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SAIEE THE OFFICIAL PUBLICATION OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | JANUARY 2018

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I trust that all our readers enjoyed a relaxing festive season, and for those who travelled on holiday - have returned safely. All the best for 2018.

It's a new year, with new beginnings and new technologies, so I thought it apt to feature what lies ahead for us in this year, technology-wise!

Things change EVERY DAY, and if you do not have your finger on the pulse, you will be left behind - unfortunately.

On page 18, I share with you new technological trends to expect in 2018. I found it quite fascinating, and I hope you do too.

With the amount of air travel world-wide, it is no surprise that techies are working on a low-carbon jet fuel. Read more on page 26.

Traditionally, control of electrical power networks has been a centralised, top down system approach. Not any more! Read the white paper on a Microgrid power solution for Africa on page 30.

With the water crisis in Cape Town, I felt compelled to publish a report from the World Wide Fund for Nature - South Africa, which held a workshop on the "Scenarios for the future water of South Africa". Read more on page 36.

Our Opinion Piece on page 56, provided by Lee Naik, discusses how technology trends drive digital excellence.

Herewith the January issue - enjoy the read!

Visit www.saiee.org.za to answer the questions related to these articles to earn your CPD points.

Since 2006, we have been involved as consulting electrical engineers across a broad spectrum of projects. These include housing estate reticulation, office buildings, warehousing, shopping centres, automobile dealerships, training facilities, and emergency generating systems, to name a few.

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JACOB MACHINJIKE
2017 SAIEE PRESIDENT

To our SAIEE members and the wattnow readers – I trust that you will have a good and productive 2018, full of promise.

Some of you are still taking a hard look at our objectives and targets for the year, and thinking of how to achieve them. In many cases available and emerging technologies will be en-ablers to reach our stated goals.

I turn my thoughts to the theme of this edition of our **watt**now magazine which covers new technologies, and I recall the words of James Comey who said *"Technology has forever changed the world we live in. We are online, in one way or another, all day long. Our phones and computers have become reflections of our personalities, our interests and our identities. They hold much that is important to us."*

Technological developments and applications are making strides in areas that include harnessing new energy sources, smart world technologies, new factories and industries, technological aides, virtual reality, internet of things, big data, data communication, data mining, smart metering and protection systems, just to mention a few. It is interesting to observe how different technologies support and enable each other, the convergence of some technologies and the disruptive nature of others. New inventions become an inspiration for the engineering profession to apply it and to make their products and services better, cheaper, faster and more competitive.

Expert input on protection systems informs that engineering professionals often ask themselves questions on how new technologies could improve their area of engineering practice, or their products and service. The next thing that we see is a numerical relay synchronised by GPS, talking to all relays in the substation via Generic Object-Oriented Substation Event, (GOOSE) messages on station bus, reading sampled values of voltages and currents on process bus, sending command to the remote end via Transmission Control and Internet, TCP/IP protocols and publishing its operation to relevant engineering departments with attached records.

This revolution never ends, and it gained exponential growth in the last few decades. When one looks back about 30 years ago, none of this was technologically possible. Theoretical background, in some cases, was formulated centuries ago, and yet developments in science and applications require that we be vigilant and sensitive to trends, because this will become our technology of tomorrow.

In power system protection engineering, the "protection revolution" has been enabled by, among other things; the rapid developments in computer technology & digitization, and the explosion of Telecommunication systems. Computer technology led to the introduction of numerical relays, optical instrument transformers, digital design of protection and control systems (IEC61850). Digital simulation tools have enabled enormous progress in the achievable precision of studies and analysis as well as understanding of the invisible world of technology.

The rapid development of telecommunication systems has enabled remote protection management, access to relay recordings, implementation of settings and configurations. The "virtual testing" of relay systems has been made possible.

New technological developments have their challenges. In some areas, the drive for innovation has to be controlled, filtered and well tested for responsible and morally defensible solutions. Artificial intelligence (AI) and the disruptive nature of some technologies require to be properly managed.

J Machinjike | SAIEE President 2017
Pr. Eng | FSAIEE

South African Institute of Electrical Engineers

Vacancy: Operations Manager

Closing date: 16 February 2018

The South African Institute of Electrical Engineers (SAIEE) is seeking to appoint an Operations Manager to manage and be responsible for the varied operations and administration of this long standing professional voluntary association.

Ideally the person should be an experienced person with good managerial/administrative experience with an innovative approach to direct and manage the operations of the Institute.

The Operations Manager will report to the SAIEE Chief Executive Officer.

The responsibilities include managing staff of about 10 persons who are engaged in providing secretariat, training and general membership services to ± 7000 electrical and electronics engineering practitioners in South and Southern Africa. The SAIEE have a diverse portfolio of activities, including the Council and Committee meetings of the SAIEE, training courses, publications, conferences and more.

More information can be found on www.saiee.org.za

Working conditions are very good, a modern office block in a secure site with 24-hour security.

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Appropriate Tertiary qualification
Management Diploma or degree is an added advantage

EXPERIENCE

At least three years of Management experience in an appropriate environment
Understanding of the role of SAIEE would be a positive point.

SEND A DETAILED CV TO:

The Chief Executive Officer – SAIEE
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Subject: Operations Manager

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WATTSUP

New Scalable Analytics Platform for Industrial IoT Applications

As connectivity and computing power continues to spread throughout industrial enterprises, the availability of data has revolutionised how companies solve issues and adapt to changes.

But producers continue to be challenged by the complexity of making data useful at the right place and time. They also lack in-house expertise for data management from the device through the cloud.

Rockwell Automation has a stated goal of enabling advanced analytics for manufacturing. Project Scio is the next step along that continuum. To make decisions when and where they matter most, a Project Scio platform reduces hurdles to unleashing information.

The platform opens access to ad-hoc analytics and performs advanced analysis by pulling structured and unstructured data from virtually any existing source in the enterprise. It can also intelligently fuse related data, delivering analytics in intuitive dashboards – called storyboards – that users can share and view. Users then have the ability to perform self-serve drill downs to make better decisions, dramatically reducing the time to value.

"Providing analytics at all levels of the enterprise – on the edge, on-premises or in the cloud – helps users have the ability to gain insights not possible before," said Christo Buys, Business Manager – Control Systems, Sub-Saharan Africa, Rockwell Automation.

"When users gain the ability to fuse multiple data sources and add machine learning, their systems could become more predictive and intelligent. Scio puts analytics to work for everyone. The scalable and open platform gives users secure, persona-based access to all data sources, structured or unstructured. And a configurable, easy-to-use interface means that all users can become self-serving data scientists to solve problems and drive tangible business outcomes."

Pasternack Debuts Quick Connect Attenuators

Pasternack, has released a new line of attenuators for quick mating and easy installation. Typical applications include DAS systems, remote radio heads (RRHs), base stations and antennas.

Pasternack's 23 new quick connect attenuators are available with QMA, QN or 4.3-10 connectors for easy mating. These attenuators support operating frequency ranges from DC to 6 GHz. They boast attenuation values from 0 to 20dB and VSWR as low as 1.15:1. The 4.3-10 attenuator models have power handling up to 15W maximum with low-PIM performance.

These quick connect attenuators eliminate the need for wrench or torque for coupling. They are easy to screw-on and allow for hand-tightening, which improves installation flexibility. *"Our new quick-connect, easy-install line of attenuators further expands our extensive product offerings of RF fixed attenuators. These new attenuators reduce installation time with enhanced electrical performance compared to previous designs. All 23 models are available off-the-shelf with same day shipping,"* said Steven Pong, Product Manager.

Fluke 3-Phase Power Loggers

Comtest is offering the latest Fluke's two 3-phase power loggers, the 1736 and 1738 giving users the data needed to make critical power quality and energy decisions in real-time. They are specifically engineered to conduct energy studies and basic power quality logging, automatically capturing and logging over 500 power quality parameters for more visibility into the data needed to optimize system reliability and savings.

The Fluke 1736 and 1738 are the first three-phase power loggers built with the Fluke Connect® mobile app and software, enabling users to measure, capture and log all relevant characteristics of electric power and enable access to management and analysis of large data sets.

Solar Power for German University in Jordan

Since November, the German Jordanian University in Madaba, south of the capital Amman, has been producing its own solar power.

The 2.11 MW PV plant was installed on Schletter Group roof and carport systems. The project was commissioned by the Jordanian project developer FB Group. *"Projects with universities are always particularly interesting,"* Adnan Daqa, Sales Manager of the Schletter Group for the Middle East, says. *"The installations are not only used for energy generation, but, as in this case they are also integrated into the training of students, to which we are happy to make a contribution."*

During the project with the German Jordanian University (GJU), engineering students were, for instance, given technical training on the project even as it was being set up. Once completed, the plant will also be used for research as well as projects. The photovoltaic system at the GJU in Jordan consists of two roof-mounted and four carport systems distributed throughout the university campus. A total of more than 6,700 solar panels with a combined output of 2.11 MW were installed.

The roof systems are mounted on the Schletter trapezoidal sheet metal systems SingleFIx and IsoTop. A challenge was designing the carport systems. In contrast to the common practice, these had to be adapted to existing parking spaces. For this reason, the systems were individually planned and custom-built to fit exactly.

For structural reasons, the carports had to be particularly lightweight and were therefore made of aluminium. In spite of these specific requirements, the entire project was completed within a short period of time: Three months after the order was placed with the Schletter Group in Kirchdorf, the systems arrived on site in Amman.

The installation was carried out by Firas Balasmeh Corporation (FB-Group), with whom the Schletter Group has already completed several major projects in Jordan. These include projects at two other universities and public institutions, each with a capacity of over 3 MW.

WATTSUP

Protect equipment and productivity levels with flexible and space saving DEHNcord during SA's lightning season

The South African summer season brings with it widespread possibilities of lightning strikes. The massive voltage fluctuations caused by lightning can damage sensitive equipment, as well as cause data loss on computers, servers and storage devices. To combat this, the DEHNcord surge arrester from lightning and surge protection expert, DEHN Africa, offers reliable protection from surges caused by lightning interference, and is flexible and space-saving.

Hano Oelofse, DEHN Africa Technical Director, notes that Type 2 surge arrestors are surge protective devices designed to discharge the currents generated by indirect lightning strikes, and which cause induced or conducted over-voltages on the power distribution network. They are installed in the main distribution switchboard.

He says, *"The DEHNcord Type 2 surge arrester, available in single-pole, two-pole and three-pole versions, can be fitted in installation systems such as the terminal compartments of end loads, cable ducts or flush-mounted systems. The compact design of DEHNcord allows it to be installed wherever the performance of a standard Type 3 surge protective device for terminal equipment reaches its limits. The lighting protection offered by DEHNcord helps to offset the possibility of lost productivity and costs for the repair or replacement of equipment after an unprotected lighting strike."*

DEHNcord therefore ensures surge protection where space is restricted. It can also be used at the transition from lightning protection zone (LPZ) 0B to 1 or higher. DEHNcord meets the requirements of EN / IEC 61643-11. It has a short-circuit current withstand capability Isccr of 25 kArms in case of mains-side overcurrent protection and a total discharge current of 20 kA (8/20 µs).

New ELPA CPD programme for electrical engineers offers earthing and lightning protection training

The Earthing and Lightning Protection Association (ELPA) is launching two very important membership programmes in January 2018. The first membership is the Surge Protection Installers' membership, which will train electricians on the proper selection, installation, placement and coordination of surge protection devices to power supply systems. The second, following popular demand, is ELPA's electrical engineers' membership.

ELPA national director Trevor Manas explains, *"One of ELPA's main goals is to provide a platform for disseminating information, and give clarity on the requirements of the relevant SANS lightning protection standards. It is acknowledged that most electrical engineers have received very little or no training in earthing and lightning protection as part of their tertiary education, with only engineers who do a high voltage post graduate course being exposed to this specialisation.*

However, most consulting electrical engineers are exposed to earthing and lightning protection applications on a daily basis, and they rely on specialist companies to provide solutions. Their lack of knowledge therefore leaves consulting engineers vulnerable to incorrect advice. The education and training of electrical engineers is therefore critical to the upskilling of our industry."

ELPA will offer all electrical engineers

Technology Enthusiast Makes Maths Learning Fun

A mobile phone app, developed by a University of KwaZulu-Natal Computer Science student, is set to make high-quality maths education free and accessible to students from various socio-economic backgrounds.

Open Omnia is a web-based programme which aims to assist students, who struggle with mathematics, to better understand the subject by breaking down the formulae and provide step-by-step illustrations for mathematical equations.

The creator and owner of Open Omnia, Lloyd Gordon from Pietermaritzburg, is working diligently to extend the web-based programme to an app for smart phones and tablets, to enable greater accessibility to a larger group of people, thus benefiting more recipients.

Scheduled for launch in April 2018, the web app is available at openomnia.com.

A student can simply type in a mathematical problem and the service returns a step-by-step solution to the problem. This ensures that students learn how to get to the answer. The programme is available free to students from different walks of life, thereby promoting inclusivity in line with government's radical economic transformation agenda.

"My goal is to grow Open Omnia to the point that it is nationally recognised and for the programme to help larger numbers of students," said Gordon.

He was shortlisted from 198 entries to emerge as the first runner-up in the 2017 Inkunz'isematholeni Youth in Business Competition. The young innovator took home a R50 000 marketing voucher to help market his innovation.

Spearheaded by Ithala Development Finance Corporation, Inkunz'isematholeni attracts youth with innovative and sustainable business concepts and provides incubation and start-up in their journey to becoming seasoned entrepreneurs.

When the competition knocked on the doors of his university, he simply had to participate. The 25-year-old is eagerly awaiting his final year academic results.

"I was most intrigued by the programme and I remember thinking to myself that this is exactly what I have been waiting for," said Gordon.

Lloyd Gordon
Creator & Owner

Amongst others, Gordon counts Jeff Bezos, the CEO of Amazon and world's largest online retailer, as his biggest inspiration.

When asked if he thinks there is enough support for young and aspiring entrepreneurs such as himself in South Africa, Gordon enthusiastically responded: *"Definitely, but as young people we expect things to happen instantly. However, things take time and we just need to keep working while waiting for that big break. I am honoured and grateful to Ithala for believing in my invention and for the financial assistance. I am excited about what the future holds for Open Omnia.*

"In the past, I have heard a lot about how the provincial development agency has helped aspiring and existing entrepreneurs and I am grateful to be given an opportunity to work with them," added Gordon.

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who join ELPA during the launch period of this programme a 50 percent discount on a two-point CPD accredited lightning protection seminar, or a free one-point CPD accredited seminar, which constitutes half of the two-point seminar.

Manas clarifies, *"By joining ELPA, electrical engineers can get the two-point seminar as well as an ELPA membership, with all of its value-added benefits, for less than four thousand rands. This is as compared to the normal price of between six and eight thousand rands for a two-point CPD-seminar."*

The two-point CPD accredited seminar is a 'Comprehensive Approach to Lightning Protection', which covers the SANS 62305 series of standards, Protection Against Lightning. Each part caries a half-point CPD accreditation. Electrical engineers who join ELPA in January or February 2018 are eligible for a 50 percent discount on all four parts of the lightning protection CPD accredited course, therefore gaining two CPD points.

The Comprehensive Approach to Lightning Protection course is offered by ELPA, in cooperation with Lightning Protection Concepts and DEHN Africa. The course provides a comprehensively detailed interpretation of the standard, as well as practical implementation of the standard's requirements. The two-point CPD course is offered through six webinar sessions. Each session will be one hour long and will be held in the late afternoon at about 5pm, with one session being presented per week. The webinars are also recorded and edited so that each webinar can be downloaded and kept for later reference.

For more info, visit www.elpasa.org.za

WATTSUP

Schneider Electric Introduces New Services to Modernize PLC Operations

Schneider Electric, the leader in digital transformation of energy management and automation, launched a new service that will help industrial manufacturers modernize their programmable logic control (PLC) systems easily, safely and more cost effectively, sometimes in less than one hour. By reducing downtime and disruption to the operation, the service provides an easier migration to the company's Modicon™ M580 programmable automation controllers. With built-in Ethernet capability and best-in-class processing power and memory, the Modicon M580 ePAC is the only PLC that can enable 100 percent ROI within three months for hybrid applications.

"Upgrading older or obsolete PLC systems is proven to increase the safety, efficiency, reliability and, especially, profitability of our customers' hybrid and process operations," said Nathalie Marcotte, senior vice president, Industry Services, Schneider Electric. *"Our PLC modernization service helps manufacturers quickly and efficiently leverage Schneider Electric's value-focused IIoT technology and expertise to gain better insight into their industrial operations. Upgrading to the Modicon M580 ePAC will empower their workforce to make better, more accurate business decisions at the right time, which enables them to drive measurable improvements to their operational profitability, safely and sustainably."*

The seamless migration combines a Unity M580 application converter with a migration expert configuration utility tool, which identifies operational gaps and provides recommendations to solve each customer's unique systems challenges. This combination enables customers to easily convert Unity software applications on both Quantum and Premium platforms to be compatible with the M580, while providing the option to produce a pre-engineering proposal for the new M580 I/O. A quick wiring system for the TSX Premium processor allows upgrades to be completed in less than one hour.

"Today's pace of business, especially in manufacturing, requires technology built for faster, more connected operations. Many of our customers are relying on older, inefficient PLCs that are less reliable, have a higher total cost of ownership and leave operations vulnerable to new and emerging threats," said Marcotte.

Massive Motors Installed By M&C At Cobre Panama

Marthinusen & Coutts, a division of ACTOM, recently executed the sub-assembly of six gearless mill drives for Minera Panamá's remotely situated Cobre Panamá project in record time, and as a result was able to hand the machine over to the mechanical teams for professional assembly well ahead of schedule.

Minera Panamá, the Panamanian subsidiary of First Quantum Minerals, is currently developing the Cobre Panamá project, located in Colón province. The mine life has been estimated at more than 30 years and will produce around 300,000 t/y copper, 100,000 oz/y gold and 2,500 t/y molybdenum.

Marthinusen & Coutts has a proven track record partnering with customers on similar complex projects, while still being able to offer a cost competitive solution. Significantly, this leading repairer of rotating machinery has an established reputation as an expert in gearless mill drive refurbishment, winding termination and testing of motor segments.

Projects previously successfully completed by the division include the installation of six Siemens gearless mill drives at various mines in north west Zambia.

Of the six ABB gearless mill drives being installed at Cobre Panamá, four will power ball mills and the other two will drive SAG mills. Importantly, these massive machines are among the largest ever installed in the world and were transported in quartered sections to site for assembly in-situ.

The sheer size of the machines, with inside diameter of 14 metres, presented challenges of its own with each segment weighing approximately 80 t. Work was done on four different positions on the machines simultaneously, 3 o'clock, 6 o'clock, 9 o'clock and 12 o'clock.

Commenting on the role that Marthinusen & Coutts played in this project, Divisional CEO Richard Botton says that a team of six highly competent and skilled technicians was responsible for the completion of the project within extremely tight time schedules. Work on the machines was performed back-to-back and this was accomplished using induction brazing equipment, and a bar wound winding with separate upper and lower stator bars, as opposed to set diamond lap-wound, formed type coils.

Get Wise About Using Variable Speed Drives

The benefits of Variable Speed Drives (VSDs) are making this technology a popular choice among users of electric motors; now, with the introduction of the WEG Insulation System Evolution (WISE®) to all WEG motor lines, customers have full assurance that all WEG motors are VSD-compatible.

"Not all standard electric motors are suitable to be used with VSDs," says Fanie Steyn, Manager Rotating Machines at Zest WEG Group. *"The motor insulation systems are susceptible to insulation damage caused by the harsh switching frequencies and voltage peaks generated by VSDs."*

Steyn explains that VSDs use power transistors – typically insulated-gate bipolar transistors or IGBTs – for the switching process. To achieve the high frequencies necessary for switching, the transistors have to turn 'on' and 'off' to conduct current repeatedly at high speeds. This results in voltage pulses with a high dV/dt, or rate of voltage change over time.

"When squirrel cage electric motors are fed by these high frequencies, the voltage pulses – combined with the cable and motor impedances – may cause repetitive conditions of over voltage or voltage overshoots at the motor connection terminals," he says. *"This may degrade the motor insulation system and reduce the motor's useful lifespan."*

To ensure that this does not occur in WEG motors, the WISE® insulation system has been developed through the use of enhanced materials in the production of the motor insulation. These materials include VSD compatible wire, insulation film, impregnation material and suitable cables.

WEG has also specially developed its LackTherm varnishes for the insulation systems of its electric motors, which are applied to the 99,9% pure copper wire during the enamelling process. These LackTherm varnishes have excellent dielectric strength, flexibility, hardness and chemical resistance, as well as strong adhesion properties.

During the impregnation process, the stator coils receive layers of high solid resins and water based coatings which are environmentally friendly and free from harmful solvents – as required by the ISO 14000 guidelines.

"This process allows any WEG motors to be used with VSDs, as the WISE® insulation system ensures that the motor windings are protected against voltage peaks and voltage variations," says Steyn.

