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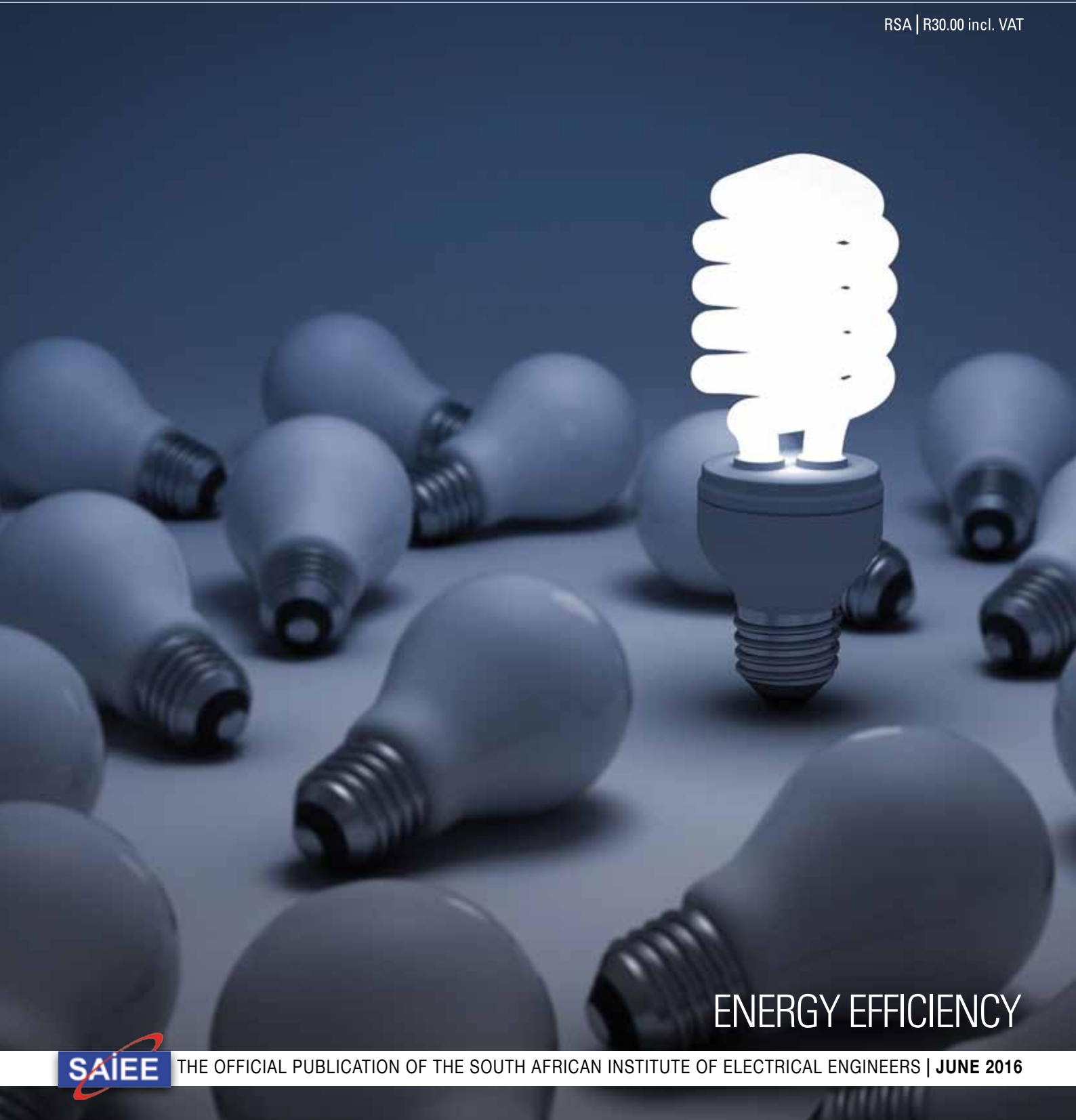

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6106

June means a few things.

It is officially the last month of autumn, days are cooler and shorter and it is the 6th month of the year, which means we have another 6 to accomplish our New Year's resolutions (which might be a distant memory for most).

19 June is also Father's Day. A Father is a son's first hero… and a daughter's first love. Fathers form the pillars of most households and communities and with this I wish all my readers a fantastic Father's Day. We might not always see you, or call you, but you are always in our hearts. YOU form the basis of how sons choose to be as grown ups, and daughters choose their husbands.

The June issue of **watt**now features a few articles on Energy Efficiency, which is a hot topic. It doesn't matter what system you are referring to, whether it is solar, hydro, wind – the question remains – "How much green will we save?"

The first feature article you will find on page 32, "Global Energy Efficiency, penned by Jason Dini, which discusses various green issues faced by Electrical Engineers.

Dudley Basson wrote another masterpiece, this time on the Green State of Denmark. This you will find on page 38.

Page 50 sports an article from Udo Gollub from Germany, who takes a look into the future, which leaves you thinking… deeply.

Herewith the June 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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TC MADIKANE
2016 SAIEE PRESIDENT

The June issue covers energy efficiency. A subject so close to my heart! I know that all Past Presidents have emphasised that, as Electrical Practitioners, we must lead by example in making South Africa a green country.

I recently wrote an article on energy efficiency, based on the project that my own company undertook on behalf of the City of Cape Town – a lighting project involving 12 buildings. Details of the article are part of this June issue.

It was a privilege to chair a session during the African Utility Week (AUW) 2016 in Cape Town. City Power scooped the Award for Best Run Utility in Africa. Pure Visionary Leadership at its best! Their energy mix, and all the various strategies pursued by that Utility are just mindboggling. Congratulations are in order to Mr Scelo Xulu, Managing Director of City Power, and his team. The SAIEE is very proud to be associated with City Power as one of our strategic Corporate Partners.

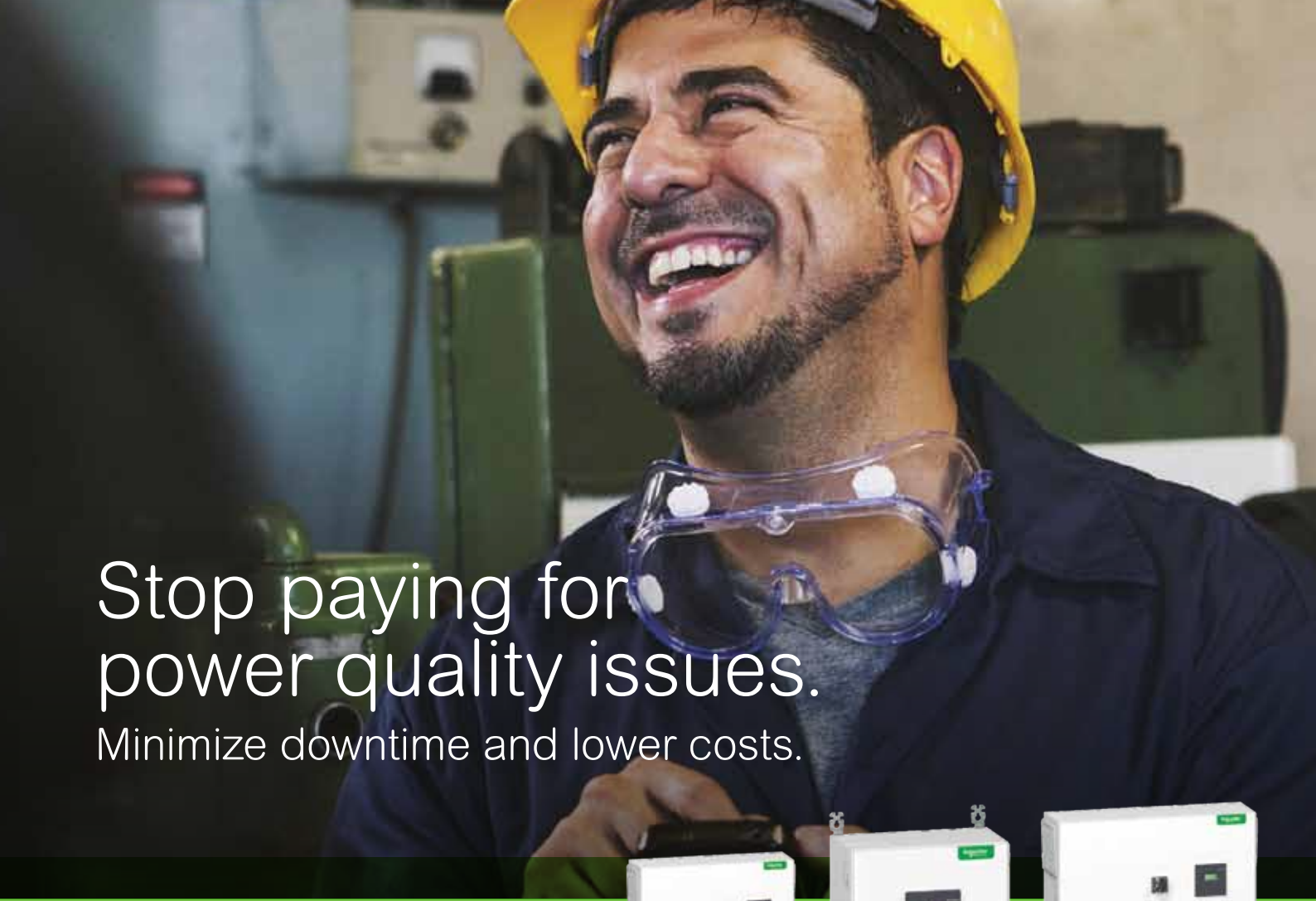
The Presidential Address continues to be an inspiring experience. It has been a privilege to meet leadership and members in various Centres. During May I visited Pietermaritzburg, Bloemfontein, Secunda and Vanderbijlpark. The more I visit these centres, the more I am convinced of the critical role centres play in making the SAIEE the vibrant organisation it has become. It is encouraging that most Universities have sufficiently developed structures and programs which promote students' involvement in the SAIEE activities. This is how we all started! It also means we can be confident of a bright future in the SAIEE, with necessary continuity and sustainability.

The #ploughback mission also took a higher gear in the month of May. It was my pleasure to participate, as we recognised and congratulated the best students, with Prize Giving Ceremonies at two universities inter alia, the University of Witwatersrand in Johannesburg and North West University (Potchefstroom Campus). As the SAIEE, we will continue to contribute and encourage other institutions of higher learning, to involve the SAIEE in such events whenever possible. This not only helps boost the confidence of the students, but also helps forge stronger relationships and partnerships between the SAIEE, tertiary institutions and industry.

On the 18th May 2016, Transnet announced their New Group Structure, and it is exciting to see that they have two engineers as part of their top executive team. Their new model is also encouraging, where all the operating divisions such as Freight Rail, Port Terminal, Pipelines, Port Authority and Properties will be reporting to an engineer, the Chief Operating Officer Mlamuli Buthelezi.

Those of us who are actively involved in social media, may have seen the recent sad pictures of unemployed, qualified engineering students, opting to carry placards in street corners to indicate their plight. As much as we are fully aware of economic challenges, I plead with our industry stakeholders, to assist by employing our future Engineers, Technologists and Technicians. Let us plough back, and invest in our children's future.

TC Madikane
Pr. (Tech.) Eng | FSAIEE



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2016 Young Professionals Essay Competition winners announced

The winners of the 2016 IEC YP essay competition is from left Mulalo Mercy Tshivhilinge and Nevin George.

The International Electrotechnical Commission (IEC) Young Professionals' Programme was launched in 2010; ensuring that technical aspects of the IEC will be maintained for the future.

Every year, we experience a growing number of technical experts, who specialize in standardization and familiarize themselves with the role of the IEC.

The South African National Committee of the IEC, has been organizing an annual competition to select two candidates to attend the International IEC Young Professional Programme.

This competition coincides with the IEC Annual General Meeting. The German National Committee (DKE) in Frankfurt is playing host to the 2016 event.

The SAIEE has been actively supporting this initiative by sponsoring the travel for SAIEE-member candidates. The interest in the competition, and in the local South African Chapter of IEC Young Professionals, has been growing each year.

After reviewing approximately 121 responses to an online questionnaire, 35 local YPs were invited to submit essays, selected from a list of topics related to standardization.

Twenty essays were received. After review by a selection panel (representatives of SAIEE, SANC and previous YPs) several essays were considered and of high quality. Some were chosen for publication in the wattnow magazine - the first in a series to appear in the July issue.

The two winners who will represent South Africa at the 2016 International IEC Young Professionals Programme are Nevin George and Mulalo Mercy Tshivhilinge.

To join the IEC Chapter of Young Professionals, contact the Representative of the Young Professionals on the IEC South African National committee, Craig Carlson on cscarlson.msc@gmail.com.

From left: Craig Carlson (IEC 2015 YP Leader), Vusi Phiri (Eskom), Preshaan Jagal (Eskom) and Pieter Smit (PTSI).

From left: Craig Carlson (IEC 2015 YP Leader), Nevin George, André Hoffmann (SAIEE Immediate Past President), Mulalo Mercy Tshivhilinge and Paul Johnson.

Young Professionals who attended the workshop, with SABS Staff.

Zimisele Secondary School's performing Grade 8-11 Maths and Science students with the Physical Science Head of Department.

Amelia Mtshali, Tshego Cornelius, Matankiso Mohlokoana, Kgomotso Setlhapelo, Nduduzo Khumalo joining the serenade at Beyers Naude High School.

SAIEE Central Gauteng Centre's (CGC) Corporate Social Investment (CSI) Project to #PayItForward, #MakeItHappen and #PloughBack

Subsequent to its establishment in July 2015, the interim Central Gauteng Centre (CGC) committee resolved to launch a Corporate Social Investment (CSI) initiative. One of the objectives of this initiative was to increase solar energy awareness among people in disadvantaged communities. Under the leadership of Gerhard Brown, MSAIEE, the CSI project raised funds through sponsorship and donations from SAIEE members, with the ultimate objective of purchasing solar lanterns and distributing them to disadvantaged communities over the Christmas period.

Since the funds raised were not sufficient to purchase enough solar lanterns for an entire community and with the imminent approach of the Christmas period deadline, the interim CGC committee resolved to keep with the #PayItForward theme and instead decided to use the funds to purchase solar lanterns and award them to high performing Mathematics and Physical Science students in disadvantaged communities around Gauteng. Furthermore, during this period, Gerhard Brown relocated to the Western Cape and Kgomotso Setlhapelo, MSAIEE, volunteered to take over the CSI initiative.

Following its election in April 2016, the new Central Gauteng Centre committee agreed to support this CSI initiative, as it exemplified the call to #PloughBack.

In collaboration with Pfuxani STEM (Science, Technology, Engineering and Mathematics) Foundation, a non-profit organisation which facilitates Mathematics and Physical Science tutoring in disadvantaged schools and the Eskom Young Professionals' Maths and Science volunteer tutors, the best performing pupils from Grade 8 to Grade 11 at five (5) schools were identified. The schools identified were: Fumana Secondary School (Katlehong); Dr Beyers Naude Secondary School (Dube,Soweto); Kenneth Masekela Secondary School (Kwa Thema, Springs); Zimisele Secondary School (Kwa Thema, Springs) and Asser Maloka Secondary School (Duduza, Nigel).

The CSI drive began, in earnest, on May 5th 2016, to coincide with Pfuxani STEM Foundation's commencement of tutoring and career guidance sessions on STEM subjects. As part of the career guidance sessions, learners were introduced to the SAIEE and its objectives and were encouraged to consider careers in Electrical Engineering.

Asser Maloka High School pupils.

Beyers Naude learners Lesego Moshe and Andre Simango being congratulated by fellow pupils.

Fumana High School Best Grade 11 Maths pupil Siphosethu Mkhatshane and Best Grade 11 Physical Science student Mpho Dlamini with Prudence Madiba, Tshego Cornelius and Kgomotso Setlhapelo.

WATTSUP

Research and Innovation Chair: Green Economy

Prof Pat Naidoo

Prof Pat Naidoo, a professional engineer and specialist consultant, currently serves the Durban University of Technology (DUT). In May 2016, he was appointed as a Professor of Practice: Electrical Engineering, University of Johannesburg (UJ) and immediately thereafter as a Research and Innovation Chair – Green Economy, Faculty of Engineering and the Built Environment (FEBE), UJ. This is an endowed chair – jointly established with Economic Development, City of Johannesburg (CoJ).

He is a Fellow of the South African Institute of Electrical Engineers, a Senior Member of IEEE (headquartered in the USA), and a member of IET (headquartered in the UK), CIGRÉ (headquartered in France) and the Institute of Directors, Southern Africa.

For the period 2014/2015, Prof Naidoo was the 105th President of the South African Institute of Electrical Engineers. In 2010, he completed his 27 years of industrial employment at Eskom South Africa; from engineer in training to post of Senior General Manager of the Transmission Group. His accountabilities included Eskom National Control, Eskom Power Pool and System Operations, Eskom leadership at the Southern African Power Pool and Eskom Joint Venture appointments as Technical Director of the Mozambique Transmission Company and as Chief Executive of the Western Power Corridor Company of SADC.

In 2014, he was appointed to the Board of Eskom Holdings SOC Limited; as Independent, Non-Executive Director. He serves on the Board Committees of Recovery and Build, Investment and Finance, Social, Ethics and Sustainability, Audit and Risk.

- Prof Pat Naidoo joins UJ, in a full-time capacity, as of 01 July 2016.
- With the faculty's quest for sustainable development, the aspect of sustainable energy will receive the direction of Prof Pat Naidoo.
- The chair is hosted through the Department: Mechanical Engineering Science (DMES), School of Mechanical and Industrial Engineering (SOMIE) but will function across various academic departments within FEBE; the function will also seek collaboration with other disciplines associated to sustainable energy, incl. economics, law, etc.

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Airports Company South Africa launches its second solar power plant in Kimberley, Northern Cape

Airports Company South Africa (ACSA) launched its second solar power plant at Kimberley Airport in the Northern Cape, further demonstrating its commitment to sustainable development. Kimberley Airport is the second regional airport in South Africa to be powered through solar energy. The opening ceremony was attended and officiated by the Minister of Transport, Dipuo Peters.

