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#ThingsThatReallyMatter

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wattnow magazine

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April, with cooler days, is waiting with its icy fingers just around the corner. The trees are changing their green coats for earthy hues of yellow, orange and brown, which spells autumn for the southerners.

This issue of **watt**now features new technological developments and our feature article informs you of some interesting innovations. Read more on page 28.

In the August 2014 issue of **watt**now, I featured a news piece on beach sand being used in increasing the life cycle of Lithium Ion Batteries. On page 42, you can read the paper on this new development.

Page 50 features our first article from the 2014 SAIEE National Student's Project Competition participants. Luan Swart informs us on the fun of recycling.

We say goodbye and thank you to Dr Pat Naidoo when he hands the reigns over to the 2015 President, André Hoffmann. We had a great and extremely fruitful 2014 and I'm sure we are a little closer to a world class South Africa.

Herewith the April issue, enjoy the read.

Minx

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Greetings from SAIEE House

The time has arrived to say thank you. Thank you to all the members for your continued and active membership of the Institute. Thank you to all the members of Council, the leadership and members of Council Committees, the Sections, the Centres, the Administration and all the employees for your contribution of excellence that was served with passion. I have enjoyed every moment of my stay. You spoilt me.

For 2014, we challenged ourselves to enhance the performance of The Institute. We challenged ourselves to seek all opportunities to reduce the cost of service to members and to increase our longer term financial sustainability. We pushed the boundaries on "what gets measured, get done". Our driving strategy is to always administer The Institute for neither profit nor loss and to grow our financial savings for longer term prosperity. For the 2014/2015 financial year, I am delighted to report on the Administration's delivery of world class performance supported by sterling business results. Let the numbers do the talking. **watt**now, definitely world's best. I refer you to the detailed financial statements, approved with no qualification, by the external auditors and Council. On behalf of all the members and past presidents of our 106-year-old Institute, I salute the effort of Council and the Administration; much appreciated and thank you. Keep up the solid performance.

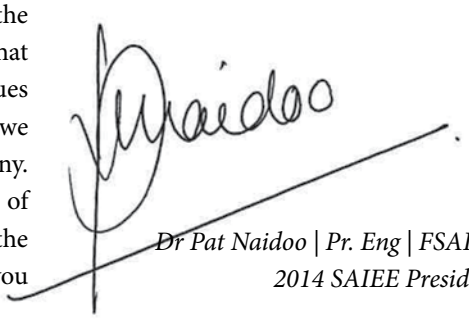
Thank you to all my colleagues at all the institutes locally, regionally, continentally and internationally. Thank you to all my industry and academic work teams at all the sites scattered across the globe. You have made my career as an engineer exciting and enjoyable; my journey in work assignments and academic study continues. Your guidance, coaching and mentorship continue to energize me.

My career as an electrical engineer, from the University of Durban Westville, to the Electricity Supply Commission of South Africa and back to Eskom Holdings South Africa is built on the foundation of the SAIEE. It is of special significance that Honorary Fellow, Dr. Ian McRae, continues to hold my hand and actively leads me as we embark on the next chapter of our destiny. Dr. McRae and I are forever in service of Eskom. We continue our workings in the confidence that we own Eskom. Thank you to the Minister of Public Enterprises, as shareholder representative of Eskom, and the President and Cabinet of the Republic of South Africa, as shareholder of Eskom, for the privilege to serve Eskom and South Africa. South Africa is the sparkling diamond in the global community. We will all work together and polish up that diamond.

On behalf of all the Members, the Past Presidents, the Members of Council, the Chief Executive and Employees, I welcome Mr. Andre Hoffman as the 106th President of the Institute. Best wishes for an enjoyable experience.

I look forward to my continued association with the South African Institute of Electrical Engineers.

Thank you



Dr Pat Naidoo | Pr. Eng | FSAIEE
2014 SAIEE President

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SAIEE PARTNER'S EVENING

Pat Naidoo, 2014 SAIEE President, played host to the 2014 Council Members and their partner's recently. The party took place at Rodizio. John & Priscilla Gossling were shaking their 'booty' on the dance floor and Angus & Michéle Hay danced like teenagers. As Pat said, "I don't have to go to gym tomorrow, I'm making up for it by dancing".

The A-team: Stan, Minx, Gerda & Pat

John & Priscilla shaking their 'booty'.

Mahle & T.C. Madikane

Pat & Maureen Naidoo

Julie & Hermann Broschk

Liz & Wayne Fisher

Gladys & Jacob Machinjike

Patrick & Bianca O'Halloran

Stan & Margaret Bridgens

Sharon & George Debbo

Ian & Melonie McKehnie

Paul v Niekerk, Pat Naidoo & Stan Bridgens

Jacques & Ansie Smith

Sue & Calvin Moseley

Barbara & Tom Eichbaum

Jeanette & Derek Woodburn

Viv Cohen with Minx Avrabos

Phillip Heydenrych & Tracey Human

Celeste Pretorius & Androzette Muller

Fikile & Andries Tshabalala

John & Maria Dal Lago

Michéle & Angus Hay

Bea Lacquet & Viv Crone

John & Priscilla Gossling

Minx & Andreas Avrabos

Louis & Joanne Griffin

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SAIEE Past President's luncheon

Past President's from left front: Bill Calder, Stan Bridgens, Bruce Jackson & Andries Tsabalala and Pat Naidoo. Back row: John Gossling, Mike Cary, Mike Crouch, Viv Crone, Ian McKehnie

Pat Naidoo, Ian McRae and Stan Bridgens

SAIEE hosted the annual Past President's luncheon in Bedfordview recently. Honorary guests, former CEO of Eskom, Dr Ian McRae, graced us with his presence. The former SAIEE Presidents shared memories, laughed and enjoyed each other's company. An afternoon well spent.

Pat Naidoo & Mike Cary

Bruce Jackson & Dr Ian McRae

Androzette Muller, Viv Crone & Bill Calder

George Lindique & Gerda Geyer

Ansie Smith & Jacob Machinjike

Andy Goodwin & Mike Crouch

Andries Tshabalala

ACTOM Electrical Products completes specialised turnkey lighting project at Vodacom's Data Centre

William Blackbeard (left) and Neil van Blerk in one of Vodacom's new Data Centre halls, which are illuminated by recessed high performance T5 light fittings, controlled by individually fitted passive infrared occupancy sensors.

ACTOM Electrical Products, the ACTOM group's distribution arm which incorporates a specialised lighting business unit, recently completed a turnkey lighting project for South Africa's leading cellular network Vodacom for its Data Centre in Midrand, Gauteng, involving designing and providing energy-efficient lighting systems for the interior illumination of the building.

The project, overseen by Taemane Consulting Engineers, Vodacom's consulting electrical engineers, was executed by ACTOM Electrical Products' lighting business unit.

"Our lighting business unit was recently expanded and enhanced, as announced earlier, through the acquisition of leading luminaires designers and manufacturers Genlux Lighting of Germiston, which also provided input on this project both in terms of design expertise and by supplying some of the luminaires used," commented Neil van Blerk, ACTOM Electrical Products' Business Development Executive.

SAIEE recruit Fellow

Peter Fowles, a Senior Member of the SAIEE since 1997 has recently become a "Fellow" of the SAIEE and is seen here (right) receiving his Certificate from the Hon. Vice President of the SAIEE, Max Clarke. He graduated from the University of Natal in 1968 with a B.Sc. in Electrical Engineering and was awarded a scholarship for Overseas Engineering Graduates by the Confederation of British Industry in 1973/74 and trained in Navigational Aids Development in London.

Peter joined the Institute as a Student in 1971 and progressed through the ranks of Graduate, Member and then Senior Member. He was the City Electrical Engineer of Pietermaritzburg for a number of years before moving into private practice and is now the Strategic Adviser to the Association of Municipal Electricity Utilities (AMEU) having been appointed to that role in 2005.

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Ambassador of France in SA visits new Schneider Electric building

Ambassador of France centre with the Schneider Electric South Africa team

Ambassador Elisabeth Barbier, France's Envoy to South Africa, together with delegates from the French Embassy and the Business French Trade Commission, recently visited the new Midrand Schneider Electric Campus (MSEC).

MSEC is an investment that is highly considered and supported by the French government. The visitors were given both a global and local overview of Schneider Electric by the Country President: Southern Africa, Eric Leger, followed by an address about the huge investment made in building.

"Customers are the resource upon which the success of our business depends. Over the years, France has become one of the key development partners of South Africa with objectives that are aligned with our country's priorities and focus on infrastructure, development, promoting sustainable development, strengthening skills and development, as well as higher education and research," says Leger.

The 12,000 square metre facility in Midrand houses the organisation's manufacturing operation, and is also the new home of its mining team, which services the whole of Africa, its Sustainability Development Business unit and Low Voltage Electrical Distribution division, as well as the Schneider Electric Academy and the organisation's data centre consolidation initiatives. Employees from the Capital Hill, Bartlett and Germiston sites, as well as certain personnel from its nearby headquarters, have relocated to this site.

EES Africa (Pty) Ltd acquires Rob Anderson & Associates cc

EES Africa (Pty) Ltd, an ISO 9001:2008 certified company which provides management, engineering and auditing services throughout Africa, has announced its acquisition of Rob Anderson & Associates cc (RAA). RAA is a Durban-based electrical and security engineering company.

