipolar downward flashes and upward flashes, as well as studying the physical processes of the lightning flashes.

José Claudio de Oliveira e Silva is an electrical engineer and has been involved with EMC and lightning protection for more than 30 years. He is a member of ABNT (Brazilian Technical Standards Association) committees on EMC and lightning protection.

Dr Hugh Hunt is a Senior Lecturer in the School of Electrical and Information Engineering, University of the Witwatersrand and is Head of the Johannesburg Lightning Research Laboratory at WITS. wn

[1] Gomes, C. (2020), Lightning Protection of Structures: How to do it wrong, WattNow, South African Institute of Electrical Engineers (SAIEE), vol 8, pg 50-57.

[2] Saba, M. M. F., Paiva, A. R., Schumann, C., Ferro, M. A. S., Naccarato, K. P., Silva, J. C. O., Siqueira, F. V. C., and Custódio, D. M. (2017), Lightning attachment process to common buildings, Geophys. Res. Lett., vol 44, pg 4368– 4375, doi:10.1002/2017GL072796.

[3] Becerra, M and Cooray, C. (2008), Laboratory experiments cannot be utilized to justify the action of early streamer emission terminals, J. Phys. D: Appl. Phys., doi.org/10.1088/0022-3727/41/8/085204

South African Institute of Electrical Engineers

JOB ADVERTISEMENT

Posted 21 September 2020

Post: Accountant

Requirements:

- Matric / Grade 12.
- Relevant Finance Degree/Diploma.
- 10 years + related experience.
- Voluntary Association experience.
- Experience working with legislated bodies.
- Knowledge of finance policies and principles.
- Computer literate and excellent knowledge of Pastel Accounting, Pastel Payroll, MS Office, Excel, PowerPoint & Outlook.
- Good planning and organizational skills.
- Ability to work independently and in a team.

Job Role:

- Manage Finance department.
- Manage all the institute's accounts, including investments.
- Liaise with external stakeholders.
- Manage and reconcile all balance sheet accounts.
- Manage salary payments, staff records and petty cash.
- Statutory payments and records.
- Oversee debtor reconciliations for all departments.
- Manage asset records and depreciation.
- Generate monthly and annual financial reports.
- Arrange annual audits.
- Secretary for the Finance and Internal Audit Committee.

Salary: Market related.
Work type: Full time.
Statute: Permanent.

Applications: leanetse@saiee.org.za
Due date: 30 October 2020, 16h00

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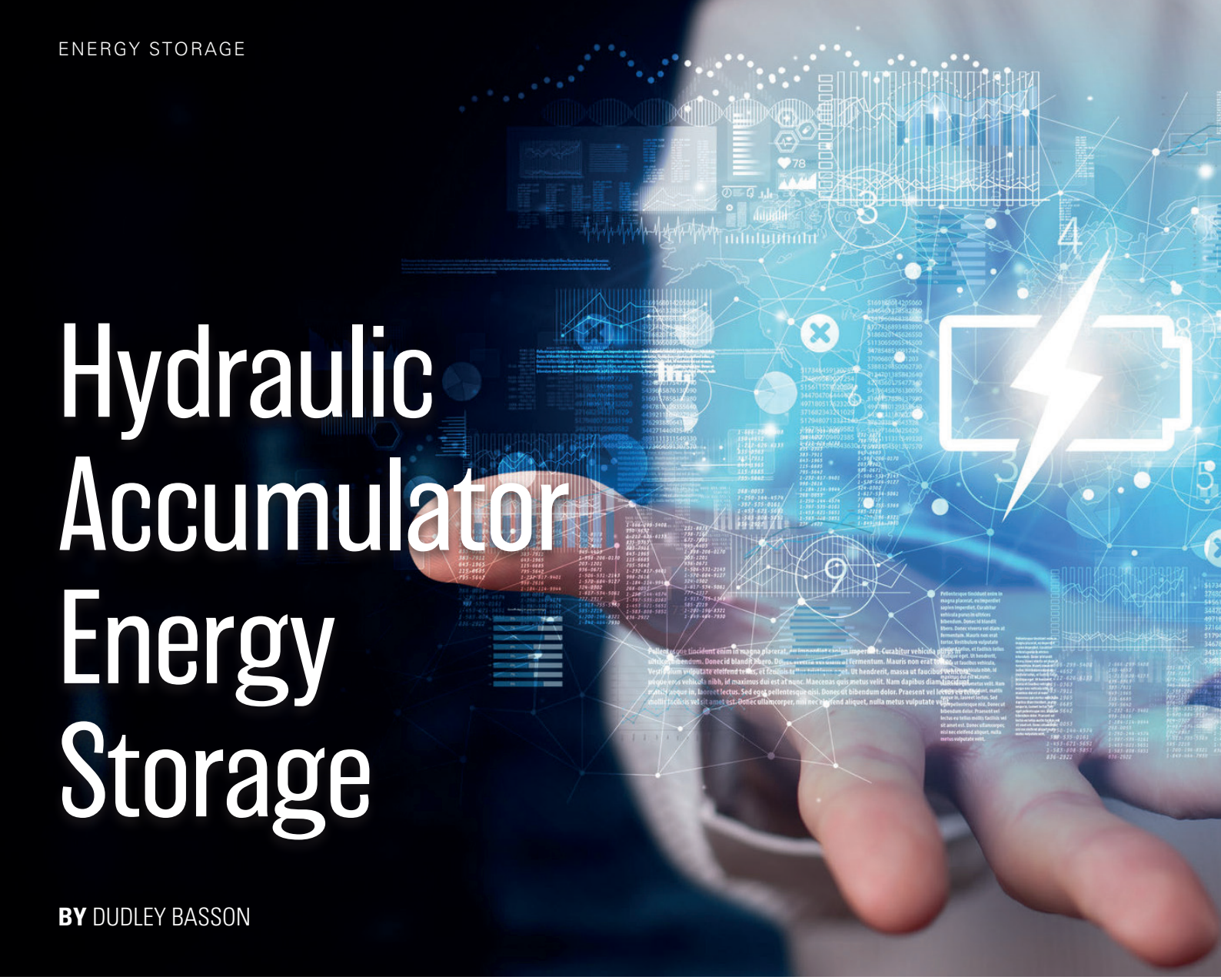