In line with the South African government's developmental imperatives, energy security and diversification of the energy matrix remains a key priority to ensure sustainability of economic activity and demonstrate consideration for the environment

The solar farm is located on 0.7 hectares of land within the airport precinct and uses an 11kV substation as it its main source of supply, which is also located on the airport's land. The construction of the plant at Kimberley Airport started in September 2015 and was completed within 24 weeks on 18 April 2016 at a cost of R13.5 million. Using photovoltaic 1620 PV panels and 18 inverters, solar radiation energy is converted into electricity. The plant is designed to deliver 500 KWp of peak production per year.

The plant uses an 11kV substation as it its main source of supply, which is also located on the airport's land. To date the plant has generated 141 870 kWh and is forecasted to produced approximately 927 000 kilowatt hours per year. During the 24-week construction period five permanent and 26 temporary employment opportunities were created. In addition, rigorous practical training and skills transfer to operate and maintain the PV plant was conducted, which included cleaning modules, replacing malfunctioning electrical components and monitoring performance of PV plant, amongst other technical skills.

The completion of the solar power plant at Kimberley Airport forms part of ACSA's broader plan to install solar farms at all its six regional. George, Kimberley and Upington Airport's plants have already been completed and commissioned. The other three remaining regional airports are: Port Elizabeth International Airport, East London Airport and Bram Fischer International Airport in Bloemfontein.

Mario López
Senior Territory Manager | RNRG

RNRG hires Mario López

Renewable NRG Systems (RNRG), a designer and manufacturer of decision support tools for the global renewable energy industry, has announced the hire of Mario López as Senior Territory Manager for the European, Middle Eastern and African (EMEA) regions to increase the company's presence in key overseas markets. Based in Seville, Spain, Mr. López will be responsible for all sales and account management for RNRG's products and services in this region.

Mr. López has considerable wind energy industry experience and was formally Senior Sales Manager at Suzlon Group responsible for wind turbine sales in Spain and Latin America.

"I am very excited to add Mario to our team. With his excellent technical background, industry experience and personality, I am sure that our customers will enjoy working with him" said Gregory Erdmann, VP, Global Sales.

"Additionally, having Mario's office in Spain and immersed in his territory, this should be a great benefit to our customers in having a close contact in the same time zone".

2016 SAIEE President, TC Madikane (middle) with some of the members of the Western Cape Centre (WCC).

Western Cape Centre Presidential Address

The SAIEE has eight Centres, which service engineers nationwide. After the SAIEE Annual General Meeting, the newly elected President visits all these Centres.

One of his many visits was to the Western Cape Centre, where 2016 SAIEE President, TC Madikane also participated in the monthly committee meeting. The Chairman, Bruce Thomas said: *"We thoroughly enjoyed TC's visit and we are looking forward in working together towards a common goal with his #makeithappen".*

From left: Rod Harker, TC Madikane & Samuel Mile.

From left: Rod Harker, TC Madikane & Bruce Thomas, Chairman WCC.

SAIEE welcomes new Council Members

The 2016 SAIEE President, TC Madikane and CEO Stan Bridgens are proud to welcome the following new members to the SAIEE Council. From left: Marius Mostert, Vincent Kobuwe, Stan Bridgens (CEO), Thandiwe Nkombule, TC Madikane (SAIEE President), Lebo Maphumulo, Zwelandile Mbebe and Mpumelelo Khumalo.

Large Storm Tactical Telescopic Mast Deal for Webb

Webb Industries, part of the listed Jasco group, recently sold a significant number of Storm Tactical Telescopic Masts that will be used in a large military project. The Storm Tactical Telescopic Mast is the latest composite, belt-driven – rather than compressor driven - mast from SMC Hilomast and is ideal for a variety of applications.

Webb MD Paul Richards says this mast has been designed to perform without fail in the very worst weather conditions and this, combined with the fact that it is light, crank-up, resistant to dust and field conditions and extremely durable has made it a popular choice amongst those, like the military, working in more remote areas.

The Storm Tactical Telescopic Mast is designed to meet stringent MIL-810G standards and, made from a composite material (glass reinforced plastic), it is lightweight yet tough and is capable of supporting a wide range of head loads including antennas, cameras, lights, and much more. Because of its composite material construction, the Storm Mast is RF transparent.

The Storm Tactical Telescopic Mast range includes models with maximum extended heights from 6m to 18 metres, with a full range of installation accessories for complete mast system solutions.

Webb is the sole distributor in Southern Africa of South Midlands Communications (SMC), which has been successfully manufacturing masts for over 50 years and whose telescopic masts in particular are renowned worldwide for their exceptional performance in even the most hostile conditions.

For more information, please contact Webb Industries on 011 719 000.

SAIEE President visits Vaal University of Technology

The Vaal Centre Committee with Stan Bridgens (CEO) and TC Madikane (SAIEE President) in the middle.

Students of the VUT Student Chapter with Mr Ruaan Schoeman (back) who lecturers at VUT.

TC Madikane (SAIEE President) with the VUT Students who attended the evening.

TC Madikane 2016 SAIEE President recently visited The University of Technology (VUT) Campus for his inaugural address. He met with the local Vaal Centre and were introduced to the newly formed Student Chapter at VUT.

The evening was well attended and everyone is gearing up for #ploughback #makeithappen!

WATTSUP

SAIEE Presidential Invitation Lecture 2016

At the recent SAIEE Presidential Invitaton Lecture (PIL), hosted by University of Johannesburg (UJ), members came from afar to attend this annual lecture.

Professor Thokozani Majoli, who hails from the University of Witwatersrand (WITS), presented a paper on "A Process Systems Engineering Approach to Synthesis and Design of Sustainable Processes".

Thokozani Majozi is a full professor in the School of Chemical and Metallurgical Engineering at Wits University where he also holds the NRF/DST Chair in Sustainable Process Engineering. His main research interest is batch chemical process integration, where he has made significant scientific contributions that have earned him international recognition.

Some of these contributions have been adopted by industry. Prior to joining Wits, he spent almost 10 years at the University of Pretoria, initially as an associate professor and later as a full professor of chemical engineering.

He was also an Associate Professor in Computer Science at the University of Pannonia in Hungary from 2005 to 2009. Majozi completed his PhD in Process Integration at the University of Manchester Institute of Science and Technology in the United Kingdom.

He is a member of the Academy of Sciences of South Africa and a Fellow for the Academy of Engineering of SA. He has received numerous awards for his research including the Burianec Memorial Award (Italy), S2A3 British Association Medal (Silver) and the South African Institution of Chemical Engineers Bill Neal-May Gold Medal.

He is also twice a recipient of the NSTF Award and twice the recipient of the NRF President's Award. Majozi is author and co-author of more than 150 scientific publications, including a book in Batch Chemical Process Integration published by Springer in January 2010.

Majozi is a B1 NRF rated researcher.

TC Madikane (SAIEE President) with Prof Thokozani Majola, PIL Lecturer.

From left: Prince Moyo, Vincent Kobuwe, TC Madikane, André Hoffmann & Jacob Machinjike.

From left: Ashley Mulholland and Zarheer Jooma.

From left: Ele Ndlovu, Prudence Madiba & Refilwe Buthelezi.

Prof Majozi's students attended the event.

SAIEE Charity Golf Day

Sixteen four-balls played in the inaugural SAIEE CGC Golf Day 2016. The weather could not have been more perfect and according to the golfers the greens were in fantastic shape.

The winners are: Nearest to the Pin on the 3rd – Rhett Kelly, Longest Drive on the 10th – Pieter Theron and the City Power Team, consisting of Jason Daniels, Amit Ramkissoon and Eddie Phillips were the winners of the day.

The day would not have been a success, were it not for our sponsors. A big thank you goes out to the following companies: Actom, Allbro, ARB Electrical, CBI, City Power, Conco, Diesel Electric, GE, Kobus Kleyn Consulting, Lapp Africa, LHM, MVEE, Schneider Electric, TE, Wegezi and Zest WEG.

2016 SAIEE Charity Golf Day winners: City Power

Team City Power.

Rhett Kelly (R),
Winner of the Nearest to the Pin on the 3rd with Patrick O'Halloran.

Pieter Theron (R),
Winner of the Longest Drive on the 10th with Patrick O'Halloran.

Team Diesel Electric.

Team City Power.

Team Zest WEG.

From left: JP Crawford, Maanda Ramutumba, Henk Klopper.

Team Kobus Kleyn Consulting.

Team Actom.

Team wattnow.

Team ARB Electrical.

Team Schneider Electric.

IN MEMORIAM

Ken Robson

On 1st May 2016 Kenneth George Robson, a Fellow of the SAIEE, passed to higher service from his home in East London.

BY | MAX CLARKE | FSAIEE

1922 - 2016

He died a few months short of his 94th birthday and 65 years of membership of the SAIEE.

Ken was born in Kimberley on 5th October 1922 and grew up in the "diamond city". After finishing school in 1938 he started work as an apprentice at De Beers Consolidated Mines. He rose through the ranks on the mine – and was also a part-time lecturer at the local Northern Cape Technical College - until he moved to a private company, Board Products, in 1947. He headed up their Experimental Department for 3 years.

In 1950 Ken moved into municipal service in Aliwal North, a career path in which he remained until his retirement. He moved to Queenstown in 1952 and then to East London Electricity Department in 1966 as Deputy City Electrical Engineer. This was followed shortly by his appointment to the CEE position which he retained until his retirement in October 1987. He held the Government Certificate of Competency and was a Fellow of the SAIEE having joined as a Graduate member in 1951.

Throughout his career his calm and wise leadership was respected by everyone with whom he had contact. He was loyal to his staff and created opportunities for advancement to all who worked in his Department. In turn, he was greatly respected by them. Ken was a staunch supporter of the SAIEE and was active in the affairs of the Association of Municipal Undertakings (AMEU). He served on the Executive Council of the Association for many years and held the Presidency for the 1977/79 term.

Amongst other things, he was a capable calligrapher. Many can testify to the pleasure they obtained from receiving a beautiful hand-written letter of thanks from Ken, in response to some or other communication, and he was extremely well read. One of his passions was biographies of famous people. He often included appropriate quotes from some eminent person in his interaction with friends and colleagues.

Ken's contribution to community life outside of work-related activities, was extensive. He served as President of the National Occupational Safety Association (NOSA) and was a Board member of the Victoria Homes Trust, a Director of Kennersley Park and Langham House. He served as National President of the Toc H, an International charity organisation that seeks to ease the burdens of others, and was a Circuit Steward of the East London Methodist Church.

He is survived by his wife Maureen and their daughter Glendyr, son-in-law Michael and their two sons, to all of whom we extend sincere condolences, on behalf of the many readers of **watt**now, who counted him as a friend.

Rest in peace, Ken. wn

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Brighter future for African power

The expansion of generation and transmission capacity, and the rapid adoption of renewables such as solar, promise economic benefits and improved quality of life across Africa, power sector stakeholders have heard.

At a stakeholders' briefing, held in Sandton ahead of the annual POWER-GEN & DistribuTECH Africa conference and business expo in July, Eskom said that great strides have been made in reducing load shedding, and stepping up power infrastructure maintenance in South Africa. Industry experts also noted that renewable energy is going mainstream, offering significant potential to provide affordable power to under-served rural areas across the continent. In addition, high-level conferences such as POWER-GEN & DistribuTECH Africa were increasingly giving African power sector players an opportunity to learn from international mistakes, and leapfrog into next generation power generation and distribution, they said.

Willy Majola, Senior General Manager: Generation Sustainability at Eskom, speaking on behalf of Matshela Koko, Group Executive Generation at Eskom, said: *"Since August last year, we have not done any load shedding. To achieve this remarkable performance, we have stepped up maintenance, and we are bringing more generation capacity online. On the transmission side, Eskom is rolling out 765kV lines for more efficient bulk distribution, and has installed over 6,000km of transmission lines in the past seven years. On the distribution side, we have electrified over 4.6 million households since 1991."*

Majola said a key factor in improving power generation and distribution was collaboration: *"We are well aware of the big responsibility on our shoulders, and the impact electricity has on our economy.*
Somebody once said 'electricity is the oxygen of our country'. It supports more than economic development as well as quality of life. Power and other infrastructure bring clean water, clean air and a better standard of living for all. We realise we cannot do it on our own. Therefore, we work with many international organisations and local universities, to increase our knowledge and overcome challenges. In line with this, our partnership with POWER-GEN & DistribuTECH Africa, which has been in place since 2012, is a beneficial one. Through this association, we meet many industry players, which enriches us."

Noting that other African countries learn from South Africa's example, POWER-GEN & DistribuTECH Africa conference chair Dr Willie de Beer said: *"South Africa is reforming the industry by default. By introducing IPPs, enabling self-built transmission grids and supporting the*

Willy Majola
Senior General Manager: Generation Sustainability | Eskom,

solar revolution, our industry is adapting to change and moving away from the hW/H utility model." Renewables, solarin particular, present significant hope for affordable power, that can be rolled out quickly in under-served areas, stakeholders said. *"Solar is reforming the industry, so utilities have to adapt to accommodate this,*" de Beer noted.

Earlier, Sindiswa Mzamo, Chief Operating Officer of the Edison Power Group and POWER-GEN & DistribuTECH Africa participant noted that Africa had reached a tipping point for the adoption of solar power. *"Across Africa, solar is the solution for powering rural communities, because it is cost effective and does not need to be connected to a grid to power an isolated geographic area. The wave of solar adoptions might be one of the most important initiatives in African power right now,*" she said.

Glenn Ensor, Managing Director of conference organisers PennWell, told stakeholders that due to the growing importance of solar power in Africa, POWER-GEN & DistribuTECH Africa would focus strongly on solar technologies and strategies this year. He also announced that a delegation of Turkish solar product manufacturers will travel to South Africa to participate in the expo, showcasing advanced solar technologies suited to African markets. *"PennWell has 106 years of experience in putting information and conferences together around the world. Although we know the power industry drivers differ by region, there are similar issues being wrestled with around the world. Through POWER-GEN, we bring international expertise here, so that Africa can learn from other regions, and move forward in the most efficient way,*" Ensor said.

The 2016 edition of POWER-GEN & DistribuTECH Africa will highlight a number of other key themes, including the maintenance and management of ageing assets, the nuclear power question, the gamut of renewable energies, and advanced technologies and smart grids.

Under the theme 'Creating power for sustainable growth' POWER-GEN & DistribuTECH Africa 2016 will be staged from 19 – 21 July at the Sandton Convention Centre, with a strong focus on renewable energy, sustainable power generation and distribution, pan-African power provision and smarter management and grids.

Because power challenges cannot be seen in regional isolation, PennWell says, greater pan-African participation has been encouraged by engaging more pan-African power stakeholders in the event advisory boards by inviting a delegation party of over 50 sub-Saharan African VIPs from Botswana, Ethiopia, Ghana, Lesotho, Namibia, Nigeria, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe, among others to attend as guests and participate in scheduled B2B matchmaking sessions with potential business partners and suppliers.

For more information, and to view the agenda, go to www.powergenafrica.com. wn

UFS Researcher part of project producing third-generation biofuels

BLOEMFONTEIN: A researcher from the University of the Free State (UFS), Prof Johan Grobbelaar, was invited to join a group of scientists recently at the Institute for Bio- and Geo-Sciences of the Research Centre Jülich, in Germany, where microalgae are used for lipid (oil) production, and then converted to kerosene for the aviation industry.

The project is probably the first of its kind to address bio-fuel production from microalgae on such a large scale. "*The potential of algae as a fuel source is undisputed, because it was these photoautotrophic micro-organisms that were fixing sunlight energy into lipids for millions of years, generating the petroleum reserves that modern human civilisation uses today. However, these reserves are finite, so the challenge is marrying biology with technology, to produce economically-competitive fuels without harming the environment, and compromising our food security. The fundamental ability that microalgae have to produce energy-rich biomass from CO_2 nutrients, and sunlight, through photosynthesis for biofuels, is commonly referred to as the Third-Generation Biofuels (3G),*" said Prof Grobbelaar.

The key compounds used for bio-diesel and kerosene production are the lipids, and more particularly, the triacylglyserols commonly referred to as TAGs. These lipids, once extracted, need to be trans-esterified for biodiesel, while a further "cracking" step is required to produce kerosene. Microalgae can store energy as lipids and/or carbohydrates. However, for biofuels, microalgae with high TAG contents are required. A number of such algae have been isolated, and lipid contents of up to 60% have been achieved.

According to Prof Grobbelaar, the challenge is large-scale, high-volume production, since it is easy to manipulate growth conditions in the laboratory for experimental purposes.

The AUFWIND project (AUFWIND, a German term for up-current, or new impetus) in Germany consists of three different commercially-available photobioreactor types, which are being compared for lipid production.

The photobioreactors each occupies 500 m^2 of land surface area, are situated next to one another, and can be monitored continuously. The three systems

Some of the researchers and technicians among the tubes of the Novagreen bioreactor (Prof. Grobbelaar on left).

are from Novagreen, IGV, and Phytolutions. The Novagreen photobioreactor is housed in a glass house, and consist of interconnected vertical plastic tubes roughly 150 mm in diameter. The Phytolutions system is outdoors, and consists of curtains of vertical plastic tubes with a diameter of about 90 mm. The most ambitious photobioreactor is from IGV, and consists of horizontally-layered nets housed in a plastic growth hall, where the algae are sprayed over the nets, and allowed to grow while dripping from one net to the next.

Prof Grobbelaar's main task was to manipulate growth conditions in such a way that the microalgae converted their stored energy into lipids, and to establish protocols to run the various photobioreactors. This was accomplished in just over two months of intensive experimentation, and included modifications to the designs of the photobioreactors, the microalgal strain selection, and the replacement of the nutrient broth with a so-called balanced one.

Prof Grobbelaar has no illusions regarding the economic feasibility of the project. However, with continued research, optimisation, and utilisation of waste resources, it is highly likely that the first long-haul flights using microalgal-derived kerosene will be possible in the not-too-distant future.

Prof Grobbelaar, although partly retired, still serves on the editorial boards of several journals. He is also involved with the examining of PhDs, many of them from abroad. In addition, he assisted the Technology Innovation Agency of South Africa in the formulation of an algae-biotechnology and training centre. *"The chances are good that such a centre will be established in Upington, in the Northern Cape,"* Prof Grobbelaar said. wn

South Africa to extend ICT reach

While the expansion of mobile broadband and fibre-optic networks are driving growth of ICT (Information and Communication Technologies) services in South Africa, additional infrastructure investment will be needed to keep pace with rapidly-rising market demand.