Founding CEO of EES Africa, Bradley Hemphill, says: *"In addition to expanding within South Africa, EES is also targeting further office expansion into selected African regions where we have already delivered projects. We strive to be Africa's technology professional service provider of choice."*

Rob Anderson, the founder of RAA 18 years ago, says: *"This is a perfect way to continue servicing our clients in the short and medium term whilst ensuring sustainability in the long term. We are excited about being able to deliver more value to existing clients through EES's national footprint and the other complementary services EES offers."*

Rob Anderson, Founder
Rob Anderson & Associates

The only TRIPLE certified arc flash suit on the market!

AJ Charnaud & Co (Pty) Ltd - a leading global manufacturer of personal protective clothing for protection against radiant heat, electric arc flash, acid, flames, fire and molten metal splash – introduces an advanced electric switching suit that is triple certified.

CHARNAUD presents a complete "head-to-foot" solution to protect workers against the thermal effects of electric arc flash. The Survive-Arc® range of product includes garments ranging from 6 cal/cm² to 100 cal/cm² in various modern styles.

One of the flagship products in the Survive-Arc® range, is the 51 cal/cm² switching suit. The popular, proven and trusted switching suit offers an exceptional weight-to-protection ration, is comfortable to wear and skin friendly.

This Survive-Arc® switching suit is the only triple certified arc flash suit on the market, meeting the requirements for: SANS 724 (South Africa), IEC 61482-2 and (Europe) and NFPA 70E (USA).

Survive-Arc® garments are made from trusted and proven personal protective fabric - permanently Flame Resistant (FR) UltraSoft®, manufactured into hoods, jackets, trousers, gloves and complemented by special footwear and other accessories.

The Survive-ARC® 51 cal/cm² switching suit is guaranteed flame resistant for the life of the garment, and is water washable, making the garment ideal to use for conditions where electric arc flash is a hazard.

Added benefits include excellent breath-ability and high abrasion resistance whilst absorbing sweat and moisture. The cotton composition ensures that the wearer stays cool in summer and warm in winter, increasing comfort for the wearer.

OPENTENDERS.com Welcomes Governments new e-Tender portal

South Africa's business social network connecting entrepreneurs with procurement opportunities – has reacted positively to the prospective launch of Government's e-tender portal, as stated in the Budget Speech last month.

OPENTENDERS Co-Founder & COO, Mnive Nhlabathi said: *"We are excited about this new Government portal as it makes our business easier and does not impact on the extra services our portal offers, such as SMME project finance and skills development."*

During his speech Finance Minister Nhlanhla Nene announced that Government would implement a central tender portal from April this year. Minister Nene said: *"It will be compulsory that all (public) tenders be advertised on this portal, and all tender documents will be freely available there. Tender advertisements in newspapers and the government gazette will be phased out."*

Nhlabathi said: *"OPENTERDERS.com offers four main services, our instant email notifications of tender and procurement opportunities from government and the private sector in South Africa and selected African countries. Project finance for qualifying SMMEs, business-to-business online networking service and training in the area of tendering and procurement.*

"The challenge our business has had with SA government tenders is sourcing tenders from over 600 different Government entities. Our service requires us to load these tenders onto our platform and arrange them into sectors before we can send out the tender notification to our members, as per the sectors they have identified," he said.

WATTSUP

Royal HaskoningDHV appoints Managing Director for South Africa

International Consulting Engineering Company Royal HaskoningDHV has appointed Salani Sithole as Managing Director for its South African operations with effect from 1 March 2015. Mr Sithole has been with the company for six years. With his wide spectrum of knowledge and experience, as well as his thorough understanding of the company Mr Sithole is well placed to further develop the South African operations.

"Ultimately the work we do is servicing end users – the people of South Africa and Africa," says Mr Sithole. *"The people of South Africa are at the heart of the proposed infrastructure development through the Government's National Development Plan. We fully support this plan in order to grow the economy of the country, alleviate poverty and thereby uplift the people of our country."*

Schneider Electric launches puts Easy9 switchgear on SA shelves, supporting local electricians' businesses

Schneider Electric, the global specialist in energy management, has launched Easy9 switchgear, a new range to help electricians with the provision of reliable switchboards in southern African homes and small-sized buildings.

A leader in switchgear technologies since the 1920s, Schneider Electric has engineered Easy9 to be affordable without compromising on safety and reliability.

According to Christo Janse van Rensburg, product manager: final distribution, at Schneider Electric South Africa, Easy9 answers the need for electricians to have access to robust products that are widely available, and will also help them to complete their installations swiftly and professionally.

The range covers miniature circuit breakers, residual current circuit breakers, surge protection devices, comb busbars, and switchboard enclosures.

All Easy9 products are manufactured in IS09000-certified plants belonging to Schneider Electric and are approved by independent authorities as compliant with local electrical safety standards.

"We work closely with electricians worldwide to help bring safe electricity to homes and buildings around the globe. With Easy9 electricians can take pride in delivering the enhanced safety and peace of mind their customers deserve. An advantage too is that it is a high-end device available at a mid-range price," adds Janse van Rensburg.

CONCO partners with City Power on key Sebenza project

Thamie Nyembe (CONCO), Sarel Peens (PSW), Hein Schuld (PSW), Shoneez Dinath (PSW), Francis Ngubeni (City Power), Victor Mogashoa (City Power), Mario Prasti (CONCO) and James Theron (PSW) – during a Sebenza contract meeting held at CONCO's offices.

Consolidated Power Projects (CONCO), through a competitive bidding process, secured the rights to construct the new Sebenza 400/275/88kV substation on behalf of City Power. The timing of this project is crucial as growth in the Sebenza area has increased exponentially without a corresponding upgrade of the aging power infrastructure. This has led to the power grid in the region becoming constrained and, led by demand, City Power is investing heavily in ensuring power supply to all consumers in the area. The project officially kicked off at the end of 2014 and completion is expected at the end of 2017. On completion, an extra 1000MVA is expected to be added to the capacity in the Sebenza area which would dramatically improve reliability and stability of the grid.

The new site adjacent to the Kelvin power station is aimed at improving the quality, reliability and capacity of power supply to the North Eastern region of Johannesburg. *"The Sebenza project will also stimulate the much need economic growth of Johannesburg as one of the hubs of the country. Part of the project's initiative is to take some of the load sitting at Prospect substation transformers to Sebenza substation, which will in turn free some capacity at Prospect substation for development in the south of Johannesburg. Economic numbers confirm that Johannesburg's growth and development has a direct link to Gauteng and the South African economy at large,"* comments City Power's Godfrey Mulaudzi (Capital Execution, Bulk Infrastructure). *"CONCO was selected as the partner of choice for a few reasons, least of which is its extensive experience in construction projects of this magnitude. Other factors considered by City Power included best-of-breed products, delivery timeframe and most importantly, value for money,"* says Clive Pillay, CONCO Business Development Director.

"CONCO with its head office in South Africa, has nearly three decades of electrical construction experience in Sub-Saharan Africa focusing on its core business as a full turnkey electrical, procurement and construction (EPC) contractor. The company has an enviable track record of projects under its belt encompassing the construction of substations and overhead power lines incorporating its own in-house protection and automation design and engineering capabilities. As a subsidiary of the listed entity Consolidated Infrastructure Group (CIG), CONCO not only has the experience but the financial muscle to undertake projects like Sebenza. The project is of such importance to CONCO that it has ring-fenced a special projects division under the leadership of Mario Prasti who is an executive director of the company. Mr Prasti has more than 30 years of experience in the industry and is a logical choice to head up such a multi-disciplinary division," says Mr Pillay.

FLIR Systems announces C2, compact full-featured professional thermal camera

Compact design and radiometric imagery for the fast troubleshooting and powerful reports that building professionals need

FLIR Systems has launched the FLIR C2, the first full-featured, pocket-sized thermal camera designed to help building professionals identify hidden heat patterns that clearly show where problems are, such as sources of energy waste, signs of structural defects, plumbing issues and more.

Its compact and slim design enables the C2 to fit comfortably into any pocket, available for immediate use to uncover invisible building issues and to show customers where potential problems are located. In fact, at 125 × 80 × 24 mm and 130 g, the sleek architecture makes the C2 the most convenient, full-featured thermal camera available on the market. For more information, please visit www.flir.com/C2.

New Technology installed at mining operation

Booyco Electronics, which has been at the forefront of Pedestrian Detection Systems (PDS) in the South African mining industry since 2006, is currently installing its PDS technology at a surface mining operation.

"We have completed the mining operation side and are currently busy with the mineral processing side, wherein lie more challenges and definitely a lot more applications. We have standardised the PDS deployment, i.e. specific zone shaping per vehicle type, which took time analysing the operational requirements," Anton Lourens, Managing Director, says.

Booyco Electronics would typically recommend a 10 m wide warning zone, for example, whereas the client would request that this zone be made smaller. *"One of the definite advantages of our technology is that it is inherently flexible, enabling us to adapt it according to specific requirements and vehicle type,"* Lourens explains.

Booyco Electronics is setting the local standard in PDS technology for surface mining operations. *"Currently there are quite a few systems out there that look at machine-to-machine interaction, but which are not necessarily applicable or effective on the pedestrian side. While we believe that we have the best solution available on the market, the industry-wide implementation of PDS technology remains an issue."*

Lourens says that the Department of Mineral Resources (DMR) has unveiled the draft version of the mandatory Code of Practice for Trackless Mobile Machinery (TMM). *"It deals with TMMs in terms of what measures are expected by the regulator and where this is going. It is already past draft stage, and we believe it will change the immediate market requirements. The DMR has also specified additional testing to ensure that all the products out there comply with the same standards."*

The mining industry has adopted a cautious approach to the implementation of PDS technology. *"There is quite a lot of work still to be done, as we are not yet at the point where these systems can just be switched on. A major challenge is that there are so many stakeholders to deal with, from the mining house and contractor to the vehicle OEM and PDS supplier. Ultimately the client has a specific viewpoint in terms of his operational requirements, so we have to ensure that all these*

stakeholders are accommodated," Lourens says.