Hydraulic Accumulator Energy Storage

BY DUDLEY BASSON

By far the best method of large scale energy storage is to use a pumped-storage hydroelectric power station. This can only be done in mountainous terrain where it is possible to have large high and low-level dams with typically a 400 m elevation difference. South Africa's Ingula power station has a maximum output of 1332 MW and a storage capacity of 21 GWh. A pumped-storage hydroelectric scheme is in effect a hydraulic accumulator.

Hydraulic accumulators have been widely used since the 19th century. These typically consist of a container with hydraulic fluid which is pressurised by stored energy which can be compressed gas, a piston loaded with weights, or a spring. Energy is obtained by releasing the hydraulic fluid or stored by pumping it back again. Hydraulic accumulators are generally of three types: piston, bladder or diaphragm. Accumulators are in widespread use, and a wide variety is commercially available.

Famous historical hydraulic accumulators were installed in 1889 at the newly built Eiffel Tower in Paris. This was part of the machinery for powering the lifts in the tower which would take visitors in large double-decker cabins up to the first two levels of the tower. The cabins were provided with seating for the passengers and two drivers. The cabins were equipped with ratchet type safety devices to prevent them from plunging in the event of cable failure. The cabins were provided with screw mechanisms for keeping them level despite the varying slope of the tower legs. At this time lifts were not used in buildings. There is a smaller iron tower (45 m) with a lift, in Lisbon, the Santa Justa Lift, opened in 1899.

The millions of building and mineshaft lifts worldwide all have a basic design

The storage and on-demand retrieval of energy remains a pressing problem and is the primary limiting factor in the harvesting of wind, PV, CSP and other renewable energy. In Europe, utilities have used negative pricing, paying the users to consume more power, to dispose of excess power generated by wind turbines. At other times the renewables cannot cope with demand, and the power supply must include fuel-driven generation.

in common – a winding house at the top of the shaft, a winding drum for the hoist cable and counterweights connected to the cabin by cable to reduce the power requirement when hoisting the cabin. The hoist load would have four components: the cabin, the passenger load, the hoist cable and the counterweight cable. The weights of the cable can be considerable in high rise lifts.

The Eiffel Tower lifts were quite different. There was no winding drum, no counterweights and all the machinery was installed at ground level and underground. The lifts were powered by a steam engine driving a water pump. When hoisting the cabins, the cable was drawn in by a piston pushing apart sheaves around which the hoist cable passed. The force applied by the piston would be several times the tension in the cable. A high-pressure hydraulic accumulator powered the piston. For descending cabins, the piston would draw the sheaves together, releasing cable and sending water to the low-pressure accumulator. The water pump would then recharge the high-pressure accumulators. The piston-sheave arrangement places a severe limit to the height to which the cabins can be hoisted. The pistons were powered by three hydraulic accumulators of some 200 tons each and pressurised to 40-60 bars.

The tower lifts have subsequently been refurbished and modernised, and two double cabin electric lifts have been added for ascending to the top of the tower. A private lift has been installed for use by the Jules Verne Restaurant. A freight lift for use by the staff has also been added.