South Africa has a set of ambitious targets laid out in its national broadband policy, South Africa Connect, which includes achieving 50% internet coverage with speeds of 5 Mbps by 2016; roughly 90% coverage at the same speeds by 2020; 50% coverage with speeds of 100 Mbps by 2020; and universal 100 Mbps coverage by 2030.

As a result, the country has emphasised improvements in both last-mile and backbone infrastructure. The country's average speed was 4.1 Mbps in the fourth quarter of 2015, according to the *"Q4 2015 State of the Internet"* report issued by Akamai Technologies, a US content delivery network and cloud services provider. This fell short of the global average of 5.6 Mbps.

Significantly, however, the report noted that South Africa's average broadband speed increased by 26% year-on-year in 2015 and was up 11% during the fourth quarter, surpassing the 4-Mbps mark for the first time.

The South Africa Connect policy also targets enhanced connectivity at schools, medical facilities and public institutions, emphasising public-private partnerships such as the Broadband for All initiative to achieve these targets.

SPECTRUM ALLOCATION

Central to achieving the South Africa Connect goals is the opening up of a wider swathe of frequencies for wireless broadband, according to Jannie van Zyl, executive head of innovation at Vodacom, a South African mobile communications company.

"If we are able to access more spectrum for mobile broadband services, this will have an extremely important benefit for all South Africans, as recent studies by the World Bank have shown that a 10% increase in a country's broadband penetration results in a 0.6% increase in GDP," he told industry media in March.

Currently, delays in spectrum allocation have hampered ICT development. Digital migration – which entails a shift from analogue to digital TV broadcasting in order to free up spectrum for increased telecoms usage – was originally scheduled in 2011, but has been delayed several times.

Telecoms operators are keen to gain access to these bands – particularly the 700-MHz spectrum that has been deemed suitable for 4G LTE services – which should become available once South Africa completes the long-awaited transition.

Licensing of other high-demand spectrum, such as the 1.9-GHz, 2.3-GHZ and 2.6-GHz bands, which are well suited for deploying next-generation mobile broadband in urban areas, is pending publication of the integrated national ICT policy white paper. As of March, the policy was still under discussion at the cabinet committee level, according to the Ministry of Telecommunications and Postal Services.

In the interim, some operators are re-purposing previous spectrum allocations to accommodate newer mobile technologies.

In doing so, however, operators will need to be careful to avoid compromising services for existing users, Mteto Nyati, CEO of MTN South Africa, told industry media in March.

EXPANDING FIBRE NETWORKS

A rise in local demand – in particular for cloud and bandwidth-intensive services – has increased the urgency of expanding fibre-optic networks.

With household consumers keen to access services like video streaming, the development of fibre infrastructure will likely gain pace in the coming years. This is according to Suveer Ramdhani, Chief Development Officer at SEACOM, a high-speed, fibre-optic cable firm. Greater scale should help to further bring down investment costs and reduce perceived risk for operators, he added.

Currently, South Africa has an estimated 180,000 km of fibre cable, the bulk of which is owned by majority-state-owned incumbent operator, Telkom.

However, private operators have increasingly moved to invest in new backbone infrastructure, which is helping to expand fibre beyond its traditional centres, in wealthier suburbs and high-density commercial areas.

"Roughly 5% of businesses are connected by fibre networks. There is massive opportunity here; however, it is capital intensive," Willem Marais, the CEO of Liquid Telecom South Africa, a data, voice and IP provider, told the Oxford Business Group late last year.

For example, in 2015 South Africa's Vox Telecom announced plans to build its own national fibre-optic network, which will connect business subscribers to its core infrastructure. The plans are part of a 5-year strategy that will also see fibre circuits deployed to secondary cities after connecting Johannesburg, Durban and Cape Town.

Additionally, in April local fibre-optic and broadband provider Metrofibre Networx announced it would replace all the leased fibre links in its 250-km core network in Gauteng over the next two years with its own fibre infrastructure. wn

UJ's FEBE rolls out new BEngTech programme

In 2017, in line with the Department of Higher Education and Training (DHET), Council of Higher Education's (CHE) new Higher Education Quality Sub-Framework (HEQSF), and Engineering Council of South Africa (ECSA) guidance, the Faculty of Engineering and the Built Environment (FEBE) at University of Johannesburg will roll out its approved three year BEngTech and Built Environment Bachelors qualifications. These new programmes are developed furthering our approach to Conceive- Design-Implement-Operate (CDIO) – the University of Johannesburg is a member of the CDIO consortia.

Consequently, most of FEBE's National Diploma and BTech programmes will be gradually phased out. The last intake of the three year National Diploma occurred in January 2016. We urge National Diploma graduates / alumnus who have not registered or completed their BTech, to register and complete their degrees as soon as possible.

BENGTECH PROGRAMMES

The programmes supports expanded access, improved quality and increased diversity of provisions, and reinforces a stronger and more co-operative relationship between Higher Education and training institutions and the workplace.

In addition, the programmes are responsive to the needs of individual citizens, employers in both public and private sectors, as well as the broader societal and developmental objectives. The programmes provide for improved articulation towards postgraduate qualifications, and exit-level outcomes are aligned with those of the Engineering Council of South Africa (ECSA), a signatory of accords associated to the International Engineering Alliance (IEA).

NEW FEBE QUALIFICATIONS

This qualification is primarily industry oriented, as the knowledge taught emphasises on general engineering principles and application.

The qualification provides students with a sound knowledge base in a particular field or discipline, and the ability to apply their knowledge and skills to particular career or professional contexts, while equipping them to undertake more specialised and intensive learning. Programmes leading to this qualification tend to have a strong professional or career focus, and holders of this qualification are normally prepared to enter a specific niche in the labour market.

TAILORED FOR RELEVANCE

Specifically, these programmes are designed to build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practicing engineering technologist. This qualification completed provides:

1. Adequate preparation for careers in the engineering profession

2. An educational base required for registration as a Professional Engineering Technologist with ECSA.
3. Entry to NQF level 8 programmes e.g. BEngTech (Honours) and Postgraduate Diplomas. Subsequently, this will pave the way for the graduate to enrol for Masters Programmes.
4. The BEngTech is the entry-level qualification for candidacy, i.e. Engineering Technologist (in this regard, the BEngTech replaces the BTech).

EXIT-LEVEL OUTCOMES / GRADUATE ATTRIBUTES OF THE NEW BENG-TECH:

As required by the Engineering Council of South Africa (ECSA), the BEng Tech Programmes will be assessed against eleven exit level outcomes (ELO). These are listed below as follows:

1. Problem Solving
2. Application of scientific and engineering knowledge
3. Engineering Design
4. Investigation
5. Engineering methods, skills, tools, including Information technology
6 Professional and Technical Communication
7 Impact of Engineering Activity
8 Individual and Teamwork
9 Independent Learning
10 Engineering Professionalism
11 Engineering Management

FEBE UJ ENGINEERING ACADEMIC PATHWAYS

The Faculty of Engineering and the Built Environment offers essentially three Bachelors Programmes.

- Three (3) year BEngTech (Engineering Technology Qualification);
- Three (3) year Built Environment Bachelor's Degree (Bachelor of Construction; Bachelor Urban and Regional Planning); and
- Four (4) year BEng Degree (Engineering Science Qualification). wn

Transnet Port Terminals provides stakeholders with latest SOLAS insights

Stakeholders participated in two Transnet Port Terminals (TPT) coordinated events in East London and Port Elizabeth in May 2016 respectively.

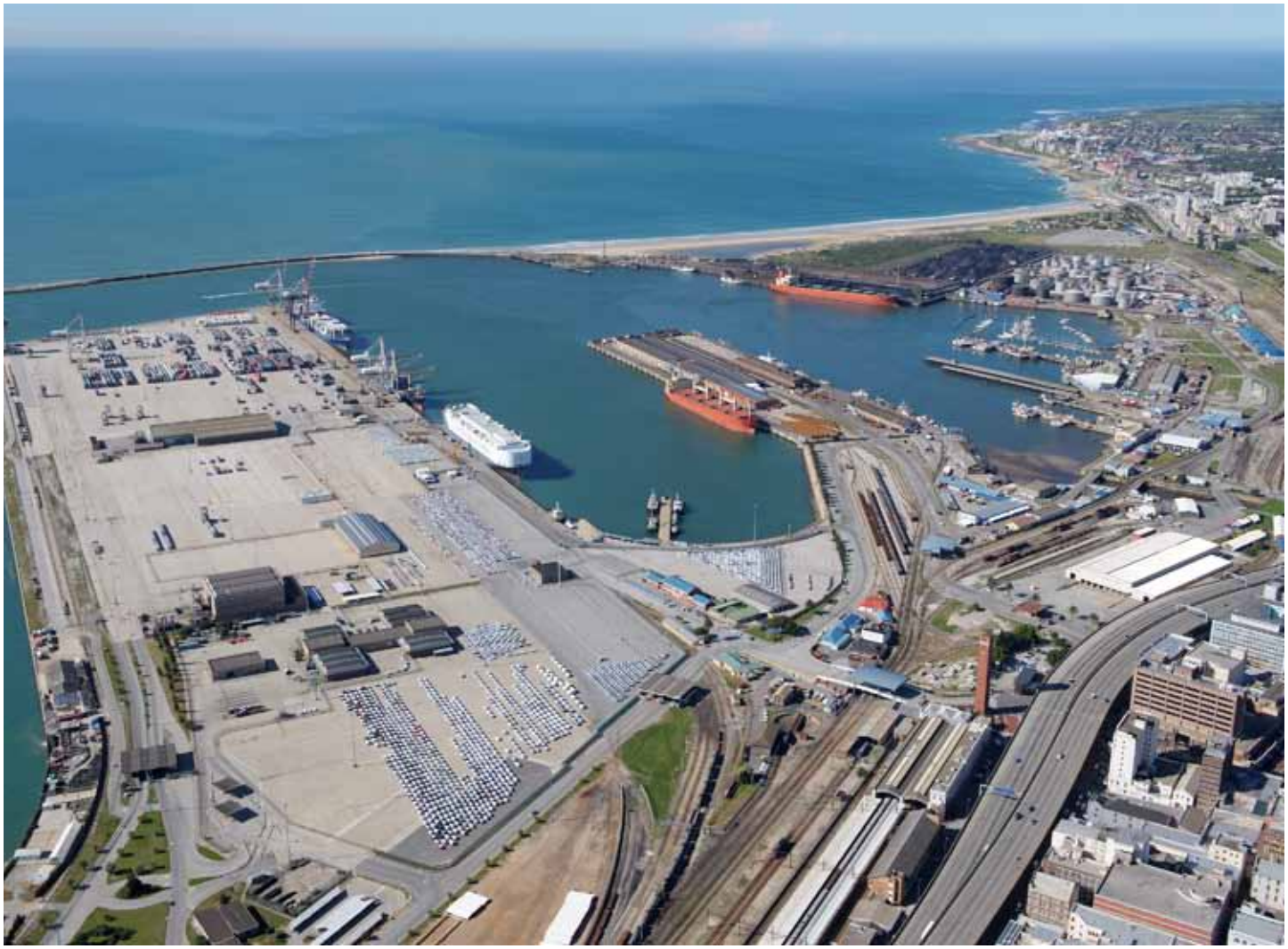
The purpose of these events was to provide an overview of the International Convention for the Safety of Life At Sea (SOLAS) requirements in terms of International Maritime Organisation (IMO) guidelines and communicate Transnet's approach to SOLAS with system implications. *"We are conducting stakeholder engagement sessions across the country in the next two weeks with the objective of outlining Transnet's position with a particular focus on TPT, TNPA and TFR. The presentations to attending stakeholders includes an overview of obligations, measures to support compliance and to clarify practical implications with respect to the enforcement date and cut over period,"* stated Darren Fraser, a lead project member of the SOLAS project at Transnet Port Terminals' Strategy division.

For its part, TPT has upgraded the existing Electronic Data Interchange (EDI) solution to Navis 2.6 which went live on 1 May at all TPT container terminals. Transnet Freight Rail site currently using SPARCS Navis 4 also moved to the new system.

The Navis version 2.3 had reached the end of product support and version 2.6 is based on an improved technology platform that assists in improving system availability. Changes are being made to the 2.6 version to accommodate the SOLAS requirements prior to the implementation date, however, there are minimal changes to what users see and work on. It is through improvements to the system architecture and the communication protocols that users will experience an improvement in response to queries performed within Navis.

The system will require that the verified gross mass and supporting information will be provided before a truck will be allowed to enter the terminal gate – a process consistent with the current pre-advice requirement for exports. The regulation will also apply to transshipments, requiring a significant amount of development and testing of EDI messages between carriers and TPT. According to Fraser, testing of the EDI messages with individual shipping lines began in April and will continue until full compliance is achieved prior to 1 July 2016.

TPT has begun inclusive EDI forums with customers to consult, and review challenges arising from the implementation of new EDI standards derived from



the SOLAS implementation globally. This inclusive approach adopted by TPT has in the past also included engagement sessions with various stakeholders' bodies since October 2015. In addition to this the TPT position was posted on TPT's website and via their social media accounts.

Transnet supports the spirit and intention of the SOLAS amendments. The IMO guidelines are clear that the shipper is responsible for providing the Verified Gross Mass (VGM) sufficiently in advance of loading the container aboard a vessel. *"Through our constant communication and interaction with the industry we are confident we will have provided sufficient support and information to all affected parties by the time the new legislation comes into affect on the 1st of July 2016, so we can achieve a smooth transition for all concerned,"* concluded Nelisiwe Mbenekazi, TPT Terminal Manager: Port Elizabeth. WN

Energy Efficiency Being Driven effectively

There is no doubt that South Africa needs to address its energy efficiency both in terms of production and consumption. The country remains one of the most energy-intensive economies in the world.

There is an urgent requirement to implement effective policy measures, coupled with financial incentives to drive the much needed move toward reduced energy consumption, and greater energy efficiency. This drive should be aimed at both industrial and commercial businesses, as well as the consumer, and should incorporate the increased drive towards the use of energy efficient electrical systems.

"Becoming more energy efficient will decrease energy intensity, bring much needed savings to the bottom line of businesses, and into the pockets of consumers. It will also facilitate greater competitiveness in the nation's economy," Louis Meiring, Chief Executive Officer of Zest WEG Group, says.

Meiring says that even though some incentives have been put in place, by the South African government to encourage the uptake of energy efficient measures, there has been reluctance on the part of majority of the industrial and commercial sector to do so. *"While a handful of large mining, petrochemical and industrial operations have programmes in place aimed at bettering the use of energy, it is not enough to rely only on a small handful to make the change,"* he says.

There are many facts and figures bandied about the industry when it comes to energy consumption, energy demand and energy efficiency, but there remains a need to gather accurate information so that appropriate energy efficiency programmes can be put in place that are industry and application specific.

The findings of the Energy Efficiency Outlook for South Africa, produced in 2015 by the International Energy Agency (IEA), clearly expresses this view that there is a need for improved data collection and analysis as the foundation for the development and implementation of an energy policy. While this related to the country as a whole, it should be extrapolated out to individual operations.

Meiring explains that it is no good simply purchasing a couple of pieces of electrical equipment, and hoping that this will have the desired impact on energy consumption, and produce savings. Many mining, petrochemical, manufacturing and industrial operations have an aging infrastructure, and it would be far more beneficial to look at the electrical distribution and usage as a whole, and then provide a holistic recommendation.

"Now, more than ever, there is a need to deploy sustainable and economically viable energy efficient technology. There does, however, require an investment by business, and the perceived long payback period has, in some cases, become a stumbling block," Meiring says.

Louis Meiring,
Chief Executive Officer
Zest WEG Group

The Energy Efficiency Savings Tax Incentive, introduced in 2013, allows businesses a tax deduction for savings achieved on a kilowatt-hour equivalent basis. The introduction of this incentive was aimed at mitigating the initial capital cost of procuring energy efficient technologies.

"What this incentive did not take into account was that, in many instances, capital expenditure programmes have been curtailed, or even put on hold, due to the current economic conditions. This has meant that many businesses simply do not have the available funds to replace large electrical equipment. In many sectors it has become a case of only replacing equipment when it is close to failure," Meiring continues.

It is significant to note that the industrial sector accounts for a third of South Africa's total energy consumption, and there is definitely opportunity to assist this sector to improve the efficiency of its production processes. In doing so, it will be possible to realise significant savings in energy consumption in the short term. However, Meiring says that it must also be understood, that the slow move by the industrial sector to embrace energy efficient technology, is not a stance of not wanting to move towards greater energy efficiency, it is simply a case of economics. It is therefore critical that further policy measures, coupled with financial incentives, are put in place to encourage industry to move towards the use of energy efficient electrical products and systems.

The move towards greater use of energy efficient technology is not new and a number of blue chip mining, petrochemical and industrial concerns began exploring these options as far back as 2006 when South Africa experienced its first episode of rolling blackouts.

Zest WEG Group has long been associated with majority of these operations, and as far back as the mid-1990s was involved in close collaboration with petrochemical and other companies. These associations gave the Group critical insights into operational criteria and this information was used in on-going product development by its principal, Brazilian multi-national WEG.

WEG, as the third largest manufacturers of electrical rotating machinery in the world, has always geared its research and development (R&D) investment towards producing energy efficient technology. Access to this R&D and a product line-up engineered specifically for reduced energy consumption, has allowed Zest WEG Group to provide complete energy efficiency packages, and not just single products.

Ever aware of the cost sensitivities within the market, Zest WEG Group made its WEG IE3 energy efficiency motor available at the same price the previous generation IE2 motor. This move was aimed at encouraging end users to move towards energy efficient products. This was done in 2014 and the Group reports a slow, but steady move towards these enhanced efficiency motors across a broad range of industries.

"This systematic replacement of old generation motors is just one example," Meiring says. *"It is also the application of appropriate technology in individual situations that will also enable operations to save money through enhanced energy efficiency. This, however, requires the intervention of skilled competent technical personnel who have a solid understanding of the industry sector in which the customer operates as well as the available technology."*

Solutions deployed can be as simple as applying an electric motor variable speed drive combination to an installation to optimise performance.