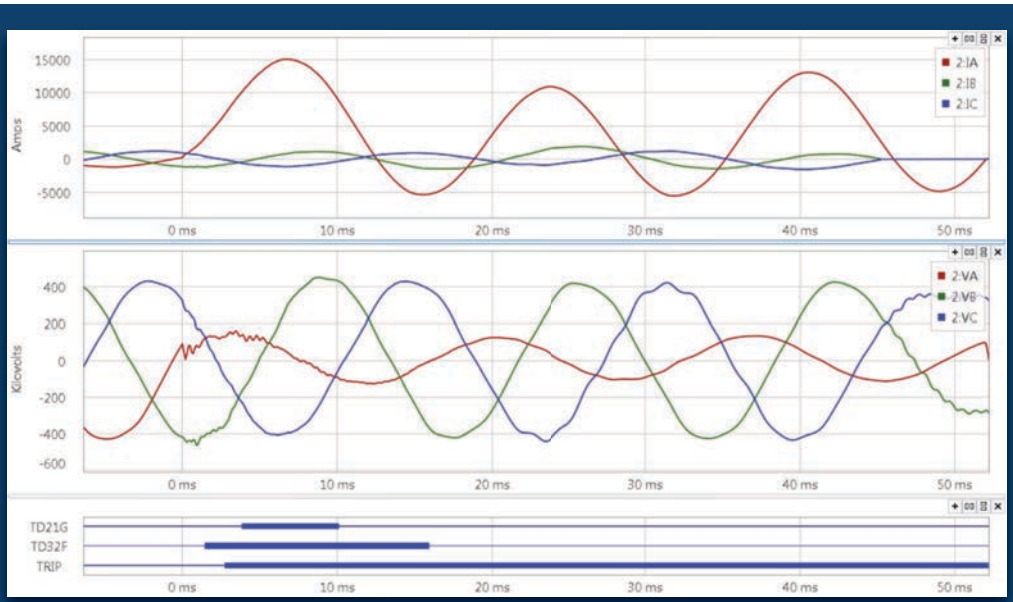
"The depth of experience and technical competence within our team proved vital to the successful completion of the work, especially given the various challenges encountered on a daily basis," he says. "The average execution per machine took just 28 days."

Another major challenge that the team had to contend with was the adverse weather conditions at the location. This region receives between five and seven metres of rain per year, with ambient temperatures often exceeding 35 degrees C and humidity levels above 80% on a daily basis.

Botton says that working closely with the OEM – ABB – on this project, was also vital to its success. He pointed out that it is not unusual for Marthinusen & Coutts to partner with OEMs on projects such as this.

The Marthinusen & Coutts team that successfully executed the sub-assembly of the six gearless mill drives.
Back from left: Wesley Ludeman, Assistant Winder; Chico Bernades, Field Service Technician; Shepard Chigmwa, Senior Winder and Keith van den Heever, Assistant Winder. Front from left: Rico Coertze, Assistant Winder and Wynand Willemse, Senior Field Service Technician.

Ultra-High-Speed Transmission Line Relay Traveling-Wave Fault Locator High-Resolution Event Recorder



Shown here is the performance of the SEL-T400L for an phase A to ground fault on a 500 kV series-compensated line. The SEL-T400L issued a TRIP command to open the breaker in 2.8 ms; this is 6 times faster than present day phasor-based protective relays.

Schweitzer Engineering Laboratories (SEL) released the SEL-T400L Time-Domain Line Protection—the world's first traveling-wave microprocessor-based relay. It detects power system faults and sends a trip signal to breakers 4 to 10 times faster than present-day phasor-based relays, offering ultra-high-speed and secure protection of critical transmission lines.

"We are protecting energy moving at the speed of light. The T400L is like moving from a car to a jet!" said SEL President Dr. Edmund O. Schweitzer, III. *"Time-domain-based protection is the future, and this is the most important thing SEL has done since releasing the first digital relay in 1984."*

Using a combination of traveling-wave (TW) and incremental-quantity protection technologies, the SEL-T400L is the fastest protective relay on the market. Faster tripping times mean improved safety, less damage to equipment, improved system stability, and better power quality.

"We designed the SEL-T400L to complement traditional line relays while dramatically reducing trip times of the complete redundant protection system. It's a quantum leap in line protection performance," said Dr. Bogdan Kasztenny, SEL R&D. *"Plus, it locates faults to an exact tower, and with 1 MHz recording, it gives you new eyes into your power system."*

Many utilities across the world have installed SEL-T400L relays to evaluate the performance of the protection, fault location, and recording functions.

The SEL-T400L, with its TW-based fault locating function, provides exceptional accuracy, and the fault location result is available before the fault is even cleared. This unique performance of the fault locator enables control applications using fault location value, like adaptive autoreclosing on hybrid (combination of overhead and underground) transmission lines. Shown here is the performance of the single-end TW fault locator on a 400 kV series-compensated line using a Bewley lattice diagram. The SEL-T400L located the fault at 135.03 km and the line patrol found the damaged insulator at 135.00 km.

For additional technical information on the protection and fault location principles used in the, please visit: https://selinc.com/products/T400L/#tab-literature

Discover the World's Fastest Transmission Line Relay

As the first traveling-wave microprocessor-based relay, the SEL-T400L Time-Domain Line Protection trips four times faster than present-day relays and with unmatched selectivity and security. Through the combination of traveling-wave and incremental quantity protection technologies, faults are cleared faster and you get improved safety, better power system stability, and preserved equipment life. And with just a handful of settings, the SEL-T400L is easy to learn, easy to set, easy to apply.

SEL-T400L Time-Domain Line Protection

This is transmission line protection, redefined.

To learn more, visit **www.selinc.com/AfricaT400L**.

SEL

High tech innovation breakthroughs

Bureau Veritas, the global leader in Testing, Inspection and Certification, recently unveiled more transformative and innovative professional solutions and services, further assisting clients to meet the growing challenges of quality, health & safety, environmental protection and social responsibility.

With a strong brand built up over 190 years, Bureau Veritas operates across six global businesses; Marine & Offshore, Agri Food & Commodities, Consumer Products, Building & Infrastructure, Certification & Industry.

New and improved service offerings were announced from various divisions within Bureau Veritas, ensuring the company delivers the highest levels of service to its customers.

COMMODITIES

The Oil & Petrochemicals activity, led by Mr Erick Naidoo in Southern Africa, announced a recent change in the internationally renowned online cloud-based reporting platform, Lube Oil Analysis Management System (LOAMS), based on feedback from clients dispersed across the globe, optimizing productivity and improving maintenance, while reducing product waste and reducing pressure on the environment.

The Metals & Minerals activity, led by Mr Gavin Hefer in Southern Africa, announced a new test offering, Transportable Moisture Limits (TML). TML, is fast becoming a global requirement, refers to the maximum moisture content permissible for the cargo of any ship that is considered safe for transportation. The cargo can liquefy, affecting the center of gravity and stability of the ship which can result in a safety and environmental concern. The company previously offered the service outside of South Africa, and recently obtained approval from the Global Technical Governance regulator to conduct the tests locally at the Richards Bay laboratory across all three methods; Flow Table, Penetration Test and Proctor Fragerberg Test. Turnaround times are now much quicker and rates are more competitive in the local market.

The Agri-Food activity, led by Ms Joanne Barton in Southern Africa, announced the unveiling of a highly innovative and high tech automated laboratory in Cape Town, thereby extending the Bureau Veritas network and footprint in Africa. New equipment introduced for testing of pesticide chemicals ensures latest legislation in South Africa can be reported on quicker with a high spec result. Food safety remains a key priority, with the laboratory geared for sudden and quick responses required for retailers and suppliers; like the current Listeria outbreak where identification and quarantine of products needs to be managed quickly and effectively.

INDUSTRY

The Industry activity, led by Mr Eric van der Linde in Southern Africa, announced that Bureau Veritas has launched various measures to better manage asset integrity management data on behalf of clients. Using advanced analytics, data can be interrogated and assimilated more effectively thereby assisting engineers

Bureau Veritas held a press briefing at the Saxon Hotel in Johannesburg on 18th January to share new innovations and technologies.

when making decisions regarding asset integrity and asset optimization; increasing efficiency, lowering operational costs and increasing profits.

CERTIFICATION

The Certification activity, led by Ms Neda Taghadosi in Southern Africa, announced the revision of various certifications: the Quality Management system ISO 9001, the Environmental Management system ISO 14001 and the Health and Safety Management system ISO 45001. Language is simpler and requirements are less directive, ensuring they can easily be integrated into clients' current management systems due to the High Level Structure nature of the system. Risk Management is also improved, ensuring customer satisfaction and improved environmental impact management. Clients are poised to benefit from sets of technical documents providing guidance on the standards and its requisites through the website www.lead.bureauveritas.com. Training courses, online self-assessment tools and transition packs have been designed to make the transition smooth, quick and efficient.

The Zambian operations, led by CEO Mr Alex Ehui announced the launch of the instrument-based Vehicle Inspection Service, bringing improved reliability and safety to load vetting. Benefiting Fleet Management clients requiring hazard control, this improvement will ensure cost and time saving efforts. Furthermore, Bureau Veritas is encouraging clients to invest in the Verification of Conformity asset, which is useful for authorities to protect citizens from counterfeit importations.

GOVERNMENT SERVICES & INTERNATIONAL TRADE

Spearheaded by Grace Mabasa, the division presented various reformed solutions for government clients through adopting and introducing various technologies which ensure improved service delivery. Inspection testing is now done electronically and in real-time, thereby improving the quality of reports, delivery periods, productivity and efficiency. The introduction of E-cert, or electronic certificates, ensures enhanced security features for clients.

Commenting at the announcement, Senior VP – Africa Region and President of Government Services and International Trade (GSIT), Mr Marc Roussel said: *"Bureau Veritas is committed to the African Continent and continues to show confidence in the regions. We have invested in our infrastructure and footprint to further enhance our offerings in support of our customers' success. It is our vision for Southern Africa to constantly exceed our client expectations through world class professionalism from a diverse and highly motivated team. We are committed to local legislation and are poised to roll out social corporate responsibility initiatives that will further improve the lives of others. We continue to develop and engineer new solutions in support of our clients' wide range of needs. We also continue to progress with the Bureau Veritas strategic plan in support of our global organization. We are excited about 2018 as we see our businesses gain momentum in Southern Africa and the Continent."* wn

2018 Top Tech Trends

With technology changing EVERY DAY, we have to stay abreast of the latest developments, and gear up for what's to happen! We take a look at what to expect for 2018. Hold on to your seats....

BY | MINX AVRABOS

Technology has never advanced faster, with the global adoption of smartphones, self-learning and agile robots, affordable genome sequencing, and ubiquitous data storage. There have been impressive advances so far in the 21st century.

Though some of the current innovations, such as 600 mph hyperloops, fully-autonomous vehicles, and artificial intelligence, are in the prototype stage, they're evidence higher quality devices, faster test times, more reliable networking, and almost instantaneous computing are quickly becoming reality.

It's just as important to think critically about where we're headed, and how we'll get there, as it is to consider the expected benefits.

TECHNOLOGY

The NI Trend Watch examines topics such as the mass deployment of the Industrial Internet of Things (IIoT), machine learning, and upcoming challenges in testing increasingly connected and electrified systems. The following is a summary of the five trends to watch in 2018.

SUCCESSFULLY MANAGE IIOT EFFORTS

Accenture estimates that 95% of companies will adopt the IIoT in the next three years to maximize uptime, optimize performance, and drive product and process innovation. In other words, implementing the IIoT is no longer about getting ahead; it's about not being left behind. Now, smart and connected "things" give companies opportunities for increased performance and lower costs, but managing these distributed systems is often an overlooked challenge.

CFE MEDIA

Companies across all industries are adopting a new breed of disruptive platforms and ecosystems that will transform businesses into engines of innovation and growth by taking advantage of intelligent technologies.

With IIoT technologies, they can harness the benefits of these state-of-the-art platforms to ultimately reduce maintenance costs and improve asset utilization. To successfully manage an IIoT strategy, companies must manage data, software configuration, and remote systems.

5G SET TO DISRUPT TEST PROCESSES

5G signifies a generational transformation that will profoundly impact businesses and consumers globally. It promises an experience that many consumers are hungry for: faster data, shorter

network response times (lower latency), instant access anywhere and everywhere, and the capacity for billions of devices. Though test and measurement solutions will be key in the commercialization cycle, 5G is set to disrupt test processes because it requires a different approach to test than previous generations of wireless technologies. A platform-based approach that is flexible and software-configurable will be essential to the development of this ecosystem.

BREAKING MOORE'S LAW

Recent publications say Moore's Law (the observation that the number of transistors on an integrated circuit doubles about every two years) is dead. Though it may be experiencing some health challenges, it's not time to start digging the grave for the semiconductor and electronics market yet.

New computing techniques and new applications for existing technology continue to advance the capabilities for high-speed input/output (I/O) and processing. As previous architectural leaps, such as multicore processors, have shown, the keys to riding the wave are the software tools and frameworks that leverage the diversifying computing elements.

VEHICLE ELECTRIFICATION

Ten years ago, a fully-mechanical coupling between the steering wheel and the front wheels was common. However, the explosion of drive-by-wire technology, combined with government mandates toward fully electric powertrains, has changed this paradigm—and it impacts more than just the automotive industry.

The reliance on power electronics and electric motor drives adds complexity to control systems, and combining these control systems makes that complexity grow exponentially. Directly, these factors increase the complexity of vehicles. Indirectly, they create an immediate need for growth in infrastructure. Making it happen requires an interdisciplinary approach to building safe and reliable control systems among other needs.

AUTOMATING ENGINEERING

Machine learning already has delivered beneficial results in certain niches, but it has potential for a bigger and longer lasting impact because of the demand for broad insights and efficiencies across industries.

As machine learning applications migrate from the consumer space alongside development platforms and converging IIoT edge node technology, business leaders are looking to engineers and the next wave of machine learning to help find uptime, yield, and efficiency improvements in a sea of analog Big Data.

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As these advancements become a reality, it's important to keep pace with how these developments will make an impact across many industries.

ARTIFICIAL INTELLIGENCE

In his 2017 forecast, Scott Zoldi, a top analyst for the world-leading big data analytics, artificial intelligence and cyber security company, FICO (Fair Isaac Corporation), suggested that we were *"just at the beginning of the golden age of analytics, in which the value and contributions of AI (Artificial intelligence), machine learning (ML) and deep learning will only grow as we accept and incorporate these tools into our businesses."*

As it happens, AI, ML and deep learning did not just grow up during 2017... They blew up.

And now as 2018 swiftly kicks off, the development and use of these technologies will continue to expand and flourish at an incredible pace. In so many ways, it's hard to quantify the expected results of such innovations as there can be many different interpretations of each, but this is where we believe the most significant impact will be felt in terms of artificial intelligence in 2018:

AI WILL LEARN HOW TO FIGHT BACK

In 2018, Defensive AI will be front and centre. We've long talked about how machine learning and AI will help companies to drive differentiation in competitive markets. This applies in the criminal world too, where attackers will use malicious AI and ML to circumvent the ones companies have in place. This arms race, in which criminals arm themselves with "adversarial machine learning," tops McAfee's 2018 security forecast.

Last year, Scott wrote about FICO's patent-pending Defensive AI technology, which will usher in systems that will seed their outputs with "faint signatures" to mislead, confuse or identify the attackers learning the AI system's response.

AI WILL HAVE TO EXPLAIN ITSELF

Explainable AI (XAI) will begin to answer the need for explanations for decisions based on scores, including those produced by AI and ML systems. We've long dealt with this challenge in fraud and credit risk decisioning, but in using ML across multiple industries, there are entire sets of proposed explanatory algorithms which are either right, ineffective or flat wrong. I look forward to these advancements as it is imperative for companies to be able to correctly explain the decisioning processes of their AI and ML systems.

AI WILL AUGMENT US

The idea that Artificial Intelligence and humans will play nice together, rather than battling it out in a Terminator scenario, is not new.

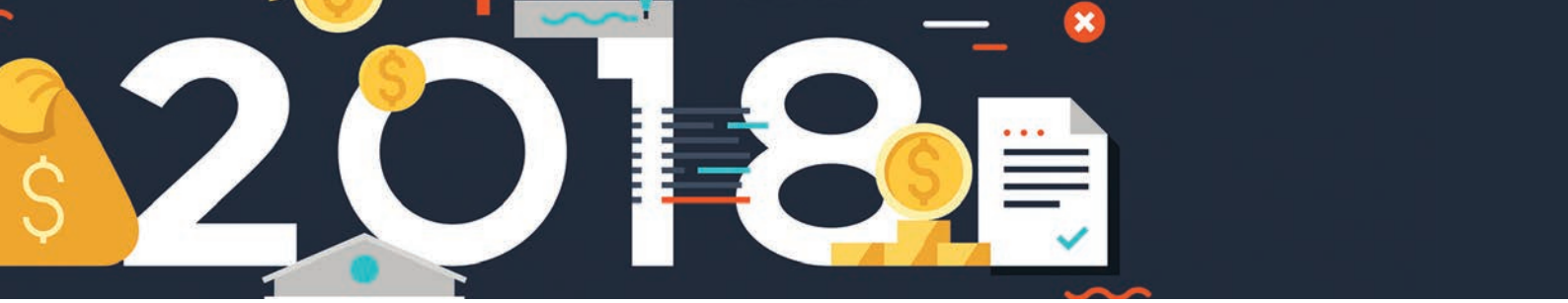
In 2018 however, AI will augment much more of the work place. Not just through better software, but through the facilitation of increasingly better versions of ourselves.

Whether it's drawing the information together for us to be superhuman at investigation, data recall, or improving how we learn new topics, AI will augment our ability to process new information. The question will be as to whether our human brains will atrophy, improve, or simply evolve to the rate and frequency of data.

AI GETS OPERATIONALISED

More than 25 years after Artificial Intelligence/Machine Learning first gained widespread use in fighting payment card fraud, the idea of using AI properly (extensively), still poses a tremendous challenge for many organisations.

Those that focus first on how to use, care, and feed their AI systems and machine learning, have been sufficiently rewarded. Far more than those that are enamored with new algorithms or increases in computation complexity, which often require more Cloud and more GPU. I believe that in 2018, companies will focus on operationalising AI, particularly in the cloud, to more easily build, refine, deploy and enhance machine learning environments.



CHATBOTS WILL GET BETTER AT UNDERSTANDING — AND MANIPULATING US

In many aspects of society, it is becoming difficult to determine what is human versus a robot; organically occurring versus automated; and real versus fake. (This reminds me of the old advertising adage: "It's what's inside that counts").

In 2018 chatbots will rapidly become more sophisticated, dramatically reducing costs of routine customer care activities while also improving the customer experience. In the coming year, chatbots will quickly understand the tone, content and predicted highest-value conversational paths to meet various objectives. On the dark side, this subtle "engagement" can turn to manipulation through AI that learns the magic words to sway our attitude, actions and possibly elicit en masse reactions.

For now, at least, I'll still go for the real human on the other end of my iPhone.

AI WILL COMBINE WITH BLOCKCHAIN

Beyond its association with cryptocurrencies, blockchain technology will soon record "time chains of events," as applied to contracts, interactions and occurrences. In these "time chains," people and the items they interact with will have encrypted identities. The blockchain distributed will be the single source of truth, allowing audit trails of data usage in models - particularly in data permission rights. Think of the latest vehicle-leasing innovation that is set to hit South Africa in the very near future: You walk up to a car, parked in a secured public bay, which you have been pre-approved to lease for the afternoon. Insurance contracts are attached to this car's blockchain. The car itself also has a history of past drivers, events, and maintenance that is codified. And as you drive through the city, you interact with toll roads and parking spaces, all automatically recorded and monitored on the blockchain. When you leave the car at your desired destination, your lease is completed and becomes auditable on the chain – with all the necessary information in place, including whether you locked the car's door or not.

Data event chains will create new opportunities for graph analytics, and novel new AI algorithms for the consumption of relationship data at scale.

In 2018, we will see new analytics around relationship epochs… Think of your daily interactions at work for example. Most days are relatively routine, but sometimes chains of events occur that have meaning, such as AML activity, bust out fraud, suicide prevention opportunities, and many others.

Understanding these webs of relationships of events will certainly add more insight. Analytics like these will feature scoring based on shifting chains and graphs. Their webs of interaction will thus hold tremendous predictive power.

GREEN TECH

In 2017, clean power gathered unprecedented momentum. Multiple automakers launched entire families of Electric Venicles (EVs), including the most exciting one yet, Tesla's Model 3. The company also started pre-orders for the Solar Roof, a type of home photovoltaic panel that will make solar panel installations less ugly.

With climate change problems mounting, national and local governments are pushing for more renewable energy and an end to fossil-fueled cars - despite hostile moves in those areas by US President Donald Trump. Elected officials and the public want fewer gas-powered vehicles and coal plants, and more EVs, solar panels and wind turbines. That will ultimately benefit your health, wallet and environment, and you'll be less reliant on large energy and oil corporations, to boot.

With the expectations of consumers, companies and governments all getting higher, 2018 has a lot to deliver. There are key deadlines, especially on Tesla's part, and if companies miss them, green buyers could go from exuberant to depressed. Here's what to expect on the consumer side for EVs, clean home power, battery storage backup, and more.

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POLITICS IS CHANGING HOW YOU'LL DRIVE AND LIVE

A car-free day in Paris, which will be banning fossil-fuel vehicles by 2030.

President Trump opted America out of the Paris climate agreement, and he and many of the Republicans who control Congress have pushed coal and oil instead of clean energy. This is despite increasing concern in the scientific community that atmospheric CO_2 levels are reaching the point of no return.

