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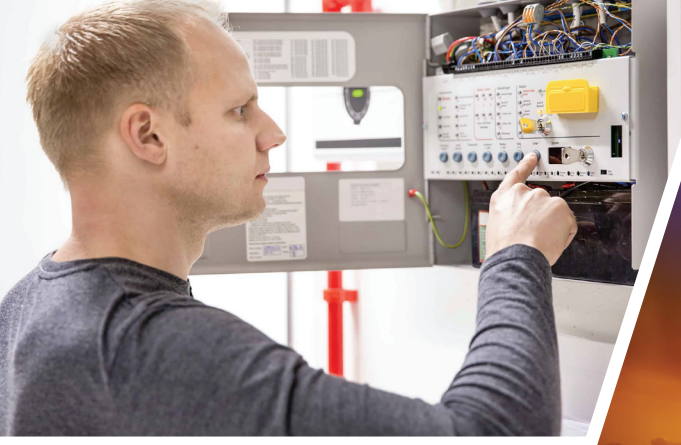
TECHNOLOGY

SAIEE THE OFFICIAL PUBLICATION OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | JANUARY 2019



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It's a new year and new beginnings.

I trust all our readers enjoyed an excellent festive break and are ready to tackle the new year, with its unique challenges.

This issue of the **watt**now features New Technologies. Technology runs our lives these days - smartphones, tablets and computers – we really can't seem to function without them. In a short amount of time, technology has exploded on to the market, and now, many people cannot imagine a life without it.

To understand how we left the dark ages (which really wasn't all that long ago), to where we are today, it is essential to understand how technology evolves and why it matters.

Our first feature article, on page 22, sports a technology forecast for 2019. This year will see a world of transformation thanks to disruptions in technology that will impact a wide range of sectors.

Our second feature article talks about business interruptions, which is a leading risk for companies in South Africa. I took the liberty of publishing an excerpt of the Allianz Risk Barometer Report for 2019. Read more on page 32.

In another technology article, I share with you of how Africa could emerge as the new champion of working flexible hours (page 48). Africa's economy could grow faster than any other continent's over the next five year. According to the World Bank's analysts, the working-age population could lead to a GDP growth of up to 15 per cent.

Please take note about the SAIEE Charity Golf Day, taking place on the 24th of April 2019 at the Pretoria Country Club. Please visit our website (www.saiee.org.za) for more information.

Herewith the January issue, enjoy the read!

Minx

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

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WATTSUP

RUSSIA AND THE REPUBLIC OF RWANDA DEVELOP COOPERATION IN THE FIELD OF PEACEFUL USE OF ATOMIC ENERGY

During an official visit of the Minister of Infrastructure of the Republic of Rwanda, Claver Gatete to Moscow, an Intergovernmental agreement on cooperation in the field of peaceful uses of atomic energy was signed between the two countries.

Rosatom Director General, Aleksey Likhachev, signed it on behalf of Russia and the Rwandan Minister of Infrastructure, Claver Gatete signed on behalf of the Republic of Rwanda.

The agreement will lay the foundation for active dialogue between two countries in the field of peaceful use of atomic energy and will allow for the practical implementation of particular projects.

The document establishes a legal basis for the interaction between Russia and Rwanda in a wide range of areas. This will include the elaboration of the project for the construction of a Center for Nuclear Science and Technology (CNST) and of a Nuclear Power Plant (NPP) in the Republic of Rwanda, as well as the development of nuclear infrastructure in line with the international requirements.

The agreement provides for the creation of workgroups for the implementation of particular projects and scientific research, along with the exchange of experts, the organisation of seminars and conferences, assistance in training scientific and technical personnel as well as the delivery of the equipment and materials.

Aleksey Likhachev emphasised: "*We are happy to share our more than 70 years' expertise in the field of peaceful use of nuclear technologies with our Rwandan partners. We hope that our cooperation in that area will contribute to the economic growth and improve the quality of life of the Rwandan population*".

TEKTRONIX REDEFINES THE ARBITRARY/FUNCTION GENERATOR

COMTEST, local representative of Tektronix, has announced the redefinition of the arbitrary/function generator (AFG) by introducing the AFG31000 series. Completely newly designed, the AFG31000 features many key firsts including the industry's largest touchscreen and new user interface that will delight engineers and researchers who need to generate increasingly complex test cases for debugging, troubleshooting, characterizing and validating devices under test.

Despite their importance in electronics test and wide adoption, AFGs have lagged behind other test instrumentation in terms of usability, making do with small displays and other shortcomings that make them hard to learn and operate. Moreover, traditional AFGs lack the deep memory and programming capability needed to compose a series of test cases with complex timing – critical for optimum test efficiency. By addressing these issues, the AFG31000 represents the first of the next generation of AFGs with features and capabilities simply not available elsewhere in the market today.

Advanced Capabilities Redefine the AFG

The AFG31000 series features a 9-inch capacitive touchscreen, the largest available on an AFG, that allows users to see all related settings and parameters on a single screen within a shallow menu tree. Similar to the modern touch-enabled smart devices, users can tap or swipe to easily select, browse, locate and change settings. The intuitive user interface saves users time in both learning and operating the instrument for major gains in productivity and efficiency.

Patented InstaView™ Feature Debuts

AFGs assume they are driving a 50 Ω impedance. However, most Devices Under Test (DUTs) do not have a 50 Ω impedance. This mismatch results in an inconsistency between the waveform as set on the AFG and the signal at the DUT. The new patented InstaView feature on the AFG31000 series addresses this problem by monitoring and displaying the waveform at the DUT without the need for additional cables or instruments. The waveform shown on the display instantly responds to changes in frequency, amplitude, waveform shape as well as the DUT's impedance, saving time and boosting confidence.

Programmable Waveform Sequencing

In addition to traditional AFG operation modes, the AFG31000 series offers an Advanced or waveform sequencer mode. In the Advanced mode, the instrument's up-to 128 Mpts of waveform memory can be segmented into up to 256 entries, and users can drag and drop long waveforms, or multiple waveforms in the sequencer and define how they are output. Compared

TRAFO'S CAST RESIN TRANSFORMERS READY FOR ACTION AT ZUIKERBOSCH

Dry-type transformer specialist Trafo Power Solutions secured the order for 13 custom-designed cast resin units for Rand Water's large Zuikerbosch Wastewater Treatment Works near Vereeniging.

The water purification and sedimentation facilities at Zuikerbosch will reportedly provide an additional 600 Ml per day to the system at a project value of R3 billion, as part of efforts to meet growing water demand in Gauteng due to steady population migration into the province.

The transformers being provided by Trafo Power Solutions range in size from 100 kVA to 1,600 kVA and have been modified to include earth fault protection and surge protection. This is in addition to the standard temperature protection features.

"The key advantages of dry-type transformers in this kind of application is their inherent safety and their ease of installation," says Trafo Power Solutions Managing Director David Claassen. *"The units can be installed inside built substations rather than having to be placed outdoors with their own civils and bunding infrastructure."*

Unlike conventional oil-cooled transformers, the dry-type units do not carry the risk of oil leaks or spillage and hence do not require special mitigation measures to protect the environment. The technology's relative safety also makes them more versatile in terms of the locations in which they may be housed. The units are self-extinguishing and flame-retardant by nature, allowing them to be categorised as 'F1' in terms of international fire ratings.

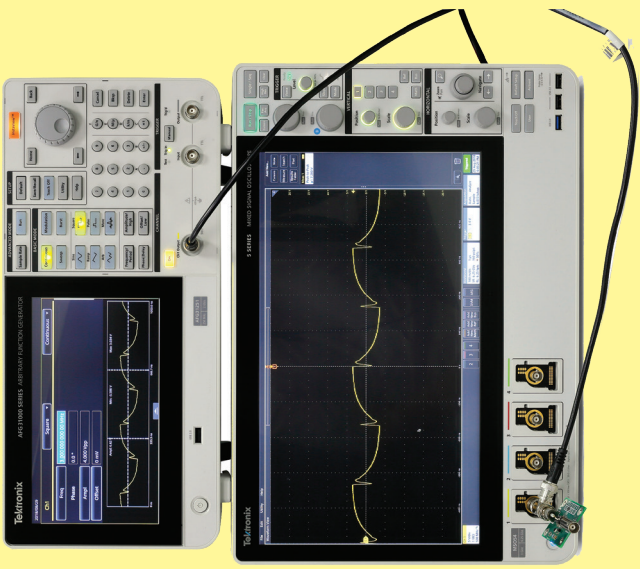
David Claassen, Managing Director of Trafo Power Solutions, says that is it most gratifying for the company to have received this order only months after the business was established.

to arbitrary waveform generators, the AFG31000 series reduces instrument costs by as much as 90 percent, giving users who need long, non-repeating waveforms, or multiple waveforms with complex timing an affordable alternative.

ArbBuilder Delivers Time Saving

Taking advantage of the large capacitive touchscreen, the new ArbBuilder tool built in the AFG31000 series enables users to create and edit arbitrary waveforms directly on the instrument without needing to create the waveforms on a PC and transferring them to the instrument. ArbBuilder improves test efficiency especially for arbitrary waveforms that need to change frequently. For users who want to replicate waveforms captured by an oscilloscope, they can save waveforms as .csv files and use ArbBuilder to load them directly into the AFG31000. Current AFG users, who are well aware of the limitations of AFGs, see the new sequencing and ArbBuilder features of the AFG31000 series as a significant boost to productivity and efficiency. The advanced features on this AFG could feasibly cut typical setup and test cycles by half.

AFG31000 series instruments are available in 1- or 2-channel configurations and deliver 14-bit vertical resolution along with 250 MSa/s, 1 GSa/s or 2 GSa/s sample rate performance. Additionally, in traditional AFG mode, users can change frequency without worrying about waveform length and sample rate. Output amplitude range is 1 mVP-P to 10 VP-P into 50 Ω loads.



V2 12665 18-18 Tek AFG31000 with scope.

WATTSUP

KZN: The investment province

The real manufacturing gross value added (GVA) for KwaZulu-Natal was estimated at R80.8-billion, making it the second highest contributor to the South African GVA behind Gauteng. This is according to MEC Sihle Zikalala. Added to this, government's infrastructure expenditure plan for the province is tagged at over R200-billion over the next seven years, further increasing the attractiveness of doing business with companies located in KZN.

The infrastructure programme involves road construction, air freight, rail, and the provision of water sanitation, services and electrification, as well as a major focus on the maritime industry. The message here is very clear. The KZN manufacturing sector is in an admirable position to gear up and take advantage of the opportunities that will arise as a result of these investments.

In addition, the country's automotive industry is aiming to increase the local content of assembled cars from around 38% and wants to double its production to 1.2 million vehicles by 2020.

"It's critical that local businesses find proactive ways in which to fight any negative influences caused by the economic downturn. We encourage these businesses to take a stand at the region's largest industrial technology exhibition, where they will be able to reach their target market in a focused and concentrated way. The KwaZulu-Natal Industrial Technology Exhibition (KITE), which is being held between 24 and 26 July 2019 at the Durban Exhibition Centre, takes the guesswork out of niche networking," says Nick Sarnadas, Portfolio Director at Specialised Exhibitions Montgomery.

Reaching industry decision makers is a task often fraught with complications and frustrations. *"Since the goal is to speak to the right people – the ones who are in a position to authorise procurements – it is of little use to take a shotgun approach. KITE has been the region's premier platform for industrial technology equipment and services providers to actively interact with manufacturing companies and government agencies for the past 38 years. We have a number of packages customised to suit individual needs, including sponsorship opportunities and seminar speaking slots. This is a fast-track way to ensure your place at the industrial table,"* says Sarnadas.

To find out more information about the exhibition visit the website at www.kznindustrial.co.za. Engage with KITE 2019 using the show hashtag #KITE2019.

France's first tidal energy plant gets smarter with QOS Energy's data intelligence platform

Sabella, a pioneering tidal and ocean stream turbine developer, has partnered with QOS Energy to improve the performance monitoring of its ground-breaking Ushant tidal energy project. The first 1 MW tidal turbine of the plant, immersed 55 metres under water off the west coast of France, is equipped with more than 100 sensors gathering data every 5 minutes. It now uses QOS Energy's powerful data intelligence platform to identify, assess and anticipate potential failures.

Sabella's 1MW D10 turbine was initially commissioned in 2015 in the Fromveur Passage, a strait that lies between Ushant Island and the Molène archipelago, off the coast of the French region of Brittany. After undergoing key technology upgrades, the tidal turbine was redeployed for the second time in October 2018. Once again, the 400-tonne machine lies on the French seabed and captures the tide to provide renewable power to the 800 inhabitants of Ushant island. To optimise the turbine's operation, QOS Energy and Sabella closely collaborated to develop specific data acquisition

Sabella D10 Tidal turbine installation.

techniques and innovative analytics tailored to the constraints of the demanding sub-marine environment.

"Operating and maintaining a utility-scale tidal turbine at such depth is particularly challenging, and data collection and analysis plays a vital role in doing so successfully. QOS Energy's data

Open-Pit Mining in Diamond Deposit

The Grib Mine, located in Russia's Mezensky District in the Arkhangelsk Oblast, is one of the largest diamond deposits in the world.

During winter, temperatures can reach -25 °C (sometimes even up to -37 °C). The "Arhangelskgeolrazvedka" exploration crew bores wells and monitors underground water levels and temperature.

Keller - represented in SA by INSTROTECH – has equipped the wells with water level monitoring systems. The use of automatic water level monitoring systems allows for savings on special-purpose vehicles as well as additional staff, who would conduct manual monitoring in remote and hard-to-reach wells.

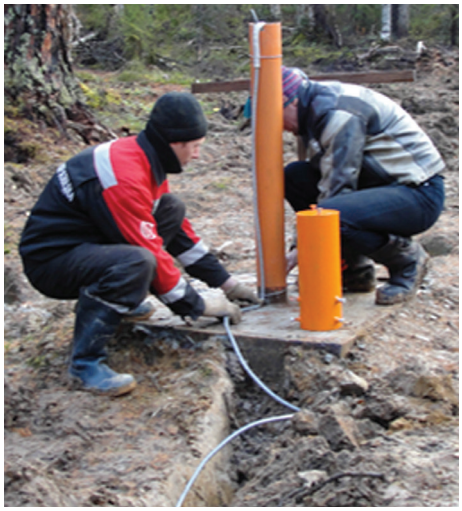
SAVING ON SPECIAL-PURPOSE VEHICLES AND ADDITIONAL STAFF

Water level and temperature is monitored within a radius of 5 km around the deposit area. Between 2011 and 2014, a total of 81 wells (with depths of 20-270 meters) were bored in order to monitor water levels. The wells are equipped with 81 Keller water level monitoring systems comprising PAA-36 X W hydrostatic pressure (level) and temperature probes as well as 59 GSM-2\ GSM-2 BOX modules for automatic data registration and transfer by GSM.

INSTALLED GSM-2 BOX

As long as the monitoring net consists of cluster water wells, it is possible to use just one GSM-2 BOX module to register and transfer data from two to three wells placed at a distance of 5-10 meters in the same cluster. It allowed the Mine to reduce the amount of GSM-2 modules required for monitoring 81 water wells, from 81 to 59.

Thus the Mine could buy 22 GSM-2 modules fewer than anticipated, an approximately 15% saving on monitoring equipment for the project. The battery of a GSM-2\GSM-2 BOX module is able to supply several level probes. The module on the other hand can register and transfer data once a day in a low temperature environment (-25 -35 °C) with a low-level or unstable GSM-signal for a few years. Interestingly, for the duration of the exploitation period (2011-2015), the Mine did not find it necessary to change the equipment batteries.



Installation of the level tubes in hard-to-reach locations

For more info, contact INSTROTECH on 010 595 1831.

intelligence platform enables our O&M team to visualise critical KPIs such as water pressure, temperature, swell energy prediction, rotor speed or torque compared to power produced. We need this cutting-edge monitoring capability to be able to fully understand performance, and effectively control potential failures," explained Jean-François Daviau, CEO of Sabella.

Sabella is among the very few companies in Europe that can provide commercially-ready tidal energy technology. Its D10 machine is designed to thrive in the harsh marine environment, and to be maintainable long-term. It boasts a simple and robust design, relying on key components redundancy to ensure a very high level of availability. Sabella's technology can be deployed as part of large tidal commercial arrays, as well as answer the energy needs of remote off-grid island communities.

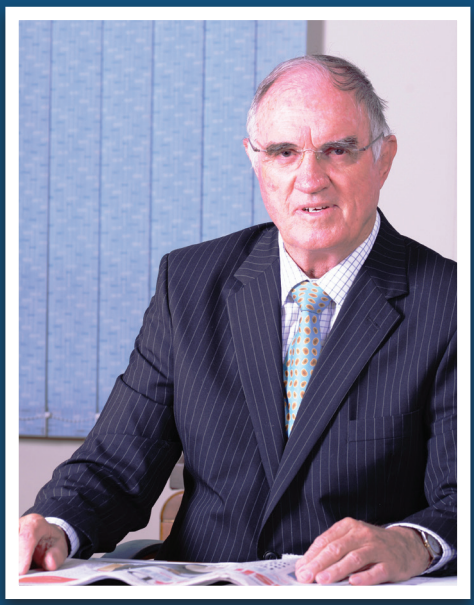
"Tidal turbine technology has great potential for off-grid islands that can now harvest their abundant tidal resources," said Daviau. *"Unlike most other sources of clean power, tidal energy produces renewable power in a regular and predictable manner, enabling operators to reliably forecast power production over the full life-cycle of a project."*

Off-grid tidal energy represents a considerable and largely untapped market, considering that about 11,000 islands worldwide are permanently inhabited by a population in excess of 730 million people in total. In most cases, off-grid island communities that are also among the first victims of climate change, rely on expensive and polluting diesel-powered technologies to ensure power supply. With an energy cost of energy per MWh that can be 5 to 10 times higher than in interconnected areas, tidal energy, potentially associated to other renewable sources and storage capabilities, is emerging as a sound economic model for off-grid islands.

"QOS Energy strongly believes that tidal energy will play an important part of the future clean energy mix, so we are very pleased to innovate with a pioneering company such as Sabella and make progress in the important field of tidal O&M.

We believe that effective plant monitoring and optimisation will be instrumental in bringing this emerging technology from the margin to the mainstream," concluded Jean-Yves BELLET, VP-CTO of QOS Energy.