Fuel stacking, or the use of multiple types of energy has long been a common practice in rural areas in South Africa, and this is because these areas only have partial or limited access to electricity. In these instances, basic biofuel usage is commonplace. This type of energy consumption approach is simple, yet very effective, and when extrapolated out is simply the hybrid model being used across numerous countries, where energy usage is met through coal fired power stations, oil and gas fired plants, wind farms and solar installations.

Zest WEG Group is able to offer technologies for most renewable energy installations, and has access through WEG to successful references where these have been leveraged to meet energy demand while at the same time offering an energy efficient solution.

There also remains the need to improve the transmission and distribution network, aimed predominantly at reducing transmission losses. Significant investment in its local transmission manufacturing facilities underscores the commitment that Zest WEG Group has to ensuring a sustainable energy infrastructure. wn

SA'S ENERGY SERVICES COMPANIES AND PROJECT DEVELOPERS

A long-term partnership with Eskom

With the current economic climate, Eskom are doing their bid in increasing productivity and competitiveness.

With mega shifts such as the slowdown and rebalancing of the Chinese economy, lower commodity and oil prices, and a gradual tightening of US monetary policy impacting both advanced and emerging economies, businesses – irrespective of the country in which they operate – have no option but to develop and adopt strategies aimed at keeping operating costs down, while increasing productivity, improving competitiveness and complying, as best as possible, with increasingly strict environmental standards in a global marketplace.

Energy efficiency – the optimal use of an expensive resource, or basket of resources, to drive a multitude of technologies, systems and processes – is one of the most important ways to drive down operating costs in business.

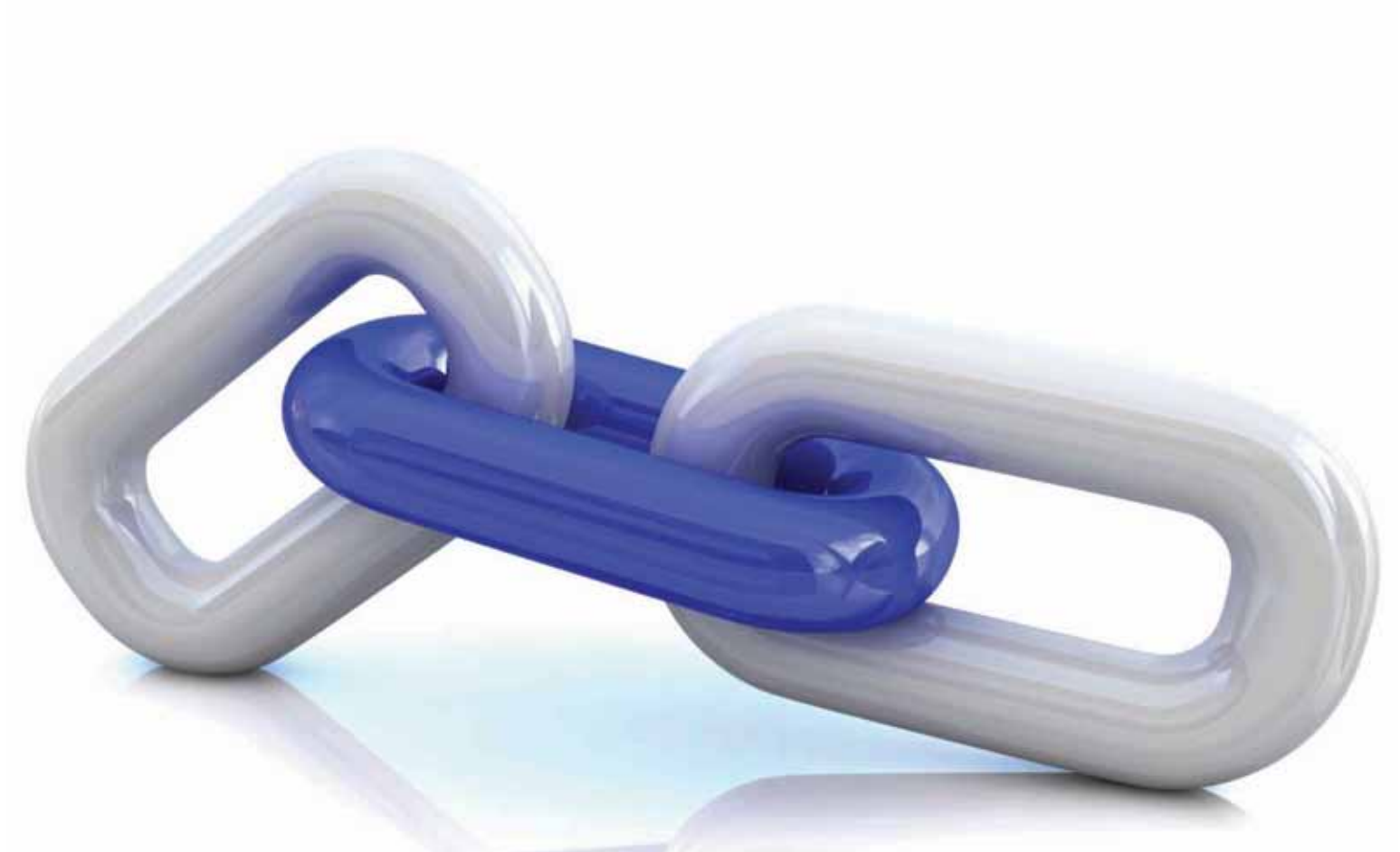
Energy Services Companies (ESCos) and Project Developers in the field of energy management, play a crucial role in this process, and are active across the globe in the service of implementing energy efficiency improvement measures, and projects for customers dedicated to streamlining their operating systems and processes.

The same is true in South Africa, where ESCos and Project Developers have been partners in initiatives and programmes rolled out by Eskom - under the auspices and guidelines of the National Energy Regulator of South Africa (NERSA) - in response to the changing energy landscape in the country the past decade. During the period 2004 to 2013, Eskom's national energy efficiency measures achieved a savings capacity equivalent to that of a six-pack power station (six units generating 650MW each) or a full year's electricity consumption by the City of Tshwane in Gauteng.

Apart from being strategically committed to keeping the power system stable, Eskom, as South Africa's foremost energy efficiency knowledge centre, is dedicated to providing advice and funding to businesses to help improve their operations through optimal energy use, and incrementally – one business at a time – improve the energy efficiency of South Africa's economy.

The ESCo Model is an example of an Eskom funding programme, rolled out in partnership with Energy Services Companies and Project Developers.

The model invites ESCos and Project Developers to identify and scope opportunities to improve energy efficiency, reduce energy usage and shift



energy load from peak to off-peak hours on behalf of customers in the commercial and industrial sectors, develop project proposals based on these opportunities, and submit proposals to Eskom for consideration.

Offering customers an opportunity to participate in stabilising the power system by reducing evening peak demand, the ESco Model considers smaller projects with a demand savings potential of between 250 kW and 1 200 kW, as well as bigger projects with a demand savings potential greater than or equal to 500 kW (kilowatt).

It is required that 500 kW projects be implemented at a single site within 6 months and achieve sustained demand savings during evening peak periods over a period of 36 months. On the other hand, it is required that 250 kW to 1 200 kW projects be implemented within 6 months at a maximum of five sites and achieve sustained demand savings during evening peak periods over a period of 36 months.

The ESCo model does not consider projects based on converting waste material into energy; renewable energy sources, such as solar and wind energy; and water heating technologies including heat pumps and solar water heaters.

Projects that can achieve demand savings of between 250 kW and 1 200 kW have been reserved for submission by Black-owned Energy Services Companies and Project Developers as part of Eskom's broader Procurement and Supply Chain Management (P&SCM) Strategy to support the sustainable development and empowerment of Black businesses, promote entrepreneurship and give Black businesses access to opportunities in the mainstream economy.

Funding for all projects is limited and Energy Services Companies and Project Developers are urged to submit proposals for consideration without delay.

"The ESCo model is one of Eskom's most important energy management tools in support of customers in the commercial and industrial sectors. It makes a significant contribution on three fronts: It helps to keep South Africa's power system stable by offering customers an opportunity to improve their energy efficiency, reduce energy use and shift energy load from peak to off-peak hours; it helps customers in their efforts to reduce operating costs and increase productivity by streamlining systems and processes; and it helps to empower and develop black businesses into sustainable suppliers of reliable, cost effective services, not only for the benefit of Eskom, but for the benefit of the economy as a whole," says Eskom spokesperson Khulu Phasiwe.

Energy Services Companies and Project Developers who are interested to submit proposals can call 08600 37566, leave their name and number, and one of Eskom's Energy Advisors will contact them.

Alternatively, they can visit www.eskom.co.za/idm or e-mail enquiries to AdvisoryService@eskom.co.za. wn

Earn CPD Credits

Global Energy Efficiency

The word 'efficiency' derived from the Latin verb *efficere* 'accomplishing', seems to enter our conversations on a daily basis in the workplace and is very often accompanied by the word energy.

BY | JASON DINI | PR.ENG | SMSAIEE

ENERGY EFFICIENCY - as understood by most of us today, is the accomplishment of achieving products or service delivery with as little energy expenditure as possible.

Generally, improvements in energy efficiency are achieved through vigorous application of commonly accepted methods on existing processes, or by adopting a complete new way of achieving our goal. Alternative technologies and innovative approaches often open doors to further avenues, and paths of increased energy efficiency.

It is no surprise that Electrical Engineers find themselves unescapably at the epicenter of energy efficiency.

DIRECTION

Various organisations seek to guide us on our never ending pursuit of this moving goal of energy efficiency. While intentions may be good and rigorous, attempts we made to carefully examine all processes and products, actual breakthroughs in energy efficiency are rare. These come from occassional accidental discovery, dreaming and the determind perseverance to follow those dreams. There are indeed exciting discoveries occurring all the time, which seem to materialize from what seems to be the imagination. The EM Drive fuel-free engine, which claims to achieve travel that we had not thought possible, is a very good example

of such a technological leap. It boasts that it will transport us from earth to mars in two to three months with super-efficient utilization of solar energy.

Amazingly, scientists still aren't sure how the engine achieves this, as it defies the present laws of physics as we understand them.

CURRENT SOLUTIONS

On occasion, pioneers of space travel also focus on earthly issues and the problems of energy management. South African-born, Canadian-American, space travel innovator, business magnate and engineer Elon Musk, recently presented his energy solutions to the world. Other companies are following suit, with similar offerings.

The products, intended initially for the domestic market, are sleek and space-age looking, and promise independence from the power grid. We are told they include the most efficient commercially available batteries for effective storage of solar energy. These rechargeable lithium-ion battery types, commonly used in aerospace applications, are not dissimilar

Global Energy Efficiency

continues from page 33

from the batteries that power most mobile telephones. In the presentations of these products, our attention is drawn to the large free energy source in the sky that we are overlooking, or at least not paying adequate attention to.

While this is not entirely accurate, since solar plants and solar geysers are indeed being rolled out at a high rate, it does spark the thought that there is still a terrible inefficiency occurring on the planet.

Energy is presently viewed as being in scare supply, and quickly depleting, but on a large scale we still continue to utilize energy, derived from fossil fuels, which gives off harmful CO_2. The sun silently beams overhead, at least in the day-time of course, offering free energy that remains largely unharnessed.

It does seem strange that the major obstacle, of effectively using solar energy extensively, is that of night and day. While we have almost abundant energy available from the sun during the daytime, at night time we are offered nothing, and therefore solar energy alone had been viewed as an incomplete solution. Throwing batteries at the problem, such as is proposed by Elon, seemed to be the only solution - an expensive one, and not a highly efficient, but ideal if you are in the business of selling batteries.

With this we do however, seem to ignore that when the sun is setting on one horizon, it is rising at another.

STATE GRID

Enter State Grid Corporation of China (SGCC), the largest electric utility company in the world. SGCC has awoken to our present energy challenges, proposing a solution of a $50 trillion global power network, that will derive energy from equatorial sunlight and arctic winds, and transmit this to all corners of the globe continuously. $50 trillion is indeed an extreme amount of capital investment; however the vision is global energy generation and transmission, mostly originating from clean energy.

On paper it is extremely attractive, and the avoidance of excessive manufacturing of batteries, through optimal spreading of solar energy, would certainly be most welcome.

SGCC is confident that this is achievable, despite some huge technological challenges. At a media briefing during an international symposium on their Global Energy Interconnection (GEI) project, their chairman Mr. Liu Zhenya, has been quoted saying *"This is the right thing to do, to benefit all the people of the world"*. The prospect of an industrial giant displaying such commitment to a cleaner energy for the future is most refreshing.

The GEI project has been described in various articles as having three general phases. Over the next few years up to 2020, clean energy development and domestic grid optimisation is proposed. SGCC expect to establish large energy bases, which they seek to interconnect among countries on all continents by 2030.

In the last phase leading up to 2050, it is expected that more strategically located energy bases, that will benefit from the most optimised clean energy generation, will be incorporated. In a nutshell, their GEI project will comprise clean energy, HV transmission and global smart grids.

LONG DISTANCE POWER TRANSMISSION

At the heart of achieving a global electricity network, lies the challenges of efficient power transmission over extremely long distances, as well as the interconnection of multiple unsynchronized national grids. Given the distances and synchronisation complexities, High Voltage DC (HV DC) transmission will certainly be utilized. This technology was first developed in the 1930's and has advanced considerably since then. HVDC transmission is much more efficient than high voltage AC transmission over long distances, due to the heavy currents required to charge and discharge long cable capacitances during AC cycles, associated with HV AC transmission.

There are indeed many long distant HVDC transmission systems already installed globally, and several ambitious installations presently in progress. The longest HVDC transmission link is said to be the 2,375 km line in Brazil, connecting Porto Velho to the São Paulo area. South Africa too, had participated in the construction of HVDC power transmission. A link called the Cahora-Bassa which connects the Cahora Bassa Hydroelectric Generation Station in Mozambique, and Johannesburg, was commissioned all the way back in 1979. The line is 1 420km, long with a maximum capacity of 1920 MW. It was also the first HVDC transmission system of its kind to operate above 500 kV.

SGCC have proposed what they refer to as Ultra-high Voltage (UHV) DC transmission to achieve the envisaged global transmission connections as indicated conceptually in Figure 1. UHVDC transmission has already been developed and successfully implemented by SGCC in China at DC

voltage levels of 800kV and 1100kV. Together with the UHVDC backbone they plan to coordinate the development of subordinate smart grids throughout various regions, in order to establish a 'Strong and Smart' universal grid. It would appear that much of the preliminary planning and designing is well underway, and SGCC have even already earmarked offices in several countries to facilitate achieving their vision, which happily includes for an office in sunny South Africa.

LOCAL ENERGY EFFICIENCY INITIATIVES

While SGCC recommend Domestic Grid optimisation, and energy efficiency, be focused on over the next couple of years, this should indeed be a priority for all irrespective. More efficient equipment does require higher initial outlay, but payback periods appear to be shrinking, especially where equipment is in operation for extended periods. There are a multitude of ways in which energy efficiency can be improved on a smaller scale.

Motors make-up roughly 30% of the world's equipment load, and more efficient motors can result in energy savings of up to 10%. Conventional transformers are some of the most efficient pieces of equipment known to us, routinely achieving efficiencies in excess of 97%, but here too more efficient options are available. Efficient transformers with amorphous cores can be utilized, which vary from being 20% to 70% more efficient, dependent on load. This may seem like a small increase in efficiency overall. However, globally an increase in a single percentage in efficiency is a substantial amount of energy saved.

The incorporation of DC grids within our power systems is an area where further energy savings can be realised. So too, is the inclusion of dynamic power factor correction systems. It does seem that energy efficient alternatives are available almost everywhere today.