An exciting development was announced for the R&D of a hydraulic accumulator for the storage of

The hydraulic accumulator in the Eiffel Tower, Paris.

energy from renewable sources. The Energy Technology Development and Demonstration Programme, under the Danish Energy Agency granted almost DKK 5 million to demonstrate new technology that stores surplus green energy in colossal 330 x 330 metres underground containers described as 'water balloons'.

In collaboration with the entrepreneurial company AquaNamic, Denmark's Aarhus University will now start construction of a 100 square metre demonstration facility for new energy storage technology that can store green energy in a hydraulic accumulator.

The technology will use surplus energy to pump water from a reservoir into a giant, specially designed membrane buried under massive amounts of soil.

The final project aims at creating a balloon of 330 x 330 metres buried under a maximum of 25 metres of soil that will be raised by up to 14 metres when the balloon is filled up. This will store 230 MWh.

Prof Kenny Sørensen, who is heading the project from the Department of Engineering at Aarhus University, remarked:

"We're about to begin analysing, designing and testing selected critical technologies related to the membrane and to the construction of the 'movable hill' that will form the terrain part of the battery. Naturally, we'll have a strong focus on abrasion testing for the membrane, and we'll need to develop a specially designed test rig to carry out lifetime tests for representative membrane solutions."

The project is being developed in collaboration between AquaNamic, Solmax, PlanEnergi, Vestas, European Energy, AquaEnergy and Aarhus University. AquaNamic has developed the technology and, since 2018, Aarhus University has contributed with verification and further development.

This project will present some interesting challenges in design and materials as well as the types of pump/turbines that will be used. It will also be interesting to see what power output can be expected. The successful outcome of this project could well be a significant breakthrough in the storage of renewable energy. wn

South African Institute of Electrical Engineers

JOB ADVERTISEMENT

Posted 21 September 2020

Post: Bookkeeper

Requirements:

- Matric / Grade 12.
- Relevant Finance Diploma/Certificate.
- 5 years + related experience.
- Voluntary Association experience.
- Experience working with legislated bodies.
- Knowledge of bookkeeping principles.
- Computer literate and excellent knowledge of Pastel Accounting, PS Office, Excel, PowerPoint & Outlook.
- Good planning and organizational skills.
- Ability to work independently and in a team.

Job Role:

- Invoicing.
- Payment of suppliers.
- Creditors & Debtors control.
- Process and reconcile all cashbooks.
- Manage suspense account.
- Journal corrections on member queries and suspense accounts.
- Purchase and keep stock of groceries for the Institute
- File POP's, invoices, cash book payments and keep audit files up to date.
- Resolve membership queries.
- Secretary for the Events and Media Committee.

Salary:	Market related.
Work type:	Full time.
Statute:	Permanent.
Applications:	leanetse@saiee.org.za
Due date:	30 October 2020, 16h00

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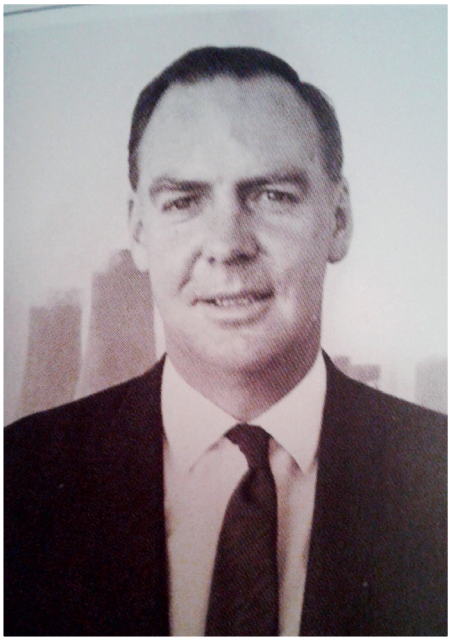
DR IAN MCRAE
- A personal memoir



A much younger Dr McRae, at age 31 the youngest RE in Eskom at the "new" Komati power station!
Photo from "A Symphony of Power"

There are probably not many Institute members who spent their careers in Eskom's Generation Division, where Dr McRae reigned supreme for most of his time with Eskom. So I thought that my involvements with him might add a personal touch to the excellent obituary published in the August issue of **watt**now.