OBITUARY - RONALD THOMAS RUSSELL



RONALD T RUSSELL
1942 - 2018

In the early hours of 27 October 2018 Ronnie Russell, 75, passed away from stomach cancer at his home in Edenvale in the presence of his wife (Faith), son (Andrew) and sister (Denise Lorimer). A few words that describe my father are service, determination and caring.

BY I ANDREW RUSSELL
ADVOCATE OF THE HIGH COURT
SAIEE MEMBER; BSC ENG. (ELEC)

On service: my father was divisional CEO of Actom Power Transformers, formerly Bonar Long Transformers, for 31 years and had served the company for over 50 years. He would almost always work Saturdays, sometimes Sundays too. He took his first day of sick leave only after the age of 70. He demonstrated this service in his dying days also, insisting on making my mother tea in the morning for as long as he could stand.

On determination: a man of humble beginnings in Boksburg, leaving Germiston High School at 16 to start work, he was proud of his SAIEE membership. He joined the SAIEE as member in May 1976. We would periodically attend SAIEE meetings together (he enjoyed the sessions at the Observatory the most), and he would recount how, in his time, he was required to study late nights after work to pass a written test to gain membership to the SAIEE. He later obtained his BCom similarly – night school after a long day's work over eight years. He carried this determination with him until his final day, insisting on getting up and dressed in defiance of cancer devouring his body and sapping his energy.

Finally, my father was caring: in the boardroom he could have a tough exterior, however I will remember him for sayings such as *"give until it hurts"* (to charity, the church etc.); and in his actions such as adopting two SPCA dogs and making them honorary members of the board, with the concomitant invitations to board meetings.

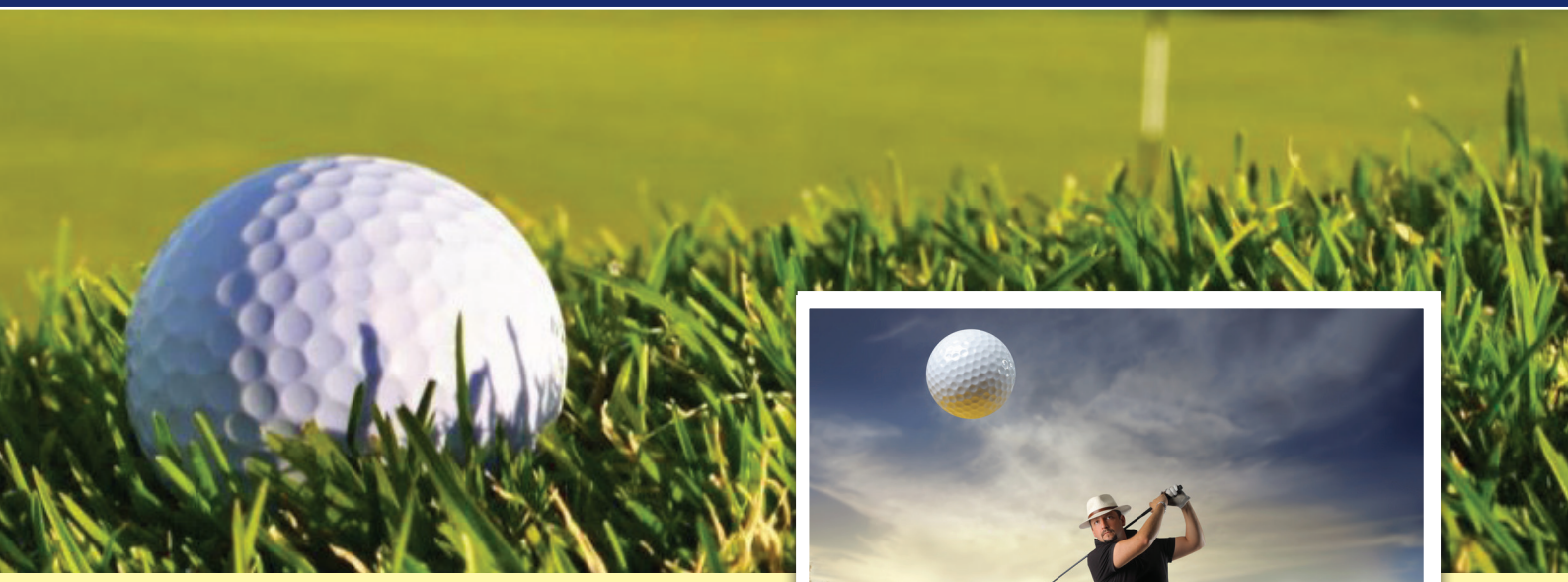
My father will be missed by many, but the character traits he instilled in us lives on.

As he would say: *"good, it's time to get on with the work now"* (first ensuring that his leather shoes were polished and shining).

ED: The SAIEE Council and its members share our sincerest condolensces for the loss to the family. wn

ANNUAL CHARITY GOLF DAY

IN SUPPORT OF YA BANA VILLAGE FOR CHILDREN



Ya Bana means "for the children." The Village is an ambitious project aimed at providing vulnerable and orphaned children with permanent housing in a family environment where trained house mothers offer love and structure. The Village believes that in order for children to become balanced and productive citizens of society, they need holistic care. The programs focus on the physical, emotional, educational, spiritual and cultural needs of the child.

Ya Bana Village was founded in 2006 when 8 hectares of property was bought by the Mabopane Foundation USA.

The property was registered and rezoned for the development of a Village for Children. Currently, the organisation is registered as a non-profit organisation, and as a Child and Youth care centre.

The village is surrounded by a community which still finds it difficult to cast off the shackles of poverty.

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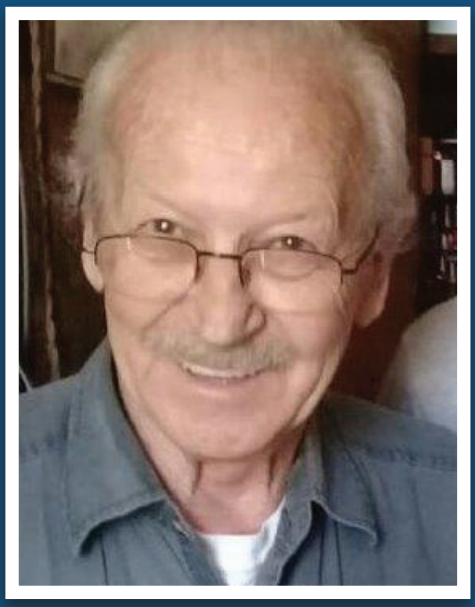


JERRY KOBYZSKY
1935 - 2018

Sometime in the early part of 2008, a well-worn Mitsubishi sedan drove into the parking area of the SAIEE Head Office in Observatory, Johannesburg. A grey-haired, moustached man of smallish stature and casually dressed, climbed out and walked across to where the work-party of Historical Section (HS) members were sorting artefacts.

BY I MAX CLARKE
CHAIRMAN
SAIEE HISTORICAL SECTION

A Tribute To A Friend…

He shook hands with all of us and said *"I'm Jerry. I'm interested in all old things. Can I see what you are doing ?"* Jerry Kobyzsky had arrived. And he stayed until he was called to higher service over a decade later.

Jerry was born on 3rd August 1935 and died on 18th December 2018. Energy, enthusiasm and friendly nature were his hallmarks. His passion for *"collecting"* was infectious. *"Helpful"* was his middle name. There was simply no stopping him *"doing"* things. He donated, repaired, cleaned and polished old items until they looked like new and many even worked again! And in-between? He was an avid photographer and carried a camera everywhere he went. He took photographs of everything objects, outings and anything unusual.

Our minutes show that he attended a Historical Section Committee meeting for the first time on the 12th August 2008. From then on he was a regular attendee. In spite of his modest command of the English language, he was never afraid to express his opinion but he always much-preferred action to words.

Not that he was shy to express himself…. He was a great storyteller and never failed to enthral us during our tea-breaks with his often-humorous tales of his experiences growing up under communist-rule in his beloved home-state Bratislava (then part of Czechoslovakia) where he trained as an instrument technician. It was here that he developed an interest in *"collecting"* even to the extent of recovering medals from old battlefield sites *(even his car, with its third engine and a million km on the clock and still going, is a collector's item!)*

Jerry made friends with all the administration staff at SAIEE Head Office – they will miss his cheerful and engaging greetings on Thursdays. At his own cost, he helped recycle the accumulation of paper and boxes at head office. Jerry hated waste of anything including time – he was always on the go. While he was thrifty with all resources, Jerry was generous to a fault in giving of his time and expertise. The SAIEE has lost one of the truest humanitarians and the best voluntary worker we ever had – and he never joined as a member!

Jerry was an Eskom pensioner and kept in touch with many of his old colleagues. Soon after joining the ranks of the Historical Section team he found that we had an "overflow" storage facility in the old Robertson compressed air station located in the general area of Johannesburg's Booysens suburb. Sorting and salvaging items from this treasure chest became one of his passions. He just never stopped retrieving items from this facility and pushing the committee to make space available to display items at Observatory.

His interests and activities spilt over into his suburban town, Alberton, where he supported the local team involved in preserving the heritage of that suburb of the greater city area, giving further proof of his passion for assisting people.

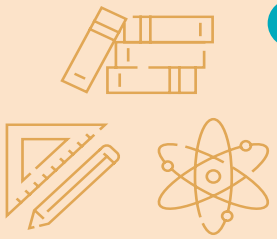
It is an understatement to say that Jerry was a very active member of the HS Team, loved and respected by all. He will be sorely missed.

Rest in peace Jerry.

The HS Team

Supported by ROSATOM

How to get free nuclear education in Russia?



1 **Make sure that you are ready to apply for an engineering degree program**

In order to succeed in this university program you need to be strong in mathematics, physics and other sciences.

2 **Find out about the number of scholarships available for nuclear studies in Russia**

Contact the Russian Center for Science and Culture or the Russian embassy/consulate in your country to learn about the available scholarships for nuclear-related degree programs, as well as the opportunities offered by the Russian universities and their requirements.

3 **Register at russia.study and fill in the application form**

Make sure to select "14.00.00 Nuclear energy technology" in the "Group of educational programs" box.

4 **Prepare the required documents and upload their scanned copies together with your application**

5 **In your application you can choose from several ROSATOM partner universities:**

National Research Nuclear University MEPhI (ROSATOM's main partner university) **mephi.ru**

National Research University – "Moscow Power Engineering Institute"
mpei.ru

Peter the Great St. Petersburg Polytechnic University
spbstu.ru

National Research Tomsk Polytechnic University
tpu.ru

Ural Federal University named after the First President of Russia B.N. Yeltsin
urfu.ru

Nizhny Novgorod State Technical University named after R.E. Alekseev
nntu.ru

St. Petersburg State University
spbu.ru

National University of Science and Technology "MISiS"
misis.ru

National Research University Moscow State University of Civil Engineering "MGSU"
mgsu.ru

Bauman Moscow State Technical University
bmstu.ru

Moscow Institute of Physics and Technology (State University)
mipt.ru/english

6 **Pass a competitive selection at the Russian Center for Science and Culture or the Russian embassy/ consulate**

The format of the examination is determined by the Russian mission in your country.

7 **Wait for a confirmation from one of the universities you have chosen. It'll appear in your account at www.russia.study**

8 **Congratulations! You have been enrolled**

ROSATOM is the Russian state atomic energy **corporation with the largest portfolio** of international construction projects **(33 NPP Units in 12 countries).**

In order to ensure that nuclear energy facilities operate efficiently in the future, ROSATOM offers its partner countries **to educate their future nuclear professionals at its partner universities.**

Talented international students can benefit from **free** nuclear education in Russia under scholarships provided by the Government of the Russian Federation.

To learn more about bursaries and application process, contact ROSATOM Corporate Academy at help@rosatom-academy.ru

Rosatom Central and Southern Africa (Pty) Ltd, 7th Floor, Sandton City Office Tower, Sandton, Johannesburg, RSA.

AN INTERVIEW

Raising the "Bar(wise)" on Lightning Protection

I had the privilege to sit down with Alexis Barwise, Director of the Lightning Protection Concepts (LPC), who visited the International Electrotechnical Commission's (IEC) TC81 meeting in Chengdu, China in November 2018.

BY | MINX AVRABOS

The International Electrotechnical Commission *(in French: Commission Électrotechnique Internationale)* is an international standards organisation that prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as "electrotechnology".

MINX AVRABOS (MA): "Alexis, give my readers a bit of background on why this meeting took place?"

ALEXIS BARWISE (AB): "Minx, TC stands for Technical Committee, and 81 is the global international Lightning Protection Code. There are 29 Member Countries and 23 Observer Countries who attend these meetings. The secretariat of the TC81 is Italy. The scope of the TC81 is to prepare international standards and guides for lightning protection for structures, as well for persons, installations, services and contents.

The objective of the standards will be:

- To develop requirements for the design and installation of Lightning Protection Systems for structures;
- To establish requirements for the design and installation of Surge Protection Measures for structures as they relate to protection from lightning effects;
- To develop basic requirements for protection against electromagnetic effects due to lightning;
- To give general guidance to IEC member countries that may need such requirements; and
- To facilitate international exchanges that may be hampered by differences in national regulations."

MA: "Why were you invited to attend the TC81 meeting in China?"

AB: "Well, I guess it begins and ends with the fact that I have been very active the last few years in challenging the status quo, in not accepting our horrific local statistics, in reworking local standards such as SANS 10142-1 and SANS 10313. I recently undertook the writing of a motivation letter to the South African Bureau of Standards (SABS) as to why I want to improve the 10313 Standard.

I highlighted the shortcomings in which the IEC 62305 (TC81) documents do not cover certain African conditions and that we need to address these, including areas such as informal settlements, grass/thatched roofs, mining applications, solar rooftop installations, outdoor sports and music events, and golfers.

None of these applications has a clear guideline from the IEC as to how to protect human lives and assets."

MA: "Interesting. So, please tell us what did you do when you arrived in Chengdu? How was your first day, attending the event?"

AB: "Well, Chengdu is one of the most polluted cities in the world, with a visibility of only 300 metres. It was quite an experience.

The first day, the IEC ran a workshop for new members. The IEC family is quite open and friendly to newbies and welcomed me with open arms. It was nice to see that everyone knew each other. I noticed that there were only two women in attendance and about 40 men.

On top of that, there were only two of us younger than 40, and everyone was older than 50, which meant the industry was represented by professionals with an age gap of 20 years between the youngest and eldest professionals, which is quite disconcerting.

I also eagerly took the opportunity to use the networking sessions to gauge if what we are doing in South Africa is on par with the rest of the world, and whether we think the same and have the same problems. Except for our high fatalities, I am pleased to report that we are right up there compared to strong lightning protection countries such as Germany, Holland and the USA.

Damien Lee, IEC, acknowledged my own observations about the age gap in the profession when he shared his statistics with us, and he announced the formation of a new Young Professionals (YP) programme, whereby younger IEC members will be allowed to participate in plenary meetings and working groups going forward. The idea, as Damien says, is to engage younger professionals at an early age and see them come through the ranks in their own country. For too long, seats have been kept by individuals and this hasn't allowed for the fullest participation of newer and younger members in the organisation."

MA: "So, as a newbie, explain this procedure to me."

AB: "At the opening of this event, the IEC presented its own statistics, which I found extremely interesting. I'd had no idea that the IEC is involved in 1,632 active projects with over 20,000 experts – awe-inspiring indeed.

However, I was saddened to learn - when the IEC went through the matrix that had been developed to showcase member attendance and involvement at meetings - that no members from South Africa have been actively involved in the past few years.

I found this information to be quite embarrassing and disappointing. The IEC is going to become stricter with member countries that are not actively involved in attending meetings.

Barwise interview

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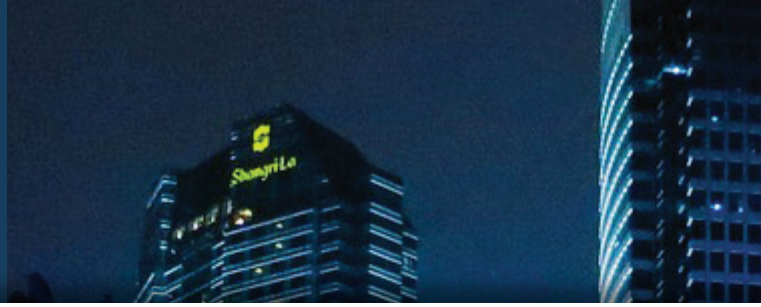


ABOUT IEC - GLOBAL REACH

99,1 % world population

99,2 % electricity generation

20 % global trade

170 countries

offices on **5** continents

84 members
86 affiliates

agreements with **200** organizations

10 163 international standards

founded in **1906**

I raised my hand and said, *'Here I am from South Africa'*, to which the Chairman of the IEC, Prof Alexander Kern, replied: *'I have been a member of this committee for many years and I know quite a few lightning experts from South Africa who are world-renowned. I'm happy to see South Africa here again – thank you, and I look forward to seeing how South Africa will contribute to the international community.'"*

MA: "And how was the second day, which I believe was the Plenary session?"

AB: "That was very interesting. All the country representatives sat in a U-shaped format, with their plaques and microphones ready to deliver comment, together with the IEC TC81 Chairman, the IEC Host Country Representative, and the IEC Secretary. We went through all the discussion points and the points that needed voting on. I must say, I felt honoured to be representing South Africa in making our mark.

As a young schoolboy playing cricket, I used to dream about walking out with my hero, AB de Villiers, and hitting a six for the Proteas. Now, when I was attending the IEC Conference recently, this is how I felt when I voted: that I was amongst several heroes of the lightning protection industry, and I was playing valuable innings for my country!

What I did mention to the committee, and which was noted, is that there is a solid European feel to the International Standard, but that they do not have half as many lightning incidents as some other countries in the world, and that we need to remember that we are working for all, including countries who could not afford to attend, but are also using these standards.

Another point that the committee discussed was that the IEC wanted to write another standard on what skills you need in order to be practising in lightning protection, to which I raised my hand and said that we in South Africa had started this process already, with the exams and courses ELPA offers to the industry. They were very impressed and in the future will be using the ELPA and LPI (USA) exams as baseline documents.