CONCLUSION

SGCC is proposing a complete new way of providing energy globally, offering renewable and efficient power delivery, to answer the looming energy crisis with a clean solution. Furthermore, their planning promotes energy efficiency at all levels, and would see us all getting involved. The GEI project appears both practically achievable, with some refinement of our current technologies, as well as dreamlike in the simplistic capturing and sharing of energy globally. This may be the beginning of a major accomplishment in energy efficiency in positively interesting times. wn

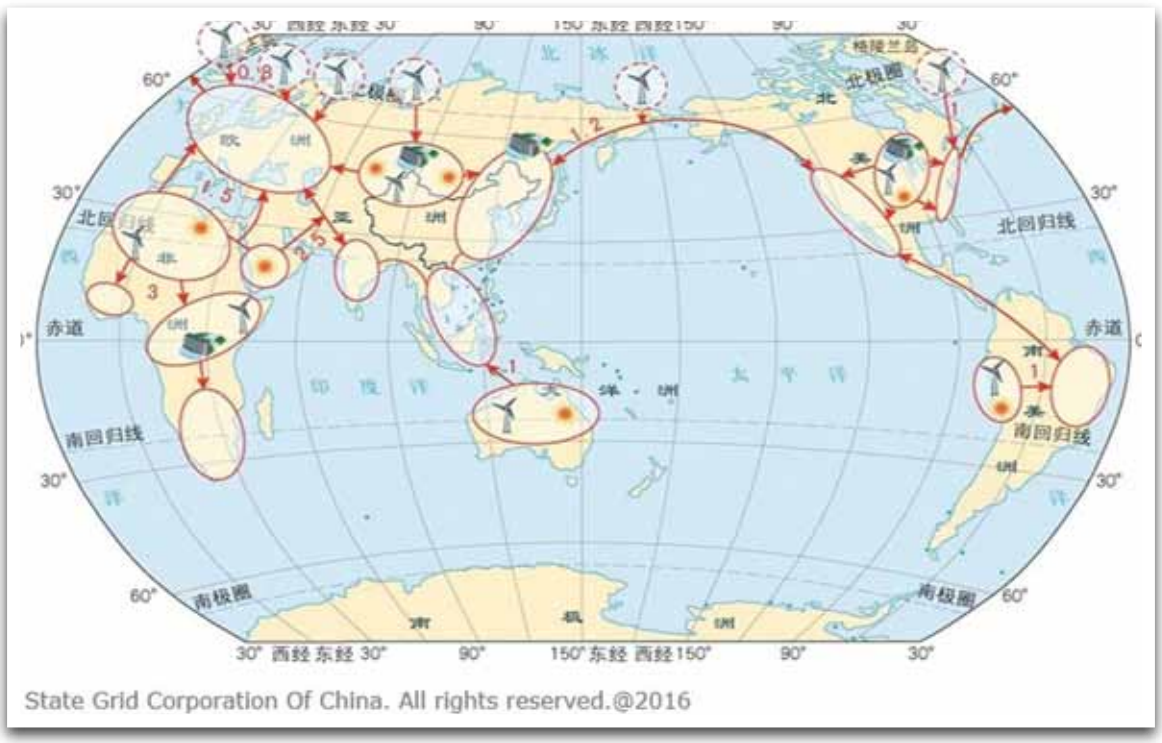
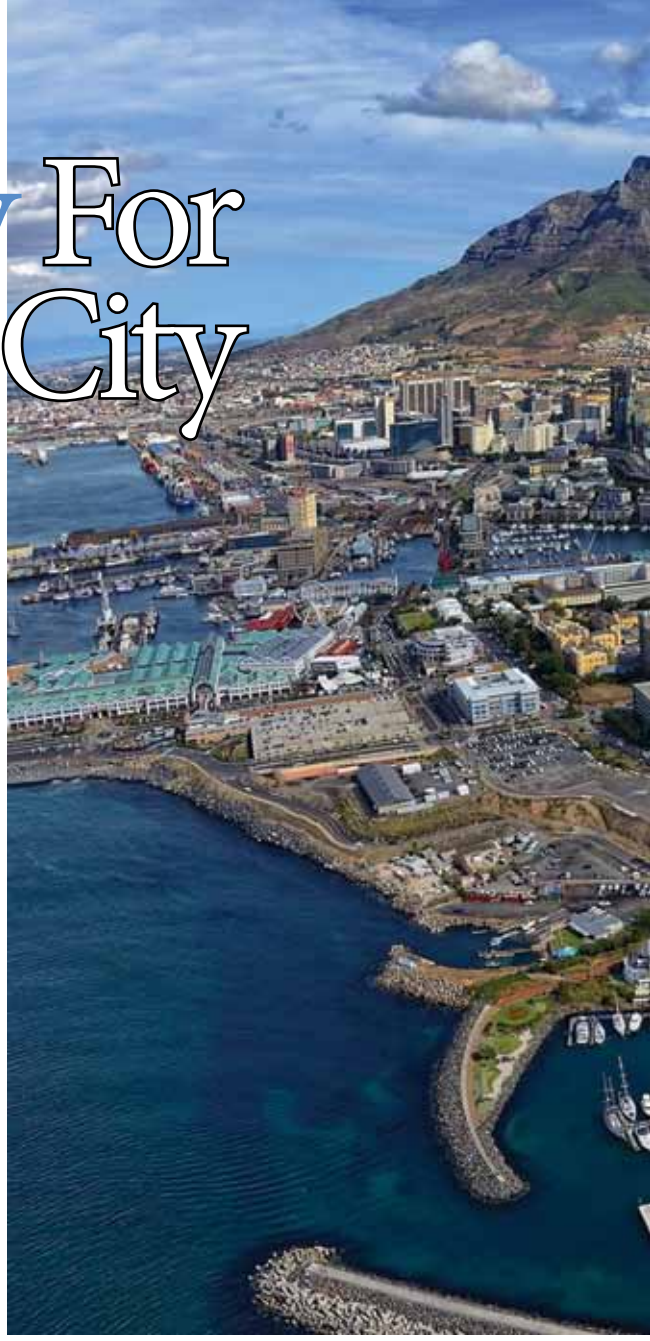


Fig 1 - Proposed UHV DC transmission connections

Saving Energy For The Mother City



In 2014, the City of Cape Town embarked on an energy efficiency implementation initiative, to improve the energy footprint of 12 city owned building complexes in the Mother City.

The project was launched by the city's Energy and Climate Change Unit, within the Environmental Resource Management Department (ERMD), led by Sumaya Mahomed. The tender for conducting the energy efficiency audits, as well as implementation of energy efficiency initiatives, was awarded to Igoda Projects (Pty) Ltd. A detailed audit of the energy consumption of all systems and equipment, in all the buildings, was conducted. A life cycle cost analysis was performed against all viable energy efficiency improvement interventions. Based on the findings, the ERMD elected to replace all lighting with modern energy efficient LED lighting. A payback of the CAPEX in less than 10 years had to be achieved, without the availability of ESKOM funding. Implementation of the

BY | TC MADIKANE | PR.(TECH) ENG | FSAIEE

Environmental Impacts			
Substance	**per kWh generated**	**kWh's saved**	**Total reduced/yr**
Liters Water Saved	1.37	1 566 224	2 145 727
Kg. Coal Savings	0.54	1 566 224	845 761
Ash Reduced / Gram	155.00	1 566 224	242 764 678
SO_2 in Grams	7.93	1 566 224	12 420 154
NOx in Grams	4.19	1 566 224	6 562 477
CO_2 in Kg.	0.99	1 566 224	1 550 561
Source: Factors- Eskom Annual Report 2012.			

Table 1: Environmental Impact of City of Cape Town, 2014 Energy Efficiency Lighting Retrofit

last building complex will be completed by the end of June 2016.

Energy savings of the new lighting systems, designed by Igoda Projects, originated from reduced power required by LED, occupancy sensors, daylight harvesting, and automatic light level control. The introduction of daylight harvesting/automatic light level control, introduced savings that cannot be achieved with ordinary sensors, and has allowed the opportunity to capitalise on naturally lit spaces, as well as improvement on older, inefficient lighting designs. The Digital Addressable Lighting Interface (DALI) sensors used, are programmed to always maintain just the minimum required lux levels at the measuring point, and prevents over illumination of the space under all conditions. A big drive to change the behaviour of city staff in order to increase energy awareness, was also undertaken, to ensure that savings relating to human habits, will continue to be realised. Savings calculated for reduced power of LED, averaged between 20%-25%, against their T8 fluorescent counterparts. Energy savings from occupancy detection were estimated at between 15%-20%, bringing the total savings due to these functions to an average of 40%.

Actual measurements of energy savings, in sample areas, showed that an additional average saving of 12% (taking seasonal changes into account) is achieved, bringing the total average energy savings in lighting to 52%. The additional energy savings helped to reduce the average payback from 7.8 years to 6.6 yrs. Environmental savings achieved are listed in Table 1.

Energy savings achieved through this project showed that improvements in energy efficiency, by means of lighting retrofits, can provide reasonable capital payback, produce substantial cost savings, relieve the impact on the environment, and can be implemented with reasonable simplicity – all of which will mean a brighter future for everyone. wn

Something Green in the State of Denmark

Great things have been happening in Denmark since the time of Prince Hamlet.

BY | DUDLEY BASSON

The first hint that electricity could be of engineering significance came on 21 April 1820, when Copenhagen professor Hans Christian Ørsted (1777-1851), during a lecture using a voltaic pile, discovered that an electric current could deflect a magnetic compass. Ørsted was a close friend of writer Hans Christian Andersen.

In 1801, on a travel scholarship in Germany, Ørsted met Johann Wilhelm Ritter, a physicist who believed there was a connection between electricity and magnetism. This made sense to Ørsted, since he believed in Immanuel Kant's Account of Reason about the unity of nature, and that deep relationships existed between natural phenomena.

Their conversations drew Ørsted into the study of physics. He became a professor at the University of Copenhagen in 1806, and continued his research into electric currents and acoustics. Under his guidance the University developed a comprehensive physics and chemistry program, and established new laboratories. In 1825, Ørsted made a significant contribution to chemistry by producing aluminium.

The 100 danske kroner note issued from 1950 to 1970 featured a likeness of Ørsted.

Denmark is the first country to have wind power capacity greater than the country's entire electrical demand, and has also become the world's foremost supplier of wind turbines. Denmark has also become a leader in Smart Grid Technology with the EcoGrid 2.0 Smart Energy Project, launched by the Technical University of Denmark in Lyngby on 11 April 2016.

This is one of the world's largest smart energy projects, which has been launched on the Danish island Bornholm. The grid will include about 1000 electricity users. This grid will later become an 'islanding zone' of the countrywide smart grid. The EcoGrid 2.0 will provide much experience in smart grid management, in preparation for the establishment of the countrywide smart grid.

The wind bloweth when and where it listeth, which means that no electricity grid can depend entirely on wind power. The country still utilises fossil fuel power generation, and has arrangements with neighbouring countries for the import and export of electrical power. Denmark is aiming to produce at least 50% of its electricity consumption from wind by 2020, to eliminate all fossil energy use in the heating and electricity sectors by 2035, and to become fossil energy independent in 2050, by substituting these with a mix of renewable energy sources. On a particularly windy day last year the wind turbines generated 140% of the country's electricity demand, necessitating the excess power to be exported to Germany, Norway and Sweden.

In order to maximise the use of wind power, it is necessary to have efficient energy storage facilities. Due to the erratic supply of power from wind or PV installations, typically only 25% of the available power can be directly used, the rest is sold. With efficient energy storage facilities, up to 50% of the energy can be locally utilised.

Researchers at Denmark's prestigious Aarhus University are engaged in developing new electrical storage technology, based on the vanadium redox flow battery. Considerable academic research has been done on the characterisation of the battery. The vanadium redox flow battery utilises two sulphuric acid electrolytes, with dissolved

Something Green in Denmark

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vanadium ions in different oxidation states. In the event of the electrolytes becoming mixed they can be restored by recharging. The battery is not damaged by being left in a discharged state. In use, the positive and negative electrolytes must be pumped past the electrodes and membrane. Research is also underway for the possible charging of redox batteries by means of sunlight.

Professor Anders Bentien of Aarhus University's Institute for Engineering Sciences commented: *"Our goal is to develop a whole new technology of the flow battery, making it cost efficient to store green electricity in the grid, based on an innovative and environmentally friendly chemical design."*

Project HyBalance has been launched, which will utilise wind power to produce hydrogen by using dynamic PEM (polymer electrolyte membrane) electrolysis technology. The PEM process can efficiently handle dynamic and fluctuating sources, with high current densities and energy spikes. The high gas purity obtainable from PEM is advantageous for safety in storage and use in fuel cells. An advantage in using PEM electrolysis is that the gases can be produced at a high pressure of 12 to 20 MPa, and for ultra-high pressure electrolysis from 34 to 69 MPa (5000 to 10 000 psi), removing the need for compression. The average energy consumption for internal differential compression is about 3%. The hydrogen will be utilised in high value markets in industry and clean transportation.

Vestas Wind Systems A/S originated in 1898 as a blacksmith shop, and diversified into several other industries, before moving exclusively into the wind turbine industry in 1989, where it currently holds the world's largest market share. The company operates manufacturing plants in 12 countries. Vestas currently has 74 GW of wind power installed in 70 countries globally. Recently MHI Vestas Offshore Wind constructed and installed two V164 8MW wind turbines for European Energy's 16MW Måde project in Denmark. These are the largest wind turbines so far manufactured, and have a blade diameter of 164 metres.

A new innovation has recently been announced – the multi-rotor turbine. In cooperation with the Technical University of Denmark, Vestas is installing a concept demonstrator to test the technical feasibility of operating and controlling a multi-rotor turbine, as well as transport and installation challenges. The single mast test device has four 225 kW 29 metre diameter three-blade turbines which can be scaled up depending on viability and requirements of niche markets.

By the end of August 2015, Denmark's onshore and offshore wind turbines reached a capacity of 5 GW. Energinet.dk's Supervisory Board plans to invest in two major electricity projects connecting the Danish and British power grids, and expanding the power grid across the Danish-German border.

Working together with the UK's National Grid, Energinet.dk will connect the two countries' electricity grids by means of the Viking Link - a more than 740 km submarine and land cable. The subsea portion will run 650 km and carry 1,4 GW at 400 kV DC. The project is expected to be fully commissioned by December 2022. The UK and Denmark are in separate time zones giving some disparity in time of peak power demand. Energinet.dk and German TenneT are working to build a 400 kV overhead line across the Danish-German border. South of the border, TenneT will expand the power grid in northern Germany. On the Danish side, Energinet.dk is proposing to build a new connection between the border and Endrup near Esbjerg. On 8 May 2016 Germany's renewable generating facilities were producing 55 GW of the country's 63 GW demand in addition to that of other power stations. In order to encourage users to use the excess power, the prices were reduced to below zero so that consumers were actually being paid to consume power. Germany is planning to be supplied entirely by renewable energy by 2050.

WORLDWIDE TOP TEN WIND TURBINE MARKET SHARE AT APRIL 2015

1.	Vestas	Denmark	13.2 %
2.	Goldwind	China	10.3 %
3.	Enercon	Germany	10.1 %
4.	Siemens	Germany	8.0 %
5.	Sulzon Group	India	6.3 %
6.	GE	U.S.	4,9 %
7.	Gamesa	Spain	4.6 %
8.	United Power	China	3.9 %
9.	Ming Yang	China	3.7 %
10.	Nordex	Germany	3.4 %

The existing Alstom submarine cables connecting the UK and France were commissioned in 1986. These cables carry 2 GW at 270 kV DC. The cables are at present mostly used for the sale of power from France to the UK. The eight cables were laid in pairs in four trenches, in order not to disturb the magnetic compasses of shipping. The sea is not used as a return conductor.

Magnetic compasses are still in widespread use for safety backup despite the availability of GPS. The impregnation compound used for HVDC cables is so viscous that there is little risk of leakage, even when the cable is damaged. For voltages above 230 kV low viscosity insulation oil is used which can result in much oil pollution if ruptured. In 1979 a damaged 420 kV Øresund cable between Denmark and Sweden caused a large oil plume. Energinet.dk is planning to replace two of the early cables linking Denmark and Sweden.

Denmark's largest energy producer, Denmark Oil and Natural Gas (DONG) has installations in several countries and also specialises in offshore drilling. This does not however form part of the Denmark 'State of Green' program.

The bridge over the Øresund strait between Denmark and Sweden is a major engineering achievement. The bridge runs 8 km from Sweden to the artificial island of Peberholm and then on to Denmark through an underwater tunnel. The bridge carries two roadways and two railway tracks.

A novel wave power generator 'Crestwing' is being developed by Danish engineer Henning Pilgaard. This device consists of two large flat pontoons hinged together – power is obtained from the flexing of the hinge. A key feature of the device is that the large flat shape causes atmospheric pressure to prevent the pontoons from leaving the surface of the water, giving maximum energy capture. A major advantage in using wave power is the continuous availability without dependence on sunlight or local winds.

Proposed Vestas multirotor turbine

The wave power generators can be deployed in places where they are no hindrance to commercial or sporting activities and can also be used in the vicinity of offshore wind turbines, where they can utilise the existing electrical distribution infrastructure.

A major CSP (Concentrated Solar Power) installation is being constructed in the Australian desert by Danish Aalborg CSP. The sunlight is focused by more than 23 000 computer controlled mirrors to the boiler at the top of a 127 metre 234 ton tower. Assembling the nine-section tower required the largest lifts to this height in Australia. The integrated energy system will use sunlight and seawater to produce heating, potable water and electricity.

The system will sustain the operation of 200 000 square metres of greenhouses, which will produce 15 000 tons of tomatoes annually. The groundbreaking concept of growing high-value crops in the desert

Something Green in Denmark

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Øresund bridge and tunnel linking Denmark and Sweden

Offshore Vestas turbines near the Storebaelt bridge

originates from Sundrop Farms, which began testing its integrated system on a small scale in 2010. The CSP site is in Port Augusta, South Australia.

Svante Bundgaard, CEO of Aalborg CSP commented: *"This groundbreaking project proves a new platform to address major global energy challenges. The construction progresses well, and we are looking forward to harvest the first sunrays in the second half of 2016".* Aalborg CSP has implemented CSP projects in several countries around the globe. The first documented use of CSP technology was developed by French mathematician, physicist and inventor Auguste Mouchout in 1866, using a parabolic mirror to heat water and produce steam which powered a steam engine.

Denmark's 'State of Green Tours' is a service for businesses, politicians, civil servants and media correspondents. Tailor-made tours are offered with an opportunity to experience Danish technologies and solutions in the fields of energy, climate adaptation, water and environment. The sites available are too numerous for all to be included in a single tour so that tours will be devised to suit the delegates particular fields of interest.

State of Green has received the *"Environmental Leadership Award"* at the GreenTec Awards show in Munich. The award was received by the Danish Minister for Business and Growth on behalf of State of Green on 1 June 2016. The award recognises Denmark's position as one of the leading green countries in the world, not least in terms of managing environmental challenges, amongst others by implementing technologies and solutions related to energy efficiency and district energy. Since 1980, Denmark's economy has grown by more than 70% while its energy consumption remained the same and CO_2 emissions have been reduced. wn

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The Picogrid is a response to the need for electrification in off-grid rural areas. The concept lends itself to the inclusion of renewable energy sources, and allows for a robust, resilient solution for rural applications. It will scale continuously by adding more plug-and-play nodes to an operational core system. In addition, it is fault tolerant, and exhibits self-healing properties.