While Booyco Electronics is engaged in ongoing discussions with OEMs, "the biggest part of our installations right now is retrofits, as many of our mining customers wish to ensure that they are compliant. That is a challenge by itself, as we often have to relocate existing equipment installed so that the PDS is working properly. The technology is such that ID installation is specific to create a particular application."

While this market sector is highly competitive at the moment, what gives Booyco Electronics its leading edge is its capability to offer a total solution. *"What we have tried to do is create a total scope of supply so that the client does not have to worry about other related safety equipment. For example, we can supply our biometric licensing readers either in conjunction with PDS or as a standalone item."*

Another significant long-term requirement will be the servicing and maintenance of Booyco Electronics' installed PDS base once the technology has been legislated. *"There are huge opportunities for us, particularly in how we have positioned our products in terms of functionality and pricing. What gives us a competitive edge is that our products are designed and manufactured for local conditions and specifications,"* Lourens concludes.

Anton Lourens, Managing Director of Booyco Electronics.

Shamwari-uYilo Launch

A Shamwari Game Reserve, part of Shamwari Group, in conjunction with key partners - South African National Energy Development Institute (SANEDI-Electric Nissan Truck supplier), Powertech (ATV battery supplier), Tracker (Vehicle telematic equipment supplier) and Imperial Green Mobility (ATV fleet supplier) have unveiled their first electric safari vehicle, which is hoped to help make the safari experience greener and more sustainable and also support Shamwari Game Reserve's anti-poaching initiatives.

An electric Nissan truck and an electric vehicle platform provided by SANEDI, will be placed at Shamwari Game Reserve for use by the Conservation Experience Programme. This 20 seater truck will be used to host and transport students as part of Shamwari's behind the scenes experiences, which expose guests to several management tasks and projects in conservation, wildlife, ecology and community incumbencies.

The 'quads', electric all-terrain vehicle platform provided by Imperial Green Mobility, will be used by the rhino anti-poaching programme and possibly a mobile film unit.

The deployment of a dedicated carport that houses a solar array at Shamwari will provide the ideal renewable source of energy for charging the vehicles. It also will provide a completely off-grid solution for a 'green' game reserve experience.

The multi industry partnership forms part of uYilo's activities to pool together various companies and organisations towards introducing e-mobility and its technologies in to South Africa. The intent is to create awareness, test performance of EVs in different roles and determine the feasibly of e-Mobility for the safari industry.

The research and development focus will be on the feasibility of developing a fully South African designed and engineered EV for the safari industry and its potential to champion several other rural industries.

Comments Joe Cloete, Group General Manager for Shamwari Group, *"This is yet another remarkable initiative that helps us in our pursuit to conserve a vanishing way of life and be more self-sufficient whilst offering guests something truly unique. This type of support will be groundbreaking in the fight against poachers. The research and development will help in developing and testing the technology at Shamwari Game Reserve for the safari industry of the future."* wn

Dr Sibongile Gumbi, Joe Cloete Group GM Shamwari, Laurence Geyer & Dr Tsakani Mthombeni

Laurence Geyer, Dr Sibongile Gumbi & Shamwari Group GM Joe Cloete

Joe Cloete Group GM Shamwari, Laurence Geyer, Dr Sibongile Gumbi, Dr Tsakani Mthombeni, Rodney Visser & Dirk Odendaal

Smart Homes to Lead with 294 Million Connected things in use in 2015

Increasing urbanisation is putting unprecedented pressure on city mayors to constantly balance the challenge of resource constraints against environmental sustainability concerns. Gartner, Inc. estimates that 1.1 billion connected things will be used by smart cities in 2015, rising to 9.7 billion by 2020.

Smart homes and smart commercial buildings will represent 45 per cent of total connected "things" in use in 2015, due to investment and service opportunity. Gartner estimates that this will rise to 81 per cent by 2020. *"Smart cities represent a great revenue opportunity for technology and services providers (TSPs), but providers need to start to plan, engage and position their offerings now,"* said Bettina Tratz-Ryan, research vice president at Gartner.

Gartner defines a smart city as an urbanised area where multiple sectors cooperate to achieve sustainable outcomes through the analysis of contextual, real-time information shared among sector-specific information and operational technology systems.

"The majority of Internet of Things (IoT) spending for smart cities will come from the private sector. This is good news for TSPs as the private sector has shorter and more succinct procurement cycles than public sectors and cities," said Ms Tratz-Ryan.

Residential citizens will lead the way

SMART CITY SUBCATEGORY	2015	2016	2017
Healthcare	9.7	15.0	23.4
Public Services	97.8	126.4	159.5
Smart Commercial Buildings	206.2	354.6	648.1
Smart Homes	294.2	586.1	1,067.0
Transport	237.2	298.9	371.0
Utilities	252.0	304.9	371.1
Others	10.2	18.4	33.9
Total	1,107.3	1,704.2	2,674.0

Table 1. Connected Things Installed Base Within Smart Cities (in Millions). Source: Gartner (March 2015)

by increasingly investing in smart-home solutions, with the number of connected things used in smart homes to surpass 1 billion units in 2017. Connected things include smart LED lighting, healthcare monitoring, smart locks and various sensors for such things as motion detection or carbon monoxide. Smart LED lighting will record the highest growth of IoT consumer applications, from 6 million units in 2015 to 570 million units by 2020.

Light will move from being an illumination source to a communications carrier incorporating safety, health, pollution and personalised services. *"Homes will move from being interconnected to become information- and smart-enabled, with an integrated services environment that not only provides value to the home, but also creates individual-driven ambience. The home will become the personal space that provides assistance or personal concierge experiences to the individual,"* said Ms Tratz-Ryan.

In addition to residential IoT investments, there are a number of IoT deployments for on-street and off-street parking guidance, road traffic guidance and traffic flow metering. A quick win within transport is the reduction of traffic congestion. California and the UK are already implementing radio receivers or sensors that are embedded on a section of highway to diagnose traffic conditions in real time. Another successful use of IoT in the city is smart parking. The city of Los Angeles, for example, has been implementing new parking meters, parking space vehicle sensors, real-time parking guidance and a full parking management system to influence demand during peak times.

"Electric mobility, charging stations and embedded IoT will generate additional IoT opportunities in smart cities," said Ms Tratz-Ryan. "This could be, for example, IoT in vehicles, or vehicle batteries sensing and communicating with the driver, or the next charging station to negotiate charging terms." New and transformative business environments and ecosystems will emerge. For instance, automobile companies are investing in streetlights with charging stations embedded in the post to reduce the infrastructure investment for automobile charging stations. Sensors allow these companies to identify vacant charge-parking spaces for their customers, communicated via mobile applications and on-board systems. They will also be the facilitators of the payment and transaction for ease of use.

While investment in IoT hardware is fundamental for smart cities, the real revenue opportunity for TSPs is in the services and analytics sector. *"We expect that by 2020, many IoT TSPs will have grown their hardware revenues through services and software by more than 50 per cent,"* said Ms Tratz-Ryan. Gartner also estimates that smart-home security and safety will represent the second-largest service market by revenue in 2017, and that by 2020, the smart healthcare and fitness market will have grown to nearly $38 billion.

"We expect commercial IoT implementations to be used across multiple industries, such as smart energy, environmental service or journey planning, which will offer TSPs the opportunity to monetise IoT by building IoT-related service models," concluded Ms Tratz-Ryan. *"Significant value contribution will come from information and data analytics of IoT, which connect services to third-party transactions and billing records, as well as enabling subscriptions or on-demand services. This enables a multidimensional value chain with different partners."*

More detailed analysis is available in the Gartner report "Smart Cities Will Include 10 Billion Things by 2020 — Start Now to Plan, Engage and Position Offerings". Additional analysis on the impact of the IoT is available in the Gartner Special Report The Internet of Things Enables Digital Business," a research collection focused on how the IoT will create new opportunities and challenges for enterprises. wn

Curro schools refuse to "load shed" education

Curro schools are using generators, supplied and installed by Master Power Technologies, to ensure their electronic learning environments are not "left in the dark" when the mains power is cut.

Curro owns a number of private schools around South Africa that are dedicated to providing a world-class education to all grades at affordable prices. The Curro vision is to deliver quality education based on international best practices. Currently the group operates more than 40 schools schools, with more in the pipeline.

Based on international best practise and the need for sustainable educational processes, Curro has embarked on a process of moving away from paper-based education where possible. It is therefore making use of tablet computers to ensure its learners and teachers have access to all the information they require.

These tablet computers link to each school's computer network via a wireless network which is also dependant on electricity to function properly. However, despite the tablets having a built in battery to sustain them, the wireless routers instantly switch off during a power outage, leaving the learners without communications to the schools servers and the information they need to access.

"Unfortunately, tablets still require electricity to recharge" says Robert Brandt, regional sales manager at Master Power Technologies. *"Batteries run out of power and with rolling blackouts becoming a fact of life once again, Curro has to ensure both the tablets and the electronic equipment they*

link to are not rendered useless each time the power dies."

To ensure learners and teachers have access to the resources they need at all times, Curro retained Master Power Technologies to install generators at its schools to ensure a stable supply of power to all its computing requirements. Brandt says four schools had generators installed before the end of 2014, and the project will continue in 2015.