The rest of the world, however, is moving forward. France, for one, created the "*Make our Planet Great Again*" initiative as counter-programming to Trump. That nation and the UK will also ban fossil-fueled cars completely by 2040. That's admittedly pretty far in the future, but France's notoriously polluted capital, Paris, has declared that gas- and diesel-burning cars will be banned much sooner, starting in 2030.

Elsewhere, China installed a record number of wind and solar energy projects in 2017 to curb its own smog issues, and has even bigger plans for 2018 and beyond. The nation wants 20 percent of its power to come from solar or wind by 2030, and to invest around $560 billion by 2020, creating 13 million jobs in the process. As China is now the world's biggest polluter, this will not only mitigate global CO_2 levels, but make green tech cheaper around the world.

These governmental actions aren't just bluster - they're already having a potential impact on your life. Many of the big car brands, including Mercedes, Honda, GM and Volkswagen, sell cars worldwide, and a lot of countries are forcing manufacturers to produce more efficient vehicles. That will have a big impact on how vehicles are built and sold in the US, regardless of who's in power.

In 2018, you'll have more choice than ever for green transportation as plug-in-hybrid choices expand and EVs become ever more mainstream. Whereas before Tesla was the only game in town for long-range electric transport, you can now choose a Chevy Bolt, Nissan Leaf or, if you're in Europe, a Renault Zoe. Next year there will be even more choices as cars like the VW e-Golf and the Jaguar i-Pace arrive.

Meanwhile, home solar panels are getting cheaper as the technology gets incrementally better each year, pushed by the manufacture of gigawatt-size installations around the world.

At the same time, the prices for home battery packs to back up said panels are also falling, as they're being manufactured on a large scale for both EVs and power backup systems like the one Tesla just finished in Australia.

What that means for you is that solar panel installations for your roof have dropped nearly a quarter in price over the past few years, and batteries are becoming a realistic option for more folks.

However, politics could again hamstring progress. The FTC may introduce new tariffs on Chinese solar panel imports, effectively raising prices across the industry. At the same time, the government is weighing whether to get rid of the $7,500 federal EV tax credit (at the moment, it looks safe), which would have a devastating impact on sales next year and beyond.

ELECTRIC, HYDROGEN AND HYBRID VEHICLES

Tesla started delivering the Model 3 in July 2017 to the nearly 400,000 people who ordered one. At that time, Elon Musk promised to build around 1,500 in September, 20,000 in December 2017, and up to 10,000 a week later in 2018. Suffice to say, that didn't happen - not even close. By the beginning of October, the company had produced just 260 cars, reportedly because of Gigafactory battery production issues and other problems.

Things have picked up since, with large numbers of Model 3s reportedly spotted at delivery centers. On top of that, suppliers recently reported that Tesla has increased

its demand for parts for up to 5,000 vehicles per week. If Tesla holds to that, it will just be a month or two behind its original schedule. Still, last quarter it produced a record 25,336 vehicles over three months (mostly Model S and Model X EVs), so 20,000 Model 3s in a single month would be a big leap.

Lucky for us, other manufacturers will be selling other new or updated EVs next year, including Chevy, Nissan, Jaguar and Audi.

Here's the best of what you'll be able to buy this year:

Chevy Bolt

Chevy wants to sell about 30,000 Bolts a year and, after some early stumbles, it's getting on track. Last month it sold nearly 3,000, and that will likely build to more than 20,000 by the end of 2017.

While it's not the sexiest of EVs, Engadget and most other reviewers really, really like the Bolt. That's because it's a fun, sporty and spacious little car that can go farther than you'd expect on a charge (up to 380 kilometers, to be exact).

For 2018, the vehicle will be largely unchanged, but it remains an excellent option.

Nissan Leaf

The 2018 Leaf may not have quite the range of a Bolt or a Tesla Model 3, but it's cheaper and can still go around 240 kms, enough for a decent mid-range trip. And having launched the Leaf in 2010, Nissan knows how to build electric cars.

For buyers next year, there's a bonus: its Pro Pilot driver assist is now here.

BMW i3

If you have more cash to spend, BMW's R750 000 i3 combines futuristic styling with the sporty fun you'd expect from the automaker. This year, a new range extender brought the maximum trip on a charge to 140 kms, enough for comfortable city driving or short trips. In 2018, it's bringing a Sport version with quicker acceleration and, more importantly, the new TurboCord EV Charger, with faster charging if you hook it up to a 240-volt power supply.

Volkswagen e-Golf

VW has been talking a lot about its I.D. electric vehicles, including the Buzz and the Crozz, but those won't be built until 2020 at the earliest. If you want a real, if somewhat boring, EV from VW in 2018, the e-Golf will be it. Next year's model will reportedly have a realistic 300-km range, making it a much more practical car than this year's model, which goes around 200 kms.

Jaguar's I-Pace

Jaguar might not top your list of affordable EVs, but if you're well-off enough to be considering a Model X or S, the I-Pace will give you something to think about next year. It will have a 90kWh battery, a 400-horsepower motor and killer looks, judging by the concept. There's no price yet, but knowing that it's Jaguar, you can expect something in the six-figure region.

Audi E-Tron Quattro

Audi opened up pre-orders to the E-Tron Quattro this year, but there was a big caveat: You had to be living in Norway. Nevertheless, the automaker plans to start selling it in 2018, probably in Europe only, but it should introduce the vehicle in the US toward the beginning of 2019. With a 95kWh battery pack, it'll reach up to

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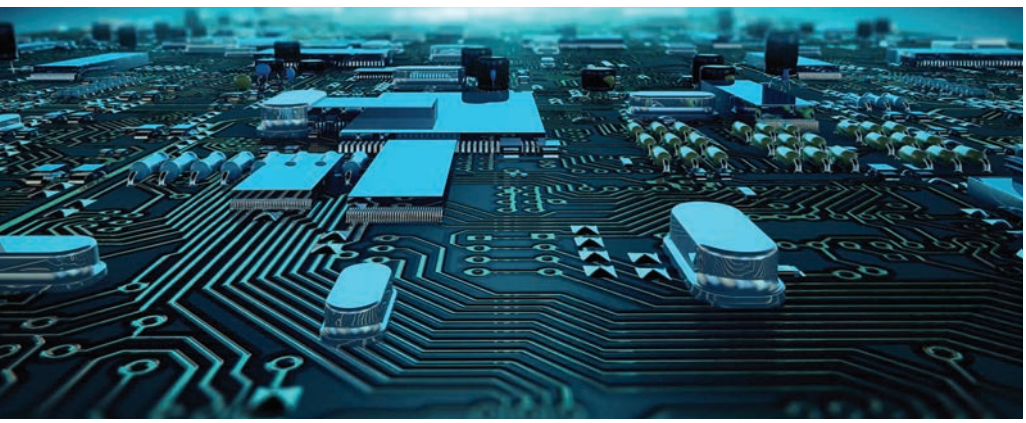

335 kms on a charge, giving Tesla - and, soon, Jaguar - a run for their money.

SOLAR POWER

Tesla is also one of the most interesting consumer solar power companies for 2017. It launched its Solar Roof in late 2016, providing an option for homeowners who want solar-powered homes but not ugly solar panels. If you're building a new home or replacing your roof anyway, the solar tiles compare favorably with pricey roofing options like slate or cedar shingles.

Customer deliveries only recently started (delays with Tesla are obviously a thing), but by next year the company should be building enough to fulfill all of its orders.

Panasonic has reportedly also started building its high-efficiency, low-profile solar panels for Tesla at the Gigafactory 2, in Buffalo. Those will sell in limited numbers next year, but reportedly won't reach peak capacity until 2019.

In a new wrinkle on the sharing economy, so-called blockchain microgrids could bring solar power to the masses. A company called LO3 Energy promises to let communities buy and sell solar power generated locally, using Bitcoin-like blockchain tech to track transactions. The system works on any size solar installation, from hundreds of homes to just two. If solar power could be shared among multiple homes or businesses, it would become a lot more affordable.

Sunpower is another company to watch. It launched a new type of panel that uses a technique called "shingling" to fit more photovoltaic cells into the same space. That could result in cheaper solar panel installations for both consumers and energy companies.

BATTERIES, HYDROGEN AND INFRASTRUCTURE

Lithium-ion battery systems are having a good year outside of EVs, famously helping Australia and Hawaii save sun and wind energy for rainy (or calm) days. Tesla again gets the lion's share of publicity for its Powerpack installations, which helped it win a $50 million bet with the South Australian government.

We also have to give a nod to Ikea, though, which has been selling inexpensive solar panels in the UK and other nations. It unveiled its own battery system in Britain (manufactured, again, by Panasonic). For R±120 000 (£6,925), you can get a package with both solar panels and the battery, including installation.

As for what you can look forward to this year, let's just say that battery tech is like Tesla itself at times - long on exciting news, but short on real, timely products.

Still, there are a few developments that could arrive to market as early as the first quarter. The most promising is perhaps StoreDot's batteries, which can be charged in as little as five minutes for both EVs and smartphones. The company has been vague about how it works, saying the tech uses nano-materials and organic compounds, but StoreDot has promised that it could arrive to market as soon°. If batteries like those used by Tesla and Chevy could be charged in five minutes rather than an hour, it would obviously make EVs a lot more practical for long trips.

More realistically, Samsung was among the first of the big manufacturers to launch a faster-charging lithium-ion battery, the 21700 cell, at the beginning of the year. It can be fully charged in just 20 minutes, a significant improvement over the 30-minute-plus charging times of current cells. The only problem: While they're already available for e-bikes and other smaller devices, Samsung reportedly won't mass-produce them for cars until about 2021.

We've detailed hydrogen's issues (efficiency and infrastructure) compared to pure EVs, but there are a few automakers still committed to the technology. Toyota and Honda are partnering with Japanese fuel firms to increase hydrogen infrastructure in Japan, eliminating one of the biggest impediments to the tech.

As for whether you'll drive a hydrogen car in 2018, the answer is "not likely." The cars are still far too expensive $60,000 (±R715 000) or so for the Toyota Mirai, and there are only a few filling stations in South Africa. Hydrogen needs economies of scale to kick in, and with EVs coming on strong, that seems increasingly unlikely.

In South Africa, there are three fully electric vehicles on sale in the market: BMW's i3 and i8, and the Nissan Leaf. Various manufacturers have several battery-hybrid vehicles available locally, including Volvo and Mercedes-Benz.

Speaking of infrastructure, with more companies launching EVs, you'll need more places to charge them besides your home. In Europe, the Ionity network will be launching more than 400 stations by 2020, including eighty 350kW ultra-fast chargers that can juice up future EVs in as little as five to 10 minutes.

In the US, there are now around 16,000 charging stations, with 13 percent of those offering fast charging. Tesla alone has 900 charging stations, with 6,000 supercharger stalls, and plans to have up to 18,000 superchargers by the end of 2018.

In Gauteng there are more than 90 EV charging stations. These are available at shopping centres and office blocks.

There are 9 Nissan dealerships with EV charging stations, 7 of them also sells Nissan LEAF. Nissan have a memorandum of understanding (MoU) with BMW where they can tap into each other's charging networks. Cape Town is also catching up with various charging stations installed across the city.

The distribution of public charging stations is wildly uneven around the globe. Places with lots of support from governments or utilities, like China, the Netherlands and California, have thousands of public charging outlets.

Buyers of Tesla's luxury models have access to a company-funded Supercharger network. But in many places, public charging remains scarce. That's a problem for people who need to drive further than the 200 - 400 kms or so that most electric cars can travel. It's also a barrier for the millions of people who don't have a garage to plug in their cars overnight.

"Do we have what we need? The answer at the moment is, 'No,'" says Graham Evans, an analyst with IHS Markit. Other manufacturers, including Nissan and BMW, have plans to install chargers in the US, often working with private companies like ChargePoint and evGo. California alone wants its power companies to have 20,000 charging stations by 2020.

THE BEST-EVER YEAR FOR GREEN ENERGY

If 2018 fulfills the potential of 2017, green energy will become an unstoppable force. Any moves the Trump administration decides to make against it will only hurt the US in the short term, as green tech becomes an economic force around the world.

The Economist pointed out that in 2018 EVs could become cheaper than gasoline cars for the first time, considering overall cost of ownership.

Sales of EVs, including plug-in hybrids, could top 200,000 units in the US this year, according to Inside EVs, and surpass a million worldwide. Suffice to say that replacing a million gas-burning cars will have a big impact on atmospheric CO_2 levels. Next year we could blow past that figure by July or August.

Even without big breakthroughs, battery tech keeps evolving and is bound to give us more capacity and faster charging times in 2018. Small tech and engineering gains will also make solar panels a bit better and a bit cheaper.

Beyond that, in 2019 and 2020, auto companies like Mercedes and VW will launch brand-new and formidable EV lineups like the EQ and I.D. series, respectively. By then, EVs with self-driving tech will be cheap, practical and mainstream.

And with solar and wind starting to beat coal, nuclear and gas-powered plants in price, the power you use for your EV and home will be cleaner and cleaner.

Will this save the planet from excess CO_2 levels? Maybe not, but we have no choice but to try. wn

A low-carbon jet fuel future?

Innovators in the fields of fuel, steel and aviation reveal how a low-carbon jet fuel made with steel process gases could revolutionise air travel

The future of aviation is being fuelled by old-school technology. Four billion years old to be precise. Scientists are now creating cutting-edge jet fuel with microbes that transform carbon to ethanol in a process almost as old as the Earth itself.

The ethanol is converted to a low-carbon, environmentally friendlier aviation fuel that could one day fulfil around one-fifth of the airline industry's global requirements.

Leading this charge is clean tech company LanzaTech, which will supply Virgin Atlantic with its fuel if a test flight proposed for this year proves successful. But this collaboration could never have got off the ground without LanzaTech first forging partnerships with steel companies, including China Baowu Steel Group in Shanghai and Shougang Steel near Beijing. For LanzaTech's fuel, called Lanzanol, is produced in a process that recycles carbon-rich gases from steel mills to create the ethanol base of its fuel.

Virgin Atlantic founder Sir Richard Branson says: *"This is a real game-changer for aviation and could significantly reduce the industry's reliance on oil within our lifetime.*

"Our understanding of low-carbon fuels has developed rapidly over the last decade, and we are closer than ever before to bringing a sustainable product to the market for commercial use by Virgin Atlantic and other global airlines."

LanzaTech experts reckon that the Lanzanol fuel formula offers a 50-70% reduction in greenhouse gas emissions compared to conventional petroleum gasoline. Some 150 million tonnes of CO_2 emissions could be cut worldwide if steel production process gases alone were used to manufacture the ethanol.

LanzaTech CEO Dr Jennifer Holmgren says: *"We can now truly imagine a world where a steel mill cannot only produce the steel for the components of the plane, but also recycle its gases to produce the fuel that powers the aircraft."*

The China Baowu Steel Group-Lanzatech partnership was able to produce more than 450,000 litres of Lanzanol per year from a single site in Shanghai, China, which could then be converted to make 225,000 litres of jet fuel. Even this experimental demonstration site was able to produce enough fuel for an aircraft to make the trip from Shanghai to London, with greater output expected from commercial production installations.

Indeed, the commercial potential seems huge. LanzaTech experts calculate they could 'retrofit' the technique to around two-thirds of all the steel plants on the planet.

If so, that would mean up to around 136 billion litres of ethanol could be manufactured worldwide every year, from which 68 billion litres of aviation fuel would be produced (in the process half a litre of fuel is created for every litre of ethanol). This figure amounts to a little less than 19% of all jet fuel expended annually – 360 billion litres.

Some steel giants are already envisioning the potential and making headway in this developing bioeconomy.

ArcelorMittal, the world's largest steel maker and a development partner with LanzaTech, is building an €87m pilot plant at its steel facility in Ghent, Belgium, to produce ethanol on a commercial basis.

The company says that for every tonne of ethanol produced, total CO_2 emissions would be cut by 2.3 tonnes, and that the ethanol process would displace eight barrels – one tonne – of gasoline.

And all this from a humble microbe that began creating ethanol some four billion years ago, in the Hadean era when Earth was, in geological terms, a mere infant of just 500 million years or thereabouts.

In the Hadean age, micro-organisms from the acetogen family used gas emissions produced from naturally occurring hydrothermal vents to grow. These gas-

fermenting organisms are some of Earth's earliest life forms and their method of using gas for their whole life cycle is one of the oldest biological reactions on the planet.

Now LanzaTech scientists have plucked this primordial 'technology' from our far-distant past to create a fuel of the future. Their proprietary microbe is also from the acetogen family. The Lanzanol technique mimics that biological reaction from the beginning of time, as steel production gas emissions are comparable to gas emissions from hydrothermal vents.

"Our understanding of low-carbon fuels has developed rapidly over the last decade, and we are closer than ever before to bringing a sustainable product to the market" said Richard Branson.

During the process, carbon-heavy process gas streams enter a fermentation bioreactor. Here microbes feed on the gas, creating as a byproduct the ethanol that is then converted to jet fuel.

In a recent milestone, a 6,800-litre batch of jet fuel was created from Lanzanol at a Beijing demonstration facility co-owned with Shougang, one of China's largest steel makers.

Success in creating such a quantity, considered a breakthrough in the journey towards commercial production, is exciting the bioeconomic world. Now the fuel must undergo more tests required by aircraft and engine makers before it is approved for regular use on commercial flights.

Says CEO Jennifer Holmgren of LanzaTech's fuel production milestone: *"The importance of our ability to make the fuel in that quantity is firstly that it shows we're 'out of the lab', that the production potential is starting to look real.*

"Secondly, we are making enough for the testing that's required for certification by the relevant authorities so we can really move forward."

Dr Jennifer Holmgren added *"In the next 30 years it's unlikely that we will be flying electric aircraft so this use of recycled carbon from steel production to power aviation is really important and exciting."*

Holmgren certainly does not claim Lanzanol is the sole future of jet fuel, but she sees it as a significant component of a "basket of solutions" to wean the world off fossils. Indeed, while the world awaits a potential electric solution for jet power, Lanzanol is firmly fitting the bill. *"In the next 30 years it's unlikely that we will be flying electric aircraft so this use of recycled carbon from steel production to power aviation is really important and exciting,"* explains Holmgren. *"Jet fuel derived from ethanol is what the world needs now – less carbon pollution, and greenhouse gas being diverted into something useful.*

"I don't think LanzaTech jet fuel is going to be the whole story, as we need many alternative fuel solutions. But I think we can contribute billions of gallons of jet fuel to the aviation industry. My goal is that in under 10 years I want to be able to supply [four billion to nine billion litres] per year of fuel that is competitive with the long-term average price of petroleum.'

This vision is clearly in step with those forward-thinking airlines that are addressing the environmental issues generated by fossil fuels. Virgin Atlantic has pledged to reduce its aircraft CO_2 emissions by 30% from 2007 to 2020. To date it has cut emissions by 9%, and senior executives therefore acknowledge they have a battle on their hands to hit their green objectives.

As Virgin Atlantic Head of Sustainability Dr Emma Harvey puts it: *"Our single, biggest environmental issue is the carbon emissions associated with our aircraft fuel use. This pretty much dwarfs everything else we do. It's clear what the priority is and we have a responsibility to address it."*

It is indeed a huge responsibility, but with LanzaTech's collaboration with steel companies, the advances in the battle for sustainability in the air, seem far from being pie in the sky. wn

GM driving into the future

General Motors announced plans to mass-produce self-driving cars by 2019.

Set to be the fourth generation of its driverless, all-electric Chevy Bolts, the self-driving car will not feature traditional controls like steering wheels or pedals.

The new addition is currently being tested on the public roads of San Francisco and Phoenix.

When they finally debut from GM's manufacturing plant in Michigan, they will be positioned as ride-hailing vehicles in a number of cities.

"It's a pretty exciting moment in the history of the path to wide scale [autonomous vehicle] deployment and having the first production car with no driver controls," said GM President, Dan Ammann.

This announcement comes at the end of the CES where large companies announced their plans to deploy autonomous vehicles and also comes right before the Detroit Auto Show.

As the vehicle will not have a steering wheel, it cannot have a steering wheel airbag.

"What we can do is put the equivalent of the passenger side airbag on that side as well. So its to meet the standards but meet them in a way that's different than what's exactly prescribed, and that's what the petition seeks to get approval for", said Ammann.

GM has already submitted a safety report to the US Department of Transportation. The report details the safety system, post-crash behaviour, local laws and human machine interface to name a few.

"We believe this technology will change the world. And we're doing everything we can to get it out there at scale as fast as we can", concluded Ammann.

Meanwhile, Korean automotive manufacturer, Hyundai similarly announced on January 5, 2018 their plans to release self-driving cars.

However, Hyundai plans to deploy their self-driving vehicles by 2020. Hyundai said it and Aurora will introduce autonomous cars that will not require human input in most conditions.

Aurora was founded by a former chief technology officer at Google's self-driving car unit, a former Tesla Autopilot director and a former self-driving engineer at Uber.

Hyundai has been pursuing partnerships to keep pace with changes in an industry that is being transformed by artificial intelligence, autonomous driving and other cutting edge-technologies.

The partnership has yet to say how its first batch of self-driving vehicles will be used, but analysts expect they will probably be marketed for commercial applications such as self-driving taxis or ride-hailing services, rather than for sales to individual customers. General Motors said in November that its self-driving vehicles will carry passengers and deliver goods in big cities by 2019.