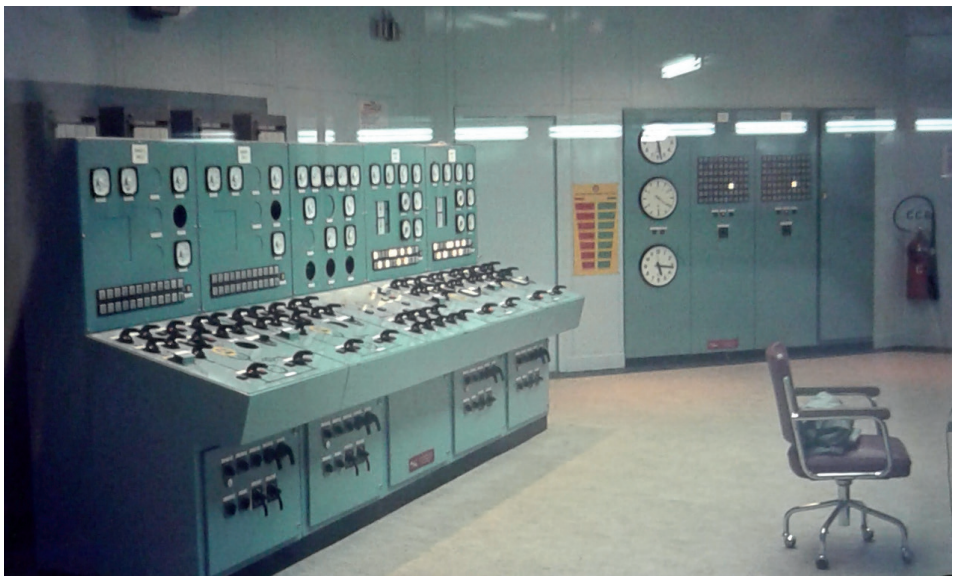
BY: BEV LAWRENCE

As a young engineering student, I applied for a bursary with Eskom and was successfully interviewed by the Chief Engineer and awarded it. Unfortunately, my Alma Mater wasn't as benevolent and denied my further progress, and so I continued studying at the less renowned Technikon. On graduating my sponsor company appointed me as a design engineer, but I felt my opportunities were too limited and decided to obtain the Government Certificate of Competency for engineers, which was a problematic qualification and in much demand. However, my design experience was unacceptable for this, as I needed operational experience with large machinery.

One day I was walking past the Eskom head office in Braamfontein, and on the off-chance wandered in and enquired whether they could help me obtain such experience. I guess our Heavenly Father intervened because within a short time I was being interviewed, and a few days later had a written offer to work as a junior Shift Engineer at the new Camden power station near Ermelo. Well, I learned a great deal about operating huge machinery (hopefully safely!) and 18 months later was accepted to write Part 1 of the "Ticket" exams, which I amazingly passed. Six months later, I faced the very daunting final three exams for Part 2, and was shocked when I received a very unprofessional "Roneoed" letter indicating that I had passed that as well! The next day I proudly showed it to the Station Manager and was promptly summoned to Dr MacRae's office in Braamfontein.

So there I was in the Melhof building at 8 am on a cold winter's Monday morning in 1971, and ushered into the presence of the still young Generation manager. He received me very cordially, and after congratulations offered me the position of Operating Manager at the new Hendrina power station. I was pleasantly surprised, but at only 28 years old felt that I lacked both the experience and confidence to fill that considerable post. He seemed astonished that anyone would refuse his offer. He went on to say that he had just been informed that the new "staff-less" hydro-electric power station at Hendrik Verwoerd dam would indeed require operating staff for six months

The Hendrik Verwoerd dam during construction, with the river stretching across the Karoo towards it source in Lesotho



The Control room at Hendrik Verwoerd power station, where we demonstrated its "hands-free" operation

to commission it and invited me to join him on a flight to see the requirements. I had several questions for him about my future, which he answered with rather drawn-out replies. And he was continually interrupted by phone calls from the station managers reporting on problems at their plants. But eventually, after several hours, I left to return to Camden, but very excited about the exciting development my career was taking.

A couple of days later, I was flown to Oranjekrag with Boss Mac and an older grizzly man, Harry Hollyer, the Operating Resident engineer. The construction site was terrific, and I was quite amazed.

Everyone seemed pleased with me as I was offered the post of Assistant Resident engineer, and we were soon on our way to a lovely house at Oranjekrag.

At first, Harry didn't seem to like me much, but after a few weeks, we got on very well. He was a very competent engineer and a terrific person once I got to know him. He was single and stayed in residence there, and in the mornings fetched me in the Peugeot 404 Eskom provided for his use. One morning he didn't arrive, so I walked over to look for him. The side of the car was seriously damaged, and Harry was snoring on the bed, unwakeable. I got to our site office, but unfortunately, Boss Mac phoned shortly afterwards. "Where's Hollyer?" he asked, rather brusquely. "He's not here sir" I nervously replied. "Where is he? - more brusquely now. "He's sick sir" I lied. "What's wrong with him?" shouted down the phone line! "I don't know sir" I replied. "Well, tell him to phone me as soon as he gets in" – end of conversation. I guess he knew about Harry's periodic binges?

The next time I saw Dr McRae was towards the end of the six month commissioning period. When he came to tell me that Hollyer was moving to SWAWEK in Windhoek, but as the remote operating link from Simmerpan was not yet installed he needed me to stay on for another six months, this time as Resident engineer, with full Factories Act responsibility. This was a wonderful time of my life – the young Manager! I had to attend McRae's monthly meeting with all the power station RE's, so I found myself in a rather august company.