Paperless education is the future as all the learners need is a tablet. All their textbooks can be downloaded to the devices along with their class work, making it easier to keep abreast of everything on the syllabus and to collaborate with each other. However, electronic devices and Internet access depend on electricity. Without a stable electrical supply, the tablets become useless after only a few hours. With the assistance of Master Power Technologies, Curro schools are embracing the future, whilst ensuring teachers and their learners are not left in the dark when the lights go out. wn

New solar PV back-up solution launched

A new addition to the Soltra range of solar photovoltaic (PV) energy generating solutions has been launched by Powermode, the Johannesburg-based power provisioning specialist.

The high capacity Soltra GTB 10 000, which complements the successful Soltra GTB 3000 in the Powermode lineup, is a 10 kVA capacity, utility grid-connected, hybrid solar PV power system targeted at small-to-medium-size enterprise and domestic markets.

"The Soltra GTB 10 000 is designed to help businesses and households cope with load-shedding and power outages, functioning as a back-up rather than a complementary power source in these eventualities. This sets it apart from conventional solar PV power systems," says Jack Ward, Powermode MD.

He says the GTB 10 000 is aimed at larger-sized installations where it is capable of dealing with bigger loads with a greater degree of backup battery autonomy. *"It is also able to obviate the need for costly diesel generators in noise-conscious environments,"* notes Ward, who adds that it's ideal for rooftop installation.

The new unit features an integrated charge controller and inverter and can be operated in three modes: linked to the electricity grid (grid-tied); as grid-tied unit with battery backup (in a hybrid configuration); or as a stand-alone hybrid unit.

Back-up is facilitated by the GTB 10 000's built-in electronic monitoring system which automatically draws current from its storage batteries should the mains power fail. *"Switchover time is a rapid 15 milliseconds,"* says Ward, adding that this is designed to protect sensitive computer and other delicate equipment from power 'brownouts' and 'spikes' common to South Africa's unpredictable electricity supply.

The computerised system is also able to automatically prioritise its power delivery channels; to back-up batteries to facilitate recharging during daytime, for example, or to appliances during user-definable peak periods. At other times the system will automatically juggle power sources between, solar, batteries and the grid to meet changing demands based on individual consumption dynamics.

"In addition, the unit is also able to feed power back into the utility grid - legislation permitting - slowing or even reversing consumption meters

to significantly minimise costs to the consumer."

Ward says the Soltra GTB 10 000 and its companion, the popular GTB 3000, represent a new-generation of cost-effective modular solar solutions requiring a comparatively low initial investment.

"The units can be expanded in terms of capacity to meet future demands. They can also be configured as three-phase solutions to meet commercial and industrial users' requirements," he explains.

With the escalating cost of utility power and the imminent arrival of 'smart metering' systems which will allow municipal authorities to bill for electricity consumption at much higher rates during peak periods in a process known as time-of-day-billing, Ward maintains that solar solutions will soon be on par with conventional power from the perspective of amortised installation and maintenance costs.

"This is particularly relevant as prices are expected to rise exponentially for power consumed during peak periods in the near future," he adds. wn

Jack Ward
Managing Director
Powermode

Digital Skills Academy Launches International BSc programmes in Africa

Digital Skills Academy, a leading international organisation delivering high-level cloud-based ICT Degrees and courses for students, post-graduate students, ICT professionals, marketeers and business, has opened in Africa.

The Academy, headquartered in Dublin's Digital Hub in Ireland, is being established in Johannesburg to deliver advanced ICT training to meet local enterprise needs in South Africa.

The Academy is known for offering one of the world's first international undergraduate online BSc degree programmes in integrated digital technology, digital business and digital design. Its BSc (Honours) in Digital Technology, Design and Innovation is now accepting registrations in South Africa for the next one-year course, which starts in October this year. Up to 50 students from South Africa will be accepted into the course, which blends online eLearning and virtual team-working with local project-team workshops and global peer groups. They will be joined by international participants from countries including the UK, Ireland and Mexico.

Digital Skills Academy CEO Paul Dunne says this format is proving highly effective for working professionals who must continually upskill in line with changing technologies and market demands, but who may not have time available to attend classes daily.

By delivering the learning experience online, and supporting virtual collaboration, the Academy enables students to get the best of after-hours flexibility and personal interaction with their teams. Dunne notes that research by IBM found that companies using eLearning strategies can boost productivity by up to 50%, while the Research Institute of America has found that eLearning is not just cost-and time-efficient; it also increases information retention rates by up to 60%.

"We conducted extensive local research before launching in South Africa, and identified a need for local ICT professionals to access effective ongoing professional development in a format that works within their time constraints. This need for advanced ICT training extends beyond ICT professionals – we have found that sales and marketing professionals, entrepreneurs and business managers working in the ICT field also had an unmet need for further education and training," he says.

With an estimated ICT skills shortage of between 30,000 and 70,000 professionals in South Africa and many ICT professions on the National Scarce Skills list, private sector partners struggling to attract and retain high level ICT skills can also collaborate with Digital Skills Academy to develop innovation projects and simultaneously upskill their employees and address their specific ICT skills shortfalls.

Digital Skills Academy has also launched its International Industry Partner Programme in South Africa, to assist in closing the soft skills and experiential skills gaps in the country's IT sector. This programme, which includes top international companies such as Oracle, Ernst & Young, O2 and BT, enables industry leaders to participate in closing these skills gaps. Course participants work on Industry Partner projects throughout their degree programmes, allowing them to graduate as work ready job candidates equipped with real world experience and the soft skills often lacking in IT graduates. These partnerships give Industry Partners the opportunity to invest their CSI funding in areas that benefit the sector they operate in, as well as allowing them to identify and audition potential talent for their businesses, while also providing an innovation pipeline for new digital products and services.

For information about the Digital Skills Academy courses and Industry Partner Programme, contact JHB 010 500 9309 or Cape Town 021 300 9257 or visit www.digitalskillsacademy.com/za

No quick fix to power crisis

While stakeholders scramble to 'put out fires' and keep the lights on, SAAEA has warned that there can be no quick fix to South Africa's power crisis.

Speaking ahead of the POWER-GEN Africa and DistribuTECH Africa power generation and distribution conferences to be held in Cape Town later this year, Alwyn Smith, spokesman for the South African Alternative Energy Association (SAAEA), says any fix will take years.

"We have left it too late. There are few, if any, solutions that could be put in place to turn the situation around in the short term. To be fair, this is not just the fault of Eskom. Eskom has been warning for years that this would happen unless more budget was allocated for maintenance," says Smith.

In the longer term, he says, energy sources such as nuclear, solar and wind power have the potential to deliver cost-effective power on a large scale. But currently, independent power producers and alternative energy plants deliver too little total capacity to significantly improve the power situation.

A nuclear reactor that could generate a significant amount of power could take nearly a decade to build. The region has an abundance of gas which could cost-effectively run turbines, he says, but this too would take time to implement. *"There is no quick fix. The best we can do right now is to bite the bullet and try to catch up on overdue maintenance on our generators."*

However, he believes that widespread net metering could alleviate the load shedding headaches facing businesses and citizens, and could go some way toward easing pressure on the national grid. Net metering allows residential customers and businesses to install solar panels at their premises and store excess power within the grid, in return for 'power credits' when needed. South Africa has been slow to move on creating an environment that allows for widespread net metering, says Smith. He speculates that this is partly due to municipalities' reluctance to give up the profits they make on reselling Eskom power. *"Net metering would relieve plenty of the current issues, but now the question is – how to implement it quickly? This is not the sort of thing you can implement overnight. You need the right policies and systems in place,"* says Smith.

The African power sector and the role of alternative energy in South Africa will be among the issues under discussion at the upcoming POWER-GEN Africa and DistribuTECH Africa conference and expo at the CTICC from 15 – 17 July this year.

The events will brings together the world's leading power equipment suppliers along with companies developing power infrastructure in Africa. Visit www.powergenafrica.com and www.distributechafrica.com.

How Africa can attract foreign and local investment for its power projects

"Investing in the power sector in Africa can be very lucrative and we have the success stories to prove it", says Evan Schiff, event director of African Utility Week, taking place in Cape Town from 12-14 May. During the largest annual power and water conference and expo on the continent, a high-level Finance & Investment Forum will specifically focus on project finance, risk management, IPPs and case studies.

Says Evan Schiff: *"$42 billion a year will be required to meet Africa's energy demand by 2040, including a private-sector financing increase of up to ten times the current levels. In order to achieve this governments and business must work together and fresh approaches will be vital. Private equity fund raising for Africa increased by 136% in 2013 to US$3.3bn, up from US$1.4bn a year earlier. Greater private sector participation and competition has been encouraged through power sector reform and long-term power purchase agreements through the state utility or other credible off-takers. IPPs are considered a solution to persistent supply constraints. It is also exciting to see that intra-African investment is gaining momentum. African investors nearly tripled their share of FDI projects over the last decade, from 8.0% in 2003 to 22.8% in 2013 according to EY's latest attractiveness survey."*

The Finance & Investment Forum will also have a special focus on renewables and innovative ways of financing green energy while creating sustainable jobs. Evan Schiff adds: *"with the African Development Bank SE4LL Fund recently confirming a $777,000 preparation grant to support a 72MW solar power plant project to become the first renewable IPP in Cameroon, it shows that there are creative investment vehicles and initiatives out there for energy projects on the continent that previously were considered too marginal for project financing".*

Earn CPD Credits

New Technological Developments in the world

In the ever-changing technology climate in which we currently find ourselves, is it hard to believe that scientists, scholars and engineers can still develop something new. **watt**now takes a look at just a few remarkable new inventions.