New Hyundai fuel-cell electric vehicle will debut at the Consumer Electronics Show in Las Vegas.

It plans to share more details of its project with Aurora during the Consumer Electronics Show in Las Vegas, where it will also unveil the brand name of a new fuel-cell SUV that will be tested for self-driving technology.

The company also plans to show off some of its autonomous driving cars during the Winter Olympics Game in February in Pyeongchang, South Korea.

Analysts predict that these vehicles will not be marketed for individual sales but instead for ride-hailing services such as self-driving taxis.

The company also plans to show off some of its autonomous driving cars during the Winter Olympics Game in February in Pyeongchang, South Korea. wn

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- Those working for a company or institute in SA which uses or contributes to electro-technical standards

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With the growth of embedded generation and other forms of Renewable Energy Sources (RES) being connected to the distribution network this level of control is becoming required at the distribution level. This has led to putting more intelligence at the plant level which has allowed greater autonomy and more local decisions to be taken. Area based approaches have been considered, whereby the network is divided into smaller regions, allowing decision making and control to be closer to the plant, whilst retaining the benefits of a wider system view. With the growth in renewable energy sources being introduced at Medium Voltage (MV) this approach also enhances the ability to enable hosting of these diverse power sources. This paper reviews the suitability of taking a control system used to manage the supply of electricity of an island, and applying it to off-grid applications whilst supporting future opportunities to be part of the national utility infrastructure.

Microgrid power solution in Africa

BY | TIM SPEARING | RICK ST. JOHN
LUCY ELECTRIC

Traditionally, control of electrical power networks has been a centralized, top down system approach. These larger systems offered a wide span of control allowing the system operator to make informed decisions to manage load flows, and to manage the supply and demand by way of balancing the system.

The developments of electrical distribution network control systems in Europe and USA have been focused on being more efficient with the assets they have, and more recently to enable the hosting capability for renewable energy sources. With the direction of achieving a greater degree of local control and autonomy this has led to the concept of the Microgrid. The Microgrid, which can be described as a set of interconnected loads and energy resources at the distribution voltage level, can operate in both island mode (off-grid) and grid connected mode. The author's company has provided the electric plant, control system and support infrastructure for managing an electrical grid on a relatively small island (similar to an off-grid network) in the Caribbean. This project provided immediate benefits to the system operator by enabling monitoring and controlling the electrical distribution network, but had also laid down the foundations to allow greater planning, more effective connection of distributed generation and renewable energy resources, as well as enabling the ability to manage customer resources.

Microgrid Power Solutions

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CONTROL SYSTEM FOR AN ISLAND IN THE CARIBBEAN

The project in the Caribbean was to design and implement a control system to manage the distribution of power and to improve the quality of service on the existing 11kV network supplying small industry, hotels and residences. The overall size of the island is shown in figure 1, being approximately 29km long by 8km wide. The island had a peak demand of approximately 40MW which was on a small grid supplied from a single power station, comprising 10 diesel generators and 12 feeders. The power was distributed throughout the island via more than 60 secondary substations, both of ground mount and overhead design. The generators were managed by their own control system but there was no means of monitoring and reporting the performance to the end user. Equally, there was no remote control of the electrical plant on the 11 kV distribution network.

The project involved installing a SCADA system (Supervisory Control and Data Acquisition) at a centralized control centre to manage the outgoing feeders from the primary substation, and to monitor and control selected switchgear on the secondary distribution feeders. The overall schematic of the control system is shown in figure 2. The communications between the control centre and the secondary switchgear was a General Packet Radio Service (GPRS) on a redundant 3G cellular system which provided sufficient bandwidth and resilience for controlling the Ring Main Units (RMUs) and overhead switches on the distribution network. The control and monitoring at the RMUs and overhead switches was achieved by installing Remote Terminal Units (RTUs) at key strategic points on the network. These RTUs were either applied as an automation retrofit kit (motor actuators to drive the switches controlled by RTU's) to existing [oil insulated] RMU's or in some cases new SF6 switchgear was installed, where the existing switchgear was not suitable for an automation upgrade.

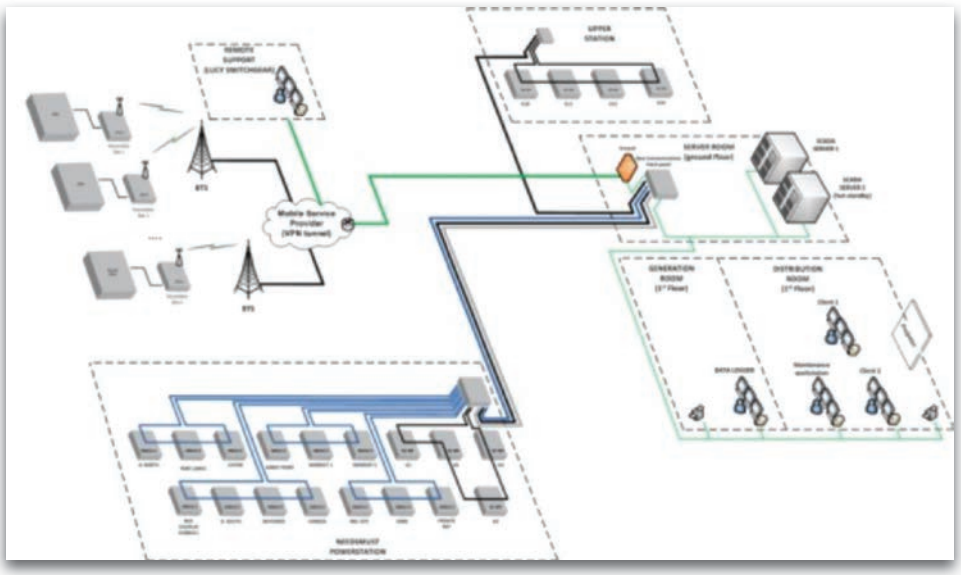

Figure 2: Overall schematic

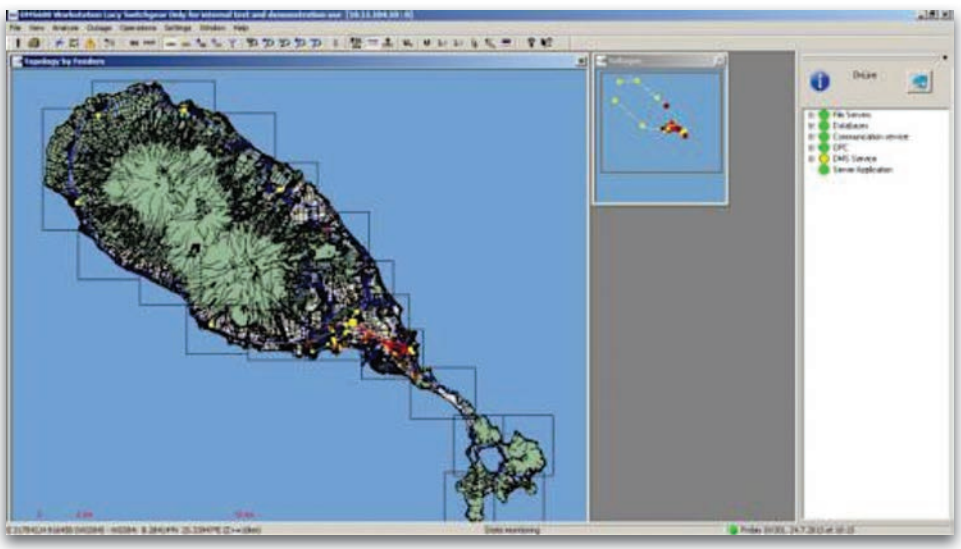

Figure 1: Overview of island

An important contributing factor to the success of this project was working with the utility customer, whose overall requirement was to develop a reliable electrical distribution infrastructure to improve the quality of service to end users on the island. The SCADA displays were customised to meet specific needs of the customer (system operator). The control room displays during the final stages of commissioning are shown in figure 3.

The benefits the customer sought were to see a reduction in the number of

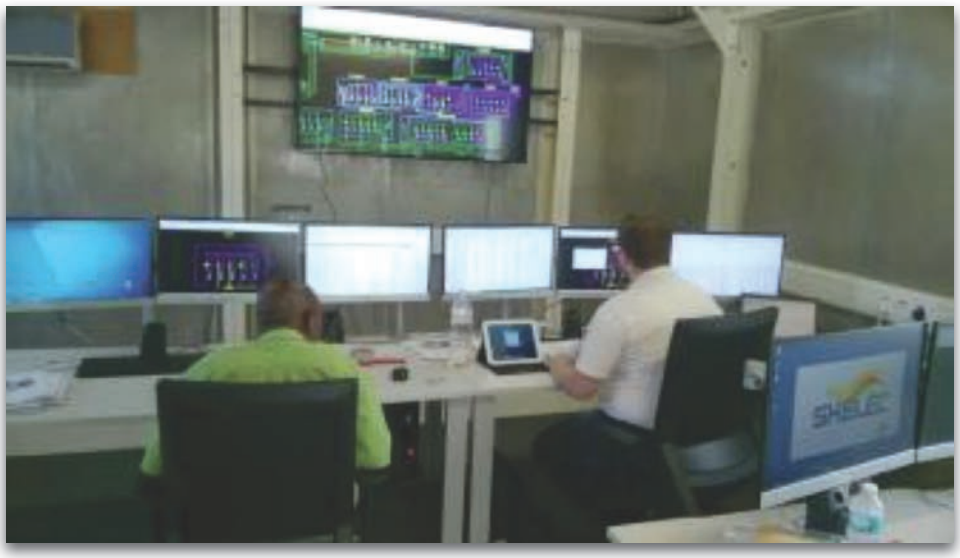

Figure 3: Control room displays

unplanned outages, having shorter outages, and being able to respond rapidly to the loss of supply. The additional benefits the solution provided were improved operational efficiencies and enhanced asset management information. This also laid down a foundation to support growth in RES on the island.

OFF-GRID DEVELOPMENT IN AFRICA

The Caribbean island project is effectively a 'large' isolated Microgrid. In moving to an off-grid application the RMUs will provide the interface to the national utility when in non-islanded mode, but there will also be a transformation to low voltage (LV) for the distribution of power within the Microgrid. The communications system provided on the Caribbean project is suitable for off-grid projects in Africa as mobile phones and the supporting cellular communications infrastructure are in common use. The communications access and use of information is still relevant, and will be used to help enable the hosting capacity of the Microgrid.

As the electrification rate in Africa is relatively low for the majority of the countries, the energy availability is a key requirement for economic development. The work developed in reference [1] supports that the implementation a Microgrid will improve accessibility to electricity, and proposes a typical Microgrid architecture supporting improved reliability, accessibility and making use of location specificity.

The control and automation architecture deployed on the Caribbean island electrical distribution system can be scaled down to be more specifically applicable to meet the requirements of a Microgrid in an island mode (off-grid) and connected mode. The requirements for the management of an electrical distribution network on an island are not dissimilar from the requirements in developing an off-grid application in Africa. Figure 4 shows a potential scaled down structure of the Caribbean project, the main difference being that the majority of the distribution is low voltage, and the control system (if required) is in the form of a laptop computer which inherently has a type of short duration uninterruptable power supply (UPS).

The voltage level of a Microgrid is normally determined by generating capacity and load level of the network. Technically, it may be that the voltage level of Microgrid is equal to the voltage of the distribution system it connects to, but it will be required to interface to the utility network via a distribution transformer. This will be the point of common coupling (PCC) to the utility network should the Microgrid operate in non-islanded mode. This is a common solution in many countries and the author's company has been involved in this type of connection [3].

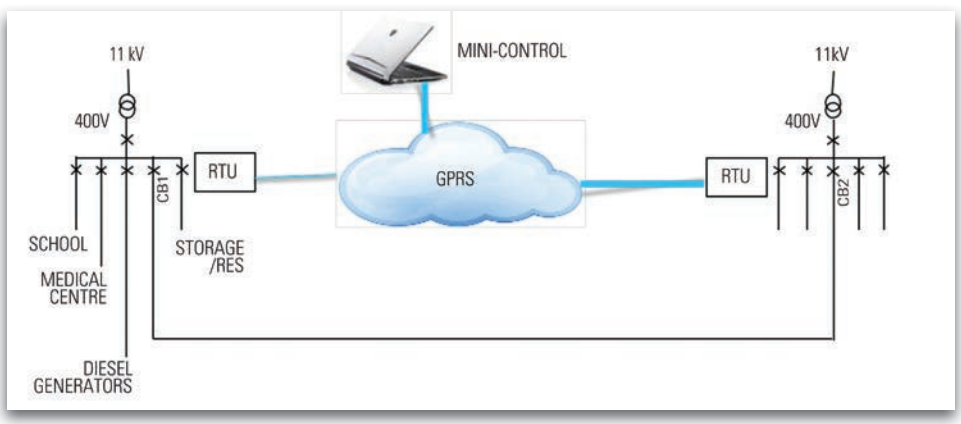

Figure 4: Microgrid structure

Microgrid Power Solutions

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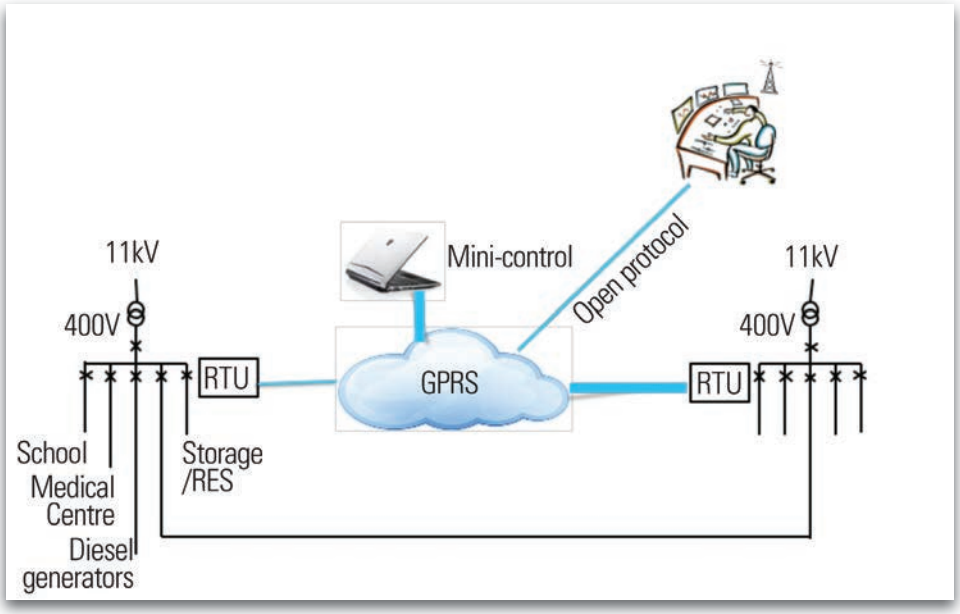

Figure 5: Microgrid interface to utility

When the energy supplied from the embedded generation within the Microgrid is sufficient to support the load then the utility network connection is not essential and the local community may find it economically beneficial in doing this.

Equally, for the utility in times of peak load, if the local generation can supplement the supply from the utility, then there is no need to cater for the maximum upstream capacity. This is an advantage to the utility because it removes the need for reinforcement.

COMMUNITY ENGAGEMENT

A key factor with developing a Microgrid in Africa would be community engagement as explained in reference [2]. This research highlighted that some of the challenges with the take-up of off-grid projects were because they can be of poor design, have a lack of local involvement, and suffer from a difficulty in transferring maintenance skills to the local community in order to make the solution sustainable.

The research concluded that local participation in technological choice and structural arrangements were essential to making the off-grid project a success. Community engagement will support the reason for developing a Microgrid and can provide the business case. For example, there are requirements to provide electrical lighting for schools in the evenings, and to provide power for refrigeration at the medical centers for storing vaccines.

The control of the Microgrid can be used to enable greater hosting of embedded generation, which means this will encourage local entrepreneurs to make use of local assets and energy sources to produce electricity to support this grid.

HOSTING GENERATION

The ability to enable the Microgrid to host generation is important in this concept because this helps the wider community to exploit income generating opportunities through providing access to embedded generation and renewable energy sources.

The control elements of the Microgrid can not only be used for managing the voltage on the grid, but also for managing the amount of generation. It will be important to keep the Microgrid operational within its voltage and thermal limits through increasing and curtailing generation. In some cases it may be required that some generation is constrained, and in others instructed to increase. This will provide opportunities for ocal supply of RES and diesel generation.

INTEGRATION INTO THE LOCAL UTILITY NETWORK

Whilst it is important that the local community have a sense of ownership, it is more than likely that the Microgrid will

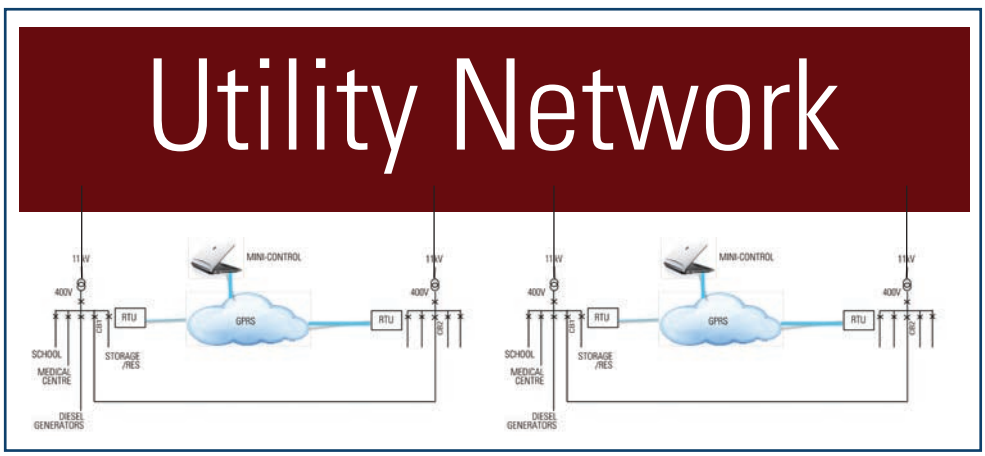

Figure 6: Expansion od Microgrid infrastructure.

be owned by the local utility company. The electrical point of connection will be via the distribution transformer at the 400V interface.

Having a basic measurement and control infrastructure will enable integration into the utilities control system, as shown in figure 5. The communication with the utility control system will use standard open protocols such as DNP 3.0 or IEC 60870-5-101/IEC 60870-5-104.

This is consistent with modern control system architectures and enables the ability to integrate the Microgrid control functionality and architecture into the utility SCADA system.

This functional structure will support the local utility through being an integral part of its network when in connected mode, and by being self-sufficient when in island mode. This will allow the utility to maximise grid utilisation without reinforcement.

The local control for the Microgrid provides the management interface to the utility SCADA. This structure can be replicated as a local building block in a geographical area, or as a consistent approach for the utility network across different regions. Each one of the Microgrids can form part of a wider network, as illustrated in figure 6.

However, in making the Microgrid suitable for connecting to the utility national grid, the Network Codes (for that particular country) must be considered.

In addition, this system is now exposing the utility SCADA to a wider environment and so it will be important that cyber security is implemented. Although not covered in this paper, the particulars of IEC 62351 [4] will need to be considered.

CONCLUSIONS

Availability of electrical power is essential for the economic development of rural areas in Africa. The development of a Microgrid will increase accessibility to electricity and support growth in rural areas.

Microgrids contain generation and load. The ability to disconnect from and parallel with the utility system is a function of running the Microgrid. Through adopting open standards there is the ability to upscale the Microgrid and develop clusters of such areas supporting the utility in planning and management of its distribution network.

An enabler to achieving this will be with the adoption of international standards as these will support integration of the Microgrid into the larger Utility network. wn

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BY | ALAN INY | THE BOSTON CONSULTING GROUP

This report is a result of a joint initiative by the Word Wide Fund for Nature - South Africa (WWF-SA) and the Boston Consulting Group (BCG).

Today's leaders are forced to grapple with so many threats and uncertainties coming from all different directions, it can be tempting to bury our heads in the sand, ostrich-style. But contrary to popular belief, ostriches do not actually bury their heads in the sand. This myth comes from the bird's strategy of lying low when trouble approaches, and pressing their long neck to the ground in an attempt to become less visible. Their plumage blends well with sandy soil, and so from a distance, this gives the impression that they have buried their heads in the sand. For the ostrich, this strategic decision is an instinct which serves them well, because most of the time their environment is predictable and the threats are foreseeable.

But leaders in our society can and must do better at tackling the uncertainty all around us, and scenarios are a terrifically underused tool to help. Take the water challenge facing South Africa: of course it's critical to tackle this challenge with a solid understanding of supply, demand, and the complex circumstances at play, which is how this report will begin. But the fact base alone is not sufficient. There can be many valid ways to interpret these facts and a range of reasonable tactics and strategies can ensue. We must go beyond the predictive mindset upon which we have been trained. After all, no matter how robust our forecasts, there will always be surprises around the bend. Scenarios will help us bring a more prospective mindset

Scenarios for the future water of South Africa

to the challenge, allowing us to better prepare for what we humbly acknowledge we cannot precisely predict.