In some respects, the Europeans are more experienced than we are in the field of lightning protection, and as such I felt that they could be quite pedantic over the smallest things, like going into details about the installation of specific clamps. And so in this vein I think that they sometimes lose sight of the real problem. I asked them, *'Do you know how many South Africans died from being hit by lightning last year?'*

And the answer to this question has nothing to do with compliance. Instead, we are not looking after those who live in informal settlements, as an example,

as well as others in our country who do not have the means to protect themselves against lightning, and those who might not be practically informed of the dangers of lightning. In Africa, there are many whose cultural beliefs include the existence of a god of thunder called 'Shango', and the existence of mythical beliefs can hinder the spreading of education around lightning protection practicalities. And so my point is that we should be focussing on how to protect those who cannot afford all these clamps and poles, and so on. The IEC represents the whole world, but does not know how lightning affects those in countries such as Africa, Brazil and New Zealand, to name but a few. The committee really liked my ideas, so we organised that, as part of Working Group 18 - chaired by Mitchell Guthrie from the US - the creation of an 'application guide' in which the IEC will list these examples I mentioned. Each participant in this working group has an item to investigate, and so I will be focussing on Informal Settlements and Thatched Roofs.

I just wanted the IEC to realise that every country has its unique problems, and that not all of them can comply with one international standard. The Chairman, Prof Alexander Kern, noted his realisation that even though the IEC was formed many years ago, it was not aware of all the lightning issues in each country, and that it should be focusing on also helping those who hadn't been able to attend the conference.

At the end of this session, I did suggest to the committee that the next Plenary meeting should be held in South Africa. I received overwhelming support for this concept, so let's hope that South Africa can host TC81 in 2020."

MA: "What did you bring back from attending the IEC TC81 meeting?"

AB: "Well, there were many realisations. Perhaps the first thing to mention should be the fact that our lightning professionals in South Africa are not lacking. We are highly qualified and are on par with the Europeans. I've come to realise that we, as South Africans, cannot allow sub-standard installations in schools, hospitals, homes and industries to continue. We need to demand more of ourselves and more of our fellow South Africans."

MA: "This is all very interesting, but what is the IEC doing to make South African citizens aware of lightning and the way to protect themselves?"

BA: "Honestly – nothing! But there is a reason. It is not the IEC's function to inform the market of such things; their role is clearly to write standards which will help such markets. It is therefore up to the technical professional bodies in South Africa to spread the awareness – organisations like the SAIEE, ELPA and the ECA. The IEC is just the governing body in writing rules and regulations in the practice of lightning protection, and it does a wonderful job in going through the legislation and updating standards."

MA: "Why is Lightning Protection not a legal requirement in South Africa?"

AB: "I wish it was! We should write legislation, present it to the government and mandate it to become law to protect our citizens. Of course, there are a few entities involved like the Department of Labour, the Department of Trade Industry, the relevant technical committees, and associations like the SAIEE, ELPA and the ECA. We can make it work, but we need the input from all professional bodies if we want this to make a real difference in protecting our people. For example, I learned during the conference that almost all European countries mandate lightning protection and I commend them for this!

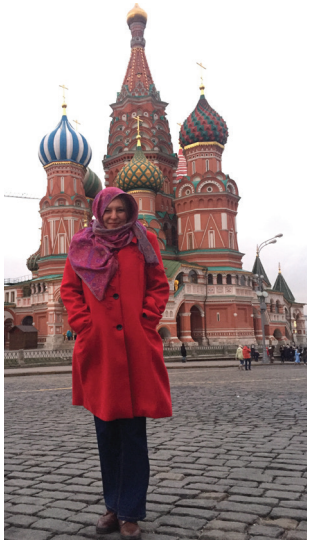
I can add this further: I believe certain buildings should be mandated to have lightning protection installed automatically, for example schools, churches, hospitals, clinics, and departmental offices where people stand in queues, such as at Home Affairs or SASSA Offices.

A combination of local and international standards is needed to transform us from being a country that accepts our unacceptable high fatality rating, to a country that demands safety and compliance through enforcing risk assessments, qualified installers, stringent inspections and proper certifications."

Alexis concluded: *"As a representative of the IEC, as well as being an independent consultant and chair of ELPA and the SANS, I will endeavour to make huge steps towards this by the end of this year. However, I am asking all professionals to please help us - ELPA and the SANS - to demand safety and certainty and help us to inform the citizens of our beautiful country about the dangers of lightning and the need for lightning protection."*

I urge all our engineers to support ELPA and get involved in the SANS by demanding lightning protection in your projects from now on - ED. wn

какая привилегия - what a privilege

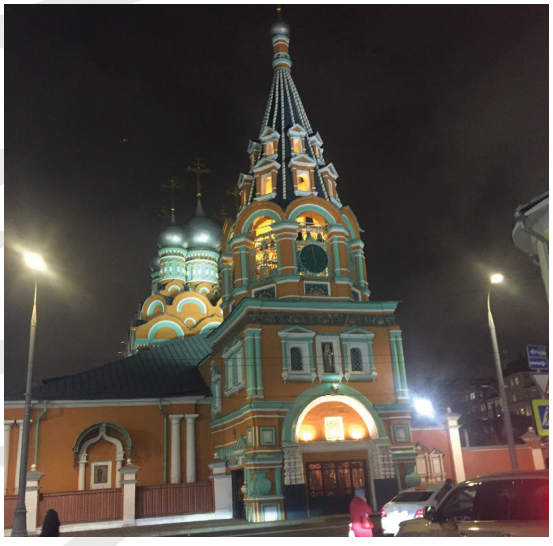


I had the privilege to be one of the judges of the "Atoms Empowering Africa" video competition, which took place in 2018 across Africa.

BY | MINX AVRABOS

The African teams arrives in Moscow.

Day 1 - City bus tour - we are all freezing!



Russian's beautiful architecture.

The competition ran from June to September 2018. Young people were invited to research various nuclear technologies, their applications and benefits to Africa; and to then present their findings, using multimedia, in particular video. The contestants posted their videos online and waited to see if they had won a week-long technical tour to Russia's nuclear facilities as well as some of Russia's most famous landmarks during November 2018.

Yours-truly went along as the media partner. What an experience…

I left Johannesburg on Sunday, 18th November 2018, to fly to Dubai followed on by a 5-hour connecting flight to Moscow with Emirates. We arrived at lunchtime to freezing cold and wet weather (0°C) at the Domodedovo Airport where we all were transferred to the Park Inn Hotel.

DAY 1

The students met with Rosatom representatives to discuss career opportunities within the company. This was followed by city bus tour where we saw many of the beautiful attractions Moscow has to offer. The following morning, we checked out and then headed of on another tour of Moscow, this time actually visiting several famous buildings, including the Kremlin.

The Kremlin is a fortified complex at the heart of Moscow, overlooking the Moskva River to the south, Saint Basil's Cathedral and Red Square to the east, and the Alexander Garden to the west. It is the best known of the kremlins (Russian citadels) which includes five palaces, four cathedrals, and the enclosing Kremlin Wall with Kremlin Towers. Also, within this complex is the Grand Kremlin Palace that was formerly the tsar's Moscow residence. The complex now serves as the official residence of the President of the Russian Federation and as a museum with 2,746,405 visitors in 2017.

The word "kremlin" means "fortress inside a city" and is often also used metonymically to refer to the government of the Russian Federation in a similar sense as to how "White House" refers to the Executive Office of the President of the United States. It previously referred to the government of the Soviet Union (1922–1991) and its highest members (such as general secretaries, premiers, presidents, ministers, and commissars).

Tomsk - minus 17˚C

The term "kremlinology" refers to the study of Soviet and Russian politics.

The tour also included a visit to the workshop of Dashi Namdakov, who is a famous Russian artist, sculptor and jeweller. Namdakov's artworks are kept in the vaults of the State Hermitage, the Russian Ethnographic Museum in St. Petersburg, the Museum of Oriental Art, and in other museums around the world. Among the renowned private collectors of works by Dashi are prominent figures from the worlds of politics and business, as well as private collectors from Germany, France, Belgium, Switzerland, Finland, Japan, the USA, Taiwan, and, of course, Russia.

After the tour, we transferred to the Domodedovo Airport, for our flight to Tomsk, which is another 5 hours into Siberia. We landed at 3 am to -17˚C, and deep snow, which was a first for many of the students, who were fascinated by it and took a gazillion selfies.

DAY 2

After we checked in to the Old Town Hotel, slept a bit, we went to visit the Engineering School of Nuclear Technologies, at the Tomsk Polytechnic University (TPU).

This is the oldest technical university in Russia east of the Urals. The university was founded in 1896 and opened in 1900 as the Tomsk Technological Institute. We were greeted by Dr Vera Verkhoturova, Director of Masters' Programme, Nuclear Power Engineering and Installations who introduced a panel which included the senior faculty staff, Liliya Kiryanova (Vice Rector for External Affairs), Oleg Dolmatov (Director, School of Nuclear Science & Engineering, TPU) and representing Rosatom, and our tourguide, Alena Georgobiani (PR manager, Rosatom Central and Southern Africa).

The School of Nuclear Science & Engineering is one of Russia's centres of excellence in the areas of nuclear physics and hydrogen energy. The School's goal is to train competent engineers and academic staff in the areas of atomic and hydrogen power engineering, experimental and applied physics, as well as new chemical, plasma, and beam technologies. The School has advanced research equipment and highly qualified academic staff; for instance, the School conducts large-scale experiments based on a nuclear research reactor (the one and only in Russia).

Also, they develop multidisciplinary technologies within the framework of the Peaceful Atom Concept, including nuclear medicine, trans-mutational neutron alloying, isotope engineering, and thorium energy. This allows the School to train qualified engineers and theacademic staff to conduct fundamental and applied research in these fields.

Tomsk has approximately 20 bursary students registered for various nuclear programmes. Dr Verkhotura said of the African students: *"Russian lecturers love the African students because they are very hardworking. Kudos to African establishments*

The African Students with Dr Verkhoturova.

Dr Vladimir Golovkov, Laboratory Head, TPU.

KVN Television Set with a lens.

A long story...

The African students playing a game at the Tomsk Nuclear Information Centre

Students meeting at the National Research Nuclear University.

Zaryadye Gastronomic Centre

to have bred such disciplined students". I asked Dr Verkhotura what her advice would be to any aspirant students who would like to study at TPU, and she said: *"Nuclear education is costly to study in any country, and we see demand from African countries who send their students to study here, at TPU. My advice will be to collaborate with Rosatom International and get involved with their scholarship programme. TPU is the best establishments for students to gain practical nuclear experience."*

After the presentations, we went to visit the Tomsk Cyclotron, where we met with Dr Vladimir Golovkov, Laboratory Head, TPU who explained to the students the limitations of the cyclotron.

After lunch, and trying to stay awake, we visited the Museum of History of, which is located on the 3rd floor of the TPU Main Building. The museum includes two exhibition rooms. The first is devoted to the history of the university since its foundation until the 1990s. Here you can see notebooks of the first students of Tomsk Institute of Technology or try on a historical student uniform.

It is a room that keeps most of the exhibit items, from the textbook on chemistry from 1910 with 2 240 pages, to early models of the first synchrotron 'Sirious', betatron and automatic lunar station 'Luna-16'. During the tour, you will be plunged into the world of TPU history, learn about the most critical developments of scientists who advanced not only Russian, but also global science, and laid a foundation of modern education.

The second room of the museum is dedicated to the contemporary stage of the University history - from the moment TPU was classified as a National Research University. You get acquainted with the activities and developments of the 7 research and educational institutions of Tomsk Polytechnic University.

After the very informative history lessons, we visited the Tomsk Atomic Information Centre. Since 2008 ROSATOM has been creating a network of public outreach centres in locations where nuclear facilities are in operation or under construction.

These are multi-purpose communication platforms designed to inform people about the use of nuclear power. Each centre is a cutting-edge multimedia hall offering 3D panoramic projection, computer graphics and stereo sound that immerse visitors using virtual reality. Visitors are invited to watch a 45-minute film about nuclear power that includes many interactive quizzes. The centres hand out booklets, educational literature and souvenirs.

In addition to their regular operating schedule, these centres host a variety of events (conferences, workshops, exhibitions, etc.) for schoolchildren, students, teachers, journalists, public figures, and nuclear industry workers. Admission is free of charge.

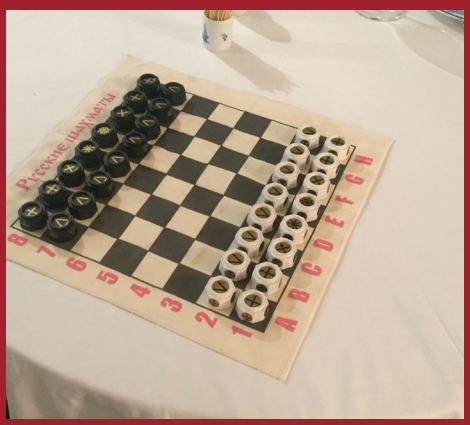
DAY 3

We left for Moscow on an early morning. From there we were transferred by bus to Obninsk, where we visited, again a private tour, the first Nuclear Power Plant (NPP). Obninsk Nuclear Power Plant was built in the "Science City" of Obninsk, Kaluga Oblast, about 110 km southwest of Moscow. It was the first grid-connected nuclear power plant in the world, albeit it at a small scale.

It is located at the Institute of Physics and Power Engineering. The plant is also known as APS-1 Obninsk (Atomic Power Station 1 Obninsk). It remained in operation from 1954 and 2002, although its production of electricity for the grid ceased in 1959; after that, it functioned as a research and isotope production plant only.

According to Nuclear Physicist, Lev Kotchetkov, who was there at the time: "Although utilisation of generated heat was going on, and production of isotopes was even enhanced, the main task was to carry out experimental studies on 17 test loops installed in the reactor." The technology perfected in the Obninsk pilot plant was later employed on a much larger scale in the High-Power Channel-type Reactors.

One quarter of a Kulebyaka four species, traditional Russian pie.



A Russian Chess Board

I'm sure I can smell smoke trying to think of my next move to beat the Grandmaster!

Later that day we met up with the students from Africa currently studying at the National Research Nuclear University (MEPhl) in Obninsk. Established in 1942, MEPhI is a leading Russian university. Six Nobel laureates contributed to the educational process and research activities at this university, which comprises 21 satellite campuses, located in 20 cities all over Russia. It combines 11 Higher Education Institutions and 20 colleges, totalling over 38,000 students and over 1,500 full and associate professors.

MEPhI faculty and students actively solve complex issues in high-priority fields. They vary from nuclear energy to nanotechnology, medicine to ecology, IT to innovation management. The new MEPhI Strategic Academic Units (StrAUs) bring together traditional departments around strategic areas to accelerate discoveries and create real impact. MEPhI exports branch campuses attract students and researchers and collaborate with research partners.

DAY 4

Our last day, back in Moscow, was discovering the Russian cultural traditions.

We were taken to the Zaryadye Gastronomic Centre for a 'gastronomic' experience. It is a modern food market, where nine different restaurants prepare dishes according to the recipes of the cuisine of different Russian regions. My gosh, I ate way too much!

We then were off to meet two Russian Chess Masters, Mr Vladimir Ivanovskii, President of the Russian Chess Federation, and Mr Zaravshan Isaev, European Champion of Russian Chess and the international grandmaster of Russian Chess. I tried to play Russian chess, which is so different from the 'westerners' chess that I'm used to – that he beat me in a few moves. It was real eye-opener.

Never in my life had I any inclination to visit Russia, but after this whirlwind tour of Moscow, Tomsk and Obninks will I definitely urge anyone to visit this beautiful country. Apparently, the summers are a sultry 35 degrees. I will be back!

Thank you, Alena Georgobiani, and Rosatom for giving me the once-in-a-lifetime opportunity. I will never forget the great hospitality of the beautiful people I met. wn

Alena and I - selfie time!

The Kremlin at night.

The canon with the biggest balls in the world.

What a great trip - saying goodbye to Tomsk.

COMPILED BY | MINX AVRABOS

Technology Releases for 2019

Herewith a few technology predictions for 2019, a year that will see the world transform thanks to disruptions in technology that will impact a wide range of sectors—and we explore them all. It's your future, discover what you're in for.

In 2019, a number of technology breakthroughs and trends will become available to the public. We take a look:

5G COMPATIBLE LAPTOPS TO ARRIVE BY 2019 THANKS TO INTEL/HP/LENOVO/DELL PARTNERSHIP.

The current 4G broadband cellular network tech is set to be replaced with the 5G standard by 2020, but it seems like Intel is not content with this schedule. The CPU maker intends to speed up things, pushing the 5G adoption to 2019, at least for the US and China zones. AT&T also announced that a true 5G network would be implemented in the cities of Dallas, Waco and Atlanta by the end of 2018.

Broadband cellular network support is usually associated with smartphones and tablets, as laptops also support Ethernet plus WiFi connections, which are faster than what most 4G carriers can offer right now. However, 5G is supposed to bring speeds that surpass even those of Gigabit Ethernet connections, and Intel thinks at least laptop PCs can benefit from this. As a result, the CPU giant partnered with laptop Original Equipment Manufacturer (OEM) companies like HP, Lenovo, Dell and even Microsoft to integrate its upcoming Extended Memory Manager (XMM) 8000 5G modems in select laptop models. The inclusion of 5G modems in consumer PCs can expand the 5G coverage and bring faster Internet connections to the average user, allowing for more fluent online gaming sessions and media streaming.

In an interview with TechCrunch, Intel presented its plans to introduce 5G to the Chinese market: *"To expand our entry into the China phone ecosystem, Intel and Unigroup Spreadtrum and RDA have established a multi-year collaboration to develop a portfolio of 5G products for mobile platforms, combining Intel 5G modems with Spreadtrum application processor technology."*

THE BENBAN SOLAR PARK, THE WORLD'S LARGEST SOLAR PARK WILL FINISH CONSTRUCTION IN EGYPT BY LATE 2019.

The Benban Solar Park aims to reach somewhere between 1.6-2.0 GW of solar power by the middle of 2019.

The projects will receive no incentives, however, it will be given a 25 year contract to sell its electricity at 7.8¢/kWh to the the state-owned Egyptian Electricity Transmission Company (EETC) and pegged to the value of the US dollar.

Currently, 29 projects have received financing – representing at least $1.8 billion. These 29 projects represent almost 1.5 GW of solar power.

The land was initially laid out with 41 unique plots ranging from 200 m^2 to 600 m^2. The total land area of the park is approximately 25 km^2.

Technology in 2019

continues from page 23

Benban Solar Park

This eastern region of the Sahara Desert has some of the best solar power resources – sunlight – on the planet. Better than the US/Mexico western desert, but maybe just behind the world's best spot in the Chilean desert highlands.

The centralization of electricity grid infrastructure – powerlines and power substations – allows for sharing of costs of expensive hardware, lowering the cost of electricity.