BY | MINX AVRABOS

DESIGNING SELF-HEALING CONCRETE WITH SHAPE MEMORY

Roads that self-repair, bridges filled with first-aid bubbles, buildings with arteries… not some futuristic fantasy but a very real possibility with 'smart' concrete.

Skin is renewable and self-repairing – our first line of defence against the wear and tear of everyday life. If damaged, a myriad of repair processes spring into action to protect and heal the body. Clotting factors seal the break, a scab forms to protect the wound from infection, and healing agents begin to generate new tissue.

Taking inspiration from this remarkable living healthcare package, researchers are asking whether damage sensing and repair can be engineered into a quite different material: concrete.

Their aim is to produce a 'material for life', one with an in-built first-aid system that responds to all manner of physical and chemical damage by self-repairing, over and over again.

Self-healing materials were voted one of the top-ten emerging technologies in 2013 by the World Economic Forum, and are being actively explored in the aerospace industry, where they provide benefits in safety and longevity. But perhaps one area where self-healing might have the most widespread effect is in the concrete-based construction industry.

Concrete is everywhere you look: in buildings, bridges, motorways, and reservoir dams. It's also in the places you can't see: foundations, tunnels, underground nuclear waste facilities, and

oil and gas wells. After water, concrete is the second most consumed product on earth; tonne for tonne, twice as much is used annually as steel, aluminium, plastic and wood combined.

But, like most things, concrete has a finite lifespan. *"Traditionally, civil engineering has built-in redundancy of design to make sure the structure is safe despite a variety of adverse events. But, over the long term, repair and eventual replacement is inevitable,"* said Professor Abir Al-Tabbaa, from the Department of Engineering and the lead of the Cambridge component of the research project.

The UK spends around £40 billion per year on the repair and maintenance of existing, mainly concrete, structures. However, repairing and replacing concrete structures cause disruptions and contribute to the already high level of carbon dioxide emissions that result from cement manufacturing. What if the life of all new and repaired concrete structures – and in fact any cement-based material, including grout and mortar – could be extended from an average of several decades to double this, or more, through self-healing?

In 2013, researchers in Cambridge joined forces with colleagues at the Universities of Cardiff (who lead the project) and Bath to

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create a new generation of 'smart' concrete and other cement-based construction materials.

"Previous attempts in this field have focused on individual technologies that provide only a partial solution to the multi-scale, spatial and temporal nature of damage," explained Al-Tabbaa. By contrast, this study, funded by the Engineering and Physical Sciences Research Council, provides an exciting opportunity to look at the benefits of combining several 'healthcare packages' in the same piece of concrete.

"Like the many processes that occur in skin, a combination of technologies has the potential to protect concrete from damage on multiple scales – and, moreover, to do this in a way that allows 'restocking' of the healing agents over time," she added.

Mechanical damage can cause cracks, allowing water to seep in; freezing and thawing can then force the cracks wider. Loss of calcium in the concrete into the water can leave decalcified areas brittle. If fractures are deep enough to allow water to reach the reinforcing steel bars, then corrosion and disintegration spell the end for the structure.

The team in Cambridge is addressing damage at the nano/microscale by developing innovative microcapsules containing a cargo of mineral-based healing agent. It's like having a first-aid kit in a bubble: the idea is that physical and chemical triggers will cause the capsules to break open, releasing their healing and sealing agents to repair the lesion.

"While various cargo and shell materials have been developed for other applications, from food flavouring and pharmaceuticals to cosmetics and cleaning products, they are not generally applicable to cement-based matrices and are far too expensive for use in concrete, which is why we have needed to develop our own," explained Al-Tabbaa.

Another challenge is to make sure the capsules will be strong enough to withstand being mixed in a cement mixer, yet fragile enough to be broken open by even the smallest of fractures. Innovative capsule production techniques are being investigated that can be scaled up to deliver the huge volumes of capsules required for use in construction.

In parallel, the team in Bath is investigating healing at the mid-range micro/mesoscale with spore-forming bacteria that act as tiny mineral-producing factories, feeding on nutrients added to the cement and facilitating calcite precipitation to plug the cracks in the concrete. Different techniques for housing and protecting the bacteria and nutrients within the cement matrix are being investigated, including the capsules that are being developed at Cambridge.

The University of Cardiff researchers are engineering 'shape memory' plastic tendons into the cement matrix to close large cracks at the larger meso/macroscale through triggering of the shrinkage of the tendons by heat.

The project team are then collectively addressing repeated damage through the creation of vascular networks of hollow tubes, like the circulatory system of a living organism, so that self-healing components can continually be replenished.

As the Cambridge researchers move closer to the best formulations for the microcapsules, they have begun collaborating with companies who can scale up the production to the levels required to seed tonnes of cement. Meanwhile, the three research groups are also beginning to test combinations of each of their techniques, to find the best recipe for maximum self-healing capability.

Towards the end of 2015, with the help of industrial partners, field trials will test and refine the most promising combined systems in a range of real environments and real damage scenarios. This will include testing them in non-structural elements in the Department of Engineering's new James Dyson Building.

"This is when it will become really exciting," said Al-Tabbaa. *"To be truly self-healing, the concrete needs to be responsive to the inherently multi-dimensional nature of damage, over long time scales. We want concrete to be a material for life that can heal itself again and again when wounded."*

RESEARCHERS USE UNMANNED AIRCRAFT TO INSPECT ENERGY PIPELINE ROUTE IN RURAL VIRGINIA

The first Mid-Atlantic Aviation Partnership based at Virginia Tech conducted a test flight using a fixed-wing unmanned aircraft to inspect an energy pipeline route; a piloted chase plane followed behind to ensure safety beyond the ground observers' sight line. The flight was a step toward making aerial inspections of energy pipelines safer and more economical, researchers say.

The flight lasted about 90 minutes and covered about 11 miles over a Colonial Pipeline Company right of way near Fork

Union in rural Virginia. The mission was overseen by the Mid-Atlantic Aviation Partnership, Virginia Tech, and supported by the Pipeline Research Council International, a collaborative research arm of the energy pipeline industry.

American Aerospace Technologies Inc., a Pennsylvania-based company that creates Unmanned Aircraft Systems for industry use, provided and piloted the test aircraft - an RS-16 UAS - which can be equipped with a special sensor package to identify threats to pipeline integrity. A piloted chase helicopter followed the unmanned aircraft for safety purposes.

"Aerial inspection of energy pipelines is federally required and typically performed using manned aircraft flying at low altitudes," said David Yoel, chief executive officer of American Aerospace Technologies Inc. *"If we validate unmanned aircraft technologies, we can reduce risks to pilots and the public, and more efficiently protect the country's critical infrastructure."*

Results thus far show that it is possible to use unmanned aircraft to conduct pipeline patrols, Yoel said. Ultimately, the Federal Aviation Administration will decide whether unmanned aircraft operations for utility inspections have met safety standards.

Virginia Tech, with academic partners Rutgers University and the University of Maryland, operates one of six FAA-approved unmanned aircraft testing programs in the nation under the banner of the Mid-Atlantic Aviation Partnership.

"This is important because it represents one of the first chase plane flights using a fixed-wing unmanned aircraft system for infrastructure inspections," said Rose Mooney, executive director of the Mid-Atlantic Aviation Partnership, headquartered at Virginia Tech's Institute of Critical Technology and Applied Science. *"We received permission from the FAA to oversee flights of the unmanned aircraft with a chase plane. Chase aircraft observations will provide the FAA and the pipeline industry with a better understanding of UAS flight safety requirements for flights that involve long duration and great distances, such as pipeline inspections."*

The research is part of Pipeline Research Council International's Right Of Way Automated Monitoring (RAM) Project, which is looking at innovative technologies to improve and automate pipeline monitoring in the United States and internationally.

Energy pipelines are mainly buried underground. Damage may inadvertently occur during land clearing, construction, or farming work.

One of the objectives of the RAM project is to enhance aerial surveillance of the right of way through unmanned aircraft and other techniques, with the ultimate goal being continuous, real-time detection and reporting of machinery threats to pipeline integrity.

"As an entrepreneur who has been dedicated to using unmanned aerial technology to inspect infrastructure since 2008, it is my hope it can be used in remote and rural areas as early as 2017," Yoel said. *"We need to do more work and additional testing to make sure we can deliver this service. I believe it is possible to improve safety and efficiency above today's levels."*

Organizers say a new round of testing will be underway later this spring.

The RS-16 aircraft has a wingspan of nearly 13 feet, a 25-pound payload capacity, and is capable of flying more than 12 hours before refuelling. During future flight tests, the aircraft will be equipped with mapping capabilities and a sophisticated sensor

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package to detect threats to the pipeline.

ENGINEERING A MULTIPURPOSE, ENVIRONMENTALLY FRIENDLY DAM

Researchers in the Philippines are using

green engineering to develop a low-cost dam that aims to prevent flooding, generate electricity, and help end food and water shortages.

Designed by a team from the University of the Philippines Diliman (UPD), the "Gaia dam" could control or prevent flooding from torrential rains on farms, along rivers and in coastal areas by minimising and re-routing the flow of water through storm runoff pathways.

Its main structural frame consists of gabion cages: wire mesh baskets filled with sturdy columns of recycled concrete cylinders or rocks, which provide stability against the hydrostatic forces pushing through the dam. Like a miniature hydroelectric power plant, the Gaia dam could divert water into the powerhouse where turbines are installed, yet do so less expensively than the concrete dams that are usually used for this purpose.