It has been a pleasure, as BCG's global leader for the scenarios topic, to partner not only with my South African colleagues, but with the World Wide Fund for Nature and the key stakeholders they have brought to the table. I am excited about the 2030 scenarios that we have developed, and the process of thinking through how we might prepare has already broadened perspectives and allowed us to define a series of very specific action items. This will make South Africa's future more robust, whatever lies ahead.

And so, dear reader, the challenge before you is clear: understand the water context, which we cover in section 1 of this report. Look at the potential scenarios, which we have developed in sections 2 and 3, and for each one, immerse yourself in that potential reality before beginning to ponder how you might prepare. And most critically, tie your own potential action items to the specific suggestions outlined in section 4. What part can you play to help South Africa overcome the current crisis – to prepare for and even shape the future? Let us allow our future strategies to be as robust and deliberate as possible – as opposed to instinctively burying, or even appearing to bury, our heads in the sand.

Water in South Africa

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WATER FUTURE SCENARIOS WORKSHOP

Water directly affects South Africa's socioeconomic development, but it is becoming an increasingly scarce resource.

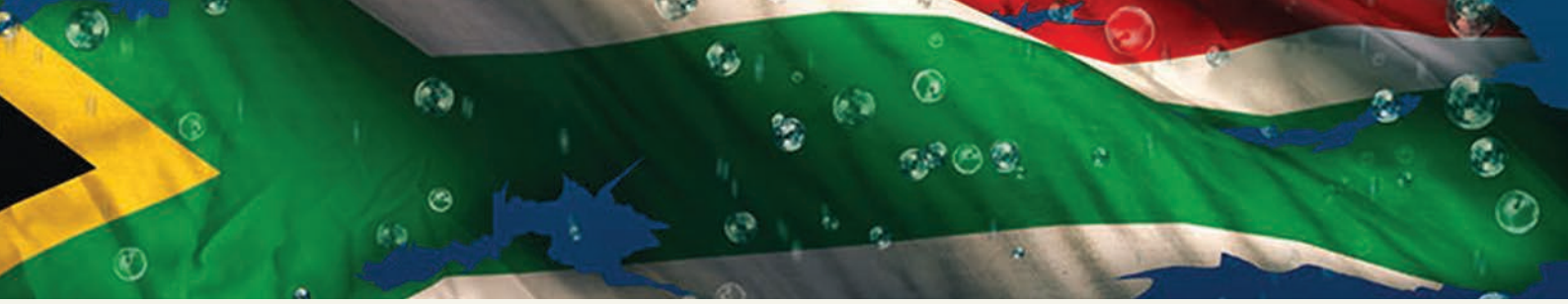
Based on current usage trends, South Africa is expected to face a water deficit of 17% by 2030, and this shortage will only be worsened by climate change. Because water is a shared resource, we are all at risk; therefore, it is critical to understand our impact on water and incorporate water management into our daily lives.

To address these issues, the World Wide Fund for Nature – South Africa (WWF-SA), supported by The Boston Consulting Group (BCG), hosted a "Future of Water" workshop in South Africa on January 31, 2017. A diverse group of key stakeholders from the public, private, and social sectors gathered to discuss specific scenarios. Workshop participants proposed four primary goals:

FOUR MAIN GOALS FOR THE FUTURE OF WATER IN SOUTH AFRICA

MAIN GOALS

1. *Become a **water-conscious country** with sufficient knowledge and skills in the water sector*
2. *Implement **strong water governance** with resilient stakeholder partnerships that advance the more explicit second phase of the National Development Plan to achieve water security under climate change*
3. *Manage **water supply and demand** regulations more rigorously and protect water resources*
4. *Become a **water-smart economy** and a leader in Africa in commercializing low-water technologies for industry and agriculture*



NO REGRET ACTIONS
WITH HIGH IMPACT AND FEASIBILITY

Six “no regret" actions that will have high impact and be feasible to implement have emerged from discussions. These actions could significantly shape the future of water in South Africa:

ACTION 1:

Improve social awareness on the criticality of water scarcity, at schools, business, and communities, through campaigns and social media platforms

ACTION 2:

Develop skilled jobs, new enterprises and capabilities to effectively maintain green and grey water infrastructure across South Africa, and reduce losses

ACTION 3:

Pilot innovative co-financing to maintain and protect ecological (green) infrastructure e combating further unnecessary water loss from alien vegetation

ACTION 4:

Implement the water pricing model to strategically differentiate tariffs in the face of continuous water demand growth, urbanization, and population growth

ACTION 5:

Commercialize and implement at scale water re-use and improved irrigation efficiency technologies

ACTION 6:

Increase access to information to share clearer understanding of water users' impact on water and to advance collective action

Collective action plays a vital role in building a sustainable water future for all stakeholders. By collaborating to mitigate risks, seize opportunities, as well as preserve and maintain this valuable shared resource, we can create a water secure future for South Africa. These action focus on what can be achieved in partnerships between civil society, the public and private sectors. A massive drive is also required to improve performance in public sector water institutions and local government.

Water in South Africa

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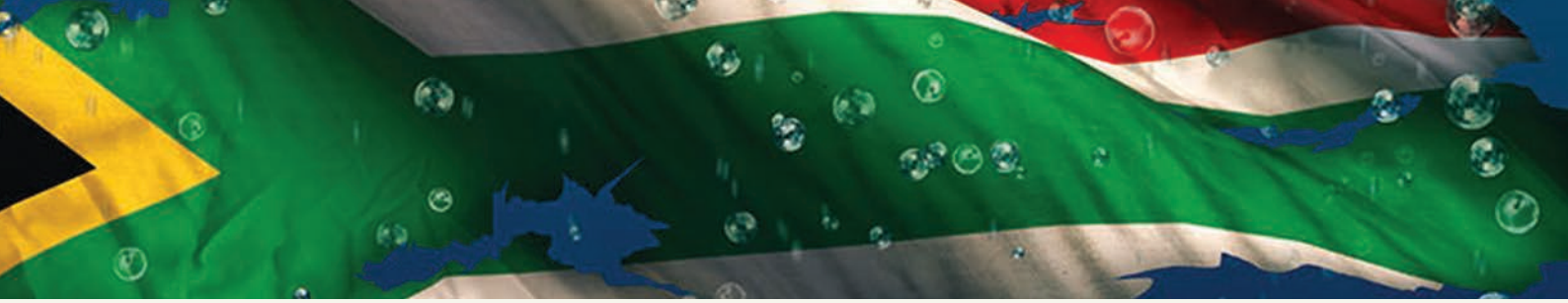
INTRODUCTION

How can we prepare for and take action to reverse South Africa's water crisis?

This question should be on the mind of every responsible leader in the public, private, and social sectors. As a critical human need and essential to our economy, water concerns every South African.

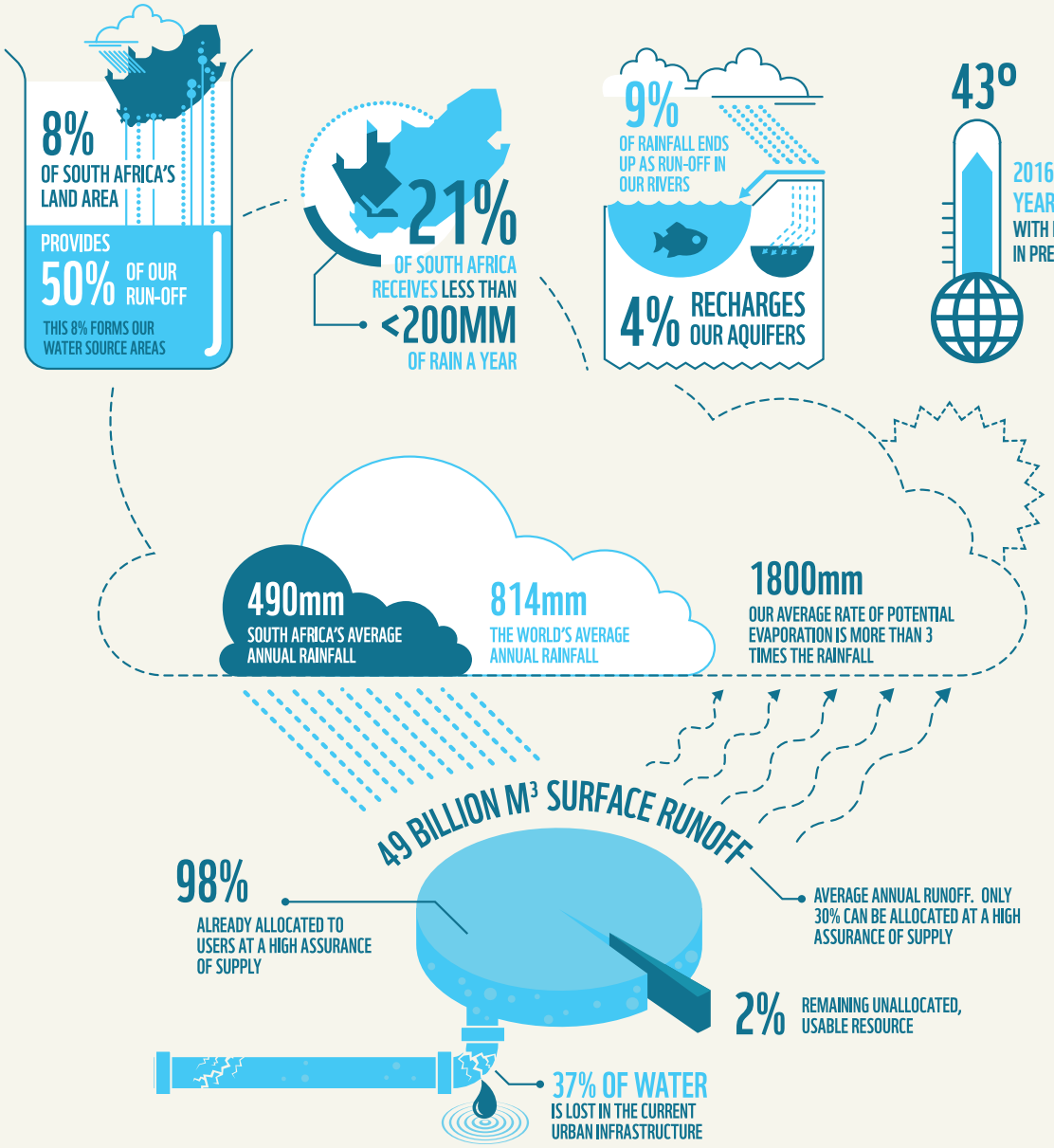
The aim of this report is to raise awareness about the threat of water scarcity in South Africa and crystallize key actions needed to build a water secure future in South Africa. This discussion was initiated with the support of stakeholders from the public, private, and social sectors on January 31, 2017, at the WWF's "Future of Water" workshop. Workshop participants addressed current and future challenges, discussed potential solutions, and mapped out a sustainable path forward.



WATER CONTEXT

South Africa is approaching physical water scarcity by 2025, and its socioeconomic development has been directly hampered by the recent drought. The drought has taken its toll on the agriculture sector, widening the trade deficit due to losses in maize exports. As a result, in the fourth quarter of 2015, the agriculture sector lost 37,000 jobs, which pushed an additional 50,000 people below the poverty line and accelerated consumer inflation driven by rising food prices. This in turn shaved off 0.2 percentage points from South Africa's economic growth in 2015. SA's water crisis is not a future problem. It's an urgent challenge today:

FIGURE 1: WATER FACTS



Water in South Africa

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WATER SUPPLY

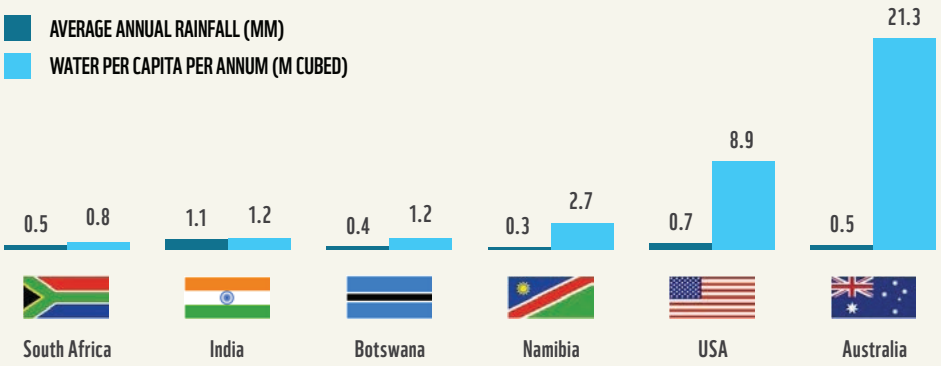
490 mm

SOUTH AFRICA'S ANNUAL RAINFALL IS HALF THE WORLD AVERAGE

Rainfall is the predominant origin of freshwater, yet SA has low rainfall and low per capita water availability in comparison to other countries: ~500 mm average annual rainfall, and 843 m^3 water per capita per annum. Approximately 30% of annual runoff becomes allocated supply, mostly from surface water.

The majority of our water supply comes from dams. Whilst only 10% comes from groundwater, this is a critical resource at times of the year when surface water is not available and during droughts. Finally, there's desalination, which is also a highly costly and energy-intensive process.

FIGURE 2: WATER AVAILABILITY IN SELECTED COUNTRIES (000 OF M^3)



Source: Department of Water and Sanitation 2015 Strategic Overview of the Water Sector in South Africa, WWF 2016 Water: Facts and Future report

WATER DEMAND

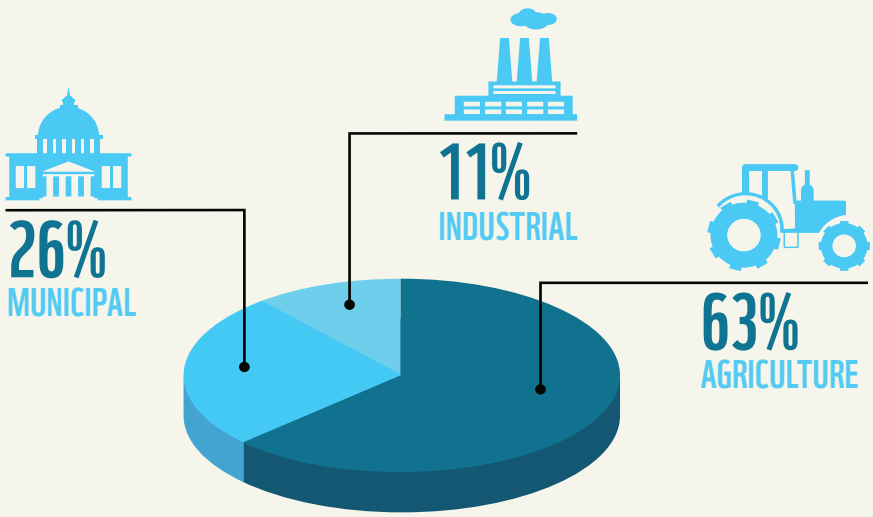
17% DEFICIT

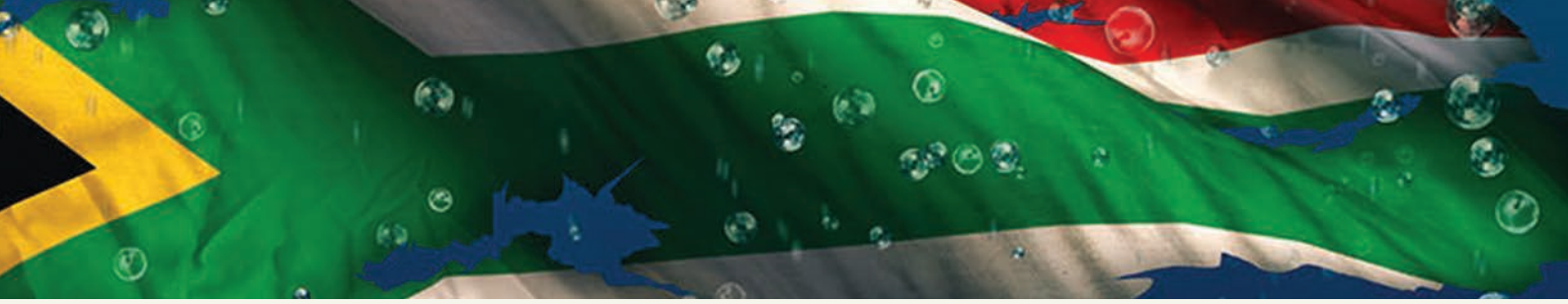
WATER DEMAND IS EXPECTED TO EXCEED SUPPLY IN SA BY 17% IN 2030

Water demand in South Africa has been witnessing a steep increase, with three major sectors driving the demand. The agriculture sector is the highest at around 63%, followed by the municipal and industrial sectors at 26% and 11% respectively.

This demand is expected to further grow at around 1% annually to reach ~18 bn m^3 in 2030 from 15 bn m^3 in 2016.

FIGURE 3: DRIVERS FOR INCREASING WATER DEMAND





AGRICULTURE

Overview

Agriculture is the largest user of water at 63%. Major water uses include:

- Irrigation of crops
- Land used for water-intensive grazing of livestock

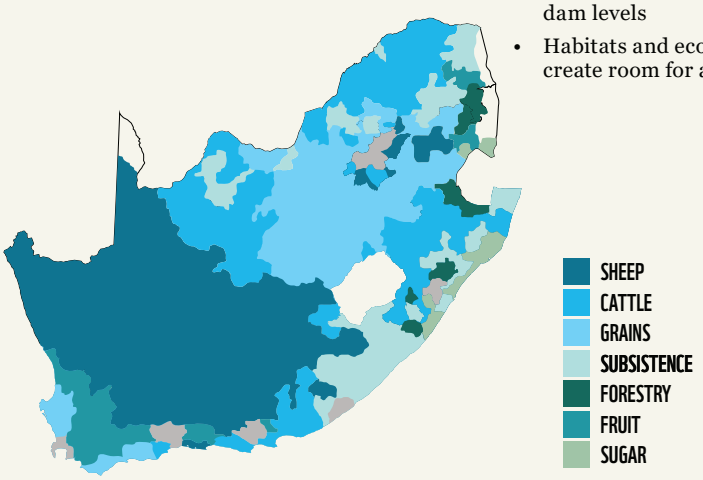
Key drivers for water supply and demand

- Weather variation: More surface water used in droughts, which depletes stores
- Population growth: More food and liquids consumed from rising number of residents
- Labour intensive sector: Government supports sector growth due to job creation
- Dietary shifts to fats/oils: Livestock requires significant water usage

Impact on water

- Fertilizer contributes to water pollution
- Over-use of stored water leads to low dam levels
- Habitats and ecosystems destroyed to create room for agricultural land

FIGURE 4: AGRICULTURE PRODUCE BY REGION



MUNICIPAL

Major water uses

Municipal sector uses 26% of water supply and is expected to grow mostly due to demographic drivers. Major uses include gardening, toilets, and personal hygiene, accounting for 84%.

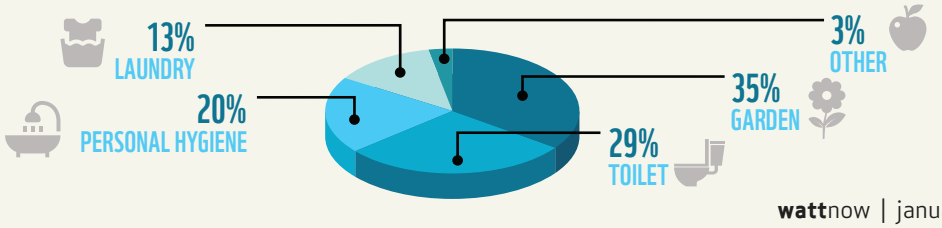
Key drivers for water supply and demand

- Population growth: Increased urbanization and standards of living
- Urbanization: Increased total water usage per household with increased access to water for families living in cities

Impact on water

- Untreated and poorly treated sewage and sewage leaks pollute the water, especially in urban areas with limited wastewater treatment
- Cummulative pollutant load from industrial areas

FIGURE 5: DISTRIBUTION OF HOUSEHOLD ACTIVITY BY WATER USE - 2009



Water in South Africa

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INDUSTRIAL

Major water uses

Industrial sector uses 11% of water supply; manufacturing is the highest user of water at 53% and expected to grow to 70% in 2030

Water uses in the industrial sector:

Manufacturing applications:

- Processing of minerals and crops
- Textile, chemical refinement
- Component and auto supplies

Mining and power applications:

- Extraction, refining, and cooling

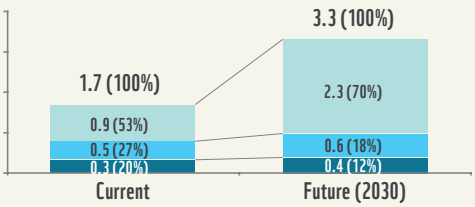
Key drivers for water supply and demand

- Weakening rand: Creates demand for water-intensive exports
- Population growth: Higher demand for water, electricity, and consumer products
- Price of water: Higher water tariffs curb water wastage and promote water reuse
- Water governance: Legislation enforces reduced water consumption and pollution

Impact on water

- Industrial spillages and acid drainage degrades water quality
- Warm water discharge disrupts surrounding biodiversity
- Large industrial disasters pollute entire water basin

FIGURE 6: WATER DEMAND (BN M^3)



Source: Water Resources Group Report 2009, National Water Resource Strategy 2013, National Water Plan Diagnostic Report 2015

WATER GOVERNANCE

Various state institutions, including Dept of Water and Sanitation, Catchment Management Agencies, and Water User Associations, are mandated to protect water resources and supply us with sustainable, safe water. Good governance of the full water value-chain, from water source areas, to taps, toilets and sewers, also requires responsible actions from the private sector and even individuals in households. Water governance is most effective when the government, private sector, NGOs, communities, and individuals coordinate efforts. Transparent processes, with high levels of shared information and coordinated action allows stakeholders to actively participate in planning and implementing water management activities, innovate in the face of climate change, and improve integration of water management efforts.