The park represents some of the complex financial models – partially backed by governments – that are coming together to help investment groups develop large-scale solar power projects at decent pricing. For instance – to help allay the fears of bankers – the 'Multilateral Investment and Guarantee Agency' (MIGA), an institution of the World Bank Group, is providing

Location of Benban

$210 million worth of 'political risk' insurance to private lenders and investors involved in the solar park.

At least 325 MW of the site will make use of NEXTracker's single axis trackers. I've sent an message via LinkedIN to the CEO to ask if he knows what kind of solar panels might be used. NEXTracker just put out a solid technical press release showing off bifacial solar panels combined with single axis trackers. Another 64 MW of single axis trackers will be deployed by German group 'Mounting Systems GmbH.'

Construction is underway on multiple projects at the site, including a 165 MW portion that just started work.

THE WORLD'S LARGEST OFFSHORE WIND FARM STARTS IS COMPLETED.

The world's soon-to-be-largest offshore wind farm has begun construction. The project, being developed by the largest offshore wind power developer – Ørsted – is located 120 kms off the coast of Yorkshire, UK.

The wind farm is named Hornsea Project One. Hornsea Project Two will follow a few years later, and Hornsea Project Three is in early planning stages.

The 1.2 GW project will be constructed of 174 7 MW turbines. The turbine model being installed – SWT-7.0-154 – is manufactured by Siemens. The site will generate 4.1 TWh of electricity per year.

According to Ørsted, an 8 MW turbine – the MH1 by Vestas – generates enough electricity in one revolution of the turbine blades to power a house for 29 hours. Production isn't necessarily proportional with turbine size, but if it just happened to be – these 7 MW units will generate 25 hours of electricity with a single rotation.

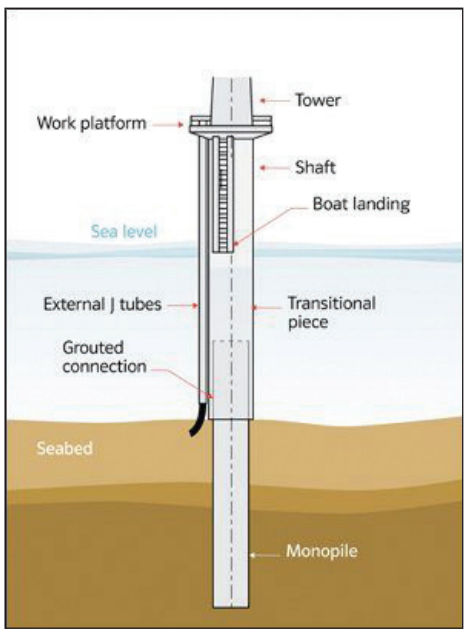
Ship Innovation – has a load capacity of 8,000 tons and can install in waters up to a 65 meter depth.

The individual blades are 75 meters long and the total area covered when the blades spin is, 18,600m^2 (4.6 acres).

The project is being built by two ships. The first is what was (and might still be) 'the most powerful heavy-life jack up vessel.' The ship – Innovation – has a load capacity of 8,000 tons and can install in waters up to a 65 meter depth.

The second ship, built by A2SEA, is named the Sea Installer. It carries the turbines and blades to the site. It can handle up to four of the 7 MW turbines at once.

Currently, the world's largest off shore wind farm is called the London Array. The project is 630 MW. The world's largest wind project is the Gansu Wind Farm Project in China. The project has a current capacity of 8 GW(!), with a planned capacity of 20 GW.



Technology in 2019

continues from page 25

The James Webb Space Telescope would be the most complex imaging hardware that NASA has attempted to put into space. It features a large mirror that will be formed by multiple individual segments moving into place and protected by a sunscreen that would also unfold after launch.

JAMES WEBB SPACE TELESCOPE IS LAUNCHED INTO ORBIT TO DISCOVER LIQUID WATER ON OTHER PLANETS

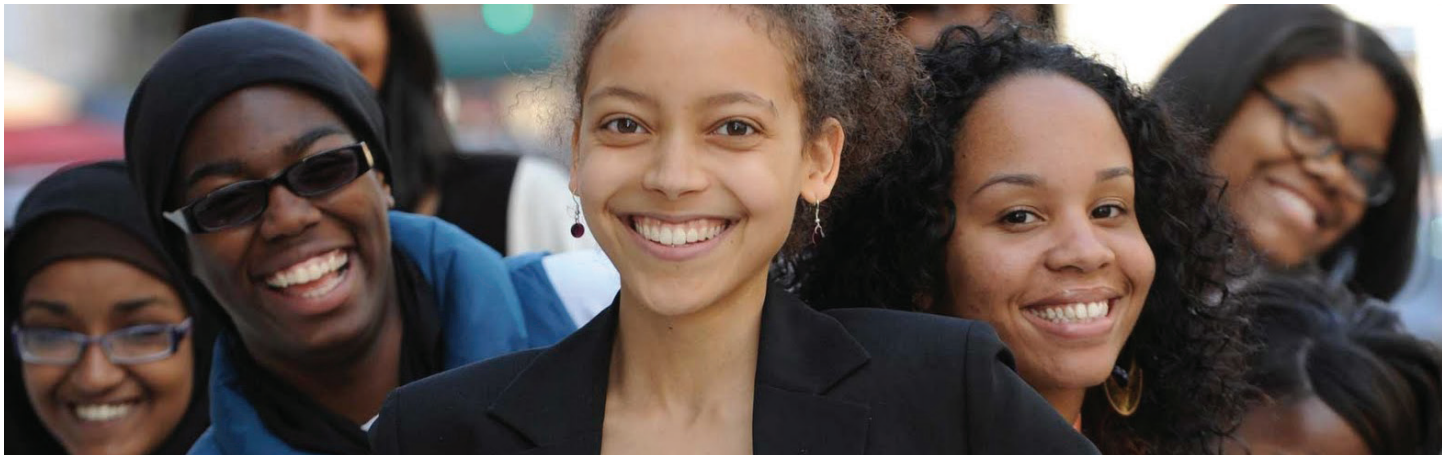
NASA's James Webb Space Telescope now is planning to launch between March and June 2019 from French Guiana, following a schedule assessment of the remaining integration and test activities. Previously Webb was targeted to launch in October 2018.

"The change in launch timing is not indicative of hardware or technical performance concerns," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate at Headquarters in Washington. *"Rather, the integration of the various spacecraft elements is taking longer than expected."*

As part of an international agreement with the European Space Agency (ESA) to provide a desired launch window one year prior to launch, NASA recently performed a routine schedule assessment to ensure launch preparedness and determined a launch schedule change was necessary. The careful analysis took into account the remaining tasks that needed to be completed, the lessons learned from unique environmental testing of the telescope and science instruments at NASA's Goddard Space Flight Center in Greenbelt, Maryland, and the current performance rates of integrating the spacecraft element.

Testing of the telescope and science instruments continues to go well and on schedule at NASA's Johnson Space Center in Houston, Texas. The spacecraft itself, comprised of the spacecraft bus and sunshield, has experienced delays during its integration and testing at Northrop Grumman in Redondo Beach, California.

HELP UNLOCK OUR FULL POTENTIAL



A job shadowing workplace experience and a post-school alumni programme are the initiatives of a unique public-private partnership, conducted under the banner of TechnoGirl. As a significant contributor to the growth of Science, Technology, Engineering and Maths (STEM) skills in South Africa, we at TechnoGirl are convinced that well-developed STEM skills are vital to our country's future competitiveness in the global economy.

TechnoGirl would like to appeal to corporate South Africa to unlock the latent potential that exists in a primarily marginalised segment of our population – young women at the beginning of their productive lives with potential in STEM.

GET INVOLVED WITH OUR INITIATIVES

JOB SHADOWING

Starting at Grade 9 and continuing until the end of Grade 11, girls are given the opportunity to immerse themselves in actual work environments where
they are then able to observe, engage and generally experience the day-to-day rewards and challenges of specific technical job roles.
Shadowing sessions are scheduled over three consecutive school holidays, annually over the three years.

ALUMNI PROGRAMME

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Technology in 2019

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The additional environmental testing time of the fully assembled observatory--the telescope and the spacecraft--will ensure that Webb will be fully tested before launching into space. All the rigorous tests of the telescope and the spacecraft to date show the mission is meeting its required performance levels.

Existing program budget accommodates the change in launch date, and the change will not affect planned science observations.

"Webb's spacecraft and sunshield are larger and more complex than most spacecraft. The combination of some integration activities taking longer than initially planned, such as the installation of more than 100 sunshield membrane release devices, factoring in lessons learned from earlier testing, like longer time spans for vibration testing, has meant the integration and testing process is just taking longer," said Eric Smith, Program Director for the James Webb Space Telescope at NASA Headquarters in Washington. *"Considering the investment NASA has made, and the good performance to date, we want to proceed very systemmatically through these tests to be ready for a Spring 2019 launch."*

The launch window request has been coordinated with ESA, which is providing the Ariane 5 launch of Webb as part of its scientific collaboration with NASA.

The James Webb Space Telescope is NASA's next great multi-purpose observatory and will be the world's most powerful space telescope ever built, serving thousands of astronomers worldwide. The 21-foot (6.5-meter) diameter infrared-optimized telescope is designed to study an extremely wide range of astrophysical phenomena: the first stars and galaxies that formed; the atmospheres of nearby planets outside our solar system, known as exoplanets; and objects within our own solar system. Webb is an international project led by NASA with its partners ESA and the Canadian Space Agency.

WORLD SALES OF ELECTRIC VEHICLES REACHES 5,900,000

Hybrid vehicles may have had pole position so far in the race to a sustainable transportation future, but electric-only vehicles are about to pull even – and they're both becoming a significant part of global vehicle sales.

Combined worldwide sales of hybrid and plug-in electric vehicles will reach 6.6 million annual units by 2020 and become almost 7% of the total light-duty vehicle market, according to Navigant Research's 2013-2020 Electric Vehicle Market Forecast.

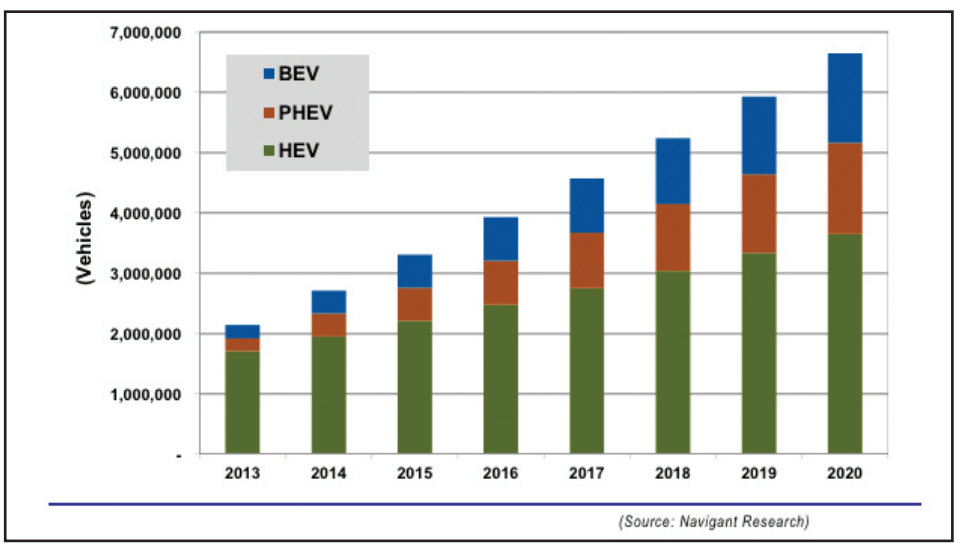
Several factors are fueling this growth, including consumer demand for less-expensive operational costs compared to fuel-powered vehicles, consistent government policy, multiple new models from major automakers, and lower battery prices.

Three different types of electric vehicles (EVs) fall under Navigant's forecast: Hybrid Electric Vehicles (HEVs), those that generate all their own electric energy; Plug-in Electric Vehicles (PHEVs), those that use electricity from the grid and fuel; and Battery-Electric Vehicles (BEVs), those that only use electricity from the grid.

While the three types of vehicles may have major differences in how they're powered, a unique combination of factors means they all have one thing in common – they're about to see a global sales boom.

Under Navigant's outlook, HEVs will grow at a compound annual growth rate (CAGR) of 11.5%, while PHEVs will sell at a 31.9% CAGR, and BEVs increase at a 31.5% CAGR over the next seven years.

So what's powering this surge? *"Electric vehicles, including plug-in models, are*



Annual Light Duty Electric Vehicle Sales by Drivetrain, Wold Markets: 2013 - 2020

becoming an increasingly important part of the global automotive market," said Navigant's Dave Hurst. *"Growth is being driven not only by the inherent appeal of the vehicles, but also by consumer demand."*

As always, favourable economics are the prime ingredient for market expansion. Fuel prices are projected to increase at a 7.2% CAGR between 2013 and 2020, while HEV and PHEV battery pack prices are expected to decrease 10% and 26% respectively by 2020 as advanced research unlocks battery innovations.

Considering battery packs can represent up to half of EV prices, while the cost to recharge a car with electricity is a fraction of the cost compared to refueling, it's clear why Navigant sees lower EV operational costs as such a major market driver.

But beyond better economics, electric-powered vehicles are becoming much more mainstream with more options available to consumers. From established models like the Chevy Volt, Nissan Leaf, and Tesla Model S to new options like the Chevy Spark EV and hybrids from most major automakers, EVs are available in almost every price and performance range.

Navigant also credits steady government policy support for the rise in EV fortunes, expecting currently available tax incentives worldwide to remain steady and provide financial support for consumers, while stricter fuel economy and emissions regulations encourage automakers to continue expanding low-carbon options.

... Meanwhile in South Africa

With the volatile fuel price - you may be tempted to consider an electric car instead.

BMW i3 (94 Ah)

"Electric vehicles are very exciting and one of the biggest expected changes in the automotive sector. In addition to being much 'greener', they have around 30 times fewer working parts which boasts obvious benefits in manufacture, maintenance and reliability," said Michael Muller, co-founder and Managing Director of CarZar.co.za.

While we are seeing a spatter of electric vehicles entering our markets, South Africa is still a long way off from seeing electric cars in every garage.

"Adoption will happen first in the most developed, densely populated cities with the highest regulatory incentives (emission controls and tax incentives for consumers and producers)," Muller said. *"Even now, adoption in developed markets is still being driven almost solely by emissions regulations and not yet market demand. This will drive the R&D and scale to make it commercially economical for adoption in South Africa, but this will take a long time."*

But would you get more bang for your buck by ditching petroleum and switching on your garage plug point?

It is significantly cheaper to get your car going with electricity than petrol.

Assuming an annual distance of around 20,000 kilometres, and a decent consumption rate of 8 litres of petrol per 100 kilometres, you are looking at an average of R27,000 (inland) and R26,000 (coastal) a year for petrol.

Compare this to the BMW i3 (94 Ah), which runs with a consumption rate of

Technology in 2019

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13.1 kWh/100 km and can drive up to 200 km per charge. The means it can use 2,620 kWh of electricity over 20,000km.

Under Cape Town's Home User tariff, the most expensive rate per kWh you can expect to pay is R2.56. At this tariff you'll pay R6,700.65 to charge your car over the course of a year.

While in Johannesburg, users can expect to pay R5,782.25 on a Residential Prepaid tariff. The most expensive rate, barring Time of Use tariffs, charges 185.91c/kWh + a Network Surcharge of 6c/kWh + VAT to get a total of R2.21/kWh. Either way, you are looking of a saving of around R20,000.

A hybrid also saves. The BMW i3 (94 Ah) Range Extender, combines a 9 litre petrol engine with electricity. This has a consumption of 11.5 kWh/100 km plus 0.6 litres/100 km and is capable of driving a combined distance of 330km (225 km of it being on electricity).

This gives you costs of R7,861.05 (coast) and R7,125.62 (inland) for 2,300 kWh + 120 litres of petrol over 20,000 km – still a huge saving.

Another alternative would be to look at the Nissan Leaf, which has an economy of 15 kWh/100 km. You'll pay R7,672.50 (coastal) or R6,620.90 (inland) to travel 3,000 kWh annually, for a distance of 20,000 km. Making for a total saving on fuel of, again, roughly R20,000 per year.

But charging at home can be a concern. While you can save significantly on petrol, there are additional costs one should consider when going electric. Charge time is one.

Depending on how far you need to drive in to work, recharge times can be important. Using your standard wall plug at home, it can take up to 10 hours to recharge 80% of a BMW i3, and 8 hours to recharge your Nissan Leaf. Rapid charging stations come at an extra cost; for example BMW's i Wallbox, costs R25,000 to install, but it can recharge your vehicle in 3 hours.

Should you feel you have half an hour free every day you could also visit Nissan and BMW dealerships that offer free rapid charging stations in major cities across the country. Compareguru.co.za have a convenient list of the stations.

Until the price of electric cars drop, its still too expensive to make sense for most consumers in SA.

There are several budget friendly fuel efficient vehicles out on the market that come in at half the price of an electric. A Volkswagen Polo, costs R235,000 and has a fuel consumption of 4.5 litres/100 km, meaning its annual costs run in at R15,372.

While the difference saved on electricity versus petrol comes in at R9,589.75 between a BMW i3 vs Polo. It will take you 38 years to make up the difference between the vehicle costs, R606,800 vs R235,000, from the amount you would save on electricity.

PREDICTED GLOBAL MOBILE WEB TRAFFIC EQUALS 16 EXABYTES

Overall mobile data traffic is expected to grow to 49 exabytes per month by 2021, a sevenfold increase over 2016. Mobile data traffic will grow at a CAGR of 47 per cent from 2016 to 2021. Asia Pacific will account for 47 per cent of global mobile traffic by 2021, the largest share of traffic by any region by a substantial margin. North America, which had the second-largest traffic share in 2016, will have only the fourth-largest share by 2021, having been surpassed by Central and Eastern Europe and Middle East and Africa. Middle East and Africa will experience the highest CAGR of 65 per cent, increasing 12-fold over the forecast period. Asia Pacific will have the second-highest CAGR of 49 per cent, increasing 7-fold over the forecast period.

The ever changing mix and growth of wireless devices that are accessing mobile networks worldwide is one of the primary contributors to global mobile traffic growth. Each year several new devices in different form factors and increased capabilities and intelligence are introduced in the market.

Last year we saw rise of phablets and more recently we see new form factors of laptops coming into the mix. More than 400 million (429 million) mobile devices and connections were added in 2016. In 2016, global mobile devices and connections grew to 8.0 billion, up from 7.6 billion in 2015. Globally, mobile devices and connections will grow to 11.6 billion by 2021 at a CAGR of 8 per cent.