Eventually, the link was commissioned, and McRae flew down with the Chief Inspector of Machinery. The Factories Act required the Employer to have a Competent Person on-site to supervise the plant operation, but Boss Mac thought that if we showed the Chief Inspector how safely the plant could be run on a remote control,

Maree and McRae with the managers in Witbank at one of their quarterly progress review meetings (me at extreme left with rest of Kendal team).

he might relax this requirement. So we duly demonstrated how the operators from Simmerpan could run up a unit and shut it down safely without any involvement from us. Then Boss Mac asked the CI what he thought. "Well It's all BS to me", he replied, "just make sure you've got a man who can get here within 4 hours". So they offered me that position at Vereeniging Area office. Still, I asked instead to be sent to Arnot to understudy the managers there, as I was determined to become a big shot at a big station eventually!

I assisted the Operating Manager, Norman Morrison, for about a year as he seemed grossly over-loaded with many duties. I suggested he ask for a full-time Assistant, but he was too proud, fearing he would be regarded as incompetent. I was then appointed as Deputy PS manager and suggested this to the equally young PS Manager, John Henderson. He liked the idea and raised it with Boss Mac on one of his Site visits.

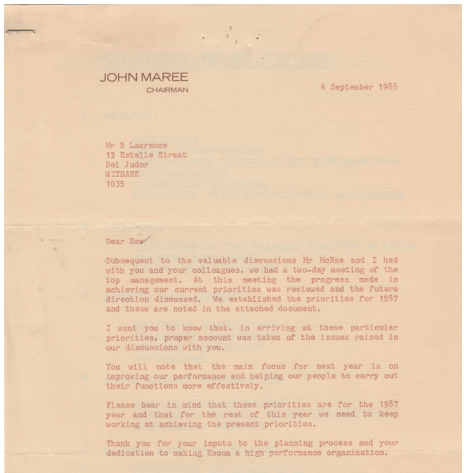
Unfortunately, it wasn't well-received, and we had to drop it. A few months later, on another visit, Boss Mac said "I've got an idea, John, but I don't think you're going to like it. I want you to consider appointing an Assistant manager for your Operating Manager because I believe he is over-loaded." What a surprise! And so that became a standard post at all the bigger stations.

On another visit, I suggested to Mr McRae that we replace the PSM's VW with a Peugeot, as the little grey Beetle gave people the wrong impression of his status within the organisation, and this too he agreed to.
Looking back - it seems incredible that the Generation Manager gave me the opportunity of a lifetime – to be appointed as a senior manager at Eskom's flagship power station at such a young age. It was an incredible act of confidence in my ability and made a massive contribution to my subsequent career. Thank you, Boss Mac!

I saw little of the big man after that until the mid-eighties, shortly after Dr John Maree was appointed Chairman, with Mr MacRae as Chief Executive. They embarked on Quarterly meetings with all the senior and middle managers, in which I was also included. Here we saw and heard these two excellent bosses, and even had ample opportunity to interact with them as they asked for our opinions and ideas. About a third of the managers kept very quiet, another bunch said maybe one thing, and a few more confident ones (like me) said quite a lot. I often put my foot in it too! Like the time I suggested, Eskom executives undergo video coaching before appearing on national TV, like not wearing white shirts. But unknown to me Boss Mac had been interviewed there the previous evening! I was very embarrassed – but he seemed to

take it in good spirit! These meetings were designed to change the Eskom management culture from an autocratic style to a more participative one, and I believe they achieved some success with that, as can be seen in the letter sent personally to each participant.

I next met Boss Mac when he arranged to visit the new Kendal station in the late eighties, where I had been appointed as Technical Manager. We were



JOHN MAREE
CHAIRMAN

4 September 1986

Mr B Lawrence
13 Estelle Street
Del Judor
WITBANK
1035

Dear Bev

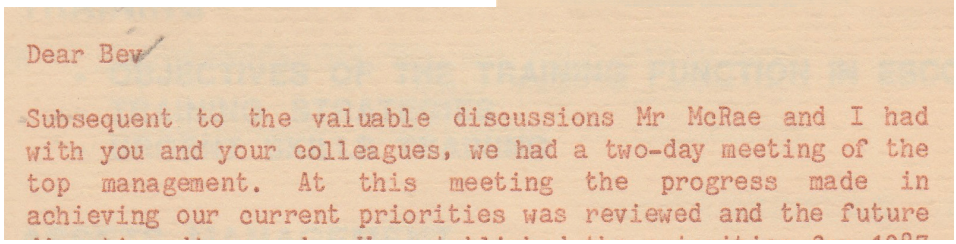
Subsequent to the valuable discussions Mr McRae and I had with you and your colleagues, we had a two-day meeting of the top management. At this meeting the progress made in achieving our current priorities was reviewed and the future direction discussed. We established the priorities for 1987 and these are noted in the attached document.