In addition, the dam is designed to release proprietary proteins and enzymes when water passes through its specialised core. Its proteins are designed to help crops absorb soil nutrients and minerals, while its enzymes would gradually dissolve the exoskeletons of insects and other pests that attack the crops, thereby acting as natural fertilizers and pesticides.

Thus, the Gaia dam has the potential to help in the production of organic crops. The UPD research team is now exploring the possibility of creating a spin-off company to produce the Gaia dam and is seeking partners to license its technology. Meanwhile, the team plans to further develop the technology and build prototypes for Filipino farms.

TOWARDS "PRINTED" ORGANIC SOLAR CELLS AND LEDS

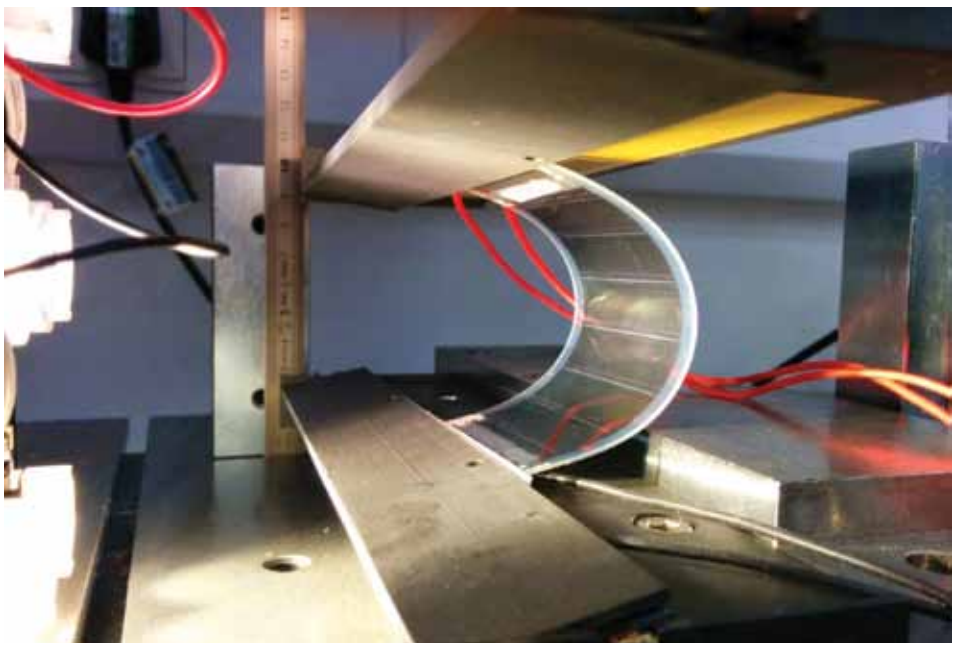
Flexible optoelectronic devices that can be produced roll-to-roll – much like newspapers are printed – are a highly promising path to cheaper devices such as solar cells and LED lighting panels. Scientists from "TREASORES" (Transparent Electrodes for Large Area Large Scale Production of Organic Optoelectronic Devices) project present prototype flexible solar cell modules as well as novel silver-based transparent electrodes that outperform currently used materials.

In order to make solar energy widely affordable scientists and engineers all over the world are looking for low-cost production technologies. Flexible organic solar cells have a huge potential in this regard because they require only a minimum amount of (rather cheap) materials and can be manufactured in large quantities by roll-to-roll (R2R) processing. This requires, however, that the transparent electrodes, the barrier layers and even the entire devices be flexible. The EU-funded project "TREASORES" aims at developing and demonstrating technologies to facilitate R2R production of organic optoelectronic devices such as solar cells and LED lighting panels.

The TREASORES project recently completed its mid-term review and has already achieved some major milestones. The international team that comprises researchers from 19 labs and companies from five European countries has, for instance, developed an ultra-thin transparent silver electrode that is cheaper than, and outperforms, currently used indium tin oxide (ITO) electrodes.

The researchers could also demonstrate a record efficiency of 7 % for a perovskite-based solar cell using such novel transparent electrodes. What's more, their first fully R2R-produced solar cells already achieved commercially acceptable lifetimes when tested "in the field". The next step is to scale up and improve the most promising technologies identified so far, say, to produce barrier materials and transparent electrodes in larger quantities, i.e. in rolls of more than 100 meters in length.

In its second half, the TREASORES project will also continue to develop other promising technologies such as transparent and flexible electrodes based on woven



A flexible organic solar cell from TREASORES project undergoing mechanical testing: the cell is repeatedly flexed to a 25 mm radius whilst monitoring its performance. Such cells have shown lifetimes in excess of 4000 hours. Credit: National Physical Laboratory (NPL), England

fabrics, nanowires and carbon nanotubes (CNTs).

The new materials have been thoroughly tested using special instruments for mechanical, electrical, and optical testing and their performance in practical devices has been characterized e.g. for lifetime and quality of illumination. Silver nanowires were used to produce flexible electrodes with a sheet resistance of below 20 Ohms/square – a measure for the electrical conductivity of thin films – and an optical transmission of 80%. Copper nanowires were even better, yielding a sheet resistance of below 10 Ohms/square and an optical transmission of 90% on glass.

They clearly outperformed current ITO electrodes, which typically have sheet resistance values of 100 Ohms/square and above for such high transparency. Solar cell devices with an energy conversion efficiency of over 3% have been made on these substrates with copper electrodes.

CNT electrode performance likewise made significant progress during the first half of the project, reaching a sheet resistance of 74 Ohms/square with an optical transmission of 90%. The organic solar cells that were produced with these electrodes reached an energy conversion efficiency of 4.5%.

All these electrode technologies suffer, however, to some extent from waviness or roughness and require a flattening layer to allow defect-free deposition of optoelectronic device stacks. That's why the researchers set out to develop yet another electrode technology, which uses thin silver (Ag) films sandwiched between two metal oxide (MO) layers. These films turned out to be much flatter. MO/Ag/MO electrode stacks provide a sheet resistance of 6 Ohms/square with an optical transmission of 85% and allowed the construction of more efficient optoelectronic devices compared to the other electrode technologies, which is due, at least in part, to the low peak-to-valley roughness of about 20 nm. With these "ultra-flat" electrodes record efficiencies of up to 7% were obtained for organic solar cells using commercially available materials for light harvesting. Using the very same electrode materials, the team achieved 17 lm/W for the production of white light organic LEDs (OLEDs) and more than 20 lm/W for organic light-emitting electrochemical cells (OLECs).

ENGINEERS STUDY THE BENEFITS OF ADDING A SECOND, SMALLER ROTOR TO WIND TURBINES

Hui Hu picked up a 3-D printed model of a typical wind turbine and began explaining two problems with the big, tall, three-bladed machines.

First, said the Iowa State University Professor of Aerospace Engineering, check out the base of each blade. They're big, round structural pieces. They're not shaped like an airfoil. And so they don't harvest any wind, reducing a turbine's energy harvest by about 5 percent.

Second, the big blades disturb the wind, creating a wake behind them and reducing the energy harvest of any downwind turbines. Hu said a turbine sitting in the slipstream of another could lose 8 to 40 percent of its energy production, depending on conditions.

Those losses prompted Hu and Anupam Sharma, an Iowa State Assistant Professor of Aerospace engineering, to look for a

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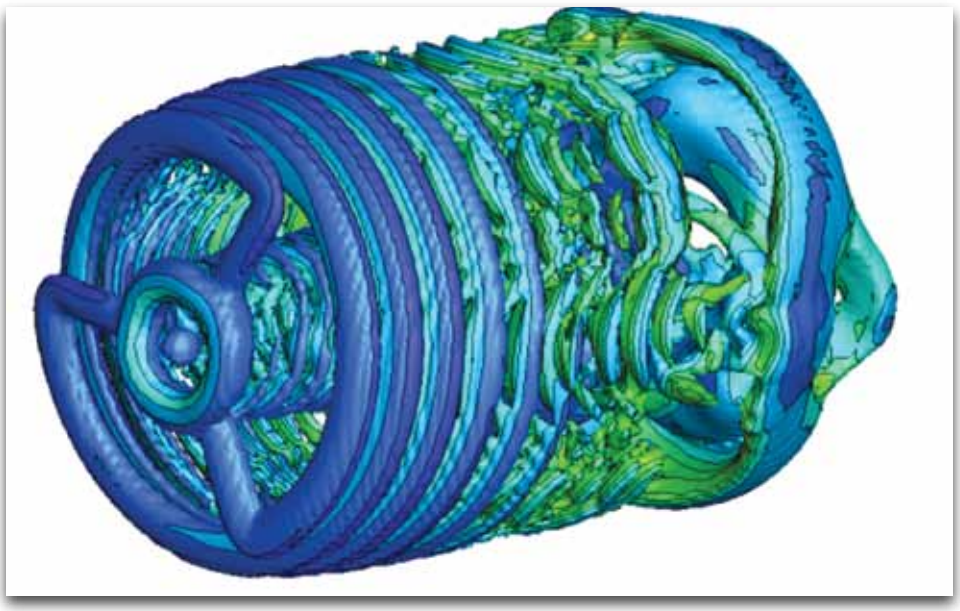


This large eddy simulation shows air going through a dual-rotor wind turbine. (The three lines at the front are the blades of the main rotor; the secondary rotor is embedded in the ring near the centre.) By tailoring the rotation and turbulence behind the turbine, Iowa State engineers say the dual rotors can boost the recharge of wind loads. And that can improve the energy harvest of wind farms. Credit: Anupam Sharma

solution. Their data suggest they've found one.