By 2021, there will be 8.3 billion handheld or personal mobile-ready devices and 3.3 billion M2M connections (e.g., GPS systems in cars, asset tracking systems in shipping and manufacturing sectors, or medical applications making patient records and health status more readily available. Regionally, North America and Western Europe are going to have the fastest growth in mobile devices and connections with 16 per cent and 11 per cent CAGR from 2016 to 2021, respectively. wn

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ALLIANZ RISK BAROMETER 2019:

- 8th annual survey globally on top business risks sees record participation of 2,415 experts from 86 countries
- Business interruption at 41% responses is #1 business risk in South Africa for the first time since 2016. Scenarios are becoming more diverse and complex with costs rising – cyber incidents ranking #2 in South Africa with 35% responses is one of the most feared trigger outpacing fire and natural catastrophes
- New emerging risks include political risks and violence at #6 and shortage of skilled workforce at #10 with 13% responses.

In the wake of mega data breaches and privacy scandals, major IT outages and the introduction of tighter data protection rules in the European Union, South Africa and other countries, cyber risk is now a core concern for businesses in 2019 and beyond.

BY | LESIBA SETHOGA
ALLIANZ GLOBAL CORPORATE & SPECIALTY

Business interruption is a leading risk for companies in South Africa for the first time

According to the Allianz Risk Barometer 2019, Cyber incidents (37% of responses) are neck-and-neck with Business Interruption (BI) (37% of responses) as the top business risks globally. Climate change (#8 with 13% of responses) and Shortage of skilled workforce (#10 with 9% of responses) are the biggest climbers globally. At the same time companies are more worried year-on-year about changes in legislation and regulation (#4 with 27% of responses) resulting in impacts such as Brexit, trade wars and tariffs. The annual survey on global business risks from Allianz Global Corporate & Specialty (AGCS) incorporates the views of a record 2,415 experts from 86 countries including CEOs, Risk Managers, Brokers and Insurance Experts.

"Companies need to plan for a wide range of disruptive scenarios and triggers as this is where their big exposure lies in today's networked society," says Chris Fischer Hirs, CEO of AGCS. *"Disruptive risks can be physical, such as fire or storms, or virtual such as an IT outage which can occur through malicious and accidental means. They can stem from their own operations but also from a company's suppliers, customers or IT service providers. Whatever the trigger, the financial loss for companies following a standstill can be enormous. New risk management solutions, analytical tools and innovative partnerships can help to better understand and mitigate the modern myriad of business interruption risks and prevent losses before they occur."*

BI THREATS CONTINUE TO EVOLVE

Business interruption remains the top threat for businesses worldwide for the seventh year running and is the top risk in countries such as the South Africa, US, Canada, Germany, Spain, Italy and China. Potential BI scenarios are becoming ever more diverse and complex in a globally connected economy, including breakdown of core IT systems, product recalls or quality issues, terrorism or political rioting or environmental pollution. In South Africa, BI is a major concern for companies ranking at #1 according to the Allianz Risk Barometer 2019 report.

"BI can lead to significant income losses, but also because multiple new triggers are emerging, especially non-physical damage or intangible perils, such as cyber incidents, and disruption caused by political violence and strikes. This trend is driven, in part, by the rise of the 'Internet of Things' (IoT) and the ever-greater interconnectivity of machines, companies and their supply chains which can easily multiply losses in case of an incident," says AGCS Africa CEO Thusang Mahlangu.

Business Interruption leading risk

continues from page 33

Both cyber and business interruption risks are increasingly interlinked as ransomware attacks and accidental IT outages often result in disruption of operations and services costing over a hundred of millions of rands . Cyber incidents rank as the BI trigger most feared by businesses (50% of responses), followed by fire (40%) and natural catastrophes (38%). At the same time, BI is seen as the biggest cause of financial loss for businesses after a cyber incident (69% of responses).

Cyber – growing awareness, growing losses
Increasing concern over cyber incidents follows a watershed year of activity in 2018. *"Cyber risk has been a major risk for a number of years, but as with any new risk it has struggled with awareness,"* explains Marek Stanislawski, Deputy Global Head of Cyber, AGCS. *"We have now reached a point where cyber is equally concerning for companies as their major traditional exposures."*

Cyber crime now costs an estimated $600bn a year up from $445bn in 2014. This compares with a 10-year average economic loss from natural catastrophes of $208bn – three times as much. While criminals use more innovative methods to steal data, commit fraud or extort money, there is also a growing cyber threat from nation states and affiliated hacker groups targeting critical infrastructure providers or stealing valuable data or trade secrets from companies. Cyber incidents are increasingly likely to spark litigation, including securities and consumer class actions. Data breaches or IT outages can generate large third party liabilities as affected customers or shareholders seek to recoup losses from companies.

RISK RISERS AND FALLERS

Natural catastrophes (28% of responses) again ranked third in this year's top 10 ranking of global business risks with 2018 being a more benign version of 2017 with its peak catastrophe losses, although economic losses still totaled close to $150bn. Ongoing uncertainty over Brexit, global trade wars and tariffs, Expropriation Bill (in South Africa) fuel corporate concerns about changes in legislation and regulation (#3 with 28% of responses in South Africa) and 27% responses globally.

In South Africa, political risks and violence (#6 with 18% of responses) and shortage of skilled workforce (#10 with 13% of responses) are the biggest climbers. *"Skilled workforce — and human capital more generally — has become the scarce resource of the digital economy,"* says Ludovic Subran, Deputy Chief Economist of Allianz. *"Competition is fierce between companies to get new recruits with competencies in artificial intelligence, data science, or 'frontier risk management' such as managing cyber or reputational risk as most of these jobs did not exist 10 years ago. Even attractive salaries do not suffice as the pool of recruits with the needed skillset is limited and the urgency to onboard them does not allow for on-the-job training."*

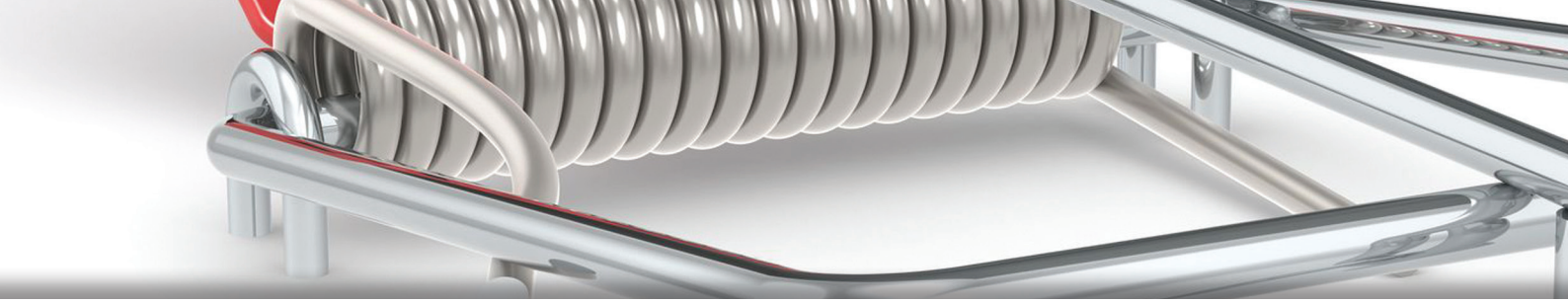
Climate change at #8 with 15% responses could not only be a harbinger of increasing losses and disruption from extreme weather events and natural catastrophes but is also likely to have big implications for regulation and liability considering rigid emission targets or new reporting and disclosure requirements in many sectors.

More information on the findings of the Allianz Risk Barometer 2019 are available online here:

- Top 10 global business risks
- Executive summary
- Full report
- Video
- Appendix Results for 34 countries
- Selected infographics

For those who want the full report emailed, please email me on minx@saiee.org.za.

On the following pages, find excerpts of the Risk Barometer report.



THE MOST IMPORTANT BUSINESS RISKS IN EUROPE

(=) 2018: 1 (46%)

Business interruption
(incl. supply chain disruption)

(=) 2018: 2 (45%)

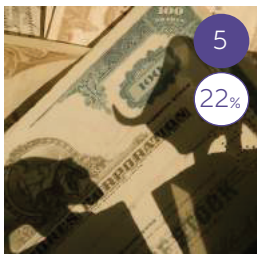
Cyber incidents[1]
(e.g. cyber crime, IT failure/ outage, data breaches, fines and penalties)

(=) 2018: 3 (27%)

Changes in legislation and regulation
(e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)

(▼) 2018: 3 (27%)

Natural catastrophes
(e.g. storm, flood, earthquake)

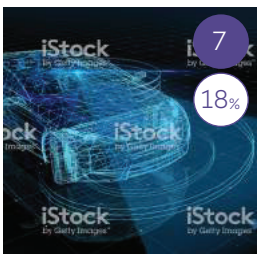


(=) 2018: 5 (22%)

Market developments
(e.g. volatility, intensified competition/ new entrants, M&A, market stagnation, market fluctuation)

(=) 2018: 6 (19%)

Fire, explosion



(=) 2018: 7 (15%)

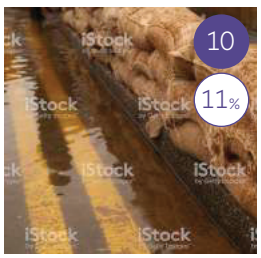
New technologies
(e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain)

(=) 2018: 8 (15%)

Loss of reputation or brand value

(▲) 2018: 10 (10%)

Macroeconomic developments[2]
(e.g. austerity programs, commodity price increase, deflation, inflation)



(▲) **NEW**

Climate change/ increasing volatility of weather

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that region.

Respondents: 905

Responses: 1,163

More than one risk and industry could be selected. Figures don't add up to 100% as up to three risks could be selected.

1 Business interruption ranks higher than cyber incidents based on number of responses
2 Loss of reputation ranks higher than macroeconomic developments based on number of responses

Business Interruption leading risk

continues from page 35

THE MOST IMPORTANT BUSINESS RISKS IN AFRICA & MIDDLE EAST

▲ 2018: 4 (27%)

Market developments
(e.g. volatility, intensified competition/ new entrants, M&A, market stagnation, market fluctuation)

▲ 2018: 3 (28%)

Political risks and violence[1]
(e.g. war, terrorism, civil commotion)

▲ 2018: 5 (23%)

Cyber incidents
(e.g. cyber crime, IT failure/ outage, data breaches, fines and penalties)

▲ 2018: 7 (21%)

Changes in legislation and regulation
(e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)

▼ 2018:1 (31%)

Business interruption
(incl. supply chain disruption)

▲ 2018: 7 (21%)

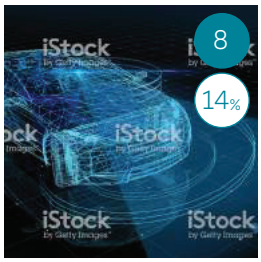
Theft, fraud and corruption

▼ 2018: 2 (31%)

Fire, explosion

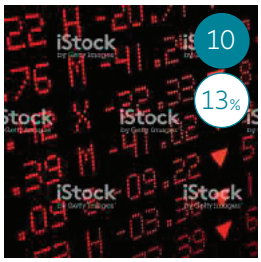
▼ 2018: 6 (22%)

Natural catastrophes
(e.g. storm, flood, earthquake)



▲ **NEW**

New technologies
(e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain)



= 2018: 10 (11%)

Loss of reputation or brand value

Source: Allianz Global Corporate & Specialty.

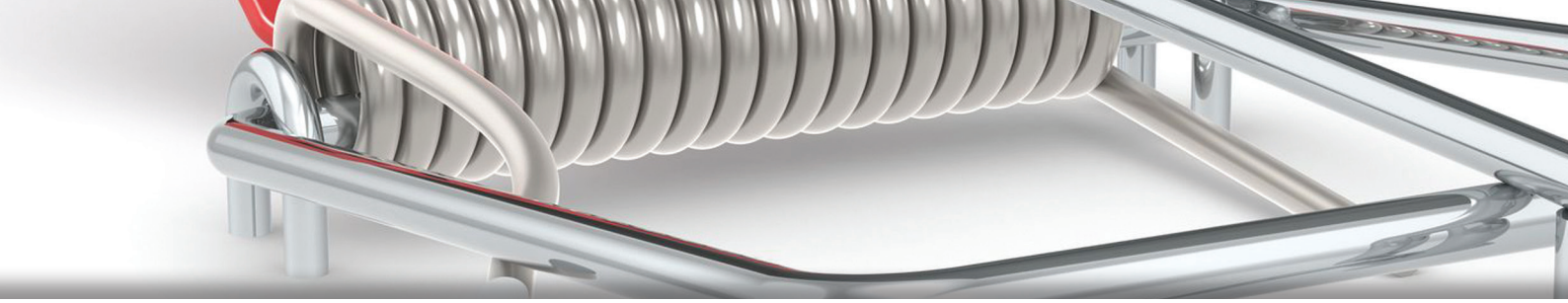
Figures represent how often a risk was selected as a percentage of all responses for that region.

Respondents: 212

Responses: 227

More than one risk and industry could be selected. Figures don't add up to 100% as up to three risks could be selected.

1 Market developments ranks higher than political risks and violence by number of responses



TOP 10 RISKS IN SOUTH AFRICA

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that country.

Respondents: 63

Responses: 68

More than one risk and industry could be selected. Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**41%**	2 (34%)	▲
2	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**35%**	1 (38%)	▼
3	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**28%**	3 (27%)	=
4	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**22%**	4 (23%)	=
5	New technologies (e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain)	**19%**	6 (19%)	▲
6	Fire, explosion	**18%**	6 (19%)	=
6	Political risks and violence (e.g. war, terrorism, civil commotion) **NEW**	**18%**	-	▲
8	Climate change/increasing volatility of weather	**15%**	8 (16%)	=
9	Natural catastrophes (e.g. storm, flood, earthquake)	**13%**	4 (23%)	▼
9	Shortage of skilled workforce **NEW**	**13%**	-	▲

NEW TOP 10 RISKS IN UNITED ARAB EMIRATES

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that country.

Respondents: 20

Responses: 21

More than one risk and industry could be selected. Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent
1	**Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)**	**48%**
2	Political risks and violence (e.g. war, terrorism, civil commotion)	**33%**
3	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**29%**
3	Natural catastrophes (e.g. storm, flood, earthquake)	**29%**
5	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**19%**
5	New technologies (e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain)	**19%**
7	Business interruption (incl. supply chain disruption)	**14%**
7	Climate change/increasing volatility of weather	**14%**
9	Environmental risks (e.g. pollution)	**10%**
9	Theft, fraud, corruption	**10%**

Business Interruption leading risk

continues from page 37

THE MOST IMPORTANT BUSINESS RISKS BY INDUSTRY SECTOR

TOP 5 RISKS IN AGRICULTURE

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 61

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Climate change/increasing volatility of weather**	**46%**	1 (60%)	=
2	Natural catastrophes (e.g. storm, flood, earthquake)	**44%**	2 (46%)	=
3	Business interruption (incl. supply chain disruption)	**36%**	3 (29%)	=
4	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**28%**	5 (21%)	▲
5	Fire, explosion	**21%**	4 (27%)	▼

TOP 5 RISKS IN AVIATION, AEROSPACE, DEFENSE

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 86

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)**	**43%**	2 (44%)	▲
2	Business interruption (incl. supply chain disruption)	**37%**	1 (45%)	▼
3	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**36%**	4 (26%)	▲
4	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**33%**	3 (33%)	▼
5	Natural catastrophes (e.g. storm, flood, earthquake) **NEW**	**19%**	-	▲

TOP 5 RISKS IN CHEMICALS, PHARMACEUTICALS, BIOPHARMA

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 81

Figures don't add up to 100% as up to three

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**59%**	1 (64%)	=
2	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**37%**	2 (40%)	=
3	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration) **NEW**	**27%**	-	▲
4	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**24%**	4 (24%)	=
4	Product recall, quality management, serial defects **NEW**	**21%**	-	▲

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Business Interruption leading risk

continues from page 38

TOP 5 RISKS IN CONSUMER GOODS

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 54

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**48%**	1 (41%)	=
2	Product recall, quality management, serial defects	**35%**	4 (23%)	▲
3	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration) **NEW**	**28%**	-	▲
4	Fire, explosion **NEW**	**24%**	-	▲
5	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**22%**	3 (28%)	▼

TOP 5 RISKS IN ENGINEERING, CONSTRUCTION, REAL ESTATE

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 211

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Natural catastrophes (e.g. storm, flood, earthquake)**	**40%**	1 (45%)	=
2	Business interruption (incl. supply chain disruption)	**33%**	2 (40%)	=
3	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration) **NEW**	**26%**	-	▲
3	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**26%**	5 (21%)	▲
5	Fire, explosion	**23%**	3 (29%)	▼

TOP 5 RISKS IN ENTERTAINMENT & MEDIA

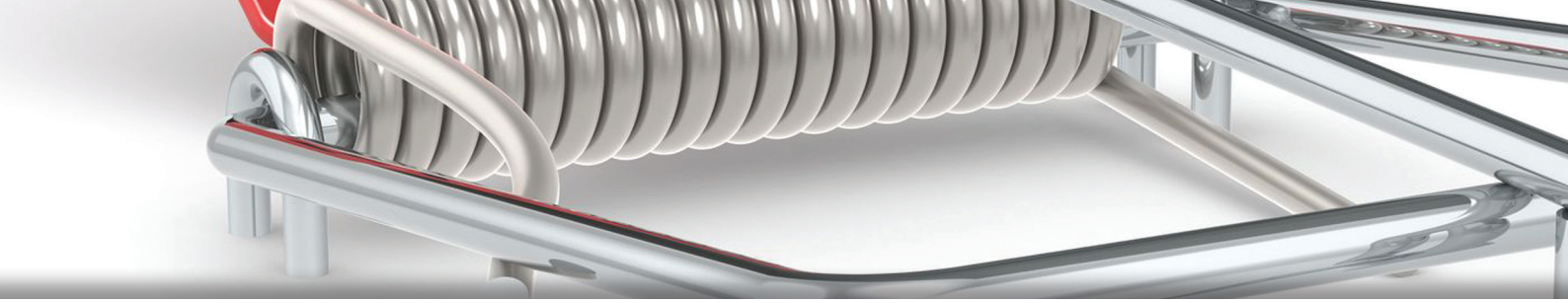
Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 55