I want you to know that, in arriving at these particular priorities, proper account was taken of the issues raised in our discussions with you.

You will note that the main focus for next year is on improving our performance and helping our people to carry out their functions more effectively.

Please bear in mind that these priorities are for the 1987 year and that for the rest of this year we need to keep working at achieving the present priorities.

Thank you for your inputs to the planning process and your dedication to making Eskom a high performance organisation.



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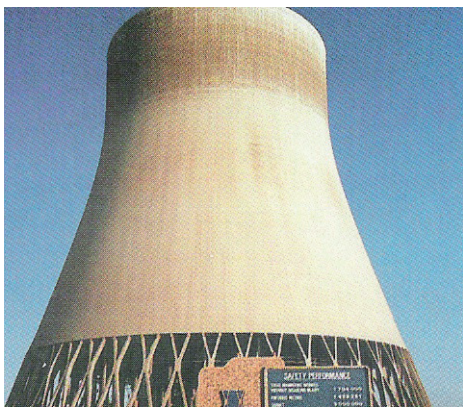
A letter sent from Dr John Maree personally to each participant at their meetings!

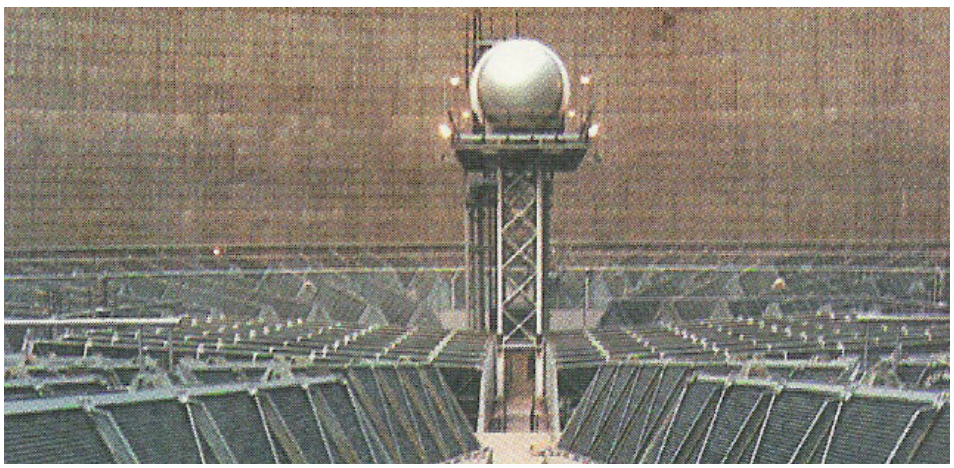
still commissioning the six massive 686MW boiler-turbogenerator units under the leadership of the PSM Peter O'Connor, who wanted to make it an occasion that would stand out from all his visits to other sites. One Boss Mac would remember! So Peter suggested we should devise some unusual or spectacular activities we could present. So we included a concert by the local school choir and a presentation on our planned performance. We anticipated having all six units on load, breaking the world power generated record for a coal-fired station (which we did achieve a couple of years later!). But the highlight for Boss Mac was undoubtedly when he was asked to sign the take-over documentation for the Unit 3 – SEATED INSIDE ONE OF THE MASSIVE COOLING TOWERS!!!

These towers use air as a cooling medium instead of evaporating water as used on earlier stations, saving millions of Megalitres of water, now a scarce resource even in Mpumalanga! It was dry and pleasantly cool inside the tower as the associated turbine wasn't running. It made for a unique situation for the Chief Executive to hold a meeting, and sign the documentation accepting a (now) R20 billion power plant into Eskom service, and I'm sure he did remember the occasion fondly.

My final, personal interaction with Dr McRae occurred years later, when we had both retired – he with an Eskom record of 50 years service! I was starting my own Consulting Engineering business and applied to ECSA for Professional registration. Needing signatures from all my Supervisors to authenticate my application, I asked him to do so for the period I had reported directly to him. So we met at his home, where he tactfully expressed his disapproval of my retiring early and wasting my talents. I hope he would be more impressed when shortly after I secured a contract with Generation division as a consulting engineer, which continued until April this year – 14 years! So thank you, Boss Mac, for your inspired leadership over the many years we were involved. May you Rest in Peace! wn



One of the very large (165m high, 165m base diameter) cooling towers at Kendal, the largest in the world!