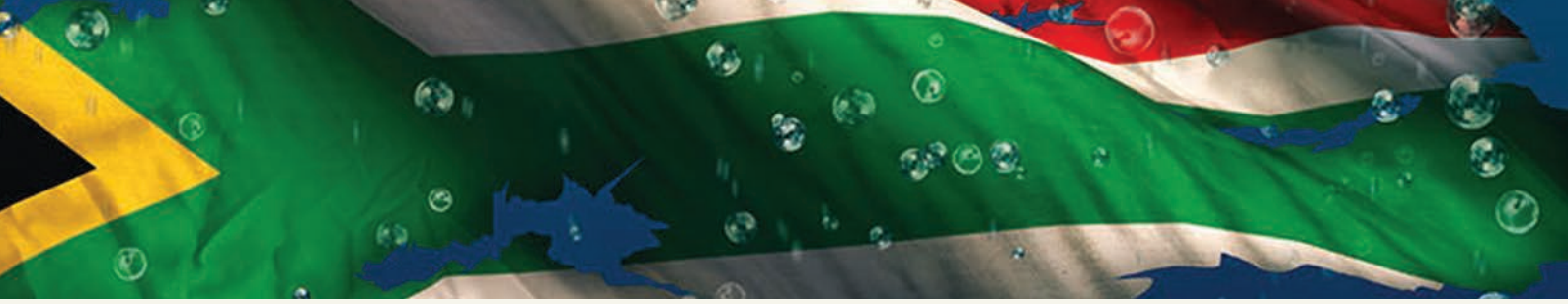
COLLECTIVE ACTION

Water risk manifests across the entire value chain. For companies, having assurance of enough water, at the right quality, time and cost is vital for plant operations. Since water flows from catchments to the ocean, all stakeholders in a river basin are mutually dependent. Hence, collective action plays a vital role to secure the future of water for all stakeholders.

'As water is a shared resource with many stakeholders, it is a shared opportunity and shared risk for everyone, whether in the public, private or social sectors.'

WWF has been promoting water stewardship, which is not only about efficient use of water, but also about how the private sector strengthens good governance in collaboration with governments, NGOs, and communities to protect this valuable shared resource. It requires acting together towards a common goal.

Collective action requires not only an understanding of water supply and demand but also creative thinking by various stakeholders about what the future might hold and what can we do to shape it. For this reason, we developed widely varying scenarios for the future of water in South Africa and explored how we might prepare for each one.



SCENARIOS

WHAT DO WE MEAN BY SCENARIO PLANNING AND WHY DO WE USE IT?

To catalyze collective action by stakeholders, WWF's scenario exploration workshop gathered stakeholders with diverse backgrounds in water-related industries.

"The Americans have need of the telephone, but we do not. We have plenty of messenger boys." Head of the British Post Office (1876)

The aim of the workshop was to better understand the current situation in South Africa and discuss the path towards a water secure future.

WHAT DO WE MEAN BY SCENARIOS AND WHY DO WE USE THIS APPROACH?

In today's fast-moving and complex world, scenarios are a powerful tool that help individuals, companies, and government bodies stretch their thinking to imagine what the future may hold and learn how to prepare for multiple scenarios.

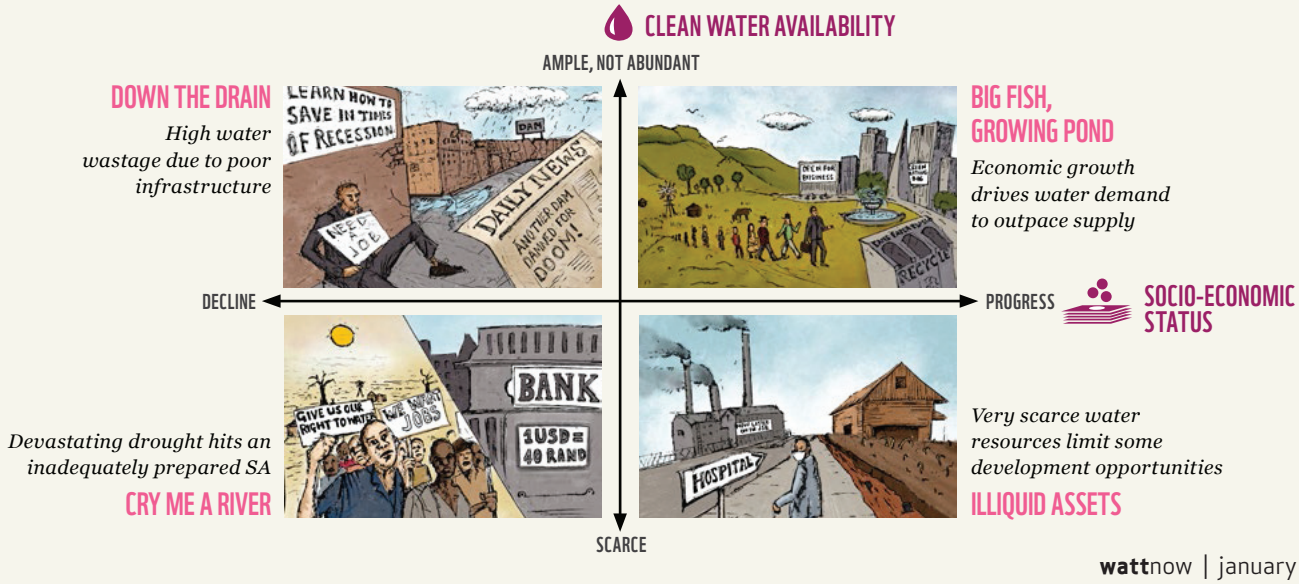
We used scenarios so that workshop participants could challenge their thinking, explore the implications of four different water scenarios in South Africa, and reflect on possible outcomes to clarify whether the current course of action is sustainable.

"There's no chance that the iPhone is going to get any significant market share." CEO of Microsoft (2007)

HOW DID WE DEVELOP THE SCENARIOS?

Our approach to scenario development used a methodology called 'axes of uncertainty.' We analyzed a range of mega-trends relevant to the future of water in South Africa, prioritized them based on impact and likelihood, and then developed two axes which collectively cover the full range of prioritized trends. The two key uncertainties chosen as most relevant to the future of water in South Africa are 1) the availability of clean water and 2) the country's ability to manage it.

While reading each scenario in the section that follows, it's important to immerse yourself in each world. How would each scenario affect your family, your business, and South Africa overall? How would you prepare for each scenario if you knew it would happen and what indicators would you monitor to detect whether that scenario was imminent? These are some of the questions the workshop participants explored, and their answers are summarized after each scenario.



Water in South Africa

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FOUR FUTURE SCENARIOS

SCENARIO ONE: DOWN THE DRAIN

Imagine a world where there is **ample water availability** across SA, yet there are excessive levels of **wastage** due to poorly maintained water infrastructure in the face of a **depressed socio-economic state. What would that world look like?**

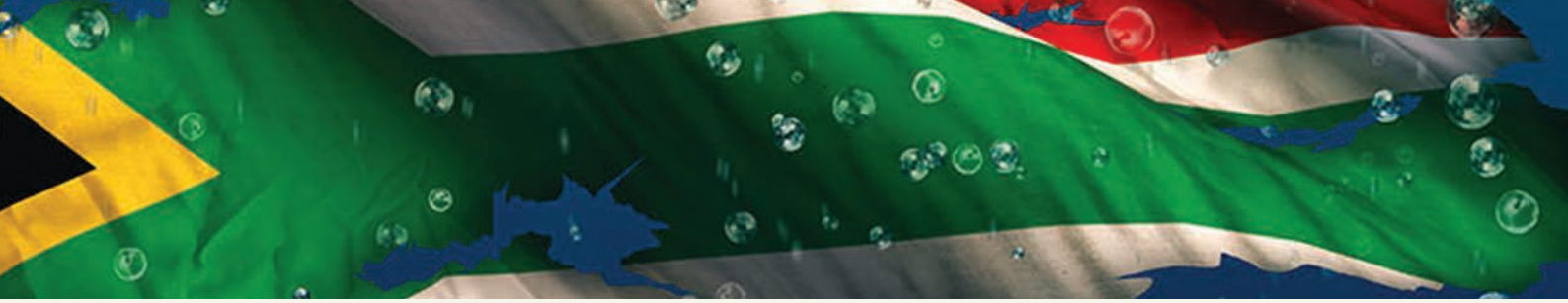
Political instability and indebted government have taken its toll on the economy, leading to a large disinvestment from SA. The weak economy has led to poor infrastructure investment, deteriorating roads, insufficient capture of rainfall and loss of water from dams.

De-prioritized environmental governance and lack of private sector incentivisation has formed a divide in public-private collaboration.

Higher rainfall levels did not boost the economy as expected, as heavy water leakages and poor infrastructure maintenance offset the increase in water availability; flushing money and opportunity down the drain.

	IMPLICATIONS AND RISKS	OPPORTUNITIES
INDUSTRIAL	Rising frequency of production defects due poor quality water as an input Higher costs to treat increased volumes of dirty water due to de-prioritized governance	Improve self-regulation around water reuse and wastewater management Reduce costs of water treatment through inclusive planning & industry collaboration
AGRICULTURE	Increasing inequality gap for smaller farmers who cannot afford private infrastructure Rising insurance costs due to higher flood risk damages profits and employment in agri. Degredation of catchment land due to poorly managed agriculture	Shift to low water-use crops in order to sustain crops during the dry season Tap into self-sufficient water infrastructure (such as boreholes and rainwater harvesting)
GOVERNMENT	Increased protests & social unrest due to poorly maintained municipal infrastructure Riffs in public-private collaboration due to lack of incentives for collective action Low levels of enforcement	Improve allocation of municipality funds to sufficiently maintain water infrastructure Provide bursaries to educate and develop skills in water management and conservation
FINANCIAL	Increased cost of borrowing in the face of growing unemployment and government debt Higher frequency of defaults on payments during economic recession Bankrupt municipalities don't pay for water	Create an innovative business model to incentivise the funding of water investments Support investments in water projects through offering more competitive contractual terms

This scenario's biggest challenge lies in the poor infrastructure maintenance and development. Most relevant indicators to monitor to be able to detect if such a future will more likely occur include observing whether there are delays in execution of water infrastructure projects, the percentage of unallocated water which measures the water lost due to water leakages along with the Water Poverty Index which measures access to water across the country. These indicators can prompt us in advance to re-prioritize infrastructure investments.



SCENARIO TWO: BIG FISH, GROWING POND

Imagine a world where there is **adequate clean water available** in South Africa and the **socioeconomic environment is booming**. Growth is not tapering off in the near future and water demand is increasing at a fierce pace. **What would that world look like?**

South Africa has established a reliable regulatory environment and a reputation for good governance, resulting in an influx of investment across many industries, including some that are water-intensive. This growth has increased employment and reduced poverty levels.

Meanwhile, businesses have been operating with responsibility toward the environment, leading to more efficient water usage, improved waste management, and investments in water infrastructure.

However, economic growth has spurred urbanization, sharply increasing domestic water use. Water demand is at an all-time high, with supply unable to keep pace.

	IMPLICATIONS AND RISKS	OPPORTUNITIES
INDUSTRIAL	Increased competition, skills level and innovation due to large presence of MNCs Differentiated tariff pricing results in rising operational costs and product prices Local 'laggard' companies will be out-competed	Invest in water management and treatment due to rising water governance and tariffs Invest in importing and adopting new technology & innovation in water-efficiency
AGRICULTURE	Accelerated urbanization results in a steep increase in water demand and food prices Degredation of catchment land due to poorly managed agriculture	Shift towards production of high quality and high calorie food due to rise in middle class Strong self-regulation of better production practices
GOVERNMENT	Increased trade and foreign investment in infrastructure due to socio-economic stability Urbanization and immigration put strain on public supply and resources	Use private sector skills and agencies to maintain & implement water infrastructure Reduced wasteful expenditure and ROI from PPPs as well as government procurement
FINANCIAL	Rising interest rates due to high demand for financing resources during economic boom Insurance industry is stable due to more certain economic environment	Strengthen innovative financing solutions to cater for the rising middle class Differentiate insurance services to maximize on urbanization and a growing target market

This scenario's looming challenge is that water demand is growing so fiercely that it's outpacing supply. The most relevant indicators to monitor whether we are heading toward this scenario include observing the rate of urbanization; the price change in water tariffs; and per capita water use, which measures the average consumption of water per person in SA as a benchmark in rating water-efficiency.

Water in South Africa

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SCENARIO THREE: ILLIQUID ASSETS

Imagine a world where South Africa's socioeconomic state is progressing and experiencing **high economic growth**, yet clean **water is increasingly scarce and costly** due to recurring drought and high levels of pollution. **What would that world look like?**

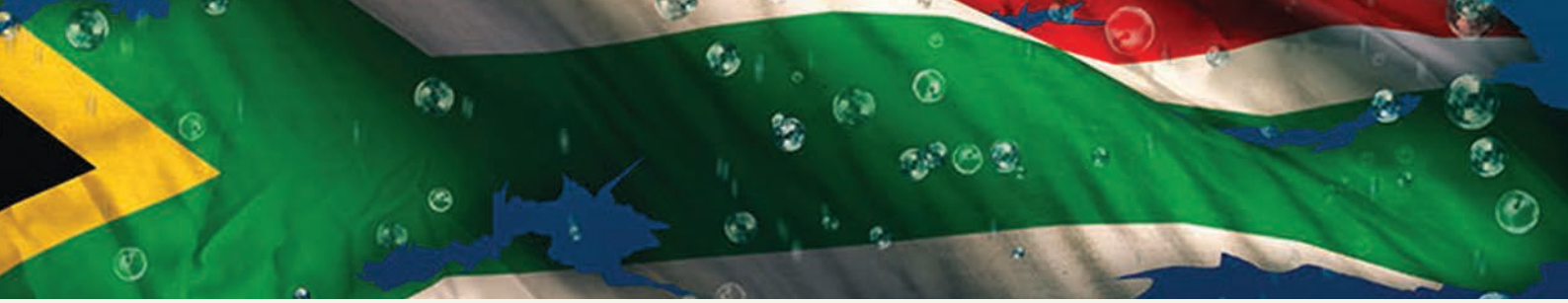
South Africa has adopted business-friendly policies and has become more welcoming to big multinational corporations (MNCs) around the world. Although this has resulted in an increase in labour productivity and economic growth overall, it has negatively impacted the availability of clean water, causing high water tariffs. This has created challenges for farms that produce water-intensive products, such as livestock, sugar, and fruit farming.

The prolonged political instability in Lesotho has slowed implementation of the Lesotho Highlands Water Project, leading to more limited water availability and strained regional relations. This dynamic, coupled with the state of the environment, has steadily inflated prices for water resources.

	IMPLICATIONS AND RISKS	OPPORTUNITIES
INDUSTRIAL	Rising pressure from environmental enterprises on polluters to act responsibly Excessive treatment costs for companies that require high volumes & quality of clean-water	Invest in reverse-osmosis process treatment and use water as "fit-for-purpose" Implement grey water reuse and a zero-liquid discharge strategy Circular-economy collaboration in the private sector leading to high levels of re-use
AGRICULTURE	Inflating tariffs result in the collapse of many emerging farmers who cannot afford water Increased foreign competition from imported products that are produced more economically	Conversion of agriculture land due to shift away from water-intensive crops Explore import opportunities in food taking in account the entire supply chain
GOVERNMENT	Rise in water-borne diseases due to pollution requires more funds to provide health service Rising strain on water resources across municipalities due to falling water quality	Incentivize investment in water management and treatment through strengthening policy Wide-scale use of low-water sanitation Inclusive planning for ecological and physical water infrastructure water projects
FINANCIAL	Increased average lending due to economic growth & unrestrained industrial boom Increasing insurance premiums due to steep rise in claims on health risks	Innovate health insurance to leverage the increased need for competitive medical plans Invest in projects protected by environmental permits at the risk of new policy enforcement

1. Water treatment process in which all wastewater is purified and recycled, leaving zero discharge at the end of the treatment cycle

In this scenario, the deteriorating availability of water leads to excessively high water tariffs for mains supplies. The most relevant indicators to detect whether we are heading towards this scenario include observing the Water Quality Index; the percentage of wastewater treated; and the percentage access to drinking water, which measures the extent to which citizens have suitable access to clean water and sanitation.



SCENARIO FOUR: CRY ME A RIVER

Imagine a world where SA is in a **severe drought** and the already poor **socioeconomic status of the country is unable to cope** with the destructive water crisis. **What would that world look like?**

SA is in an economic recession whereby the agriculture and mining sectors are quickly contracting, causing sky-rocketing unemployment and a fall in exports.

Despite recent political stability, SA is suffering the consequences of a prolonged lack of investment in infrastructure and technology.

Climate change has shifted rainfall patters with widespread drought and intense cyclonic events causing wide-spread devastation across Southern Africa. As such, SA is in a desperate state of economic and physical water scarcity.

	IMPLICATIONS AND RISKS	OPPORTUNITIES
INDUSTRIAL	Rise in monopolies due to large company contracts with government to secure water Severe financial losses for water-intensive players due to unpredictable water cuts	Invest in new technologies in wastewater treatment and water demand management Advance and grow new sectors in desalination and groundwater pumping Circular-economy collaboration in the private sector leading to high levels of re-use
AGRICULTURE	Destruction of properties occurs due to land grabbing of land with water supply Desperately low yields result in small-scale farmers to revert back to subsistence farming	Invest in drought-resistant GMO crops for the seed market to leverage their position Provide small scale water solutions to rural areas through social enterprises
GOVERNMENT	Violent protests break-out due to revoked right of water and rising inequality Large companies & MNCs secure water to sustain operations, while smaller companies migrate	Invest efforts in raising awareness of the value of water and conversation methods Implement strict water governance to monitor and control domestic use
FINANCIAL	Increased claims in the insurance industry result from severe El Nino weather conditions Rising pressure on financial institutions for loans in the period of economic recession	Form new financial models to cope with high risk circumstances Focus on micro-financing to support small farmers from going bankrupt

In this scenario, the biggest challenge is South Africa's inability to effectively combat the harsh effects of the prolonged drought and intense floods under climate change, coupled with an unstable and depressed socioeconomic climate. The most relevant indicators to detect whether we are heading towards this scenario include observing the forecasted impacts of climate change, the employment and poverty rate, and changes in the free right of water, which points to the degree of inequality and respective social unrest in the country.

Water in South Africa

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WHAT DOES THIS MEAN GOING FORWARD?

Whether we run businesses or households, work in companies, or lead governmental departments, our actions impact water, and in turn we are impacted by water. Each and every individual has a role to play in achieving a water secure future.

Participants in the "Future of Water" workshop discussed and debated high-priority goals to address the problem of water scarcity in South Africa and proposed several actions that can be taken to achieve these goals.

WHAT ARE THE BROAD WATER-RELATED GOALS?

Workshop participants discussed broad water-related goals for South Africa. Four goals emerged as essential:

1 WATER-CONSCIOUS COUNTRY

Become a water-conscious country with sufficient knowledge and skills in the water sector

2 STRONG WATER GOVERNANCE

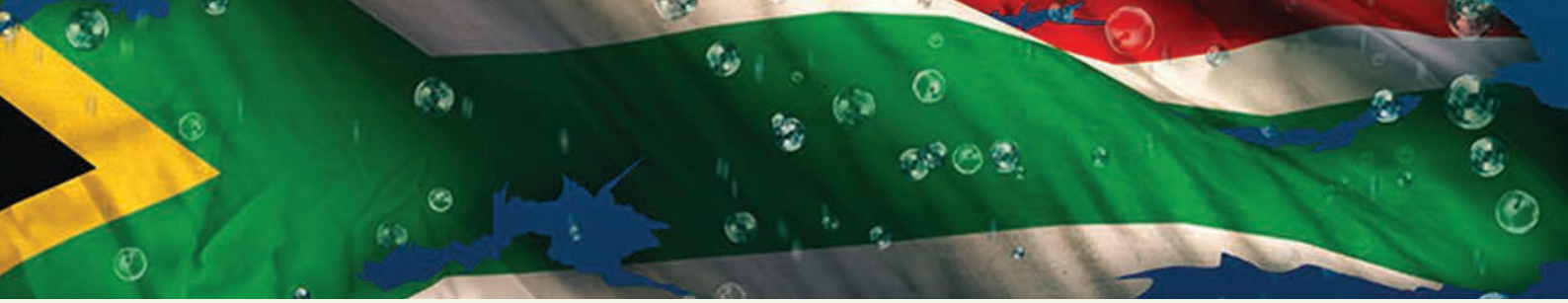
Implement strong water governance with resilient stakeholder partnerships that advance the more explicit second phase of the National Development Plan to achieve water security under climate change

3 WATER SUPPLY AND DEMAND

Manage water supply and demand regulations more rigorously and protect water resources

4 WATER-SMART ECONOMY

Become a water-smart economy and a leader in Africa in commercializing low-water technologies for industry and agriculture



WHAT ACTIONS CAN BE TAKEN TO ACHIEVE THESE GOALS?