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)**	**40%**	1 (33%)	=
2	Business interruption (incl. supply chain disruption)	**31%**	4 (28%)	▲
3	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation) **NEW**	**26%**	-	▲
4	Loss of reputation or brand value **NEW**	**22%**	-	▲
5	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration) **NEW**	**18%**	-	▲



TOP 5 RISKS IN HEAVY INDUSTRY (E.G. STEEL PLANTS)

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 32

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**69%**	1 (56%)	=
2	Fire, explosion	**38%**	1 (56%)	▼
3	Natural catastrophes (e.g. storm, flood, earthquake)	**25%**	3 (44%)	=
4	Environmental risks (e.g. pollution) **NEW**	**22%**	-	▲
4	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**22%**	5 (21%)	▲

TOP 5 RISKS IN HOSPITALITY, LEISURE, TOURISM

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 45

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**47%**	2 (31%)	▲
2	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**40%**	4 (28%)	▲
3	Fire, explosion	**38%**	3 (29%)	=
4	Natural catastrophes (e.g. storm, flood, earthquake)	**31%**	1 (37%)	▼
5	Political risks and violence (e.g. war, terrorism, civil commotion)	**24%**	5 (24%)	=

TOP 5 RISKS IN MANUFACTURING (INCL. AUTOMOTIVE)

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 221

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**63%**	1 (74%)	=
2	Natural catastrophes (e.g. storm, flood, earthquake)	**32%**	3 (32%)	▲
3	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**29%**	2 (40%)	▼
4	Fire, explosion	**26%**	4 (29%)	=
5	Product recall, quality management, serial defects	**24%**	5 (20%)	=

Business Interruption leading risk

continues from page 41

TOP 5 RISKS IN MARINE & SHIPPING

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 100

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Natural catastrophes (e.g. storm, flood, earthquake)**	**34%**	1 (34%)	=
2	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**32%**	2 (31%)	=
3	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation) **NEW**	**28%**	-	▲
4	Business interruption (incl. supply chain disruption)	**26%**	2 (31%)	▼
5	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration) **NEW**	**24%**	-	▲

TOP 5 RISKS IN MINING

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 19

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**68%**	1 (50%)	=
2	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**42%**	4 (19%)	▲
3	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**32%**	4 (19%)	▲
4	Environmental risks (e.g. pollution) **NEW**	**21%**	-	▲
4	Political risks and violence (e.g. war, terrorism, civil commotion)	**21%**	3 (31%)	▼

TOP 5 RISKS IN OIL & GAS

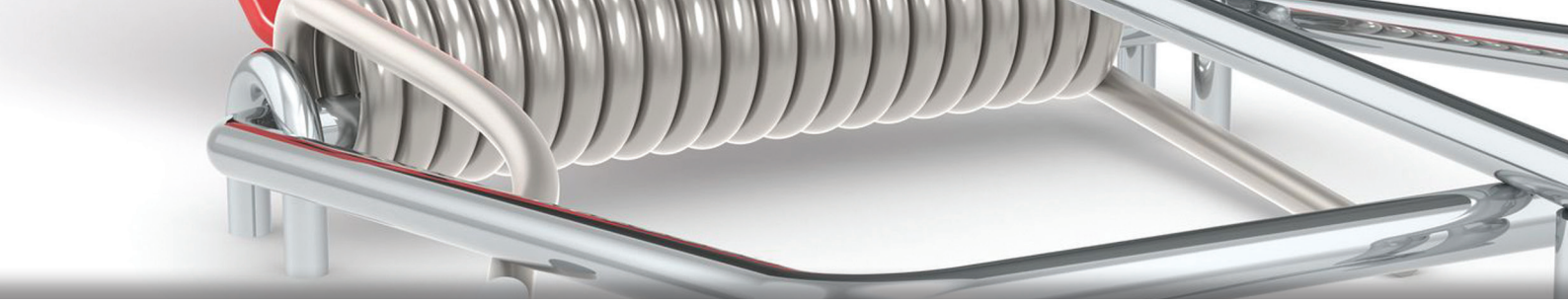
Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 64

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**53%**	3 (46%)	▲
2	Fire, explosion	**44%**	2 (49%)	=
3	Natural catastrophes (e.g. storm, flood, earthquake)	**36%**	1 (53%)	▼
4	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**31%**	4 (31%)	=
5	Environmental risks (e.g. pollution)	**30%**	5 (22%)	=



TOP 5 RISKS IN POWER & UTILITIES

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 89

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**52%**	1 (58%)	=
2	Fire, explosion	**34%**	4 (29%)	▲
3	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**33%**	2 (47%)	▼
4	Natural catastrophes (e.g. storm, flood, earthquake)	**27%**	3 (46%)	▼
5	Climate change/increasing volatility of weather **NEW**	**25%**	-	▲

TOP 5 RISKS IN THE PROFESSIONAL SERVICES (E.G. LAWYERS)

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 132

Figures don't add up to 100% as up to three risks could be selected.

1 New technologies ranks higher than loss of reputation or brand value by number of responses

Rank		Percent	2018 rank	Trend
1	**Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)**	**40%**	1 (49%)	=
2	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**36%**	2 (30%)	=
3	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**24%**	4 (25%)	▲
4	New technologies (e.g. impact of increasing interconnectivity, nanotechnology,artificial intelligence, 3D printing, autonomous vehicles, blockchain) **NEW**	**21%**	-	▲
5	Loss of reputation or brand value[1]	**21%**	5 (23%)	=

TOP 5 RISKS IN RENEWABLE ENERGY

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 51

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**45%**	2 (46%)	▲
2	Natural catastrophes (e.g. storm, flood, earthquake)	**41%**	1 (51%)	▼
3	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**33%**	3 (42%)	=
4	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**31%**	4 (29%)	=
4	New technologies (e.g. impact of increasing interconnectivity, nanotechnology,artificial intelligence, 3D printing, autonomous vehicles, blockchain) **NEW**	**31%**	-	▲

Business Interruption leading risk

continues from page 43

TOP 5 RISKS IN RETAILING, WHOLESALE

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 127

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**47%**	1 (43%)	=
2	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**31%**	3 (28%)	▲
3	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**30%**	2 (40%)	▼
4	Natural catastrophes (e.g. storm, flood, earthquake)	**29%**	5 (22%)	▲
5	Fire, explosion	**21%**	4 (25%)	▼

TOP 5 RISKS IN TECHNOLOGY

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 76

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)**	**53%**	1 (59%)	=
2	New technologies (e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain)	**42%**	3 (35%)	▲
3	Business interruption (incl. supply chain disruption)	**40%**	2 (42%)	▼
4	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**24%**	5 (19%)	▲
5	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**18%**	4 (25%)	▼

TOP 5 RISKS IN TELECOMMUNICATIONS

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 48

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)**	**58%**	1 (77%)	=
2	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**40%**	4 (28%)	▲
3	Natural catastrophes (e.g. storm, flood, earthquake)	**38%**	3 (33%)	=
3	New technologies (e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain) **NEW**	**38%**	-	▲
5	Business interruption (incl. supply chain disruption)	**31%**	2 (44%)	▼

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Life Is On | Schneider Electric

Business Interruption leading risk

continues from page 44

TOP 5 RISKS IN TRANSPORTATION

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that industry sector.

Responses: 90

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2018 rank	Trend
1	**Theft, fraud, corruption**	**29%**	2 (32%)	▲
2	Business interruption (incl. supply chain disruption)	**28%**	1 (37%)	▼
3	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**26%**	5 (24%)	▲
4	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation) **NEW**	**22%**	-	▲
4	Fire, explosion **NEW**	**22%**	-	▲

THE MOST IMPORTANT BUSINESS RISKS BY COMPANY SIZE

TOP 10 RISKS FOR LARGE-SIZE ENTERPRISES*

*>€500mn annual revenues

Source: Allianz Global Corporate & Specialty.

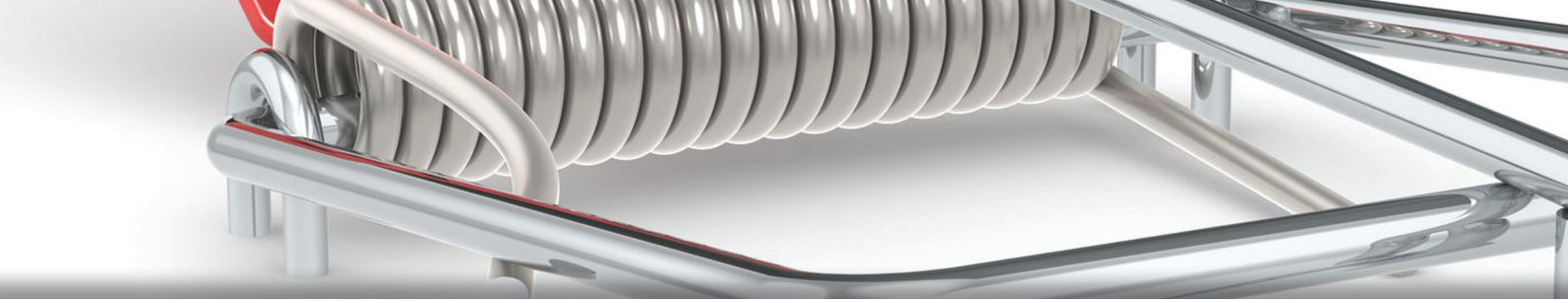
Figures represent how often a risk was selected as a percentage of all responses for that company size.

Responses: 1,445

Figures don't add up to 100% as up to three risks could be selected.

1 Natural catastrophes ranks higher than changes in legislation and regulation based on number of responses

Rank		Percent	2017 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**44%**	1 (48%)	=
2	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**41%**	2 (45%)	=
3	Natural catastrophes (e.g. storm, flood, earthquake)	**28%**	3 (31%)	=
4	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)[1]	**28%**	4 (22%)	=
5	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**22%**	5 (21%)	=
6	New technologies (e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain)	**19%**	7 (16%)	▲
7	Fire, explosion	**17%**	6 (19%)	▼
8	Climate change/increasing volatility of weather **NEW**	**13%**	-	▲
8	Loss of reputation or brand value	**13%**	8 (15%)	=
10	Product recall, quality management, serial defects	**10%**	10 (10%)	=



TOP 10 RISKS FOR MID-SIZE COMPANIES*

*€250mn to €500mn annual revenues

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that company size.

Responses: 619

Figures don't add up to 100% as up to three risks could be selected.

Rank		Percent	2017 rank	Trend
1	**Business interruption (incl. supply chain disruption)**	**38%**	2 (37%)	▲
2	Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)	**32%**	1 (39%)	▼
3	Natural catastrophes (e.g. storm, flood, earthquake)	**29%**	3 (32%)	=
4	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**24%**	6 (18%)	▲
5	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)	**23%**	5 (21%)	=
6	Fire, explosion	**19%**	4 (23%)	▼
7	New technologies (e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain)	**17%**	7 (14%)	=
8	Climate change/increasing volatility of weather	**14%**	8 (12%)	=
9	Loss of reputation or brand value	**12%**	8 (12%)	▼
10	Political risks and violence (e.g. war, terrorism, civil commotion)	**11%**	10 (11%)	=

TOP 10 RISKS FOR SMALL ENTERPRISE COMPANIES*

*<€250mn annual revenues

Source: Allianz Global Corporate & Specialty.

Figures represent how often a risk was selected as a percentage of all responses for that company size.

Responses: 818

Figures don't add up to 100% as up to three risks could be selected.

1 Natural catastrophes ranks higher than market developments by number of responses

Rank		Percent	2017 rank	Trend
1	**Cyber incidents (e.g. cyber crime, IT failure/outage, data breaches, fines and penalties)**	**32%**	2 (30%)	▲
2	Changes in legislation and regulation (e.g. trade wars and tariffs, economic sanctions, protectionism, Brexit, Euro-zone disintegration)	**30%**	5 (22%)	▲
3	Natural catastrophes (e.g. storm, flood, earthquake)	**27%**	3 (28%)	=
4	Market developments (e.g. volatility, intensified competition/new entrants, M&A, market stagnation, market fluctuation)[1]	**27%**	4 (27%)	=
5	Business interruption (incl. supply chain disruption)	**26%**	1 (33%)	▼
6	Fire, explosion	**21%**	6 (21%)	=
7	New technologies (e.g. impact of increasing interconnectivity, nanotechnology, artificial intelligence, 3D printing, autonomous vehicles, blockchain)	**19%**	10 (12%)	▲
8	Climate change/increasing volatility of weather	**13%**	7 (13%)	▼
8	Shortage of skilled workforce **NEW**	**13%**	-	▲
10	Loss of reputation or brand value **NEW**	**12%**	-	▲

Why Africa could emerge as the new champion of flexible working hours

The World Economic Forum is bullish on the economic possibilities. *"This could dramatically raise labour productivity and per capita incomes, diversify [the] economy, and become an engine for stable economic growth, high-skilled talent and job creation for decades to come,"* says Richard Samans and Saadia Zahidi, authors of *The Future of Jobs and Skills in Africa.*

But of course, it's not quite that simple. Only recently the International Labour

Africa's economy will grow faster than any other continent's over the next five years and flexible working is a huge part of that future. The African workforce is mushrooming, and by 2035, its numbers will have increased by more than the rest of the world's regions combined.

According to World Bank analysts, this expanded working-age population could to lead to a growth in GDP of up to 15 per cent – equivalent to doubling the current rate of growth in the region.

BY I GIDGETTE OSBORNE

Organisation warned that both sub-Saharan Africa and Northern Africa are facing challenges in terms of job creation, quality and sustainability.

Despite the creation of 37 million new and stable wage-paying jobs over the past decade, only 28 per cent of Africa's labour force hold such positions, according to a McKinsey Global Institute report. Instead, some 63 per cent engage in some form of self-employment or 'vulnerable employment', such as subsistence farming or urban street hawking.

Add to this the logistical difficulties for the stable wage-paying workers in actually getting to Africa's urban centres. Millions in the continent's congested cities endure long, difficult commutes. Kenya, Algeria and Central African Republic hold three of the top four slots for longest commute

Flexible Working Hours

continues from page 49

times in the world, while recent data shows that poor transport could cost South Africa's economy a huge 104 billion dollars a year.

The result is stagnation and emigration. Sub-Saharan Africa has the highest emigration rate globally (1.5 per cent, against a global average of around 1 per cent, according to UN population statistics), due to a lack of decent work opportunities.

ON THE CUSP OF CHANGE

Yet change is coming. According to the World Economic Forum, Africa stands to benefit in a big way from the Fourth Industrial Revolution. While the First Industrial Revolution used water and steam power to mechanise production, the Second used electric power to create mass production, and the third used electronics and IT to automate production – the Fourth fuses technologies such as AI, robotics, the Internet of Things, biotechnology and quantum computing.

Africa has already seen significant technological investment in its major cities, including increased access to mobile broadband, fibre-optic cable connections to households, and power-supply expansion. This, combined with the rapid spread of low-cost smartphones and tablets, has enabled millions of Africans to connect for the first time.

And as the Fourth Industrial Revolution unfolds, Africa is poised to develop new patterns of working. In the same way that mobile phones have allowed some regions to bypass landline development and personal computers altogether, Africa may be uniquely positioned to jump straight past the adopted working model in other countries to a more liberated future of remote and flexible working.

A NEW WAY OF WORKING

In many ways, flexible working is the perfect fit for a continent with a geographically diverse, work-ready population and a strong mobile communications network, which lacks the infrastructure to support urban working patterns. Why insist on big hub offices and long commutes when there's a way to harness talent from across the continent? Instead, the solution could be a distributed, virtual workforce, with companies that integrate virtual freelance workers. It's already starting to happen. A report on trending professions in Africa in the last five years shows that the number of entrepreneurs has grown by 20 per cent. And online platform work is on the rise, allowing many of these entrepreneurs to launch innovative start-ups that solve real-world problems and create jobs.

One example is Gawana, a Rwanda-based ride-sharing company co-founded by African entrepreneur Agnes Nyambura. The new company solves a problem – long-distance transport that gets people from A to B affordably – and provides job opportunities for East Africans. Travellers making their usual journeys are able to advertise any spare seats in their car using the Gawana app and earn money for the trip by 'working remotely' from their car – in other words, simply driving to their destination.

Another example is Lynk, a Kenya-based start-up app that connects users to their desired service providers – be it an accountant, a graphic designer or a personal assistant. With one in six people unemployed in Kenya, previously these skilled individuals might have struggled to find formal employment. Now they're able to open the app, accept a job, and often work remotely to complete their assigned tasks. This system is also better for the worker, who's able to track his or her hours and obtain references that help to secure further work.

A GROWING DEMAND FOR AFRICAN CODERS

Big global businesses are already starting to recognise the untapped potential of Africa for their tech needs, in the same way that companies did with India 25 years ago. In the new world of work, remote employees don't even have to be on the same continent – let alone the same office as their employers.

For example, Moringa, a Nairobi-based coding school that develops African tech talent, trains more than 250 new students a year. Its graduates go on to work remotely for the likes of global bank Barclays, which has offices in countries including Kenya, Ghana, Botswana, South Africa and Zambia, and Safaricom, an East African telecommunications company.

As African cities such as Nairobi, Lagos and Kigali become major tech hubs with a wealth of well-trained tech experts at hand, global job opportunities abound. And, because of technology, individuals can work from their home countries rather than move to the countries where big multinationals reside, thus contributing to local economic growth.

AN OFFICE AWAY FROM THE OFFICE

Flexible workspaces are becoming an essential part of a modern country's business infrastructure. *"For us, a high*

degree of interest has come from local and international businesses willing to establish a footprint in Angola, as well as from companies that need to rationalise and downsize unused resources, namely office space," says Rui Duque, Regus Country Manager for Angola.

Two major brands that have used Regus to grow in Africa, are Google and P&G. Google has 50 employees with Regus in Kenya, and P&G has 100 employees in the country. Though they have the finances and resources to build their own offices, start-up costs can be expensive in developing countries, and getting an office up to spec with high-speed broadband, useable meeting rooms and desk space can take up valuable time. Plus, using flexible office space reduces the commitment for these big organisations, many of whom are still testing the water in new African cities.

African businesses are using flexible working as a way to attract talent. In a recent survey by Regus, senior executives and business owners confirmed that flexible working could be used to avoid employee churn (and the consequent expense of recruitment agencies), with 71 per cent of respondents pointing to flexible working as a perk that attracts top talent.

Flexible workspace is also a preferred option for workers. Seventy-seven per cent of African workers said they'd choose one job over another similar one if it offered flexible working, while 56 per cent would actually turn down a job that ruled out flexible working.