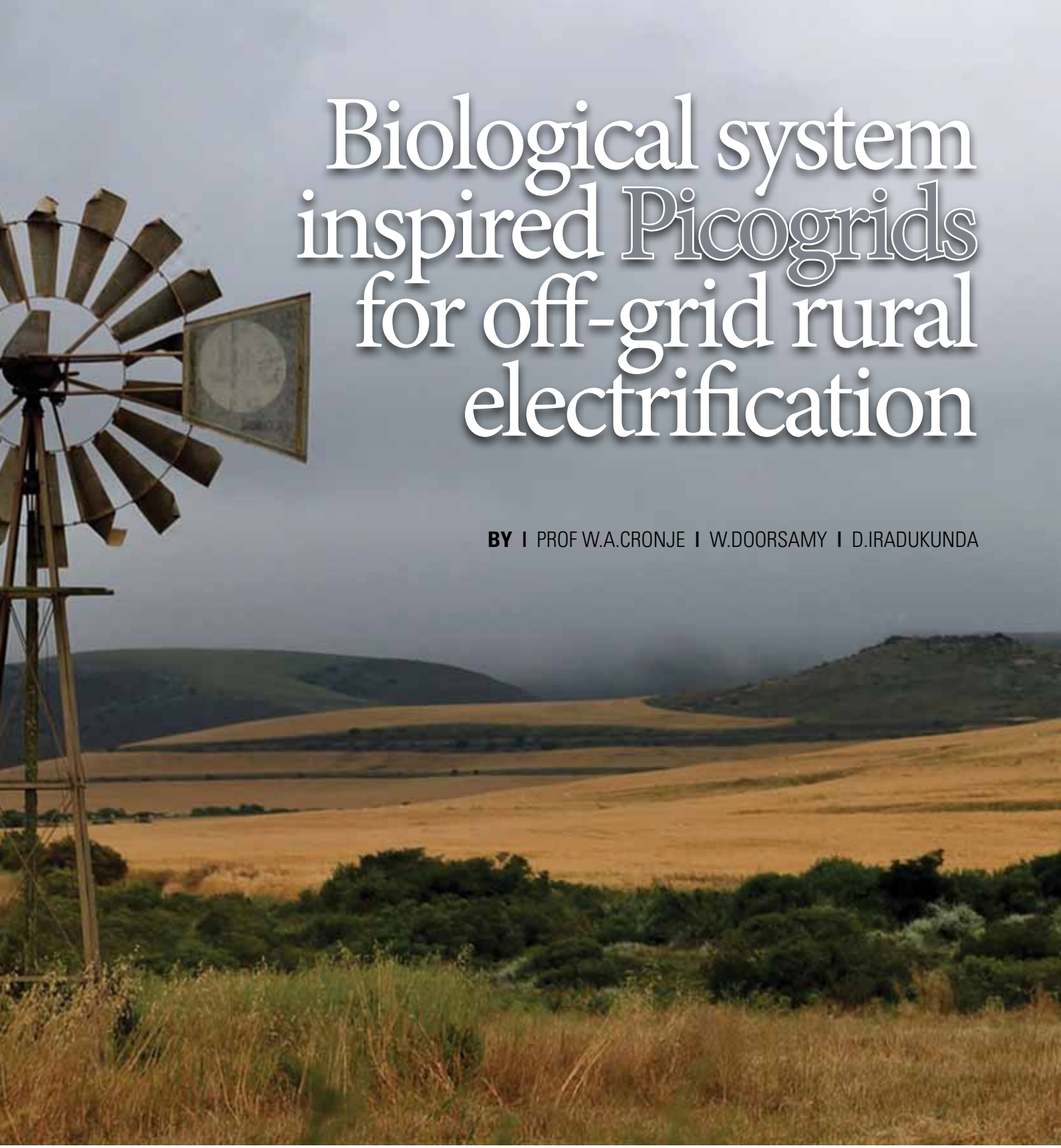
The idea of Picogrids has evolved over the past decade. The need for off-grid electricity in mostly rural areas, is an acute problem across the whole planet, that which is well known, and has been studied extensively. At the same time, the technological advances in tapping renewable energy sources, like such as the sun, has been impressive.

However, this is not delivering significant benefits to potential off-grid electricity users, in mostly rural areas. The Picogrid concept is an attempt to take the best concepts available in electricity generation and distribution, since the inception of electrification, and capitalise on the latest technological advances in ICT, power electronics and renewable energy technologies, such as PV.

The Picogrid concept is the result of a clean-slate approach, avoiding the historical baggage of established power systems doctrine. Additionally, this concept derives inspiration from the cell phone revolution in underdeveloped regions, and it also exploits biomimetic models from natural systems such as ant colonies.

Biological system inspired Picogrids for off-grid rural electrification

BY | PROF W.A.CRONJE | W.DOORSAMY | D.IRADUKUNDA



The electrification challenge in developing countries has tremendous social and economic impacts. In an IEEE Smartgrid newsletter entitled "Electrical power in Africa: Challenges and opportunities" there are positive aspects that can be taken from the lack of existing energy infrastructure, as highlighted by Krogh et al. The power systems in advanced industrial countries are built around the century-old paradigm of large-scale generation, which rely primarily on fossil and nuclear sources. Furthermore, these existing systems are supported by massive technological and regulatory infrastructures. The absence of the regulatory apparatus, and existing infrastructures in developing countries, offers the possibility of introducing

Picogrids

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renewable technologies at a fundamental level, and the opportunity to lead the way for microgrid technology. An example of this is the boom in mobile telecommunications in the absence of older landline systems and accompanying infrastructure. Figure 1 compares the primary energy usage to the Human Development Index (HDI), with bubble sizes representing the CO_2 emissions for various developing and developed countries. HDI is a composite statistic, based on life expectancy, education and income per capita indicators. Essentially, the targeted area is common to all countries - i.e. high sustainability and high standard of living. However, the challenges in achieving this target differ significantly. For developed countries, the aforementioned pre-existing infrastructure must be replaced with sustainable alternatives, without compromising living standards. The challenge for developing countries is to ensure that new infrastructure for improving living standards are sustainable.

The Picogrid shown in figure 2, illustrates a true grid for low voltage DC electrical distribution, between a number of different sources, loads and storages units. The concept allows for a true plug-and-play end-user experience, and easily expands and grows to accept more loads, sources or storage, as the demand evolves. It incorporates safety features and flexibility in deployment, currently unrivalled by other similar concepts.

In rural areas, unserviced by electrical utility-grids, the users of electrical apparatus have to resort to other means of electricity generation. This will most often be in the form of liquid fuelled generator sets. Recently solar PV and wind energy has surged into the spotlight due to decreased costs, improved reliability and their ability to generate electricity directly from ambient conditions, such as sunshine and wind. These technologies naturally lend themselves to the distributed generation required in rural and other off-grid scenarios.

A classical limitation of the distributed energy generators is the power limit imposed by the equipment. A motor-generator set has to be upgraded, if the load demand outgrows the capacity of the generator. The addition of incremental generation capacity is possible with a rotating generator, but it comes with cost and complexity penalties, because load sharing is difficult to achieve in a simple and elegant way. For smaller electrical systems, such as a single household, these penalties are simply too severe.

Most rural users would not be able to afford a single, once-off investment in a rotating generator system, or a modern PV system with storage, that meets all their current and projected future needs. Often users in remote rural regions would receive electrical energy services from NGOs, or through dedicated governmental support. A need for the ongoing reconfiguration, and expansion of these systems has been identified. This need is not provided for by most current generation Solar Home Systems, and similar solutions in the marketplace.

The Picogrid concept in figure 2, attempts to address this niche by applying true-grid operation to low-power (<1kW) low-voltage (<100V) systems. It is intended to provide an open architecture, where appliances (loads, energy sources and storage systems) from different manufacturers, can be mixed and matched on the grid, and still operate reliably as a

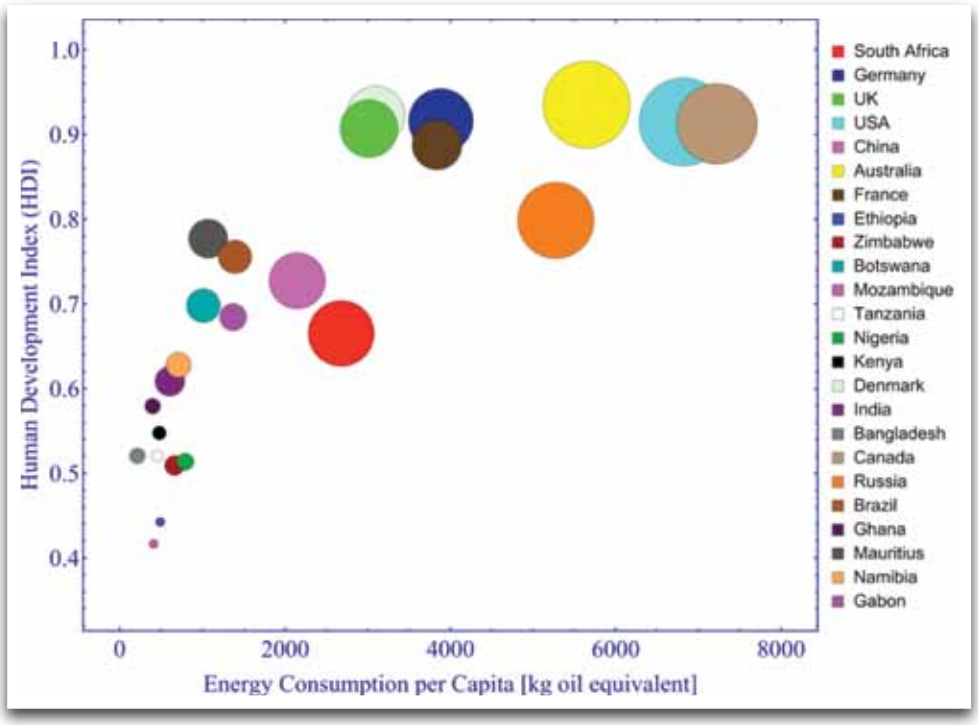

Figure 1: Human Development Index versus Energy use per capita for selected countries

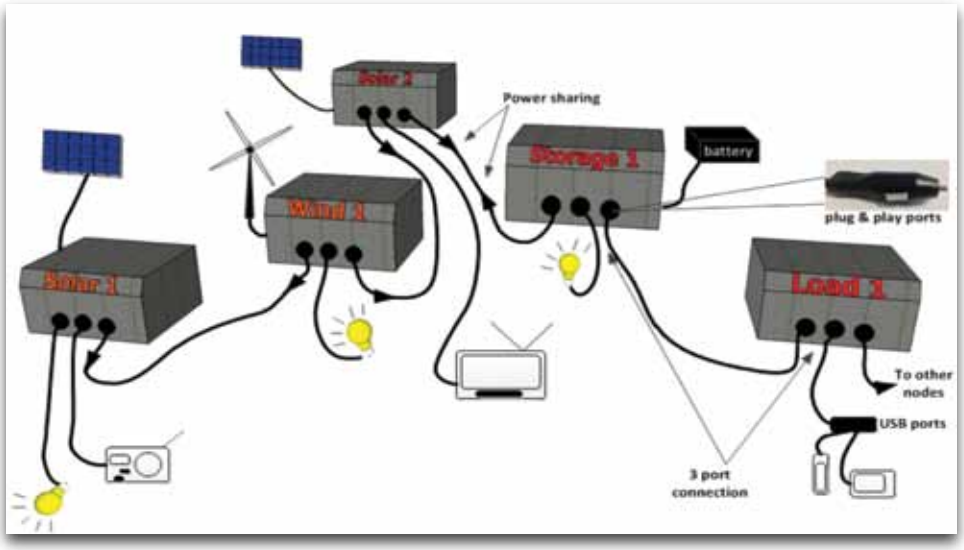

Figure 2: A Picogrid with five nodes (each with a three-port connection)

whole, while allowing for expansion and reconfiguration with plug-and-play ease.

INTELLIGENT NODES INSPIRED BY NATURE

Biomimetics deals with the study and imitation of nature's designs, methods and processes, and is becoming increasingly involved with emerging subjects of science and engineering. An example is the use of social systems in nature, for the development of distributed artificial intelligence.

Social insect colonies - although comprising very simple individual organisms, with limited capabilities - can perform highly complex tasks, with a high degree of flexibility and robustness in a dynamic environment.

The intelligent nodes on the autonomous Picogrid, takes inspiration from a class of self-organising behaviour in social insects, called stigmergy. Each node performs its assigned task, in collaboration with other nodes, to fulfil the overall goals of the picogrid. In this way, collective activity is coordinated by each node's response to, and modification of its local environment, as opposed to instructions from a central controller.

This stigmergic agent-based approach offers the following benefits:

- Simpler agents are used instead of a single complex agent, which decreases the overall complexity of the Picogrid system.
- The reliance on a single controlling entity is eliminated, thereby decreasing the likelihood of catastrophic failure.
- The internal state of each agent does not need to be directly known by another agent, or by a single controlling agent, thus eliminating the need for related infrastructure.
- System-level outcomes may be achieved through sub-system tasks, which improves modularity, flexibility and robustness.
- The use of bounded agents (intelligent nodes) in a potentially unbounded environment (Picogrid), supports scalability.

The Picogrid concept is therefore based on intelligent energy processing nodes, and passive or intelligent load nodes, interconnected to form an electrical energy distribution grid. As shown in figure 2, the Picogrid requires at least one node (either a source or a storage node), in order to kick-start the grid. The nodes can be connected in any configuration (a credit to the three-port connection), and are able to indirectly coordinate with one another, based on the voltage level of the Picogrid.

The only task that a Picogrid user has, is to plug the different nodes together, and add loads. Any node added to the grid will initialise itself in a stigmergic manner, by first checking the grid voltage, and then suitably responding with respect to existing nodes on the grid.

A FLEXIBLE ARCHITECTURE

The flexible arrangement of appliances as nodes of the Picogrid, is its first strength. This relieves the end-user from the constraints imposed by the solar home systems available today. Additionally, this flexibility allows for the evolution of operational solutions on-site, that could not have been accounted for during manufacture of the nodes. This also allows freedom to address the voltage-drop problem, that exists in any purely radial electricity distribution system. The freedom to deploy additional sources at different points on the Picogrid, can also mitigate voltage-drop problems.

The cornerstone for the flexible topology, is the availability of three grid-connection ports on each module, making up a node on the Picogrid. Figure 2 illustrates this concept, where one line represents both the positive and negative conductor

Picogrids

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	Source-node	Load-node	Storage-node
V_{over}	Trip the node, sleep & restart	Trip the node, sleep & restart	Trip the node, sleep & restart
V_{high}	Curtail production	Dispatch loads	Maximise charging
V_{nom}	Reduce production	Increase load	Increase charging
	Increase production	Decrease load	Reduce charging
V_{low}	Increase production	Curtail loads	Curtail charging
V_{under}	Trip the node, sleep & restart	Trip the node, sleep & restart	Trip the node, sleep & restart

Figure 3: Picogrid protocol showing different actions taken by the nodes

(DC system) required for making the connection. This approach allows for more intricate topologies, of almost any configuration, to be constructed when a large number of nodes - each with three ports - are connected together. The flexible architecture of the Picrogrid is also attributed to its scalability, and plug-and-play features.

The addition of new nodes, to grow and extend the system, should be a transparent process for the end-user. Ideally, there should be no upper limit on the growth or extension of the grid.

Basic errors, such as short-circuits and overloading, should be dealt with in an elegant and transparent fashion. Overloading should be dealt with transparently, to assist the user in arriving at a workable system, even if by trial and error. This is important, as the end-user is not intended to be a technology enthusiast, or have formal training. A light form of user interaction can be expected, based on error indications.

Safety of people, animals and equipment are a priority. Any operational mistake or error should, at most, lead to a safe shutdown of the system. For example, an over-current fault should not lead to a fire hazard, but rather a blown fuse, or preferably, a safe and elegant shutdown of the system.

A low DC voltage (eg. 12V) can work well in this regard. Besides inherent compliance with modern electronic loads, renewable energy sources and storage devices, the DC system is attractive because it avoids the complexities of AC systems, such as synchronisation and reactive power flow.

With the envisaged application in rural settings, without high-level technical support, it is important that the Picogrid exhibits extremely high resilience. The abilities to self-configure and to heal itself, when certain errors/faults are present, will be extremely valuable in successful deployment in remote rural areas. Once the basic elements (1 Source, 1 Load, 1 Store) have been plugged together, the system should commission and operate by itself. Thereafter, adding additional loads, sources or storage, should be completely transparent to the user.

THE PROTOCOL

The heart of the Picogrid operation is the behavioral Protocol, obeyed by all the participating nodes on the grid. The protocol is simple, and the goal is to ensure that the grid reaches stability, and stays stable at all times. This will ensure the maximum level of supply integrity.

Some level of fluctuation on the system is allowed, DC-bus voltage variation in this case, to allow for the various nodes to track the events unfolding on the Picogrid.

Essentially, all intelligent nodes taking part in the Picogrid operation will endeavour to stabilise the voltage, and sources will adjust their supply current into the grid to ensure voltage stability. Energy stores present on the grid will also do the same, by charging and discharging.

Intelligent load nodes can add and shed loads to also ensure stability. This mirrors the operation of any large utility grid. The goal here is to implement this as a form of cooperative control, through distributed decision making, rather than relying on a centralised controller.

Figure 3 shows the different actions taken by each node that connects to the Picogrid. There are five different states, based on the voltage level of the Picogrid; V_{over}, V_{high}, V_{nom}, V_{low}, V_{under}. The Picogrid concept

revolves around the green zone, shown in figure 3. This is the stable operation, with a nominal voltage of 12V. Each node's action is thus aimed at keeping the Picogrid in the green zone. The first step for every node that connects to the grid, is to check the current state of the Picogrid and then take the necessary action.