The following actions were identified to support these water-related goals in South Africa:

1 BECOME A WATER-CONSCIOUS COUNTRY WITH SUFFICIENT KNOWLEDGE AND SKILLS IN THE WATER SECTOR

EDUCATE AND SHARE BEST PRACTICES

- Educate on the value of water and water conservation in schools
- Use social media to share examples of best practices on water efficiency
- Promote and share best practices from water stewardship partnerships and programmes via an online platform aimed at protecting water resources

COMMUNICATE AND CAMPAIGN

- Communicate Department of Water and Sanitation's relevant policies and strategy documents that encourage district & municipality collaboration and the transition to a low water economy
- Engage new partners in water sector to showcase and present new technology
- Share experiences and knowledge acquisition on water challenges and opportunities from various provinces

DEVELOP SKILLS AND CAPABILITIES

- Develop skills and capabilities to effectively maintain water infrastructure by training in local communities to fix water leaks
- Transfer service delivery responsibilities to regional utilities where municipalities lack technical capacity (Dean to review)
- Develop skills and provide job opportunities in water management and wastewater treatment

2 IMPLEMENT STRONG WATER GOVERNANCE WITH RESILIENT STAKEHOLDER PARTNERSHIPS THAT ADVANCE THE NATIONAL DEVELOPMENT PLAN

MONITOR COMPLIANCE AND ENFORCEMENT

- Establish water-use compliance and disclosure reporting requirements for Johannesburg Stock Exchange listed companies
- Strictly enforce punitive action for non-compliance with water use entitlements and wastewater treatment requirements
- Regulate, enforce and effectively collect water tariffs

ADVOCATE STAKEHOLDER PARTNERSHIPS

- Incentivize the private sector via water stewardship programs to plan, invest in and implement water management systems and infrastructure
- Develop public-private partnerships models to upscale maintenance and service delivery of utilities
- Develop a business case to advocate for prioritizing water in national budget
- Transparent access to information from government (eg on conditions for water-use)

DEVELOP INNOVATE FINANCING SOLUTIONS

- Co-finance clearing of alien species and convert alien plant biomass into a commercial bi-product to sell and finance the ongoing removal of this vegetation
- Strengthen regulatory framework to incentivize innovative financing (e.g. hydroelectric power sold and returns reinvested in water infrastructure)
- Explore innovative and off-budget financing mechanisms
- Look to successes and lessons learnt from financing models adopted internationally to fund infrastructure in the water sector
- Explore opportunities to invest in ecological infrastructure through blue or grey bonds, issued by government, municipalities, or multi-national banks

Water in South Africa

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3 MANAGE WATER SUPPLY AND DEMAND REGULATIONS AND PROTECT WATER RESOURCES

IMPLEMENT DIFFERENTIATED TARRIFS

- Differentiate water tariffs across various industries and consumption levels
  - Charge increasing tariffs for water use over a certain consumption threshold
  - Include the full cost of water in the revised pricing model
  - Prepare for a pricing strategy in the face of a revoked right to water

MANAGE WATER QUALITY

- Incentivise stakeholders to monitor and rectify contribution to water pollution
- Promote interdependencies of industries to trade and share water at different levels of cleanliness through water treatment agreements
- Establish a "fit for purpose" domestic water policy, where water is separated per quality based on usage needs

MANAGE WATER INFRASTRUCTURE AND DEMAND

- Fast-track critical water infrastructure engineered and ecological projects by resolving bottlenecks identifying delays in the pipeline
- Benchmark water-use efficiency across industries compared to best practice
- Incentivize zero-liquid discharge in industrial sector through recycling and reuse
- Fix and develop hydro-power stations in dams to use water effectively for sustaining operations, productivity and economic growth

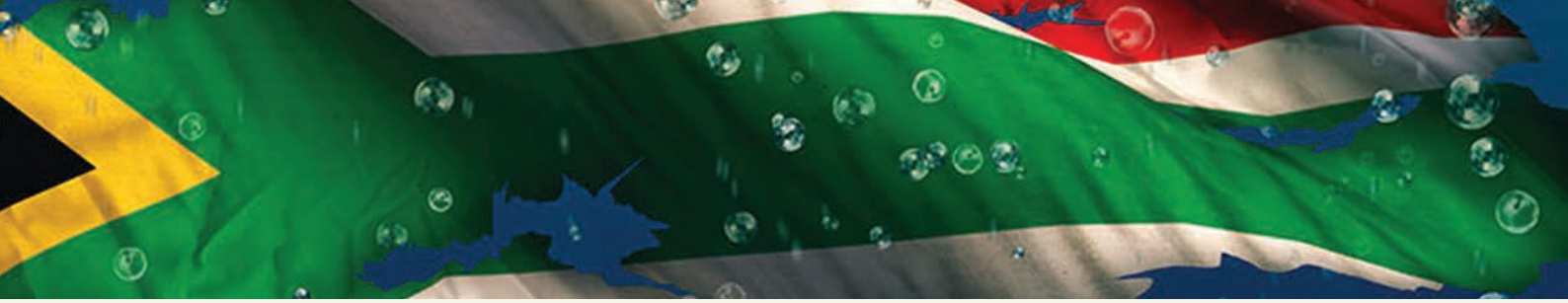
4 IV. BECOME A WATER- SMART ECONOMY AND A LEADER IN AFRICA IN COMMERCIALIZING LOW-WATER TECHNOLOGIES FOR INDUSTRY AND AGRICULTURE.

INVEST IN RESEARCH COMMERCIALIZATION AND TECHNOLOGY

- Adopt smart water technologies in irrigation techniques and water reuse to sustain the agriculture sector
- Stimulate commercialization and development of new technologies in water management and promote the implementation of new solutions
- Set up rule-based algorithms to calculate and control how much water should be utilized according to seasonal/cyclical patterns & refine water policy accordingly

COLLECT SHARE AND MANAGE INFORMATION

- Enhance information sharing and spread awareness of water users' impact through using a centralized data-sharing platforms
- Incentivize major water-users to quantify and report on their water-footprint
- Engage district municipalities to collect information on water and sanitation services backlogs and consolidate data at a central point of access
- Enhance wide use of water assessment tools to improve stakeholder decision-making



WHAT INDICATORS DO WE NEED TO MONITOR?

Stakeholders were encouraged to discuss the potential indicators we should monitor to detect that we may be heading towards a certain future.

LEVEL OF WATER AVAILABILITY

ENVIRONMENTAL

- Ecosystem health indicators
- Water Quality Index
- Level of dam capacity
- Forecasted impacts of climate change
- Levels of protection of Water Source Areas

REGIONAL AGREEMENTS

- Delays in execution of water infrastructure projects
- Establishment of new trans-boundary agreements
- Increased regional trade in virtual water

INNOVATION AND INFRASTRUCTURE

- Growth of local market for smart water technology
- Numbers of published papers and patents for water-smart technologies
- Progress on the water R&D roadmap
- Commercialisation of local water solutions
- % of wastewater treated

DEMAND AND SUPPLY MANAGEMENT

DEMOGRAPHIC AND ECONOMIC

- GDP growth
- Rate of urbanization
- Poverty rate
- Water Poverty Index
- Per capita water use
- % access to safe drinking water

POLITICAL

- Changes in the free right of water[2] legislation
- Prioritization of water in National Development Plan
- Corruption Index
- Wasteful expenditure levels in water institutions

LEGISLATION/GOVERNANCE

- Enforcement of environmental levy
- Price change in water tariffs
- Requirement for compulsory water licenses
- Wastewater[3] trading credits

1. Index measures SA's relative position in the provision of water, considering resources, access, capacity, use, and environment.
2. Right to access sufficient water, free 6kl per household per month.
3. Wastewater is any water that has been adversely affected in quality by anthropogenic influence.
Source: WWF water-risk filter and workshop stakeholder discussions.

Water in South Africa

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CONCLUDING REMARKS

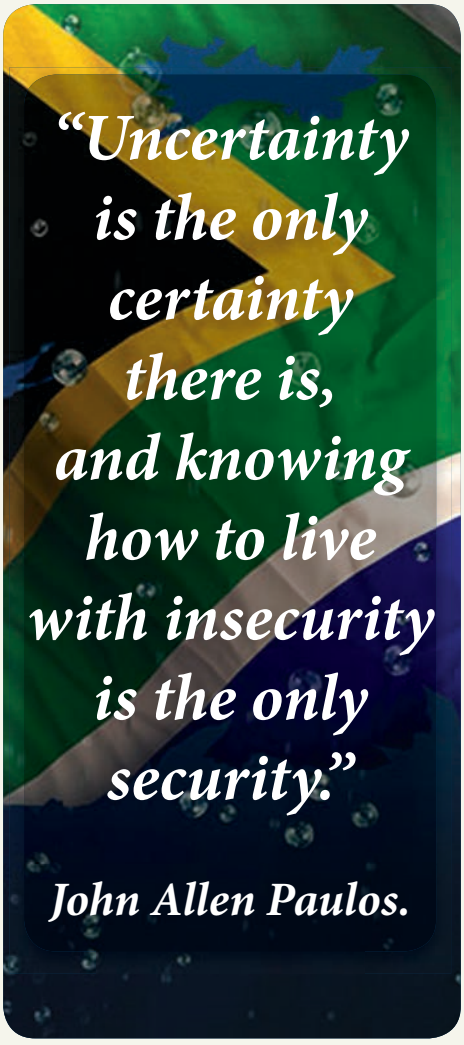
South Africa has just survived its worst drought in over 20 years, and learned some harsh lessons along the way.

Although the Cape is still in the grip of a deepening disaster, a greater danger may be that the floods in the rest of the country wash away the good resolutions to be better prepared and strengthen water governance. As one of the stakeholders in our workshop on the scenarios said *"Our biggest fear is that this drought was a slap in the face and not a knock-out!"* Was it enough to drive a systemic change in our view of the value of water and catalyse a real transition to a low-water economy?

Exploring scenarios on South Africa's water futures with the BCG scenario experts and water sector experts, helped to surface our assumptions about how we will cope with different potential futures. Scenarios are a powerful tool that enable us to think in different boxes. Some of us have a strong belief that government will be able to engineer solutions in the future via water pricing and new dams. Others have lost faith in the government's ability to implement and deliver under ever more challenging climate scenarios, and believe that more private sector involvement is the key to stronger governance of our water system.

In the complex, real world of unknown political, economic, and climate variables, we cannot predict with confidence where we will end up. However, our discussions showed that – whether we move towards strong governance and a growing economy (Big Fish, Growing Pond) or end up with supplies failing under climate change and crumbling governance (Cry Me a River) – there are actions we could take now that would prepare us better for all eventualities. We have already taken steps towards greater water consciousness as a nation during the 2016-17 drought. We need to understand more explicitly how partnerships can build the necessary skills and competence to do more with less, equitably and sustainably.

There are real opportunities for South Africa to lead Africa in the transition towards a water-smart economy, with new technologies and enterprise innovations that ensure our water security. But we need to take decisive steps now, and not wait until the next drought. wn



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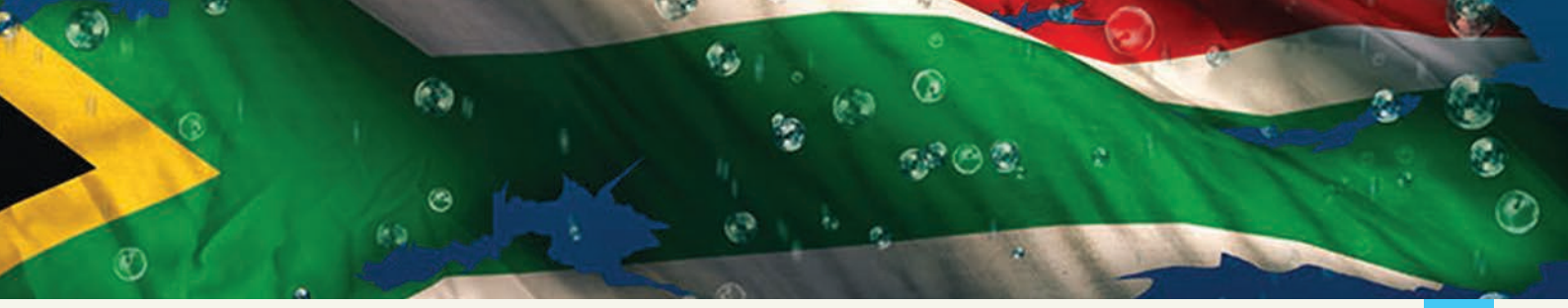


South Africa's water situation in numbers

50%

Surface water comes from 8% of our land area

25%

Lost to leaks in municipal systems

46%

South Africans have a water source in their house

R 700 bn

Needed to upgrade engineered water infrastructure

WWF

Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

www.wwf.org.za/

IN MY OPINION - LEE NAIK

The Technology Trends Driving Digital Excellence in 2018

Many would say that in this age of exponential technology acceleration, a start-of-the-year tech trends report is rapidly becoming an exercise in futility. But don't believe them.

BY | LEE NAIK

Yes, tech is seemingly moving at light-speed as we power into the Fourth Industrial Revolution, but its trajectory is far from unpredictable. After all, technology solutions are always aimed at tackling a problem – and as a species, our problems and priorities haven't changed all that much for centuries.

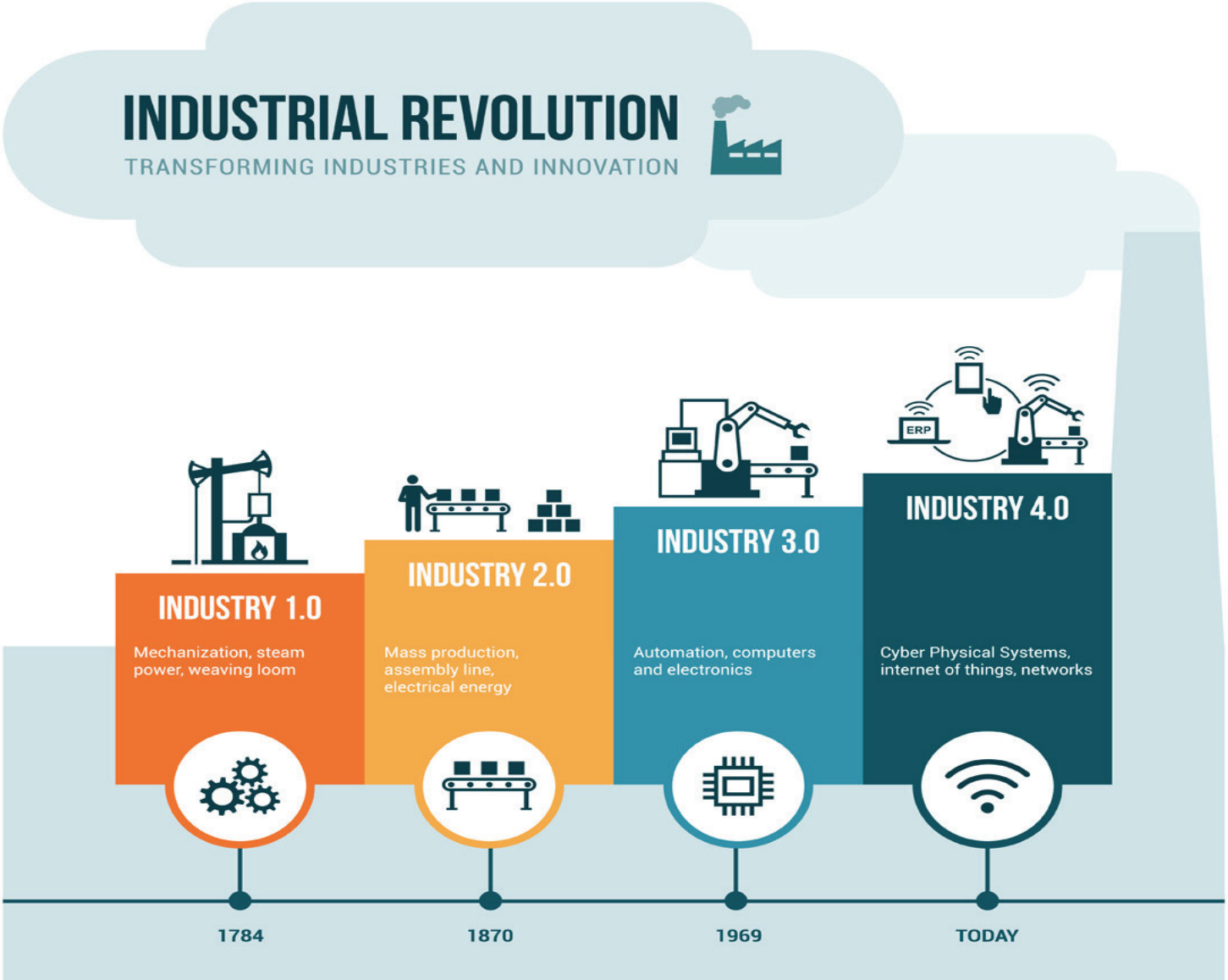
Efficiency, speed, equality, an end to suffering, and prosperity – these are the values and priorities that generally drive us forward, as societies, individuals and organizations. And the business tech trends of 2018 are no exception.

While it may not be difficult to predict which way the tech winds are blowing, what is challenging is finding the right moments to act. This is especially true of African businesses, where the environment is often so different from the United States, Asia, and Europe. It's important to understand global trends, of course, but hyper-focusing on what's happening overseas can blind you to revolutions in your own back yard. With that in mind, I've drawn not just from the global experts and industry analysts, but my own understanding of the local continental landscape to build a guide for the year ahead that is specific to Africa.

THE HUMAN FACE OF AI

We've reached a point in AI development where robots can beat you at chess and Go. But the real interesting work in the machine learning realm isn't around the processing power, but rather, the intersection of human and artificial intelligence, where people interact with, well, not-people.

Forget chatbots. There hasn't been a user experience interface devised yet that can simulate the complex emotional and linguistic intricacy of human to human interaction – but 2018 might be the year all that changes. Consumers' need for more real-time services, and the tempting possibilities of using technology in classically "human to human" scenarios means that refining



the conversational and emotional side of AI will be a strong focus in the coming year. The exciting part, however, isn't that more realistic AI-driven conversations are taking place (though that's rather impressive, too). It's the AI working behind the scenes that is really stealing the show - not AI that purports to be more human, but AI that enables us to become more human.

Imagine if a poor, under-resourced cancer patient living in Africa suddenly had access to the world's finest oncologists. Imagine if AIs trawling billions of social media posts could accurately identify those most at risk of suicide and reach out to them proactively. These things are already happening. And of course, futurists like Elon Musk have already started working on the ultimate goal of Human Machine Interfaces – the seamless connection of mind and machine, which promises to completely revolutionise the way we interact with technology and, consequently, each other.

In both the business and humanitarian contexts, AI in 2018 will be less concerned with passing the *Turing Test, and more about making sure that human beings are equipped to handle the varieties of culture, language, and life experiences of the citizens on planet Earth.

PUSHING AUTOMATION TO THE TIPPING POINT

Times are tough for African economies. Thankfully, automation holds the potential to relieve much of the financial burden for businesses and governments alike. 2018 will be a year of even more organisations realising the cost-cutting and streamlining benefits of process automation, particularly on the repetitive and time-consuming tasks becoming all-too-familiar in increasingly digital work environments.

Today's customer exists in an always-on world, and expects an always-on, omni-channel customer experience. Last year saw the Department of Home Affairs make incredible leaps in reducing its notorious bureaucratic backlogs through automation. Meanwhile, in retail, Pick 'n Pay is piloting a somewhat controversial self-service checkout project. Expect to see more large-scale projects of this sort in the coming year, with the current state of the economy creating a bigger need for competitive advantage and cost-cutting measures among businesses across every sector.

** The Turing test, developed by Alan Turing in 1950, is a test of a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human.*

2018 Technology Trends

continues from page 57

With more businesses than ever realising automation isn't just a future innovation, but a critical part of any organisation, it's time for the workforce to begin bot-proofing. Unemployment need not necessarily be on the horizon. With the World Economic Forum predicting that 65% of children entering primary school today will end up working in jobs that do not yet exist, it's an excellent time for South Africa to start investing in education around keeping AI systems running.

IT'S THE END OF THE APP AS WE KNOW IT

As of December 2017, Statista reports that the Google Play Store boasts a total of around 3.5 million applications available, with Apple's App Store currently at 2.2 million. These are huge numbers, but the figures are not particularly surprising. Here's something that is, though: what was once thought of as a literally limitless way of delivering specialised chunks of functionality to consumers is facing some resistance thanks to an array of platforms that make your stock-standard app dated in comparison. The human, physical world is fighting back, and so-called "phygital" experiences will continue their rise in 2018, especially as the tactile Generation Z increase their buying power.

The app is a channel to the customer - an effective one at that - so why, then, is excitement waning? Enterprises that invest in an app just to keep up with the corporate equivalent of the Joneses, unfortunately, can only expect their rates of success to diminish in the coming years. An app is simply not a business model. It's only one aspect of an effective omni-channel strategy, and for a business to maintain relevance, attention must be paid to the sweeping changes affecting the app ecosystem at large.