AN EXCITING FUTURE

According to the World Economic Forum's Global Competitiveness Report, the most competitive countries in the world are those that nurture innovation and talent in ways that align with the changing nature of work

If the trends of the past decade continue, Africa will have created 54 million new, stable wage-paying jobs by 2022. It seems clear that remote and flexible working will be a huge part of this growth. wn

Earn CPD Credits

Africa has only recently commenced the fixed line fibre journey. In this new wave of deployment, best practices from more mature fibre journeys need to be adopted, one of which is the incorporation of edge data centres.

BY | BRADLEY HEMPHILL
PR.ENG | B.SC (ENG) | ATD | CDCP | DIGITAL INFRASTRUCTURE STRATEGIST

The increasing need to move data over extended networks due to rapid regional African growth has made it necessary to bring fully-fledged computing infrastructure closer to the end-user. A solution to this is edge computing and the deployment of regional and edge data centres. Integral to planning the implementation of an edge data centre is re-imagining the current Central Office (CO) as an edge data centre.

Requirements of the Central Office of the future

THE CENTRAL OFFICE (CO)

Applying digital infrastructure principles is possible to transform existing CO design so that it can be utilised as an edge data centre and thereby change the CO of today into the CO of the future.

The traditional CO was the telephone exchange. It was the aggregation point of all the subscriber circuits in the area of service, and it had connections to other exchanges. It hosted the switching and related equipment which delivered the telephony service, and it was essentially copper based.

The modern CO is fibre based and serves as the aggregation point of the various circuits and equipment required to deliver services

Central Office of the Future

continues from page 53

to subscribers. It may host equipment like the Optical Line Terminal (OLT) and Optical Distribution Frames (ODF), also called Fibre Distribution Frames (FDF), depending on the technology of the network.

The CO, whether traditional or modern, provides the necessary power and cooling for this equipment. In some cases, the CO might include some components of the core network. The function of the CO is key to the operation of the network, and therefore the design thereof has a direct impact on the network's performance and cost.

RESEARCH

The requirements of the future CO and some solutions to those requirements had to be investigated. This was done by considering the context in which the CO will be constructed and the predicted trends in fibre access networks globally. Research regarding what other operators are doing and the solutions currently offered by suppliers was also conducted. Some of the principal research findings are highlighted below.

AFRICAN CONTEXT

The number of CO characteristics will determine the framework in which the fibre network will operate. Two aspects that need to be considered are the climate and the social conditions. The CO that is to be designed will be used in various African countries.

Several climate types can be found within the continent of Africa. It has warm and hot climates combined with high humidity in specific climate zones. Some coastal countries experience monsoons in the warm season and thunderstorms are a frequent occurrence in many African regions.

Concerning conditions, African countries face high unemployment rates, which lead to high crime rates. The vandalism and stealing of equipment is a problem that many utilities and service providers in Africa face. We need to consider another social issue, which is a shortage of skilled labour due to the inadequate education systems. The difficulties utilities and service providers experience regarding this shortage is exacerbated by the fact that many African towns are far from central business centres. Skilled technicians may need to travel long distances to reach infrastructure when repairs are needed.

PREDICTED TRENDS

One trend that has been observed in recent years is the use of edge computing to meet latency and other requirements. In the past, data such as video content had to be transported over long distances from a data centre to the end-user, which resulted in high latency. With the increase in the demand for services that require fast download rates, such as streaming services and online gaming, the need for reduced latency has increased. Edge computing offers the solution by moving the content and data processing closer to the end-user. The Central Office Re-architected as a Datacenter (CORD) replaces the traditional CO and is designed so that service providers can use the fibre network's CO, which is close to the end-user, as a data centre.

OTHER OPERATORS

Chorus is a telecommunications infrastructure provider and the owner of the majority of New Zealand's telephones lines and exchange infrastructure. Chorus gives retail service providers the ability to install equipment in Chorus's COs to build a network [1].

Telefonica is a Spanish telecommunications provider and managed to lay out fibre-optic cables reaching 31 million premises in a relatively short period, despite the 2008 recession which cut Spain's GDP by nearly a tenth [2]. One method Telefonica used to attract new customers was to offer discount bundles that include mobile, fixed, broadband and television services [2]. Now Telefonica is aiming to further improve and expand their services by developing their own Central Office Re-architected as a Datacenter (CORD) based platform, which can be used for edge computing to deliver content at low latency [3]. Additional services will be included as Telefonica further develops the platform.

CityFibre promotes themselves as the UK's largest alternative provider of wholesale fibre network infrastructure. They emphasise planning, rather than evolving their networks. This means that they plan a system so that it will eventually be able to provide fibre to every building in every city. Therefore, although the infrastructure they are currently building will not serve all these buildings, the design and location of the installation, including the CO, will allow them to expand their network to every building in the future quickly. CityFibre thereby ensures that their infrastructure is future-proof.

SUPPLIERS

CommScope has published numerous white papers on how COs will increasingly be used as edge data centres and what that means for the design of COs. According

to CommScope, the main factors that need to be considered when designing a CO as an edge data centre is a location; power; heating and cooling; infrastructure planning; and physical layer infrastructure [4]. The geographical area of the CO, as well as the actual physical site, must be considered as the CO must be close to the desired target market and the conditions at the site will determine numerous parts of the CO design. Power planning must ensure that the CO will always be operational and must consider future power requirements as well. Heating and cooling is essential to the operation of the CO and must be performed as efficiently as possible to reduce OPEX.

Infrastructure planning addresses the overall design and security of the CO. Lastly; it is essential that the preparation of the physical layer infrastructure considers future technology and connectivity. Other suppliers, such as Fibre Connex and Nexans, emphasise the fact that their COs are quick to install, facilitate cost savings and are future proof due to factors such as easy to assemble parts, pre-terminated equipment and modularity.

REQUIREMENTS

After researching the requirements of the future CO, it can be concluded that many elements need to be considered in the design phase. The CO requirements are as follows:

- Modular
- Robust
- Autonomous
- Secure
- Overall installation deskilled
- Edge server ready
- Cost efficient

MODULAR

The CO must be designed so that it is modular. The CO will require increased fibre capacity as the number of locations which take up service increases. Modularity will ensure that the improvements in, as well as the replacement and repair of damaged components, can be undertaken in a live environment so that no downtime is experienced on the unaffected equipment. Furthermore, modularity will future-proof the CO because it allows for the installation of future technologies.

ROBUST

The CO will be located somewhere in Africa; therefore the African context must be considered in the CO design. The African climate requires that the CO be robust. The CO will need to be waterproof and will require cooling. In areas that experience thunderstorms, lightning protection is required. The structure of the enclosure must also be strong enough to protect the internal equipment from the harsh environment and vandalism.

AUTONOMOUS

The CO will be an unmanned-facility, most likely in a remote location, and must, therefore, be autonomous. It must be able to monitor and control its internal environment unless some problem is encountered that requires human intervention. The internal environment of the CO should ideally be maintained between 30 and 35°C, which requires an efficient, self-correcting cooling system. The CO will need an early fire detection and suppression system that also sends remote alarms to central management and response service personnel. A backup power supply is required in the case of power outages, which can be a frequent occurrence in African towns and cities due to unreliable power utilities. If a problem occurs that the CO cannot correct, such as damaged equipment, the system must send a report with the exact component that requires repair to the relevant persons. Additionally, the system must be able to perform an emergency shutdown procedure in an emergency condition, such as an uncontrollable fire breakout, critical loss of utility and backup power, natural disaster or unforeseeable circumstances.

SECURE

The CO must be access controlled to ensure the security and integrity of the equipment installed in the CO. The security system must be able to detect when access is gained to the CO and whether the entry is authorised. Not only must the entry of unauthorised persons send an alarm to the relevant people, but the entry of authorised personnel at unofficial times must also signal an alarm.

DESKILLED INSTALLATION

By reducing the skill needed to install the CO the training required by technicians is cut, the time required to complete the installation is lessened, and the risk of installation errors is lowered.

EDGE SERVER READY

Edge computing is a technology trend that is being used to solve the problem of transporting data over long distances between data centres and end-users, which causes difficulties such as latency. With edge computing, data processing is performed at the edge of the network, close to the end-user. Therefore, to ensure that the infrastructure or service provider can remain competitive, the CO will need to be edge server ready.

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COST EFFICIENT

Cost efficiency is a core element of any project and is usually a balance between the CAPEX and OPEX. Both of these must, therefore, be considered during the design of the CO to ensure the competitiveness of the service provided.

The decision to design and build

Once the CO requirements had been defined, the available solutions offered by suppliers were reviewed. It was found that there was nothing appropriate that met the stringent requirements; therefore, the next logical step was to design and build a CO.

RESULT

MODULAR

The three aspects of the CO that need to be modular are the active, passive and electrical components. The active components are the networking equipment while the passive components are the patch panels where the fibre from the field terminates. Modular types of networking equipment and patch panels were chosen for the CO.

On the electrical side, there must be enough power available for the full design capacity of the CO from the utility as well as the internal backup power system. The CO cabinet also allows for equipment to be changed quickly and has space for upgrades.

ROBUST

The CO cabinet is made from a 90% aluminium alloy, which is highly damage resistant. The doors are sealed with rubber strips to ensure it's waterproof and the access keypad has a cover to protect it from water damage. There is active and passive cooling inside the CO, but this will be discussed in the next section.

AUTONOMOUS

The CO is cooled using both active and passive cooling. The CO cabinet is double walled to promote passive cooling via natural convection.

Active cooling is provided by a heat exchanger, which has a sophisticated controller that can monitor the temperature and adjust the cooling according to the current heat load. The inclusion of free cooling technology results in highly efficient operation.

An AC energy meter measures the power supplied and when there is no power, such as in the case of a power failure, a generator will start up. A DC power supply is used to provide power in-the-time it takes the generator to start up. The electrical components are protected from power surges by an AC surge protector.

A smart controller monitors the health of the CO. If it detects a problem, it will send an alarm report to the relevant people so that the issue can be investigated. A fire sensor is installed to ensure the CO shuts down in the event of a fire and will also trigger the sending of an alarm report.

SECURE

An electronic lock with a keypad is used to secure the CO; therefore a code is required to gain access to the CO interior. The lock can also be opened using mechanical keys if there is no power.

A biometric reader could be used instead of a keypad and has the advantage of being able to identify the persons entering the CO. An alert is sent to the relevant person anytime the CO door is opened.

OVERALL INSTALLATION DESKILLED

This was done by purchasing simple-to-install and pre-assembled equipment, such as pre-terminated fibre patch panels. Modularity eases installation because new equipment can be installed in a live environment.

By future-proofing the CO, upgrades can also be done quickly. Effective cable management improves the technician's ability to gain quick, easy and correct access to fibres. Additionally, proper cable management reduces the risk of service interruption due to the mishandling of one thread to gain access to another. Drawings inside the CO, adequate record keeping and alarm reports also assist technicians.

EDGE SERVER READY

For a CO to be edge server ready it needs to be able to act as a Point of Interconnect (POI), and the CO must, therefore, be designed so that other service providers can install their equipment within the CO. There must be space for this inside the CO as well as a sufficient power supply. The service providers can thereby provide fibre-based services to end-users who are connected to the fibre network and improve the end-user experience because data-analysis can now be performed in the field at the CO.

COST EFFICIENT

In the case of a smart CO, the initial CAPEX is usually more than if a typical CO was installed. This is because more advanced equipment is required, such as the autonomous environmental monitoring system. The smart CO, however, has a lower OPEX. The smart CO is, and costs can, therefore, be saved on check-ups because

the CO monitors itself. The smart CO is also able to detect accurately which parts need replacing, which reduces the time spent to make repairs, thereby reducing maintenance costs. The environmental monitoring system ensures that the CO is cooled efficiently, which reduces cooling costs. An additional cost benefit of using a smart CO is the fact that the CO is modular which allows for the addition of equipment on an as-needed basis rather than initially fitting the CO for full capacity.

CONCLUSION

Regional growth means that fully-fledged computing infrastructure needs to be brought closer to end-users. The CO, typically situated at the network edge, serves as the aggregation point or host for various circuits and equipment required to deliver services to subscribers. COs will increasingly be used as edge data centres, and it is important to consider what this means for the design of COs. The modern CO is key to the operation of the fibre network. In addressing the requirements of the contemporary/future CO, it is necessary to consider the context in which it will operate and the predicted trends in fibre access networks globally. wn

SOURCES

[1] Chorus consults industry on future fibre products (Source: Chorus)

[2] Why Spain is a case study for super-fast broadband (Source: Telefonica)

[3] Telefonica 'gets its hands dirty' with OnLife Network (Source: TM Forum)

[4] Checklist for building an edge data centre (Source: CommScope)

Digital – Confucius Institutes

DIGITAL RESEARCH AND INNOVATION INSTITUTES IN THE ERA OF THE FOURTH INDUSTRIAL REVOLUTION

As the University of Johannesburg (UJ) contextualises its Global Excellence and Stature strategy for the Fourth Industrial Revolution (Industry 4.0), I was invited to deliver a talk on the construction of a "digital" Confucius Institute (CI). The discussion was prepared for the Presidents' Forum, 13th Global CI Conference, Chengdu, China.

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The UJ-NanjingTech CI initiated three (3) years ago and had already made significant strides in fostering collaboration between South Africa and China. For the research and productive partnership, understanding of the cultural context is helpful – beyond communication, to the cooperation, also for an ecosystem that is solution seeking, is innovative and humanity-serving. Resulting from this understanding is also the quest for developing collaborations and defining boundaries that enable for a mutually beneficial long-term relationship.

So what does a "digital" institute mean and what are the implications for such an institute in the era of the Fourth Industrial Revolution? International collaboration has traditionally taken the approach of many interactions through in-person visits; technology, through e-mail, has improved our ability for communication, later through Skype or "Hangouts" and now in an instantaneous way – through WeChat, WhatsApp, and other "instant messengers." In this case, the first aspect of Industry 4.0 is to communicate textually in one's language, understanding that technology is still improving, and using online human language translation. WeChat provides for translation "at a click." Gmail and other mail browsers provides a language translation plug-in. The translation feature can be configured for seamless communication.

At times communication, through email, occurs briefly, such "efficiency" and textual limitation of emotion, creates miscommunication. The instant messenger services of WeChat and WhatsApp allows for voice communication. In future, the voice-to-text and thus translation or archival capability will improve. In the "infancy" state, of what is to come, UJ is already exploring voice recognition tools for voice-to-text conversion. For example, https://www.speechtexter.com/ - also available as a mobile app.

The second aspect of integrated voice recognition and translation technology is upcoming. The tools are supported by databases with a large number of different accents and thus catering for accents will further develop. Our preliminary exploration with Speechtexter is already quite promising.

At present, the CI teaches Mandarin and as an essential component of understanding Chinese culture. However, it appears that traditional teaching can be blended with digital tools. Of course, when one uses digital translation tools, one is often contributing their voice and "voice print", and the database continues to build through the "super-computing" cloud. Often the voice is "taken" without knowledge of the user, and this has ethical implications. However, when I recently

called the Nedbank Credit Card division, the indication was that the "voice print" will be taken for future security. This is an interesting authentication concept, and this is the third aspect relating to the digital CI. The aspect of "voice print" means that if the CI is conducting an oral language examination, with a machine as an evaluator, the device will be able to authenticate the user, then the user would access the assessment, and afterwards receive opportunities to improve – or providing the grading/certificate.

In between the "teaching" and "assessment," the learning platform used supports the learner in their academic journey. Learning management systems can utilise individual data to provide customised support – for instance, the learner will be appropriately advised if they scroll too fast through online study material! Aggregate data is analysed and provided to the module facilitator allowing for group support; there is provision for peer-to-peer discussion and social media variety. Of course, the databases continue to build for module improvements and the next offering. UJ is also utilising "Blackboard Predict," which is an "early warning system" such that the learner can be timeously supported. The aspect of customised support for the individual or a group, and thus improving module engagement, is the fourth aspect.

The fifth aspect of digital CI is digital recognition. As of September 2018, UJ provides digital certificates. Graduates can access their digital certificates, and the same will be applicable for students as they complete their CI assessment, with a machine or otherwise, and the certificate will be provided electronically. In future, a social media badge will also be presented. The association of the badge, together with the individual's experience, will most likely convert to some form of digital "recommendation" (just as we find "user ratings" for accommodation and other objects!) LinkedIn already provides for this. This provides another complication for the traditional university – as the compilation of skills, of experience, of qualification, and this digital recommendation "rating" could evolve into another "seal" for employability. Perhaps this becomes an alternative to "recognition of prior learning (RPL)." I will share a secret when I get new applications for a job – I review the submissions – this is necessary, brings about process consistency. However, I do also look at LinkedIn profiles. If an applicant has a favourable skill score, and if the skill relates to the job at hand, I feel good about that (look, I have to use this information in a way that it does not bias me!) For documents, we already have something called a "digital object identifier" (DOI) – are we moving towards a global digital ID? Such an ID would then relate to various parameters, such as skills, individual health, energy consumption, emotional intelligence, technology versatility, agility, etc.

Aside from the artificial intelligence supported collaboration, another important aspect is of accessing areas, through virtual domains or simulations – using virtual and augmented reality devices. The visual ability to "walk in" another laboratory or in a country (even another planet!) virtually is also of interest. Such an environment would benefit from the translation technologies, textually and otherwise, and in a way to facilitate interactions. The idea here is not necessarily to "replace" real-life views or visits but to augment the realities in a way that learning experience can be enhanced.

The various provisions of a digital institute also have a favourable implication for inclusivity –more users can be accommodated in different ways. For differently-abled persons, there is an added accessibility level.

Without a doubt, there is the collaborative benefit of the "digital" infrastructure as it brings us closer to one another – at the same time, there is also a fear:
In all of this – text, voice, visual, virtual and otherwise – intelligent algorithms harvest data, the data sets build, and ultimately the infused utilisation of this – for good or bad will eventually dictate humanity's progress. wn

Our Expert Answers

Information provided by Zest WEG Group

QUESTION ONE

What items need to be considered when designing a bulk fuel tank installation for a generator application?

ANSWER ONE

A bulk fuel tank installation needs to be designed in accordance with the by-laws of the city where it will be installed. City by-laws differ based on the municipality jurisdiction and it is always recommended that a professional fire engineer designs and approves the installation.

The system is designed around the amount of fuel that needs to be stored and the containment area needs to comply with the relevant fire regulations.