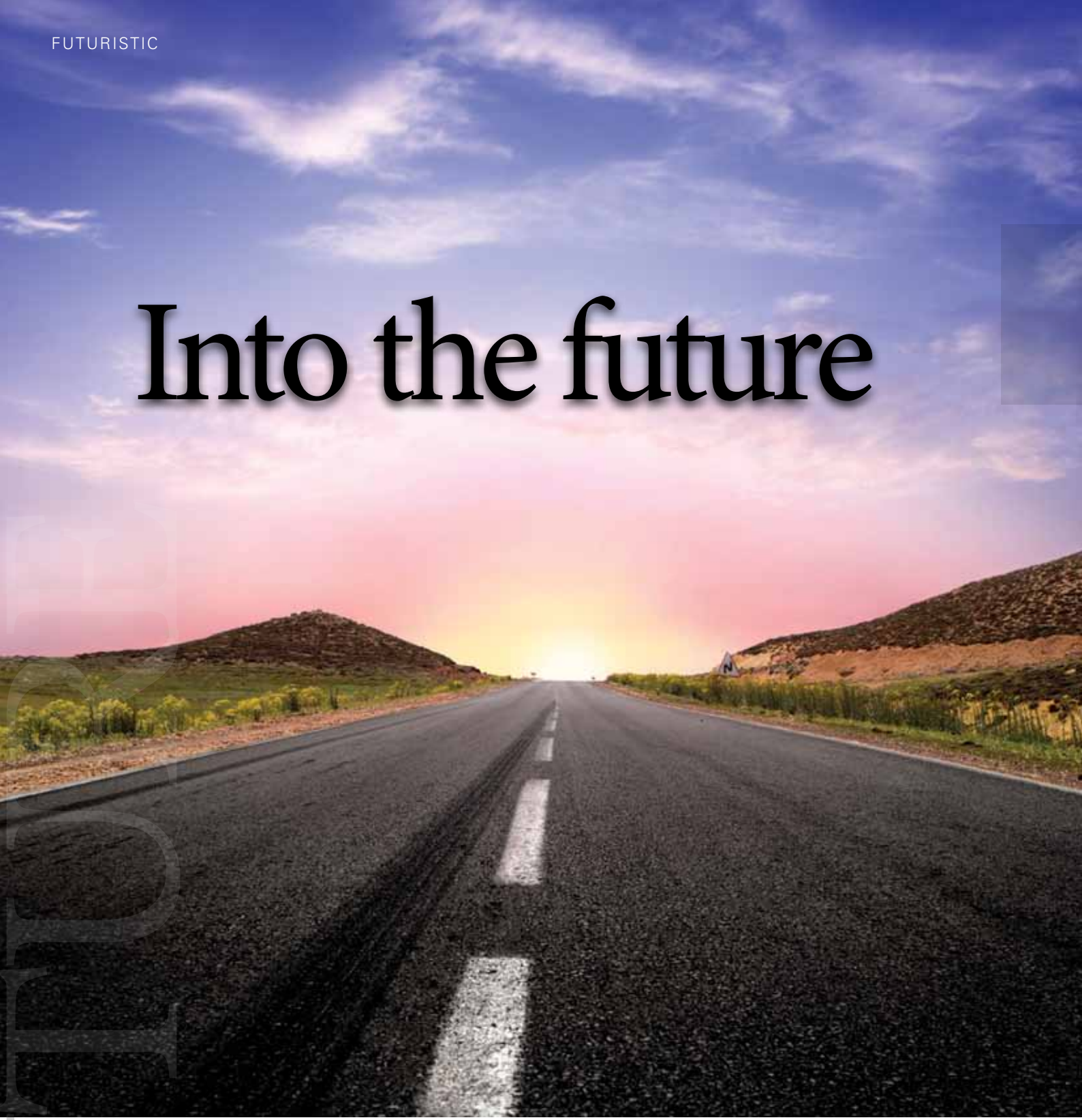
Changes in weather patterns will affect the state of the grid. A very sunny or windy day will increase the power generated by a solar or wind node respectively. This will tend to push the state of the grid towards the V_{high} or V_{over} regions shown in figure 3. A source node's intelligence informs it to either increase, or decrease its power generation, depending on the state of the Picogrid. A storage node will charge its battery when the Picogrid is in V_{high} or V_{over} states. The node will then trip, sleep and restart only if the battery is full, and the Picogrid is still in the V_{over} state. A load node will initiate load shedding, when there is not enough power on the Picogrid, such that it falls in the V_{low} and V_{under} states. The reverse process occurs when there is excess power on the Picogrid.

CONCLUSION

The Picogrid concept presented in this discussion, allows for low power, modular, extensible electricity supply, based on renewable energy sources. Its open architecture allows for multiple manufacturers or vendors, to supply a variety of different equipment, that will safely interact to form a larger electricity distribution system. That is provided the equipment conforms to the Picogrid standard, as discussed here.

The proposed Picogrid concept has been validated using on an experimental 12V DC system at Wits University over the past two years (2014 - 2015). Ongoing research and development can bring exactly the same benefits to 48V systems. This can provide higher power, and eventually extend the concept to even higher voltage and power, in both DC and AC forms. wn

Into the future



Predictions are difficult (especially about the future)! But some of these patterns are already half established. How to keep humanity busy (and earning) is becoming increasingly uncertain. And how to deal with population numbers is another matter. But at least the GINI index may not be so critical if most of essentials are dog-cheap.

BY | UDO GOLLUB AT MESSE BERLIN, GERMANY

For those of us who are about to amble into the sunset on our Zimmer frames, this is simply interesting. We inhabited a world where people used cosy concepts like pension, nest egg, job security, promotion in the work place and other reassuring socio economic terms.

For those who are in mid-career or are only entering the world of (non) work now, this makes for scary/exciting reading - depending on how ready you are to change in mid-air — if it is at all possible.

And for the generation still in their nappies… well, it is a matter of how parents prepare them for an unimaginable world when they enter the world of 'work' in 20 years time.

RISE AND FALL

In 1998, Kodak had 170,000 employees and sold 85% of all photo paper worldwide. Within just a few years, their business model disappeared and they were bankrupt. What happened to Kodak will happen in a lot of industries in the next 10 years – and most people don't see it coming. Did you think in 1998 that 3 years later you would never take pictures on paper film again?

Yet digital cameras were invented in 1975. The first ones only had 10,000 pixels, but followed Moore's law. So as with all exponential technologies, it was a disappointment for a long time, before it became superior and mainstream in only a few short years. This will now happen with Artificial Intelligence, health, self-driving and electric cars, education, 3D printing, agriculture and jobs.

Welcome to the 4th Industrial Revolution. Welcome to the Exponential Age. Software and operating platforms will disrupt most traditional industries in the next 5-10 years.

Uber is just a software tool. They don't own any cars, but they are now the biggest taxi company in the world. Airbnb is the biggest hotel company in the world, although they don't own any properties.

ARTIFICIAL INTELLIGENCE

Computers become exponentially better in understanding the world. This year, a computer beat the best Go player in the world, 10 years earlier than expected. In the US, young lawyers already don't get jobs. Because of IBM Watson, you can get legal advice, (so far for more or less basic stuff), within seconds. With 90% accuracy, compared with 70% accuracy when done by humans. So if you are studying law, stop immediately. There will be 90% fewer generalist lawyers in the future; only specialists will be needed.

'Watson' already helps nurses diagnose cancer, four times more accurately than doctors. Facebook now has pattern recognition software that can recognize faces better than humans. By 2030, computers will have become 'more intelligent' than humans.

CARS

In 2018 the first self driving cars will be offered to the public. Around 2020, the complete industry will start to be disrupted. You don't want to own a car anymore. You will call a car on your phone; it will show up at your location and drive you to your destination. You will not need to park it, you only pay for the driven distance and you can be productive whilst driving. Our kids will never get a driver's licence and will never own a car. It will change the cities, because we will need 90-95% fewer cars for our future needs. We can transform former parking spaces into parks. At present,1.2 million people die each year in car accidents worldwide. We now have one accident every 100,000 kms. With autonomous driving, that will drop to one accident in 10 million km. That will save a million lives each year.

Electric cars will become mainstream around and after 2020. Cities will be cleaner and much less noisy because

Into the future

continues from page 51

all cars will run on electricity, which will become much cheaper.

Most traditional car companies may become bankrupt by tacking the evolutionary approach and just building better cars; while tech companies (Tesla, Apple, Google) will take the revolutionary approach and build a computer on wheels. I spoke to a lot of engineers from Volkswagen and Audi. They are terrified of Tesla.

Insurance companies will have massive trouble, because without accidents, the insurance will become 100 times cheaper. Their car insurance business model will disappear.

Real estate values based on proximities to work-places, schools, etc. will change, because if you can work effectively from anywhere or be productive while you commute, people will move out of cities to live in a more rural surroundings.

Solar energy production has been on an exponential curve for 30 years, but only now is having a big impact. Last year, more solar energy was installed worldwide than fossil. The price for solar will drop so much that almost all coal mining companies will be out of business by 2025.

WATER FOR ALL

With cheap electricity comes cheap and abundant water. Desalination now only needs 2kWh per cubic meter. We don't have scarce water in most places; we only have scarce drinking water. Imagine what will be possible if everyone can have as much clean water as they want, for virtually no cost.

HEALTH

The Tricorder X price will be announced this year - a medical device (called the "Tricorder" from Star Trek) that works with your phone, which takes your retina scan, your blood sample and your breath. It then analyses 54 biomarkers that will identify nearly any diseases. It will be cheap, so in a few years, everyone on this planet will have access to world class, low cost, medicine.

3D PRINTING

The price of the cheapest 3D printer came down from 18,000$ to 400$ within 10 years. In the same time, it became 100 times faster. All major shoe companies started printing 3D shoes. Spare airplane parts are already 3D-printed in remote airports. The space station now has a printer that eliminates the need for the large amount of spare parts they used to need in the past.

At the end of this year, new smart phones will have 3D scanning possibilities. You can then 3D scan your feet and print your perfect shoe at home. In China, they have already 3D-printed a complete 6-storey office building. By 2027, 10% of everything that's being produced will be 3D-printed.

BUSINESS OPPORTUNITIES

If you think of a niche you want to enter, ask yourself: "in the future, do you think we will have that?" And if the answer is yes, then work on how you can make that happen sooner. If it doesn't work via your phone, forget the idea. And any idea that was designed for success in the 20th century is probably doomed to fail in the 21st century.

WORK

70-80% of jobs will disappear in the next 20 years. There will be a lot of new jobs, but it is not clear that there will be enough new jobs in such a short time.

BEWARE of these unsafe products

» There are more than 3000 electrical fires annually in South Africa and there are many more with unknown causes that could be electrical. Cases of electrocution are not widely publicized.
» The products illustrated below and purchased in February & March 2016 are a tiny sample of a range of sub-standard, unsafe electrical products being distributed in South Africa on a large scale.
» The problem also extends to safety devices such as circuit breakers and earth-leakage units that do not perform their function and endanger lives and property.
» Such products do not comply with compulsory standards and are illegal. Distributing such products is a criminal act, yet unscrupulous suppliers are able to distribute them with apparent impunity.
» Non-compliance is difficult to assess and unsuspecting customers are using unsafe products in their homes and in commercial and industrial buildings.
» Some sub-standard products are distributed under different brand names and in packaging that obscures their identity.
» Documents produced as authorisations to distribute products are not always reliable proof of compliance with regulations, as may be the case here.

Except for the AP-02 adaptor which has visual non-compliances, the SAFEhouse Association has had the electrical products depicted below tested by an accredited laboratory. They have been found to be non-compliant with SA regulations and are unsafe.

PRODUCT: UNBRANDED PLUG-IN ADAPTOR TYPE AP-02 in VALUPAK packaging

	STANDARD REFERENCE & NON COMPLIANCE	CONSEQUENCE	RISK TO USER
1	SANS 164-2 Sockets not enclosed in 12mm deep well.	No earth-leakage protection. Live pins exposed on entry.	Risk of electric shock. **This product design is dangerous and has been banned for many years.**
2	SANS 164-1 – SANS 60884-1 Clause 8: Marking – no manufacturer's name	No identification	Rejection by National Regulator for Compulsory Specifications.

PRODUCT: REDISSON PLUG-IN ADAPTOR TYPE R-36 in VALUPAK packaging

	STANDARD REFERENCE & NON COMPLIANCE	CONSEQUENCE	RISK TO USER
1	SANS 164-1 Pin diameters fail	Reduced contact and contact pressure from socket outlet.	Risk of overheating.
2	SANS 164-2 Well depth fail	Risk of live pins exposed on entry.	Risk of poor live and neutral pin contact leading to overheating.
3	SANS 164-1 Depth of entry hole fail	Shallow hole reduced entry of E pin.	Risk of poor live and neutral pin contact leading to overheating.
4	SANS 164-1 Pin length fail	Longer E pin reduced entry of L & N pins.	Risk of poor live and neutral pin contact leading to overheating.
5	SANS 164-1 No-contact gauge fail	Shallow contact allows pin contact early on entry.	Risk of electric shock if pins are touched on plug insertion.
6	SANS 164-2 Single pin insertion fail	Malfunctioning protective shutter can allow entry of single metal objects.	Risk of electric shock.

PRODUCT: REDISSON PLUG-IN ADAPTOR TYPE R-38 in VALUPAK packaging

	STANDARD REFERENCE & NON COMPLIANCE	CONSEQUENCE	RISK TO USER
1	SANS 164-1 Pin diameter fail	Reduced contact and contact pressure from socket outlet.	Risk of overheating.
2	SANS 164-6 Pin entry hole diameter fail	Entry holes too small – possible damage to plug.	Problematic functionality.
3	SANS 164-2 Single pin insertion fail	Malfunctioning protective shutter can allow entry of single metal objects.	Risk of electric shock.

What to do? .....some guidelines:

- Purchase brands you know and can trust.
- Ask your supplier to confirm compliance with safety regulations.
- Be suspicious of prices that are substantially below those of other, similar products on offer.
- Examine products for obvious signs of inferior design, materials or workmanship
- Be suspicious of products and packaging that lack basic information such as Voltage, Amperage and, for instance, in the case of electrical cable and wire, a description of the applications for which the product is suitable or not.
- Look for markings such as the SABS mark – and try to authenticate this as the mark can be used fraudulently.
- The "CE" mark is widely used but is NOT an indicator of independent certification of compliance with regulations.
- Check with the SAFEhouse Association. It may have information to assist you.

SAFEhouse has identified a retailer of the abovementioned products, the "Checkout" chain of stores, in KwaZulu Natal. In 2015 the retailer was advised of these findings, but is still offering the products for sale.

SAFEhouse has attempted to make contact with the retailer's supplier, Delta Electrical, in order to share its findings, but has been unsuccessful.

SAFEhouse has attempted to make contact with the importer of the products but has had no response to the approach.

SAFEhouse reports its findings to the National Regulator for Compulsory Specifications and, where applicable, lodges complaints with the National Consumer Commission.

In our view, these products are dangerous and should be withdrawn from the market. Sold products should be recalled as users are at risk.

SAFEhouse appeals to the importer, distributor and retailer of the products to make contact at the email address or telephone number below. SAFEhouse cautions sub-distributors, retail chains, hardware stores, electrical contractors and end-users.

The South African **SAFEhouse** Association is an independent, registered, non-profit organization established by the electrical industry and committed to communicating with customers.

The South African **SAFEhouse** Association has been established to combat the proliferation of dangerous electrical products and services by:
- Making the market aware of the risks in using such products and services
- Exposing sub-standard products and services
- Persuading specifiers, suppliers and distribution channels not to recommend or to offer such products and services for sale

For more information contact:
Pierre Nothard: Tel: 011 396 8140 | Email: pierren@safehousesa.co.za

www.safehousesa.co.za

SAFE™ HOUSE

As at 16/03/2016

Into the future

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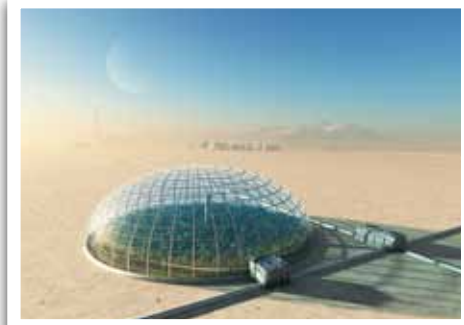


AGRICULTURE

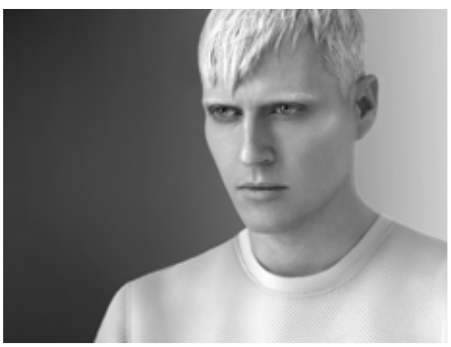
There will be a 100$ agricultural robot in the future. Farmers in 3rd world countries can then become managers of their fields instead of working in them all day. Aeroponics will need much less water. The first veal produced in a petri dish is now available. It will be cheaper than cow-produced veal in 2018. Right now, 30% of all agricultural surfaces are used for rearing cattle. Imagine if we don't need that space anymore. There are several start-ups which will bring insect protein to the market shortly. It contains more protein than meat. It will be labelled as "alternative protein source" (because most people still reject the idea of eating insects).

APPS

There is already an app called "moodies" which can tell the mood you are in. By 2020 there will be apps that can tell by your facial expressions if you are lying. Imagine a political debate where we know whether the participants are telling the truth and when not!

CURRENCIES

Many currencies will be abandoned. Bitcoin will become mainstream this year and might even become the future default reserve currency.



LONGEVITY

Right now, the average life span increases by 3 months per year. Four years ago, the life span was 79 years, now it is 80 years. The increase itself is increasing and by 2036, there will be more than a one-year increase per year. So we all might live for a long, long time, probably way beyond 100.

EDUCATION

The cheapest smartphones already sell at 10$ in Africa and Asia. By 2020, 70% of all humans will own a smartphone. That means everyone will have much the same access to world class education.

Every child can use Khan Academy for everything he needs to learn at schools in First World countries. Further afield, the software has been launched in Indonesia and will be released it in Arabic, Swahili and Chinese this summer.

The English app will be offered free, so that children in Africa can become fluent in English within half a year.

Whew! wn

P.S. At least the toilet roll manufacturers are safe.

THE ULTIMATE HAND-HELD POWER QUALITY ANALYZER

Introducing the Pure BlackBox

The Pure BlackBox is an advanced Class A power quality analyzer embedded with *Elspec's innovative PQZIP technology.*

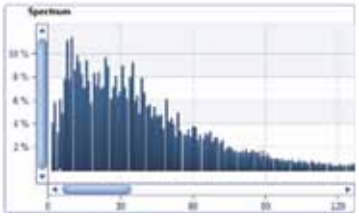
It is an **easy to use plug and play device** that continuously records all power quality parameters with no threshold and recording configuration needed. The device is available in two versions: Single Phase and 3-Phase.

PQZIP

The PQZIP continuous recording enables it to easily predict, prevent and troubleshoot issues without the need to set up triggers or thresholds in order to capture a specific event. With PQZIP the installation is straight forward!