What they've done is add a smaller, secondary rotor. One model had three big blades and three mini-blades sprouting from the same hub. The other had a small, secondary rotor mounted in front of the big rotor; the two sets of blades separated by the nacelle that house the generating machinery on top of the tower. *"To try to solve these problems, we put a small rotor on the turbine,"* Hu said. *"And we found that with two rotors on the same tower, you get more energy."*

Using lab tests and computer simulations, Hui and Sharma have found those extra blades can increase a wind farm's energy harvest by 18 percent. *"These are fairly mature technologies we're talking about – a 10 to 20 percent increase is a large change,"* Sharma said. The Iowa Energy Center awarded Hu and Sharma a one-year, $116,000 grant to launch their study of dual rotors. (The two won the energy center's 2014 Renewable Energy Impact Award for the rotor project.) The National Science Foundation is supporting continued studies with a three-year, $330,000 grant.

Hu is using experiments in Iowa State's Aerodynamic/Atmospheric Boundary Layer Wind and Gust Tunnel to study the dual-rotor idea. He's measuring power outputs and wind loads. He's also using technologies such as particle image velocimetry to measure and understand the flow physics of air as it passes through and behind a rotating turbine.

How, for example, is the wake distributed? Where are the whirling vortices? How could the wake be manipulated to pull down air and recharge the wind load?

Wei Tian, a postdoctoral research associate, together with Zhenyu Wang and Anand Ozbay who are doctoral students, are assisting Hu.

Sharma is using advanced computer simulations, including high-fidelity computational fluid dynamics analysis and large eddy simulations, to find the best aerodynamic design for a dual-rotor turbine. Where, for example, should the second rotor be located? How big should it be? What kind of airfoil should it have? Should it rotate in the same direction as the main rotor or in the opposite direction? Two doctoral students, Aaron Rosenberg and Behnam Moghadassian, are assisting Sharma.

Hu said Sharma's computer modelling will drive the design of the next generation of experimental models he'll take back to the wind tunnel. *"We hope to get even better performance,"* Hu said.

The idea to look for better performance by adding a second rotor to wind turbines came from a previous study on how hills, valleys and the placement of turbines affected the productivity of onshore wind farms. One thing they learned was that a turbine on flat ground in the wake of another turbine loses a lot of power production. That presented Hu and his collaborators with another problem to study. *"When we study more, we learn more," Hu said. "And therefore we find more problems. In research, the most difficult thing is not solving the problem, it's finding the problem."* wn

Looks can be deceiving.
And often DEADLY.

This case was the subject of legal action.
The following distributors placed statements of apology and product recall in various South African publications:

- **Ridgeway Builders Centre trading as Morgan's Hardware of Lenasia, Gauteng.**
- **Wirelec Industries of Devland and Micromatica of Lenasia, Gauteng.**

Counterfeiting and selling non-compliant products and services are criminal acts.

Be Safe. Always ask for and use SAFEhouse members' products and services:

SAFE HOUSE™
Suppliers you can trust

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 this proliferation of dangerous 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
Cell: 083 414 4980 | Tel: 011 396 8140
Email: pierren@safehousesa.co.za

www.safehousesa.co.za

As at 06.03.2015

Composite materials for Transmission and Distribution Structures

Recognising the growing regional demand for safe and reliable electrical power infrastructure, Baybridge Investments introduces into the Africa market, composite transmission, distribution and telecommunications structures that are not only stronger, lighter, non-conductive, easier to transport and quicker to install but are also corrosion-proof, environmentally friendly, have no resale value and have lower life-cycle costs than equivalent wood, steel and concrete structures.

BY | IAN BRAID | BSC ENG | MBL | FSAIEE

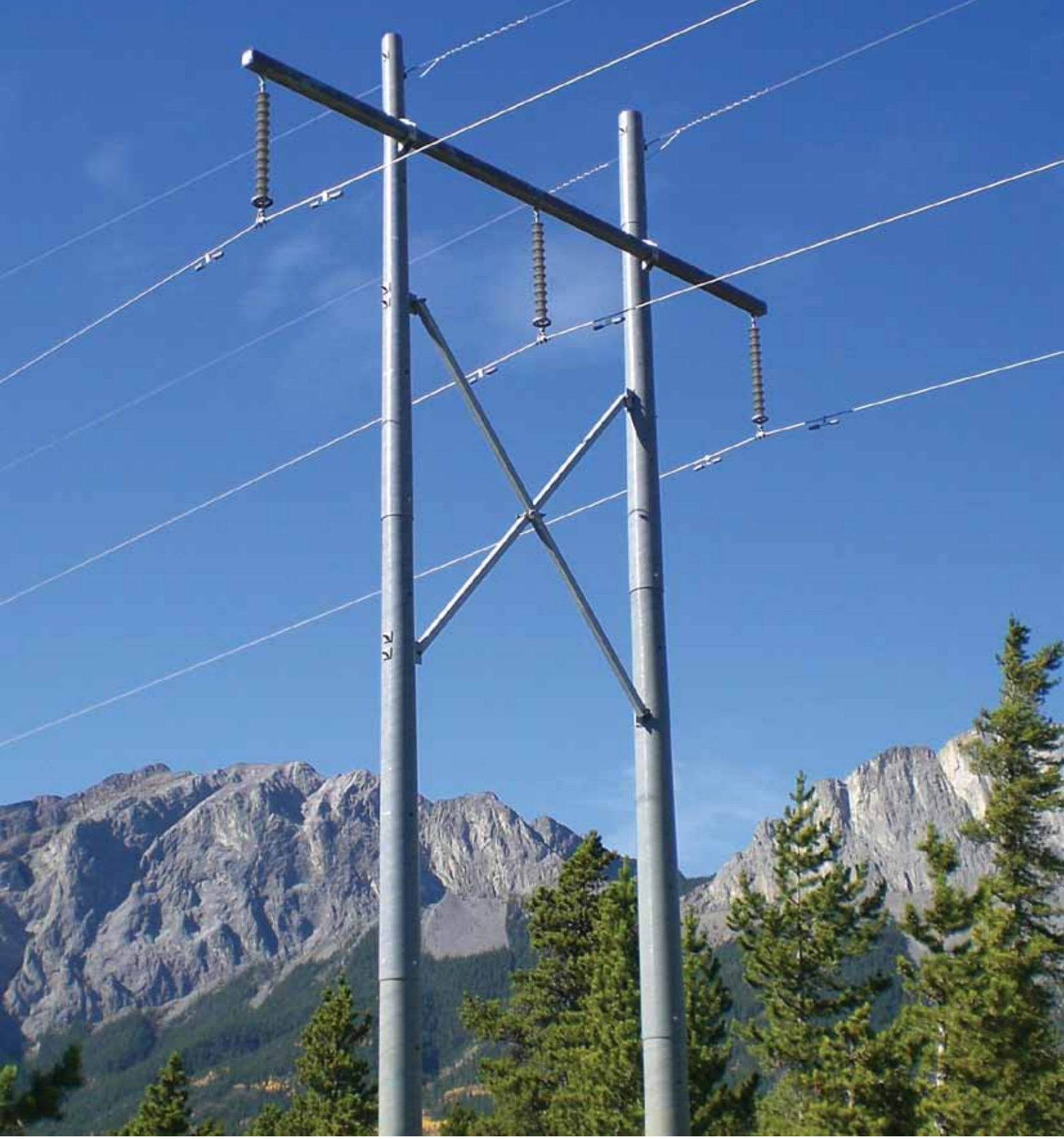
Baybridge Investments (SA) (Pty) Ltd ("BISA") is a South African-based company that invests in innovative infrastructure technologies to help fulfill the developmental needs of countries in Southern Africa, and rest of Africa in the medium to long term.

BISA has acquired the agency and distribution rights to market, sell and supply the full range of composite poles from RS Technologies Inc. of Canada, as well as the full PUPI range of composite crossarms and crossbraces from Geotek Inc of USA. BISA has recognised the huge and growing demands in Africa for electrical power infrastructure, not just in generation but also in transmission and distribution. The need for improved solutions that overcome the limitations of the currently used wood, steel and concrete structures has led BISA to invest in the sourcing and supply of composite structures.

COMPOSITE MATERIALS

Significant advancements have been made in the design of composite materials, in particular with fibre reinforced polymers (FRPs). FRP's are increasingly used as structural materials for large-scale industrial applications, including pressure vessels, bridges and utility poles. The replacement of traditional building materials (wood, concrete and steel) by FRPs can be attributed to their highly tailorable characteristics, with constituents materials chosen for specific, desirable properties.

This results in various composite products which are stronger, lighter and longer lasting than products made



with traditional materials. However, with their increasing presence in outdoor environments, it is important that the long-term weathering characteristics of the FRP products are considered in infrastructure design. Temperature, moisture and ultraviolet (UV) radiation are the most significant weathering factors influencing the mechanical properties of FRPs. The ability to withstand weathering is driven by the UV protection properties of the polymer matrix.

Composite poles and crossarms for transmission, distribution and telecommunications networks are now available manufactured using high-strength E-Glass fibres and polyurethane resins. Such products are manufactured using either filament-wound or the pultrusion processes. Two different methods of UV

Composites for Structures

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protection are available. For poles, a UV-stable aliphatic resin is incorporated into the laminate wall and for crossarms, a combination of UV protective coatings and a UV-resistant polyester veil are bonded onto the surface of the structure.