The inside of a Kendal cooling tower, showing some of the hundreds of air-cooled radiators

The history of Railway Signalling

I met Peter at the IRSE Annual Convention 2016, held in Beijing, China - during which the IRSE China Section was inaugurated. The impression I got of him was formulated by a lengthy yet technically fascinating conversation we had at the foyer of the Grand Hyatt Beijing Hotel. He had a vast knowledge of the railway discipline, yet he never lacked depth. This impression was fortified when I bought and read his 444-page book: A Chronology of UK Railway Signalling 1825 - 2018. He has reviewed some of my work, I specifically chose him because of his depth, and I would be guaranteed to receive the most technically-sound review.

BY I P.S.P. NKUNA (2020)

Peter Woodbridge is a Chartered Engineer with 39 years of experience in Railway Signalling, mainly in the UK. He is the Technical Authority for Signalling working for one of the railway companies in the UK

Peter's work is, by far, one of the very few and most recent railway history preservatory works that I have come across throughout my railway career, so far. Admittedly, I have read and examined several articles and lectures of prior years; I am yet to see a piece of work that gives a methodically crafted chronology of the evolution of railways as neatly and intentional as Peter's book.

The book does not only capture the historical events that contributed to the development of UK railway signalling as we know it today but he intelligently, whether intentional or not, leaves the reader asking pertinent questions: As railway professionals, how have we constructively evolved the railway system to respond to the

Review of A Chronology of UK Railway Signalling 1825 - 2018, by Peter Woodbridge (2018).

many railway accidents/incidents in our environment? How have we innovated and implemented solutions that contribute to the aversion of safety-related incidents?... Are we mere onlookers, participating only in moderated discussions that perpetuate idle skindering? What will railway professionals living in the year 2211 write of the railway history we have created, today? How are legislative railway authorities doing in entrenching safety and standardisation within the railway industry - are they doing well?

The book gives an account of 193 years of a chronology of significant railway events that shaped legislation, principles and rules of UK railway signalling from 1825 to 2018. This review is befitting, as a good portion of the South African railway was founded on British railway principles, during the early years of the colonial era, during the 1800s. The book, therefore, serves as a relevant reference.

Peter's primary objective for writing this book, (which resonated with my environment) amongst others, emanated from his questioning of the perception that "...the rate of the introduction of new technology into the railway industry was unprecedented." Sam Loveless (2017). Secondary to this, Peter's observation of a significant deterioration of "...the level of knowledge and understanding beyond the bare minimum needed to undertake the actual job was extremely poor" - combined with the isolation of the railway industry from other industries, he decided to include material that

supports the extension of railway knowledge. Peter emphasises that the book does not go into technical details of signalling, but instead addresses its evolution.

Methodically, Peter dissects the 949 entries of the most significant events by topic categories ranging from Accidents and Incidents, Block working - enforcing of following train separation on uni-directional double lines, Brake, Companies, Electrical/ Electronic discoveries and inventions, Interlocking (controls, computer/ solid-state, mechanical lever-frames, relay-based), IRSE History, Legislation - Railway Specific, Miscellaneous Milestones, Operations Control, Points, Power Distribution, Power Signalling (Lever Frames, Panels), Remote Control, Signals, Signalbox, Single Line - enforcing occupation only by a single train on a line used in both directions, Telegraph/Telephone/ Communications, Transmission Based Signalling - Including Automatic Train Operations, Train Detection, Train Describer - including passenger information and Automatic Route Setting, Train Warning & Protection Systems, VDU Train Control.

Peter, through the study of the various incidents related to the different subsystems, makes an argument that railway signalling evolved by accident.

For these incidents, he narrates the detail behind the incidents and links it to the findings and the changes to technology and legislation, as their result.

This approach provides a platform for railway professionals, both academic and practical, to apply the lessons learnt then, to the immediate environments. A summary of a few are presented:

THE INFLUENCE OF ACCIDENTS ON INNOVATION

COMMUNICATION SYSTEMS: 25th August 1861 - London & Brighton Railway, a collision with a reversing train, in the Clayton Tunnel, took place due to the slow information transmission rate of the "speaking telegraph". This communication system was later changed to a "position instrument" - this provided an instant response, always visible, an indication of the state of the line became known as the "block telegraph".

SIGNALLING SYSTEMS: 2nd December 1873 - Menheniot, a head-on collision on a single line led to the introduction of starting signals at each loop on the line. This solution was meant to have addressed or minimised the conflicting verbal miscommunication presented by signalmen at the time. Till this day, we have starting signals at each loop to give movement authorisation.

OPERATIONAL DEFICIENCIES: 7th August 1876 - Somerset & Dorset Railway, facts that were formed after a head-on collision on a single line, revealed the following insight:

- Both the trains that were involved in the head-on collision were not scheduled in the operations timetable and were not supposed to be in the area;
- The accident occurred at a signal box which was not meant to exist;
- Personnel overstretched without adequate resources;
- Personnel who were insufficiently trained and incompetent;
- People expected to work in unsuitable conditions.