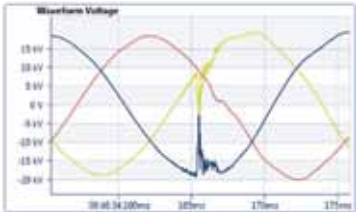
The BlackBox

Outstanding Features:



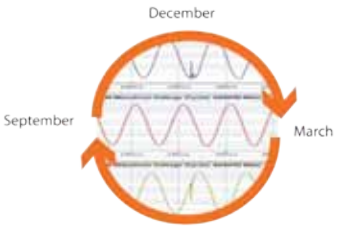
Extended Harmonics Recording

The Pure BlackBox records and stores 128 harmonics components at 50Hz resolution and 512 inter-harmonic components at 5Hz resolution for both voltage and current.



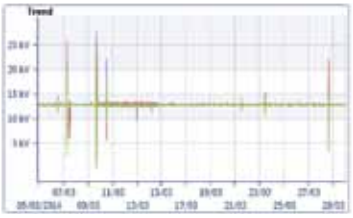
Get the most accurate information

The Pure BlackBox records voltage and current waveform sampled at a rate of 256 Sample/Cycle at 50/60Hz, which provides information at a very high resolution, enabling it to detect and analyze the slightest change.



Continuous Waveform Recordings

The Pure BlackBox is the only hand held analyzer able to record and store all electrical parameters, at any given time for more than a year with no gaps in the data. It provides a clear and comprehensive view of network conditions at all times, offering the most advanced power quality analysis capabilities.



Supreme Trend Resolution

More than 5,000 power quality parameters such as RMS, THD, power, power factor, unbalance and harmonic are logged continuously for more than a year at ½ cycle, 10/12 Cycles, 150/180 Cycles, and 2 hour resolution.

Impact Power Innovations

Energy Efficiency through power quality

Contact our professional team of Power Quality Specialists for all your enquiries.

0861 357732 (0861-ELSPEC) or email info@impactpower.co.za

Proudly Bidvest

ELSPEC When Power Meets Quality

IN MY OPINION : NEIL CAMERON

Rethinking the central plant for greater efficiency

Almost 40% of the power required to run a building is consumed in one place: the central chilled water plant.

BY | NEIL CAMERON | GM | JOHNSON CONTROLS BUILDING EFFICIENCY, SYSTEMS & SERVICE: AFRICA

A 20-60% saving in this energy use can be achieved by operating a facility's central plant - the chiller, the air handling units, and the terminal units – as a single, integrated system rather than a collection of independent components and controls.

At the intersection of mechanical systems and networks, new solutions are emerging to make continuous dynamic optimisation of central plant systems a reality.

The larger the building and cooling load, the more critical it is to design, operate and maintain the central chilled water plant holistically, to achieve improved efficiencies and sustainable performance gains. In South Africa this is rarely the case.

Chillers, air handling and terminal units are typically managed separately, using built-in systems that do not respond to changing conditions, or the performance of related systems. This results in suboptimal performance and inefficiencies.

Some examples of stand-alone strategies not fully optimised set the scene. Such a chiller strategy may see a controller used to define how many chillers run at one time and the temperature of the water in the chiller.

Seldom does it look at what the building needs and adjust chillers to deal with over- or under-capacity. Air handling units may have a set temperature to control return air. Terminal units that bring air into working areas are often adjusted by building occupants to suite their own comfort levels.

In an optimised strategy, the temperature and humidity of the room can be communicated via the terminal unit sensors to the air handling units and central plant. The temperature of the water used by the chiller will adjust to more accurately meet facility needs, while air handling units will make use of return air at different temperatures to better support facility needs. With a prize of an up to 60% increase in central plant energy efficiency through use of an end-to-end solution, the question is: what's holding companies back?

REMOVING CENTRAL PLANT OPTIMISATION (CPO) BARRIERS

Chiller plants are costly and sophisticated pieces of machinery, and the majority have very specific control systems. Factors such as safety, operating thresholds and interlocks need to be taken into consideration.

With a knowledge gap too wide to leap, organisations choose to avoid the risk of tampering with systems, and rather stick to standard manufacturer control systems.

There is also a product gap to be overcome. Many building management or other systems do not have the capability to integrate with, or control central plant equipment effectively.

The good news: thanks to technology developments, solutions are now available that can be used with any chiller, pump or tower brand in both new construction and existing buildings, as long as there is an effective Building Automation Systems (BAS).

These solutions deliver the potential to achieve and sustain ongoing savings throughout the entire lifecycle of a Heating, Ventilation and Air conditioning (HVAC) system.

Time to CPO Return on Investment (ROI): six months to one year depending on utility tariffs and chiller usage.

Optimisation of plant performance requires a combination of design considerations and operating decisions. While optimal design, updates and upgrades will improve plant performance, an integrated operating strategy, enabled by intelligent CPO software, usually part of a BAS, can improve efficiencies, deliver sustainable performance gains, and assist to reduce environmental impact.

The CPO enables building owners and operators to see essential plant components' operating parameters, uses smart algorithms to vary temperature and flow, and provide intelligent coordination between chiller power and plant auxiliary energy usage – in other words, it helps manage the entire system.

Optimisation decisions are based on optimal power relationships among components, while control is based on relational control algorithms and calculations. This enables continuous automatic adjustment to meet real-time building loads.

For the facility manager working remotely, or 24/7, the CPO's cloud-based analytics and management capabilities deliver constant commissioning and real-time reporting, trend analyses and optimisation verification.

To put the system in place, a service provider is needed that has the ability to control central plant equipment effectively, that can help put in place a central plant operations and integration strategy, and can operationalise it. Look for a solution provider with expertise in network and mechanical engineering systems, that also has the deployment experience (and references) to deliver on promises of energy efficiency.

The RIO on a CPO project, depending on utility tariffs and chiller usage, is typically six months to one year. The investment may include an assessment of HVAC systems, development of a strategy, upgrades or refurbishment of equipment, deployment of the CPO solution to integrate all HVAC components, and operationalisation.

Central plant represents a big opportunity for increasing savings. With new solutions that address traditional CPO barriers, it's something forward-looking facility managers should consider. wn

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

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

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

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

We look forward to hearing from you.

- Ed

The rapid pace of technological change and product development is a global trend that affects entire economies. We may have access to more information than ever before, but is this information readily understandable? Does it give us insight into the fundamental issues? Is it precise and based on technical clarity?

QUESTION ONE

My electric motor keeps experiencing bearing failures. Why would that be?

ANSWER ONE

Bearings are used to help reduce the friction in moving or rotating parts. Bearings reduce this friction by having two surfaces roll over each other. The tolerances and clearances in bearings, as well as the roller surfaces, are critical to the performance of these components. Any form of damage or contamination by foreign particles, such as dirt, steel shavings or even lint, could damage and shorten bearing life. Bearings are very sophisticated components and crucial parts of an electric motor, any rotating machine or part thereof.

QUESTION TWO

What types of common bearing failures does one encounter, and which would be most applicable to a belt pulley type arrangement?

ANSWER TWO

The most common types of bearing failures are caused by foreign matter, improper mounting or handling before mounting, bearing misalignment, vibration, corrosion and bearing fatigue. The type of loading encountered on a belt pulley type arrangement is referred to as radial loading. The most common type of failure associated with radial loading is bearing fatigue.

QUESTION THREE

Why does this type of load cause premature failure of the motor bearing?

ANSWER THREE

Bearing fatigue is a result of stress within the bearing, which causes the metal to move, flex and distort. This type of stress is influenced by the magnitude of the load, and the number of times such a load is encountered. In short, the roller elements create a concentrated area of tension and compression in front of them as they roll. The metal in the bearing components is subjected to this strain. This scenario can occur in the inner or outer ring or the balls. The tension and compression of the components causes an initial crack, developing into a network of small cracks and ultimately the metal fractures and flakes; this is often referred to as spalling. There are various factors that go hand in hand with the fatigue, and all of these will influence the time before failure. This fracturing, once initiated, will continue and worsen, and ultimately cause the premature failure of the bearing.

QUESTION FOUR

What can be done to resolve the problem of continual bearing failures?

ANSWER FOUR

Ball bearings are the most common bearings found in electric motors, although electric motors are also available with roller

WATT?

bearings. Where necessary an electric motor manufacturer will specially design and manufacture according to your requirements for specific applications.

An example of such an application would be a vertical turbine pump, where the rotor would encounter "up and down" axial thrust.

Another type of application where this would be necessary would be a centrifugal pump. In a centrifugal pump the radial loading would be from a pressure differential, on each side of the vanes. Ball bearings are designed to handle both radial and axial thrust loads, and should you experience a failure in this instance, the load is most likely outside of the motor and bearing design.

The contact point between the ball and the outer bearing race is small due to the spherical shape of the bearing. If the bearing becomes overloaded due to a high radial load, the motor is loaded outside of its design parameters, and this will cause the failure.

The best solution is to consider the thrusts and design the motor with the correctly selected bearings, and, further to this, install and tension the belts and reduce the radial loading on the bearings. If the stresses caused by improper installation cause the bearings to fail, there will be additional complications causing future failures and downtime not just in the motor but in the pump as well.

If it is not possible to reduce the radial load, and this radial loading is still within the design parameters of the motor, one would need to assess the viability of switching to roller bearings.

Roller bearings or cylindrical bearings have cylindrical shaped bearings instead of balls. The point of contact between the bearing races is in a line, rather than on a concentrated point as in the case of ball bearings. This increases the surface area that carries the load, and distributes the load over a larger area. The larger area can handle higher loads without deformation or overloading of the bearing.

As long as bearings are greased as per the recommended re-greasing intervals or are replaced before they fail or initiate further damage to other working parts, your machinery should enjoy a healthy lifespan. There are many options available when it comes to testing the performance of your bearings. wn

Russia and Nigeria signs agreement on Nuclear Research Centre

On May 31 of 2016 on the sidelines of the VIII International Forum ATOMEXPO 2016 the Russian Federation and the Federative Republic of Nigeria have signed an agreement on cooperation in construction of the Centre for Nuclear Research and Technology in Nigeria.

The Russian side was represented by the General Director of the Rosatom corporation, S.V. Kirienko, and the Nigerian delegation was represented by the General Director of the Nuclear Energy Commission of Nigeria F. Erepano Osaisai.

Sergey Kirienko has stressed that he understands perfectly well the logic that the Government of Nigeria is following, and which is trying to develop all aspects of the nuclear power. He also said that our Nigerian partners are not only developing the technology, but are also investing in the human capital, as they have been sending their students to trainings for several years in a row now. This year it's 20 students.

The Agreement provides for a construction of a Centre on the basis of the multi-purpose research two-circuit pool-type reactor of the Russian design and a nominal power rating of 10 MWt on the facility of the nuclear technological centre in the city of Sheba-Abuja.

The Centre will allow Nigeria to begin work on familiarization with nuclear technologies and their implementation in the fields of science, medicine, agriculture, as well as other fields of human activities. In particular, the Centre will allow Nigeria to start manufacturing the radio isotopes for widespread use in diagnostics and treatment of oncological diseases, the increasing availability of nuclear medicine for the country's citizens.

The Centre will be equipped with the cutting-edge equipment for performing research within the framework of the Nigerian National nuclear research program. Being the largest scientific and research base in the country for training of highly qualified specialists in various domains, the Centre will promote the growth of specific education and science level in the country. wn

calendar

JUNE | JULY

JUNE 2016

7-8	Design of Economical Earthing Systems	Western Cape	khuvutli@saiee.org.za
7-9	Fundamentals of MV Protection	Johannesburg	roberto@saiee.org.za
8-9	Optical Fibres, Cables & System Fundamentals	Johannesburg	roberto@saiee.org.za
14-15	Cloud Computing Fundamentals	Johannesburg	roberto@saiee.org.za
14-16	Carolinas Energy Association Sustainability Workshop	Johannesburg	gary@carolinasenergy.com
22-23	HV Circuit Breaker, Operating & Maintenance	Johannesburg	roberto@saiee.org.za
27-30	Managing Projects Effectively	Cape Town	khuvutli@saiee.org.za
28	Design of Economical Earthing Systems	Johannesburg	roberto@saiee.org.za

JULY 2016

6	Broadband Breakfast	Johannesburg	minx@saiee.org.za
6-7	Photovoltaic Solar Systems	Johannesburg	roberto@saiee.org.za
11-12	MS Project Professional 2013	Cape Town	khuvutli@saiee.org.za
13-14	Core Financial Management Skills for Engineers	Johannesburg	roberto@saiee.org.za
19-21	PowerGen Africa & Distributech	Johannesburg	www.powergenafrica.com
20-21	Incident Investigation & Management	Johannesburg	roberto@saiee.org.za
20-21	Leadership & Management Principles & Practice	Johannesburg	roberto@saiee.org.za
26	Medium Voltage Electric Cable Jointing & Terminating	Johannesburg	roberto@saiee.org.za
27-38	Fixed Broadband Access Technologies	Johannesburg	roberto@saiee.org.za

June

Movers, shakers and history-makers

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

1 JUNE

1707 England, Wales and Scotland were united to form Great Britain.

2 JUNE

1953 The coronation of Queen Elizabeth II, was the first major international event to be televised.

3 JUNE

1889 The first long-distance electric power transmission line in the United States is completed, running 14 miles (23 km) between a generator at Willamette Falls and downtown Portland, Oregon.

4 JUNE

1784 Élisabeth Thible became the first woman to fly in a hot air balloon, which covered 4 kilometres in 45 minutes, and reached an estimated altitude of 1 500m.

5 JUNE

1981 George Harrison releases "Somewhere in England".

6 JUNE

2009 Palm, Inc. released the Palm Pre smartphone in an attempt to regain market share, after their Treo line of smartphones were overtaken by Apple's iPhone.

7 JUNE

1975 Sony introduced the Betamax videocassette recorder for sale to the public.

8 JUNE

1978 Intel introduced the 16-bit 8086 processor with clock speeds of 10, 8, and 5 MHz. The 8086 would become the basis for the series of processors used in "IBM Compatible" PCs and the x86 family (later marketed under the name "Pentium").

9 JUNE

1993 The motion picture Jurassic Park premiered in Washington D.C., USA. It was the highest grossing film in history at the time, the contributions of Jurassic Park to the field of special effects were perhaps as important as the original Star Wars movie 16 years prior.

10 JUNE

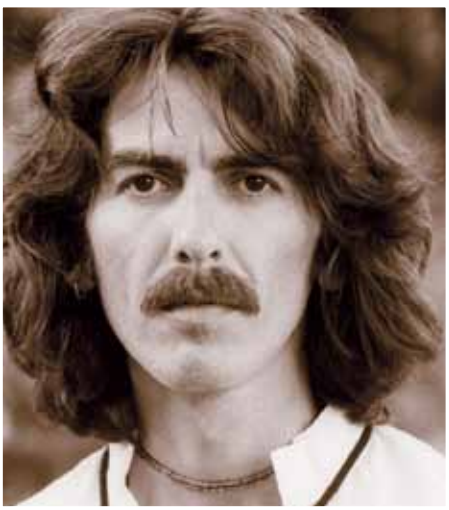
1858 Two ships (the Niagara and Agamemnon) and their support vessels set sail from Keyham Dockyard, UK, headed out to begin work on what would become the first operational Transatlantic cable.

11 JUNE

1978 Texas Instruments Inc. introduced the Speak & Spell, a talking educational toy for children. The device featured the first electronic duplication of the human voice on a single chip of silicon.

12 JUNE

1550 The city of Helsinki, Finland was founded by King Gustav I of Sweden.



13 JUNE

1920 The U.S. Post Office Department ruled that children may not be sent by parcel post (?!?).

14 JUNE

1822 Charles Babbage unveiled his design for a machine that he called the Difference Engine, the first example of a mechanical computing machine.

15 JUNE

1909 The International Cricket Council (ICC), was founded as the Imperial Cricket Conference by representatives from England, Australia and South Africa. It was renamed the International Cricket Conference in 1965, and took up its current name in 1989.

16 JUNE

1903 Henry Ford incorporated the Ford Motor Company with ten investors and $28,000.

17 JUNE

1997 Hackers deciphered computer code written in the Data Encryption Standard, which had been designed to be an impenetrable encryption software.

18 JUNE

1863 American inventor, J.J. Richardson, received a patent for the ratchet wrench with changeable sockets.

19 JUNE

1976 Ten months after being launched from Earth, Viking 1 spacecraft entered into orbit around the planet.

20 JUNE

1963 The so-called "red telephone" link was established between the Soviet Union and the United States following the Cuban Missile Crisis.

21 JUNE

1834 American inventor and businessman Cyrus Hall McCormick patents the reaping machine.

22 JUNE

1633 The Holy Office in Rome forced Galileo Galilei to recant his view that the Sun, not the Earth, is the centre of the Universe.

23 JUNE

1960 The United States Food and Drug Administration declared that Enovid was the first officially approved combined oral contraceptive pill in the world.

24 JUNE

1717 The Freemasons were founded in London.

25 JUNE

1975 After 477 years of Portuguese rule, Mozambique became independent. Samora Machel became president.

26 JUNE

1498 It is believed the toothbrush was invented in China - it was made out of boar bristles.

27 JUNE

1972 The iconic video game company, Atari, was founded by Nolan Bushnell and Ted Dabney.

28 JUNE

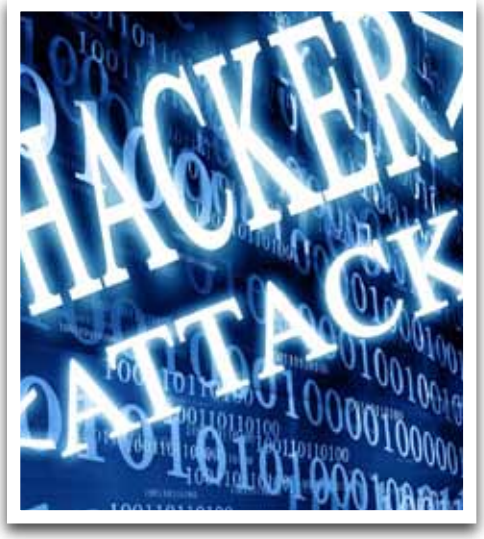
1846 Belgian inventor & musо, Adolphe Sax patented the saxophone.

29 JUNE

2007 Nearly 6 months after it was introduced, Apple's highly-anticipated iPhone went on sale. One million iPhones were sold in only 74 days.

30 JUNE

1937 The world's first emergency telephone number, 999, was introduced in London, U.K. wn



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