The apps that will thrive in 2018 are the ones that emphasise their ability to solve a real-world problem – those that connect consumers to solutions and services that can tangibly improve their lives.

They build on well-established concepts and delivery models to create a more seamless interaction between the digital and physical worlds, and technologies like AI and artificial or augmented reality are helping them do it.

If businesses focus on using apps to bring problem and solution together, that's half the battle won. The question they need to ask themselves is: "If my customers only had room for 5 apps on their phones, would my app be one of them?"

KNOWING ME – THE RISE OF ALTERNATIVE DATA

The world we live in is connected and digital, yet remains far from egalitarian. From growing SMEs into prolific employers, to improving access to education and housing, so many of the most desperately needed facets of development depend heavily on access to healthcare, banking, and other financial and social services that should – in theory – be accessible to all.

Unfortunately, Africa is a notorious "thin-file" population, with large sections of unbanked and lacking in credit history. Infrastructural challenges mean that many people are also excluded in the social sense. Millions lack permanent physical addresses, identification documents, and many other essentials needed to take meaningful part in the social economy.

But the classical definition of a "data footprint" is rapidly expanding, granting often life-saving access to critical services that can uplift individuals, businesses and communities. In knowing people, businesses, governments and NGOs are granted the ability to do better by them, and new forms of alternative data are presenting exciting new possibilities for exploring their potential to solve problems of financial and social inclusion in an unfair world. Africa, with its lingering rhetoric of colonialism and Apartheid, can benefit greatly from giving the marginalized and disenfranchised the voice they deserve.

With something as simple as a permanent address and an identity or social security number, millions across the continent can go from invisible and neglected, to counted and prioritized.

South Africa's own National Development Plan for 2030 is an ambitious undertaking for which alternative data will be essential. With access to public services for the poorest of the poor as its mantra, how is the government to begin including those citizens who live in deeply rural areas? What about those without Internet connections, or even electricity and running water? Unique ways of finding, and quantifying such populations are what alternative data does best. The key might lie in drawing insights from places nobody has thought to look before.

CUSTOMER EXPERIENCE GETS UP CLOSE AND PERSONAL

New technologies have completely overhauled the way that Generation Y, Z and beyond consume marketing. But with hyper-personalised, proactive marketing experiences taking centre stage, traditional

psychographic and ethnographic research is often not enough to deliver new, meaningful experiences.

As IoT connectivity increases and more sensors collect more data from more people, there are rich ecosystems of unstructured data from which to design new experiences, products, and services.

Imagine being able to monitor your customer's emotions as they happen – right down to capturing the goosebumps on their skin. That has the potential to transform anything from retail to healthcare to productivity.

And if anything can hold a sensor, anything can be used as a source of data to understand the subject at hand – and offer insights to create immersive, multisensory experiences.

The question for South African businesses isn't just 'are you beefing up your IT skills?', but rather, 'are you hiring and empowering the right creatives, data experts and strategists to make sense of the vast variety and volume of data that's already out there?'

Of course, all of the above is just the tip of the iceberg in terms of the exciting new developments taking place every day. wn

WATT? is a forum related specifically to the industrial and commercial electrical sector.

Do you have any burning questions, topical issues or points of interest about the electrical industry, from the perspective of a contractor, supplier or professional service provider? Submit your comments, thoughts, ideas, suggestions or questions for the attention of our industry experts, and these will be addressed in a future issue of the magazine. This is your forum, and we would like to hear from you!

WATT? is an opportunity for people on the ground to engage with each other and related professionals in an informative and friendly manner. This is a platform for you to discuss anything related to your particular sector, to highlight anything new, or to ask a specific question related to a technical topic or to engage in general industry issues. . Please note that we will not be considering anything related to the domestic sector, such as residential wiring.

We hope that this section of the magazine not only becomes a regular feature, but that it is widely read and distributed among your peers. Remember, it can only become a success with the full participation of our readers! Send your burning questions to minx@saiee.org.za - subject 'WATT?'.

We look forward to hearing from you.
- Ed

QUESTION ONE

What is an Air Handling Unit (AHU) and what benefits can be achieved using Variable Speed Drives (VSD) to control the AHU?

ANSWER ONE

An AHU is used to recondition and distribute or circulate air as part of a heating, ventilation, air conditioning and cooling (HVAC) system. The function of the AHU is to regulate the intake of dirty or air from outside, recondition it through a series of filters racks and supply it as fresh air to the interior a building.

HVAC systems are commonplace throughout buildings and similar enclosed structures, and there is a need to be able to efficiently and effectively control the air flow. Historically, the most common method has been to use a belt and pulley system, but this is known as a high maintenance system.

Use of VSDs in an AHU application offer several significant benefits overall, and it is important to understand each of these.

SPEED CONTROL

VSDs are used to adjust the speed of an electric motor thereby offering precision control. This capability to control the speed of the motor allows for a reduction in load on the system resulting in energy savings. VSDs also allow for system automation and optimum climate control.

Optimum control of the AHU via the VSD, with the ability to reduce the speed when necessary and only increase when the demand for air in the building increases, will translate into decreased kWH with associated bottom line savings. Where control of the HVAC system is not done using a VSD, constant unnecessary air flow often results in energy wastage.

An added advantage is that VSDs can be controlled through the Building Management System (BMS).

INCREASED AIR FLOW

Optimisation of the HVAC system is easily achieved using VSDs which allows for the correct level of air flow to be distributed on demand into the building. As mentioned above the ability to increase the motor speed thereby increasing the air flow allows the system to adapt and react in accordance with demand.

CONTROLLABLE OPERATION

A significant advantage when using a VSD in an AHU is that you end up with a controllable system which allows easy adaptation to current or future changes that may be required. These changes could include a sudden increase, a reduction in air flow or a no-air requirement. The ability to control the HVAC system to this level will provide major energy savings.

ENERGY SAVING

With the increased emphasis on reducing energy consumption across all industry sectors, it is the responsibility of every individual to use forms of energy effectively and efficiently. The capability of a VSD to control the speed and limit the starting current of an electrical motor is probably the main energy saving factor when applying VSD technology to an HVAC application.

VSDs limit the start-up current of an electric motor ensuring that no more than 150% current for 60 seconds will be drawn from the electrical network. This feature of the VSD facilitates full electrical protection and starting capability of the motor.

If the efficiency of the overall system is improved, then the power demand will drop proportionally with increased efficiency. Almost all fans are over designed because of unknown and/or variable factors and seldom work at their maximum designed efficiency point.

Fitting a VSD to an AHU motor, allowing motor speed reduction, changes the absorbed power of the load allowing the motor to operate at a lower power consumption leading again to major energy savings.

MAINTENANCE SAVINGS (LESS MECHANICAL STRESSES)

When a VSD is installed in an AHU application, greater control of the motor's operation results in less mechanical stress. This will lead to lower maintenance requirements with less frequent belt replacement. In addition, the system will be quieter during operation while still being able to maintain comfortable temperatures and humidity levels within the building.

QUESTION TWO

Please explain how energy reduction is achieved using VSD's?

ANSWER TWO

AHUs are responsible for a substantive portion of the running costs of a building. By using a VSD to control or regulate the speed or torque requirement of an electrical motor, electrical consumption will be reduced by eliminating energy wastage.

Energy savings are achievable through affinity laws. The affinity laws explain the relationship between variables involved in fan performance, including capacity and power consumption. The power required to run a fan is proportional to the cube of the speed. As an example, 80% speed is equal to 51% power consumption or 50% speed is equal to 12.5% power consumption. The affinity laws show that flow is proportional to motor speed, pressure is proportional to motor speed squared and power required is proportional to motor speed cubed.

In all HVAC applications, air flow is only required to meet demand and this is often not constant. Air flow can be regulated by varying the electric motor speed and this is easily achieved using a VSD. In these applications, the significant energy savings achieved by the use of the VSD will provide rapid payback in AHU applications. wn

Information provided by Zest WEG Group

January

Movers, shakers and history-makers

COMPILED BY | JANE BUISSON-STREET
FSAIEE | PMIITPSA | FMIITSPA

1 JANUARY

1939 Bill Hewlett and Dave Packard formalized their business partnership. They decide to name the company after themselves and used a coin toss to decide the order of their names; Hewlett-Packard had a 50/50 chance of being named Packard-Hewlett.

2 JANUARY

1906 The Wanderers Cricket pitch was played on for the first time when South Africa played against the Marylebone Cricket Club (MCC). South Africa won with 1 wicket.

3 JANUARY

1957 The Hamilton Watch Company introduced the first electric watch to never need winding. However, its battery life was so short that frequent battery replacements were necessary. It was an instant hit because the novelty of never needing to wind the watch proved extremely popular.

4 JANUARY

1972 Hewlett-Packard introduced the first handheld scientific calculator, the HP-35. The precision of the calculator was greater than most mainframe computers of its time.

5 JANUARY

1933 Construction began on the Golden Gate Bridge, as the workers began excavating 93 000 cubic metres of dirt for the structure's huge anchorages.

6 JANUARY

1688 A Dutch ship, the Rosenberg, carrying Huguenots, left for the Cape from the Netherlands.

7 JANUARY

1963 Ivan Sutherland had developed Sketchpad, one of the earliest programs that allowed direct manipulation of objects on a computer screen. Using the Sketchpad, a user could create and manipulate graphical figures with a light pen.

8 JANUARY

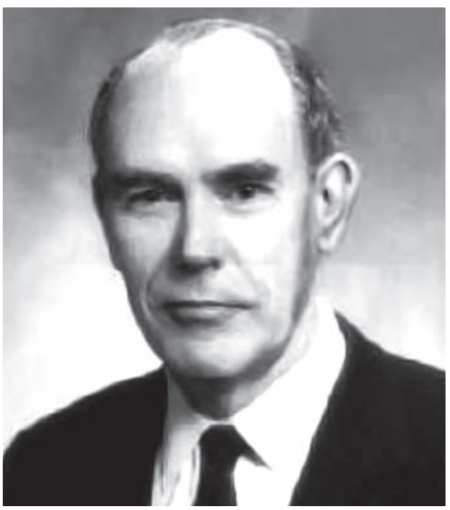
1912 The South African Native National Congress, later known as the African National Congress, was founded by John Langalibalele Dube who was also the first president.

9 JANUARY

1894 W.K. Dickson, an employee of Thomas Edison's movie studio, received a copyright for a motion picture film. The 5 second demonstration was a 47-frame film that showed a man sneezing. This man, Fred Ott, is now most famously known for having this sneeze recorded in film.

10 JANUARY

1863 The world's first underground railway service opened in London - the Metropolitan line between Paddington and Farringdon. Approximately 40,000 Londoners travelled on the trains during the first day.



11 JANUARY

1935 Amelia Earhart became the first person, man or woman, to fly solo from Hawaii to California.

12 JANUARY

1997 According to Arthur C. Clarke's 2001: A Space Odyssey, the fictional HAL 9000 computer became operational. In the 1968 movie adaptation, the computer's stated, *"I am a HAL 9000 computer, Production Number 3. I became operational at the HAL Plant in Urbana, Illinois, on January 12, 1997,"* put his birthdate in 1992. Both dates have now passed with no super-intelligent, human-like HAL computer in sight.

13 JANUARY

1874 The U.S. Patent Office issued a patent for the Spalding Adding Machine. This precursor of calculators and computers were mechanical adding machines that could do simple arithmetic.

14 JANUARY

2008 Apple Chief Executive, Steve Jobs demonstrated Apple's new MacBook Air notebook during the Macworld Conference & Expo in San Francisco.

15 JANUARY

1986 The National Science Foundation opened the National Centre for Supercomputer Applications (NCSA) at the University of Illinois, a national "Centre of Excellence" for research into high-performance computing.

16 JANUARY

1690 The Galiot Noord was wrecked fifteen miles (24 km) west of Cape St Francis after a survey voyage to Delagoa Bay and Natal. Most of the crew, who tried to walk back to the Cape, died on the way.

17 JANUARY

1934 Johannes Jacobus Jonker found what is now known as the Jonker Diamond at the Elandsfontein mine in South Africa. The diamond was 726 carats, which at the time was the fourth largest uncut gem ever found. The diamond was found approximately 5 km from where the largest diamond, the Cullinan Diamond, ever found.

18 JANUARY

2005 The Airbus A380, the world's largest commercial jet and nicknamed the "Superjumbo", is unveiled at a ceremony in Toulouse, France.

19 JANUARY

1983 The Apple Lisa, a desktop computer developed by Apple, was launched. It was one of the first personal computers to offer a graphical user interface (GUI) in a machine and was aimed at individual business users for a price of US$9,995 for a 5 MB hard drive.

20 JANUARY

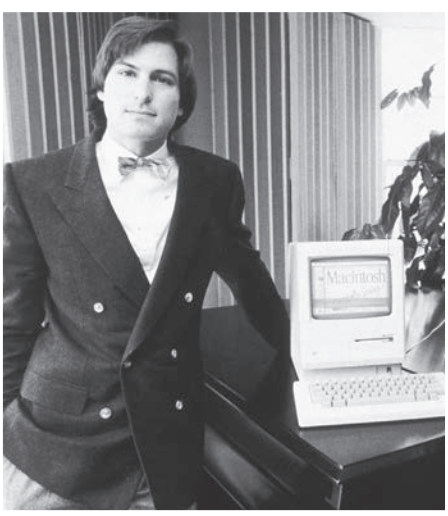
1697 Captain William Kidd's ship, the Adventure Galley was reportedly sighted off the coast of Cape Town. He was a Scottish sailor who was tried and executed for piracy after returning from a voyage to the Indian Ocean.

21 JANUARY

1976 The commercial service of the Concorde began with the London-Bahrain and Paris-Rio routes. It could travel between New York and London in about 3.5 hours. The Concorde flew commercially for 27 years until being retired on November 26, 2003.

22 JANUARY

1984 Apple Computer launched the Macintosh, the first successful mouse-driven computer with a graphic user interface, with a single $1.5 million commercial during the Super Bowl.



JANUARY

continues from page 63

23 JANUARY

1909 The RMS Republic, a passenger ship became the first ship to use the CQD distress signal after colliding with another ship, the SS Florida, an event that killed six people. CQD, transmitted in Morse code, was one of the first distress signals adopted for radio use.

24 JANUARY

1901 Emily Hobhouse, an English social worker reported to the British government that she found 2 000 women and children in shocking circumstances in the British concentration camp at Bloemfontein.

25 JANUARY

1950 The original microwave oven patent was issued to Percy LeBaron Spencer who accidentally discovered that microwave energy could heat food when a chocolate bar in his pocket melted while he was experimenting with a microwave tube.

26 JANUARY

1896 The oldest teacher training college in South Africa, Murray Hall, was opened on 26 January 1896, in Wellington, Western Cape, South Africa. This area is where the 1688 French Huguenot refugees settled and was known as Limiet Vallei.

27 JANUARY

1985 Coca Cola started distribution in the Soviet Union, 12 years after Pepsi.

28 JANUARY

1998 Radio Shack opted to partner exclusively with Compaq, rather than IBM, to sell PCs throughout their 7,000 stores. Six years later, IBM sold its PC division to the Chinese company Lenovo.

29 JANUARY

2016 Boeing announced that work has commenced on the modifications of a commercial 747-8 to be the next Air Force One Presidential aircraft, expected to be operational by 2020.

30 JANUARY

1899 Dr Max Theiler, the first South African to be awarded a Nobel Prize was born on this day. He studied medicine at the University of Cape Town Medical School from 1916 to 1918. Theiler joined the Rockefeller Foundation in 1930, where he headed the research team that did extensive research on yellow fever and other viral diseases.

31 JANUARY

1995 AT&T Bell Laboratories and VLSI Technology announced plans to develop strategies for protecting communications devices from eavesdroppers. The goal was to prevent problems such as insecure cellular phone lines and Internet transmissions by including security chips in devices.

(I will leave it to you to decide whether they were successful or not). wn

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calendar

FEBRUARY | MARCH 2018

FEBRUARY 2018

5	High Voltage 'Roofline' System	Swindon, UK	www.theiet.org
7 - 8	Cyber Security for Industrial Control Systems	London, UK	www.theiet.org
14	Photovoltaic Solar Systems	Johannesburg	roberto@saiee.org.za
20 - 22	2018 IEEE International Conference on Industrial Technology	France	www.ieee.org
20	Keeping The Lights On; The Bit You Don't See	London, UK	www.theiet.org
21	Fundamentals of Power Distribution	Johannesburg	roberto@saiee.org.za
22	Fundamentals of Long Term Evolution (LTE) Mobile Communications	Kwazulu-Natal	www.saiee.org.za
26 - 28	2018 5th International Conference on Renewable Energy	United Arab Emirates	www.ieee.org
28	Substation Design and Construction	Johannesburg	roberto@saiee.org.za

MARCH 2018

4 - 6	11th International Symposium on Mechatronics and its Applications	United Arab Emirates	www.ieee.org.za
5-6	Fundamentals Of Developing Renewable Energy Plants	Johannesburg	roberto@saiee.org.za
6-9	Advanced Microprocessor Based Power System Protection	Johannesburg	roberto@saiee.org.za
13	SAIEE Charity Golf Day	Glenvista, Johannesburg	geyergsaiee.org.za
13 - 14	Design Of Economical Earthing Systems For Utility Electrical Installations	Johannesburg	roberto@saiee.org.za
15 - 16	ARC Flash	Johannesburg	roberto@saiee.org.za
15 - 17	2018 10th International Conference on Computer Supported Education	Portugal	www.ieee.org
20 - 22	2018 35th National Radio Science Conference	Egypt	www.ieee.org
27 - 28	Power & Electricity World Africa 2018	Johannesburg	www.terrapinn.com
28 - 30	2018 IEEE 4th Middle East Conference on Biomedical Engineering	Tunisia	www.ieee.org
29	SAIEE AGM	Johannesburg	www.saiee.org.za

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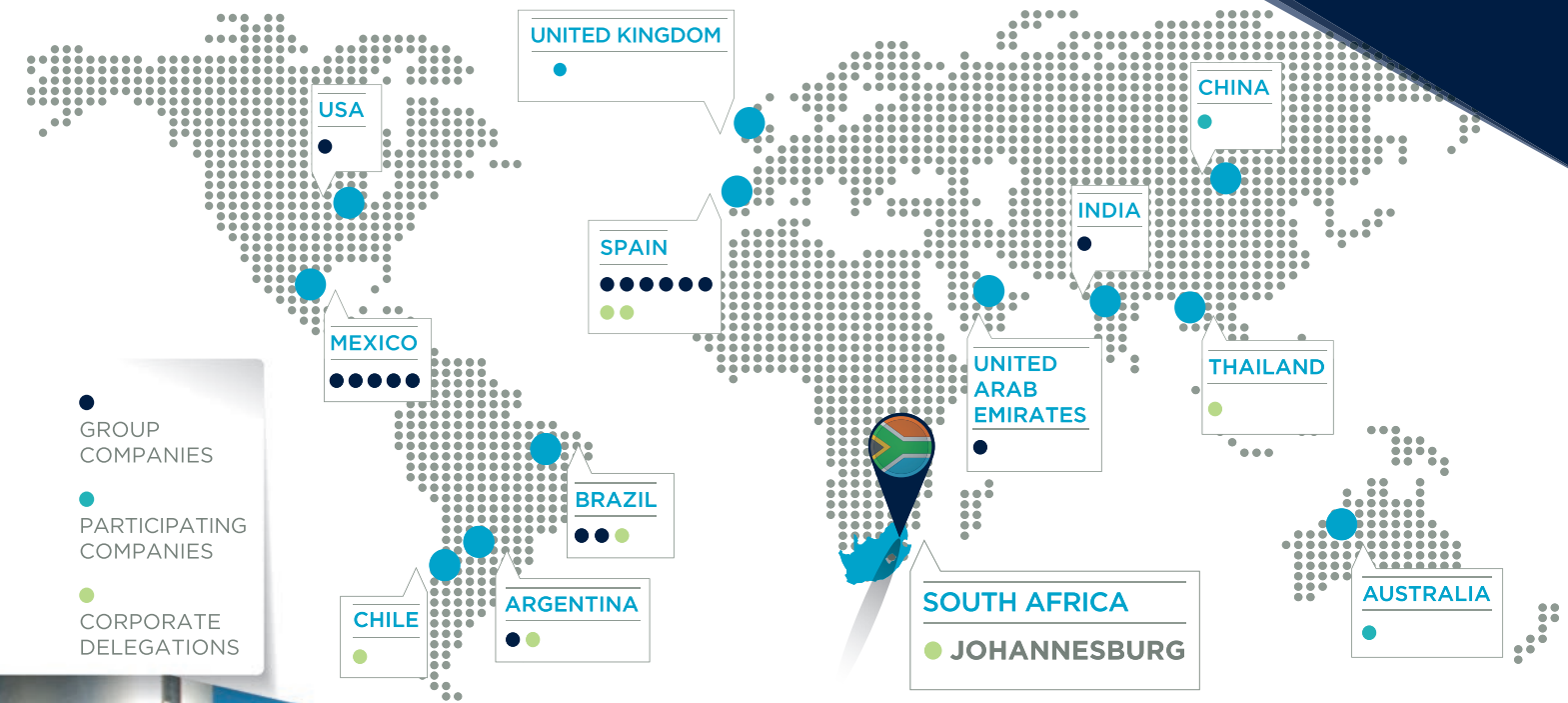

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