The conclusion reached by Captain Tyler was: *"Railway working under such conditions cannot, whatever the system employed, be expected to be carried on without serious accidents".*

Though Peter does not make it clear in any form of conclusion if his primary objective for writing this book was met, the historical evidence presented in the book has brought to light that there are numerous railway events and incidents that have shaped the railways to what we know it to be, today.

The introduction and evolution of railway signalling technologies and railway legislation have, throughout the years, been influenced by these events and incidents. The account thereof does demonstrate that, in no small degree, railway signalling technologies indeed evolved by accident.

Through the study of history and having the ability to learn from it, combined with the willingness to absorb and apply knowledge, any railway system has the capability of functioning at its optimal. This book, when studied for application, offers an opportunity to learn from past events to manage the railway system effectively and would also provide an opportunity for not having to engage in activities that see us repeatedly report on injuries, fatalities and loss of assets without a clear legislative direction.

It would potentially see the railway networks being effectively managed and maintained from both the legislative and operations perspective.

The history narration in the book highlights the critical role of railway regulatory bodies in enforcing standardisation and safety of the railways - these were and still are practically authority-entrenching bodies rather than partaking at a ceremonial level. wn

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SAIEE CALENDAR

OCTOBER 2020

06	**SAIEE Training Academy - Online CPD Course:** Internet of Things Standard & Applications - Day 1
07	**SAIEE Training Academy - Online CPD Course:** Internet of Things Standard & Applications - Day 1
08	**SAIEE Training Academy - Online CPD Course:** SANS 10142 - PART 1 & OHS ACT - Day 1
	69th Bernard Price Memorial Lecture "Leaving a Legacy" Presented by: Roger Price
09	**SAIEE Training Academy - Online CPD Course:** SANS 10142 - PART 1 & OHS ACT - Day 2
12	**SAIEE Training Academy - Online CPD Course:** Planning Strategic Feasibility Studies - Day 1
13	**SAIEE Training Academy - Online CPD Course:** Planning Strategic Feasibility Studies - Day 2
	SAIEE Training Academy - Online CPD Course: Fundamentals for Financial Evaluation of Projects- Day 1
	Rotating Machines Webinar Vibration Measurement and Analysis of Electrical Rotating Machines
14	**SAIEE Training Academy - Online CPD Course:** Planning Strategic Feasibility Studies - Day 3
	SAIEE Training Academy - Online CPD Course: Fundamentals for Financial Evaluation of Projects- Day 2
15	**SAIEE Training Academy - Online CPD Course:** Planning Strategic Feasibility Studies - Day 4
	SAIEE Training Academy - Online CPD Course: Fundamentals for Financial Evaluation of Projects- Day 3
	SAIEE Training Academy - Online CPD Course: Earthing & Lightning Protection - Day 1
16	**SAIEE Training Academy - Online CPD Course:** Earthing & Lightning Protection - Day 2

To organize a webinar on the SAIEE Platform, please complete the **Webinar Booking form**.

OCTOBER 2020 (CONT)

20	**SAIEE Training Academy - Online CPD Course:** Cables Course - CIGRE/ESKOM - Day 1
21	**SAIEE Training Academy - Online CPD Course:** Cables Course - CIGRE/ESKOM - Day 2
	Rotating Machines Webinar Overview of power generation and generator technologies
22	**SAIEE Training Academy - Online CPD Course:** Cables Course - CIGRE/ESKOM - Day 3
	wattnow Tech Talk: Robotics
29	**SAIEE Training Academy - Online CPD Course:** Photovoltaic Solar Systems - Day 1
30	**SAIEE Training Academy - Online CPD Course:** Photovoltaic Solar Systems - Day 2

NOVEMBER 2020

5	**SAIEE Training Academy - Classroom CPD Course:** Photovoltaic Solar Systems - Day 1 - Bloemfontein
6	**SAIEE Training Academy - Classroom CPD Course:** Photovoltaic Solar Systems - Day 2 - Bloemfontein
11	**SAIEE Training Academy - Online CPD Course:** NEC & FIDIC Tendering and contracts for Engineers - Day 1
12	**SAIEE Training Academy - Online CPD Course:** NEC & FIDIC Tendering and contracts for Engineers - Day 2
	SAIEE Training Academy - Online CPD Course: Incident & Investigation & Root Cause Analysis - Day 1
13	**SAIEE Training Academy - Online CPD Course:** Incident & Investigation & Root Cause Analysis - Day 2
17	**SAIEE Training Academy - Online CPD Course:** Design Thinking & Innovation for Engineers - Day 1
18	**SAIEE Training Academy - Online CPD Course:** Design Thinking & Innovation for Engineers - Day 2

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