A few common items are:

1. Spill containment – any area where fuel may be spilt needs to be contained in a 110% bunded area. This bund will limit, contain, divert, minimise and manage the impact of spillages and fires. The bunded area needs to be sloped so that the liquid can be collected in the sump area. A suitably rated sump pump needs to be available to disperse the diesel.

2. Fire protection – adequate fire protection and detection needs to be allowed for as well as foam filling inlets and portable firefighting equipment. All equipment supplied and installed needs to as per the applicable SANS standards.

3. Adequate ventilation – which may include natural or forced ventilation, fire dampers and will allow for 30 air changes per hour. All fumes will be expelled through the outlet ducts or louvres.

4. Correct access – via suitably rated fire doors that must open outwards and the locking mechanism must be capable of being opened from the inside. No person is to be able to enter the fuel room without the correct authorised access.

5. Symbolic signs – Appropriate safety signs that comply with SANS 1186-1 need to be installed in and around the fuel installation. Signage prohibiting open flames to be displayed inside and out of all doors leading into the room.

6. Electrical safety – design needs to be implemented to ensure that all electrical equipment is suitably rated and where possible it needs to be mounted externally to the fuel storage area. This ensures that the correct hazardous areas classification is adhered to.

These are a few of the important items and it is always important to note that each installation's requirements may vary based on the municipality's requirements.

QUESTION TWO

What role does the power factor play on a generator set?

ANSWER TWO

Power factor is the ratio between the kW and the kVA drawn by an electrical load where the kW is the actual load power and the kVA is the apparent load power. It is a measure of how efficiently the current is being converted into useful work output and is a good indicator of the effect of the load current on the efficiency of the supply system. Electrical machinery is typically rated at a 0.8 power factor for three phase systems and 1.0/unity power factor for single phase systems.

In terms of building load, a load with a power factor of unity is considered to be the most efficient and to achieve this, power factor correction is implemented to increase the site power factor if required.

All alternators are wound at 0.8 power factor lagging as an international standard and are the main areas of concern when the power factor rises above 0.8 to unity.

- This results in alternator overheating and the AVR becomes unstable, which affects the output voltage
- The engine will not have sufficient kW to power the alternator to 100% of its kVA rating, and this causes the generator to stall or shutdown on under frequency.

It is recommended that when the power fails and the load is run on generator that the power factor correction be switched off before the generator takes load. This will assist in keeping the power factor closer to 0.8 to ensure optimal generator performance.

QUESTION THREE

What are the benefits of generating at low voltage (LV) or medium voltage (MV)?

ANSWER THREE

There are a few items to be considered when deciding between the benefits of a LV or MV generator power supply. Deciding factors include price, availability, site

design, and all these factors need to be weighed up before deciding which option to use.

In terms of pricing, LV alternators are more affordable when compared directly with an MV alternator however consideration needs to be applied to what is required on site.

When generating at LV and distributing at MV, you will require a step-up transformer. The cost of the step-up transformer and LV cable reticulation will need to be taken into consideration when selecting which option is more cost effective. LV alternators and spares are readily available as a wide number of manufacturers keep stock or manufacturing time frames are substantially shorter. MV alternators have a longer lead time as they are not required as frequently.

After installation you will need to consider the service costs. An LV installation will always cost less to service as there are no special technical requirements compared to an MV installation which will require properly trained MV technicians to service equipment correctly and safely. wn

JANUARY

January means is "month of the wolf" in Saxon terms. Means "janus' month." Janus is the god of the doorway in Roman Mythology. As in, January is the door to the new year.

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

1 JANUARY

1971 The IEEE Computer Group formally changed its name to the IEEE Computer Society (CS).

2 JANUARY

1975 Microsoft founders, Bill Gates and Paul Allen, wrote a letter to MITS, USA, offering a version of BASIC for MITS's "Altair 8800" computer. The contract for BASIC reflected the first time Gates and Allen referred to themselves as the company Microsoft.

3 JANUARY

1983 Instead of Time magazine's "Man of the Year", they named it "Machine of the Year." When introducing the theme, Time publisher John A. Meyers wrote: *"Several human candidates might have represented 1982, but none symbolized the past year more richly, or will be viewed by history as more significant, than a machine: the computer."*

4 JANUARY

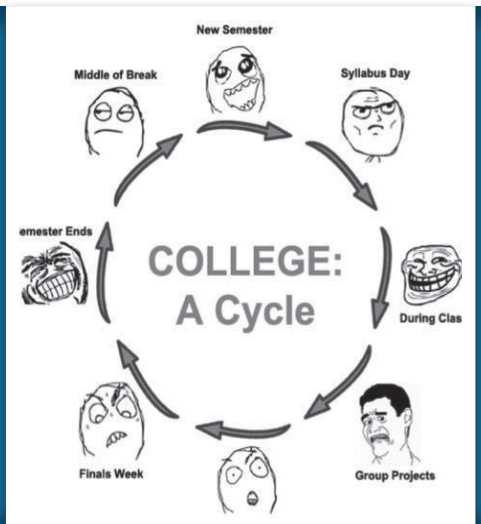
1863 4-wheeled roller skates are patented in the US by James Plimpton, whose design was the first dry-land skate that could manoeuvre in a smooth curve and which allowed for turns and the ability to skate backwards.

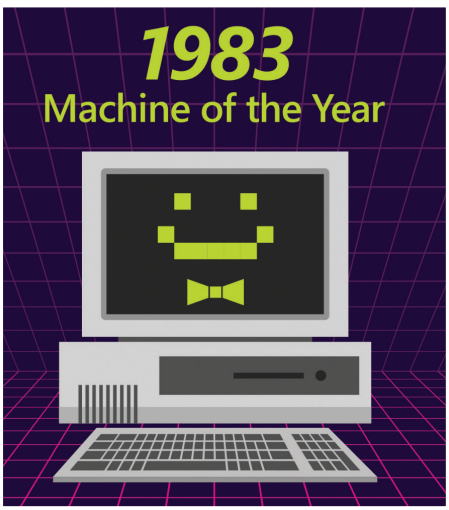
5 JANUARY

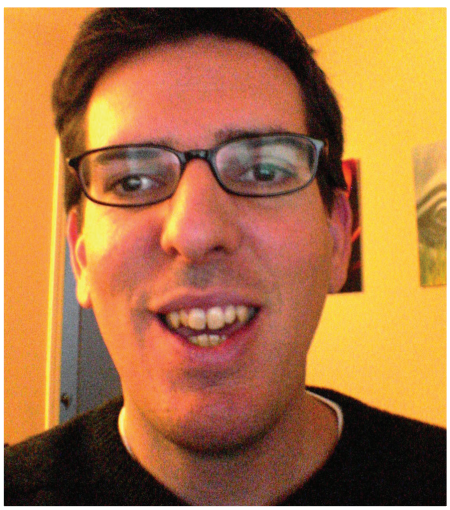
1948 Warner Brothers-Pathe showed the very first colour newsreel. Pictures of the Tournament of Roses Parade taken New Year's Day and the Rose Bowl football classic were seen by theatre audiences. The newsreel was made using the Cinecolor process.

6 JANUARY

2010 Using a desktop computer in an academic pursuit, Fabrice Bellard announced that he has computed pi to roughly 2.7 trillion digits and revealed his methods used in accomplishing this task.







7 JANUARY

1839 Louis Daguerre made the first announcement of his photographic system at the Académie des Sciences in Paris, France. The French government had bought the rights to the process from him, and then were going to made them freely available to the world. However, this process had also been patented in England and Wales on 14 Aug 1839 - only five days previously.

8 JANUARY

1996 Jacques Cousteau's Calypso was accidentally rammed by a barge and sank in Singapore Harbour. He was a French naval officer, oceanographer, marine biologist and ocean explorer, known for his extensive underseas investigations. Over the years, he made modifications. He was aged 85 when he lost the ship and was attempting to raise funds to replace it but died 25 Jun 1997. The Calypso was raised and taken to France to restore as a museum.

9 JANUARY

1998 Two teams of international collaborations of scientists announced the discovery that galaxies are accelerating, flying apart at ever faster speeds, by observing distant, ancient exploding stars. This observation - named as Science magazine's "Breakthrough of the Year for 1998" - implies the existence of a mysterious, self-repelling property of space first proposed by Albert Einstein, which he called the cosmological constant.

10 JANUARY

1949 RCA introduced the "single," the 7-inch diameter 45 rpm record in the U.S. A single could play eight minutes of sound per side.

11 JANUARY

1964 Surgeon General of the United States Dr. Luther Terry, M.D., published the landmark report Smoking and Health: Report of the Advisory Committee to the Surgeon General of the United States saying that smoking may be hazardous to health, sparking national and worldwide anti-smoking efforts.

12 JANUARY

2004 The world's largest ocean liner, RMS Queen Mary 2, began its maiden voyage.

13 JANUARY

1976 The first machine for reading printed matter aloud was given its first public demonstration, by its inventor, Raymond Kurzwell. Using a camera with a computer, pages of printed matter were scanned, the letters analysed, and reproduced in synthesized English speech at 150 words per minute.

14 JANUARY

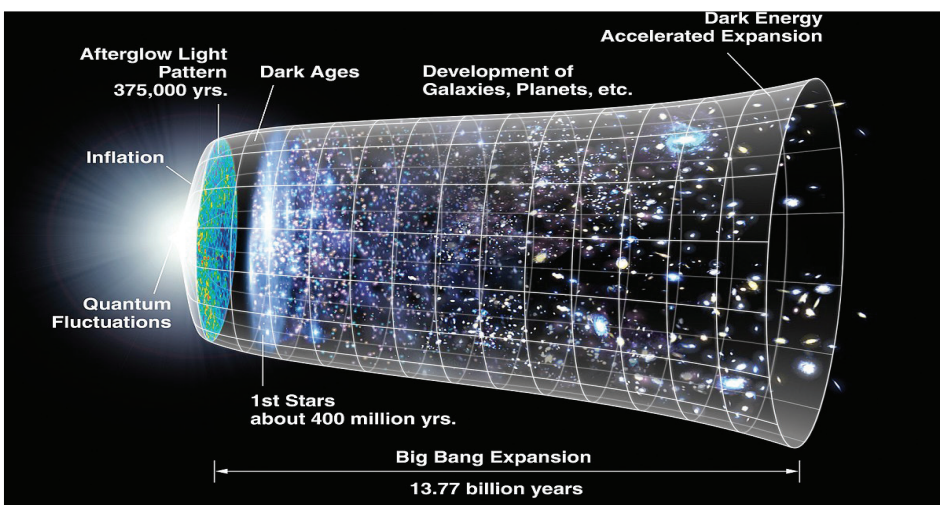
2005 The Huygens space probe landed on Titan, Saturn's largest moon. It had been released from the Cassini spacecraft when its orbit around Saturn converged with the path of Titan on 24 Dec 2004.

15 JANUARY

1955 The first U.S. house to be both solar-heated and radiation-cooled started up its system. It was built in Tucson, Arizona by solar physicist Raymond W. Bliss, Jr. The system was built at a cost of nearly $4,000 for labour and materials. It was made using a large slanted slab of steel and glass that converted sunlight into heat, which was ducted into the house. Summer cooling used the same ducts and associated fans and controls.

16 JANUARY

2018 Temperatures reach −67 °C in Russia's Yakutia region, four degrees shy of the record low of −71 °C recorded in 2013 in Yakutia's village of Oymyakon.



January

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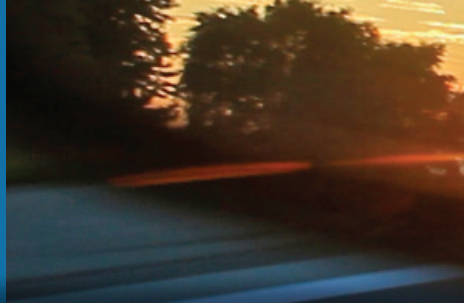

17 JANUARY

1929 Edwin Hubble presented his now classic paper that first showed the universe was expanding (and later provided observational evidence for the Big Bang Theory). But Hubble explicitly made no such an interpretation. He left that to the reader. His paper was simply titled *"A Relation Between Distance and Radial Velocity Among Extra-Galactic Nebulae."*

18 JANUARY

2018 In a world first, a drone rescued two swimmers off the coast of Lennox Head, New South Wales in Australia by dropping a safety device to them.

19 JANUARY

1903 King Edward VII and President Theodore Roosevelt exchanged greetings in a coded radio exchange between Cape Cod, USA and Cornwall, England.

20 JANUARY

1986 Britain and France announced plans to build rail tunnels underneath the English Channel, the Chunnel.

21 JANUARY

1840 Charles Wheatstone and William F. Cooke were granted the earliest English alphabetic telegraph patent, which was popular in England and Europe because it did not require a trained telegraphist to read or send the messages.

22 JANUARY

2014 New data published independently by NASA and the National Oceanic and Atmospheric Administration show that the global warming trend is continuing.

23 JANUARY

2018 The organizers of the Google Lunar X Prize announced that the $20 million grand prize for a commercial lunar lander would expire on 31 March 2018 without a winner.

24 JANUARY

1984 Apple Computer, Inc. released its Macintosh computer with an unprecedented media campaign, including a ground-breaking TV commercial shown during the 1984 Super Bowl. It sold for about $2 500, the Mac used a Motorola 68000 microprocessor and had 128k of RAM (memory).

25 JANUARY

1961 Walt Disney Productions' animated movie 101 Dalmatians premiered.

26 JANUARY

1997 The New York Times chronicled the debate between electronic and paper books in an article about the new San Francisco Public Library. Critics complained that the library sacrificed too much book space for computer terminals, had too many books for online information, and lamented, as well, the end of the traditional card catalogue that marked a move to the information age for many libraries.

27 JANUARY

1983 The pilot shaft of the Seikan Tunnel, the world's longest tunnel with an undersea segment (53.85 km), between the Japanese islands of Honshū and Hokkaidō, broke through.

28 JANUARY

1855 A locomotive on the Panama Canal Railway ran from the Atlantic Ocean to the Pacific Ocean for the first time.

29 JANUARY

1697* Isaac Newton received a copy of Johann Bernoulli's challenge, the long-standing brachistochrone problem.

Newton solved it the same day. Bernoulli's New Year's present on 1st January 1697 to the mathematical world was the problem:

"To determine the curved line joining two given points, situated at different distances from the horizontal and not in the same vertical line, along which the mobile body, running down by its own weight and starting to move from the upper point, will descend most quickly to the lower point."

(Bernoulli coined the name from Gr. brachistos, shortest; and chronos, time.) Newton forwarded his solution to the Royal Society—anonymously. When Bernoulli read the solution, he shrewdly guessed it was Newton's work. By legend, he said, *"I recognize the lion by his paw."*

30 JANUARY

1998 A new glue, Dermabond, able to replace painful stitches, won the unanimous vote of a medical advisory panel for the Food and Drug Administration and approved it for marketing in the USA in August of that year.

This is a medical-grade glue that is a chemical cousin of Crazy Glue (Super Glue)(which is too toxic to repair cuts) using proprietary cyanoacrylate technology.

31 JANUARY

2018 A super Blue Moon Total Eclipse occurred. This happened when the moon was entirely inside the Earth's dark umbral shadow, and it lasted 75 minutes. This full moon was also the third in a series of three straight full moon supermoons – that is, super-close full moons. It's the first of two Blue Moons in 2018. So it's not just a total lunar eclipse, or a Blue Moon, or a supermoon. It's all three … a super Blue Moon total eclipse!

The moon's orbit is not perfectly circular, meaning its distance from Earth varies as it goes through one cycle. The closest point in its orbit is called the perigee. A full moon that happens near perigee is called a supermoon by some. Its proximity makes it seem a little bit bigger and brighter than usual, but that's the extent of its effects on Earth. The distinction is usually hard to notice unless you're looking at two pictures side by side. WN

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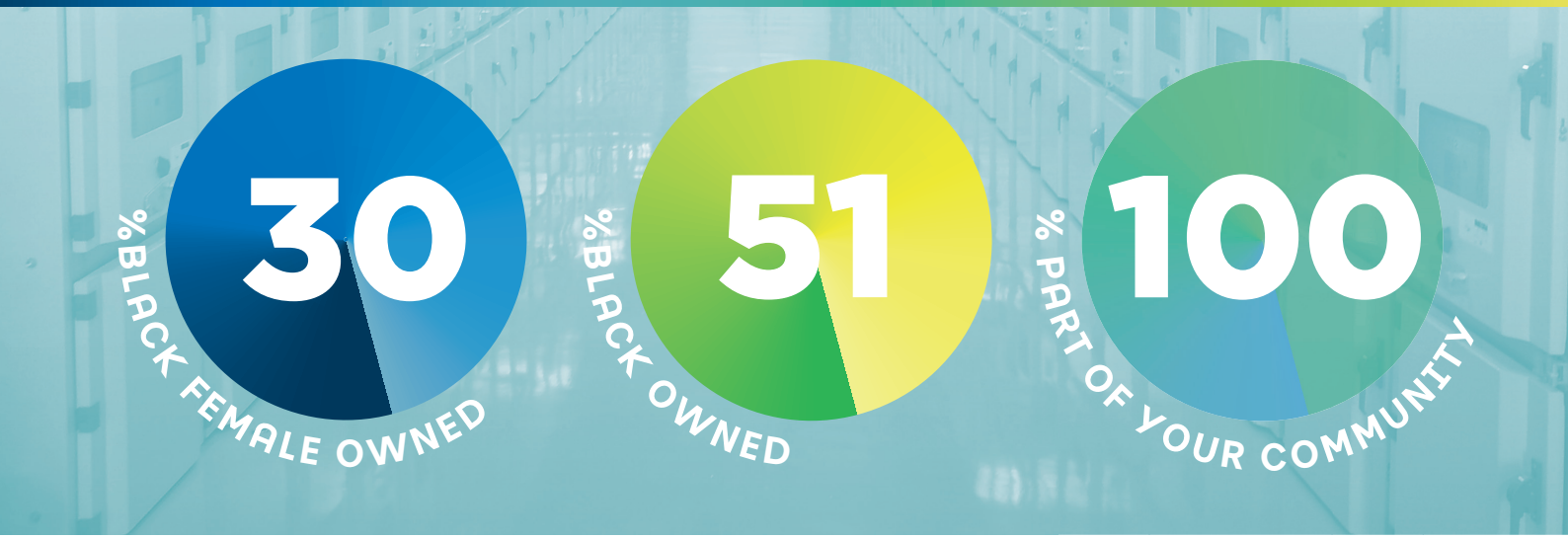

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Melvin Jones

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