External factors such as location characteristics, ultraviolet light, and insect/animal infestation can severely limit the lifespan of traditional steel, wood and concrete poles. Other factors, including salt air and rust, can corrode or compromise a pole's integrity, shortening its lifespan and making replacement a necessity. However the material composition of composite poles eliminates all of these wear factors. By being impervious to insects, birds, and animals, it eliminates damage caused by scratching, pecking, boring and other destructive behaviour.

As a result, utilities are beginning to recognise that composite poles and crossarms manufactured with these new materials hold promise for dramatically reducing pole life cycle maintenance cost. These improvements also hold promise of reducing the initial cost of setting a pole as well as reducing the need for pole replacements.

COMPOSITE POLES

RS has developed a range of high performance modular utility poles which provide a cost-effective, reliable solution where environmental conditions, mass, physical access, lead time, aesthetic considerations, transportation, high strength, enhanced safety and long service life are required for new lines or pole replacement, as supplied to over 300 utilities around the world.

RS's composite utility poles are constructed from combinations of up to eight standard-sized tubular modules to create poles up to 47.2m in length that use standard industry hardware. These poles are manufactured from industry-standard E-glass fibre rovings bound together through the filament winding process with ultra-strong polyurethane thermosetting resins.

MODULAR DESIGN

The unique tapered design of the RS composite pole provides the ability to achieve a wide variety of pole lengths and strengths. With modules that can be nested, the eight module system can be configured to build virtually any pole length from 9.1m up to 47.2m in different strength categories, which lowers the lead time for deliveries, reduces inventory requirements and simplifies transportation, handling and installation. This also results in superior emergency preparedness and significantly reduced inventory requirements and associated costs.

UV PROTECTION

Two different polyurethane resins are used in the manufacturing of the poles. The inner portion of the pole wall uses an aromatic polyurethane resin. A UV stable aliphatic polyurethane resin is used in the outer layers of the pole wall, which lasts for the life of the pole, and prevents degradation from UV radiation and weathering effects.

This integrated layer of protection is achieved in a single step manufacturing process creating a monolithic laminate which does not scratch or flake off, offering a vastly superior UV protection than traditional composite coatings. RS's poles are designed to achieve an 80 year service life based on 14 000 hours of ASTM G154 accelerated QUV testing.

RS provides a 41 year limited warranty against failure of its poles.

INSTALLATION FLEXIBILITY

Lightweight poles can be assembled in 15-20 minutes per pole with a four man crew. When setting the pole, in addition to using lighter duty machinery, modularity allows for installation sequencing options. The entire pole can be assembled on the ground and then installed. Alternatively, the base can be installed first and the remaining top modules added at a later time either one at a time or as a preassembled unit. On-the-fly line design changes to pole height and strength are easily accomplished by simply adding or removing the desired module. Pole modularity also provides for simple circuit height adjustments, future system expansion and revenue generating joint use potential. Compared to traditional pole materials, smaller helicopters can be used to lift fully constructed H-frames for challenging location drops. Norwegian utility NTE has calculated that the installed cost of RS poles is about 10% less than wood when span lengths are optimised and helicopters are used for installation. RS poles are easily cut and/or drilled in the field. Significant cost savings can be achieved seeing that cast concrete foundations are not required.

ENVIRONMENTAL COMPATIBILITY

RS poles are highly compatible with the environment in a number of ways. RS poles never need to be treated or maintained with any chemical additive or coating throughout their 80 year projected service life. RS poles are inert and therefore there is no leaching of chemicals, unlike wood poles, which keeps the environment free of hazardous preservatives.

RS poles are made using an advanced polyurethane resin that does not emit hazardous air pollutants (HAPS) or volatile organic compounds (VOCs) during the manufacturing process. With no damaging pollutants emitted during manufacturing, RS poles can be produced efficiently with no health risks to workers or the community.

The modular design of RS composite poles allows individual pole sets to be nested in compact bundles when being transported. This leads to a significant improvement in the number of poles that can be shipped in a single truckload. The result is fewer trips, less fuel and fewer emissions. A fraction of the weight of traditional materials, RS composite poles can be handled and installed using much smaller equipment. This again reduces CO_2 emissions and damage to the environment – from the time that the pole leaves the factory, to the time that the pole is set in the ground. The 80 year service life of RS poles means that traditional utility poles will require replacement at least once and sometimes twice as often as that of composite RS poles. Pole replacement requires resources and the less maintenance and replacement required, the lower the carbon footprint of that pole.

As a non-wood material, RS poles offers the opportunity to help preserve our forests by reducing deforestation. In addition, by the very nature of the design of RS poles, narrow wayleaves /servitudes are required.

ELECTRICAL PERFORMANCE

RS poles have been subjected to numerous electrical tests performed by Kinectrics Inc. of Toronto, Ontario, Canada. These tests showed that RS poles possess excellent dielectric properties, comparable to standard industry requirements for a hot stick or insulated boom. The non-conductive nature of RS poles increases tracking safety when working in live-line environments, reduces the possibility of pole fires caused by electrical tracking to the

Composites for Structures

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pole and provides reduced touch and step potential in the event of a system fault.

MAINTENANCE

RS poles require no scheduled maintenance due to the embedded UV protection that lasts for the life of the pole. RS poles are also environmentally inert and impervious to pest damage, eliminating the need for treatments to preserve pole integrity. A basic visual inspection for signs of damage can be carried out at the same time that grounding and hardware inspections are conducted per the utility's normal inspection frequency. Hardware re-tensioning is also less frequent because RS poles have a coefficient of thermal expansion close to that of steel.

NEW PRODUCTS

In additional to its standard pole offerings, RS has introduced new products as described below.

POLE SHIELD

RS has introduced a "snap on" fire shield that provides utility poles, including RS poles, protection from fire and abrasion. A pole shield is an all aliphatic, filament wound shield with a 4mm wall thickness, about 60% thickness reduction compared to a standard RS pole. Shields are cut on along the length and can be "snapped" onto existing wood, steel, concrete or composite poles. Shields are fastened onto the pole with screws or stainless steel bands.

PRODUCT RANGE

RS Distribution (RSD) poles have been introduced as a lower cost solution for lighter loads typically observed at distribution voltages. These poles have an approximate 35% wall thickness reduction from a nominal wall thickness average of 11mm on RS standard poles to 7mm. These RS Distribution poles represent a very competitively priced distribution modular composite pole that delivers the same service life, no scheduled maintenancem and reliable performance associated with RS standard poles. The length focus of RSD poles is 11m to 15.6m.

XTREME PRODUCT RANGE

RS Standard poles have been used up to 240kV and tested up to 330kV. However at 420kV and above the typical loads include broken cables, transverse and longitudinal winds, and unbalanced heavy ice, and such loads require a higher strength than that which a pole comprising RS standard modules can deliver. The RS Xtreme (RSX) modules have a wall thickness that is 50% thicker than that of RS standard modules, with increased stiffness and higher load capability.

COMPOSITE CROSSARMS AND CROSSBRACES

PUPI crossarms and crossbraces are products of Geotek Inc., an internationally recognised producer of reinforced pultruded products for the electrical utility, animal containment, nursery and consumer markets. Geotek contributes nearly 40 years of pultrusion experience to the PUPI manufacturing process. PUPI is the leading brand of fibreglass components around the world.

Engineered for superior load capacity and resistance to ultraviolet radiation and weathering, leading utilities choose PUPI fibreglass crossarm and crossbrace components for consistent performance and long term return on investment. Geotek designs and manufactures tangent crossarms, deadend assemblies and braces and mounts.

DURABILITY

PUPI fibreglass crossarms are designed to be the most durable alternative to wood, steel and even other composite crossarms. PUPI heavy-duty construction and exclusive TorqueGUARD bushings protect against damage during hardware installation and provide maximum resistance to bolt and pin torque. In many applications a single PUPI crossarm has the strength to replace two or more wood crossarms.

RELIABILITY

PUPI crossarms are engineered products, manufactured with a fibreglass pultrusion process that creates products of the highest quality and consistency. Unlike wood, PUPI crossarms are totally free from knots, and imperfections that can cause failure over time. PUPI components can withstand transient loads that cause wood crossarms to fail. Because these crossarms are specifically designed for utility use, they have the strength to handle any situation, yet are also light weight and easy to install.

LONGEVITY

SunGUARD UV protection is thermally-bonded to the surface of every PUPI product, providing the most durable protection available against UV damage. Rigorous testing shows that SunGUARD UV coating will maintain its effectiveness for at least 60 years, in any climate. Additionally, every PUPI crossarm is completely filled with closed-cell sealant to lock out moisture and contaminants. There has never been a failure of a SunGUARD-treated PUPI crossarm due to environmental degradation.

CUSTOMER FOCUS

Understanding customer needs at a deep level has been a key to the success of

PUPI crossarms. It has extensive design and testing capabilities that assure the best solutions to customer's application needs. Geotek understands the critical nature of the services that its customers provide, and responds quickly to requests for emergency shipments. Every PUPI product is backed by a dedicated support team that is ready and willing to do what it takes to get the job done. PUPI mechanical properties are available for electrical utility engineers and designers. A PUPI properties library file is available for use with PLS-POLE design software.

LEADERSHIP

Geotek developed the first commercially successful composite crossarm and has led the way since its first crossarm was shipped in 1990. Geotek has invested in materials laboratory and testing facilities that sets them apart from the competition. Today, Geotek is the market share leader in fibreglass crossarms giving them the largest installed base and the longest service record of any composite crossarm manufacturer. Geotek's products are used at hundreds of utilities across North America and the world. Geotek's track record and dedication to its customers are what keeps PUPI customers coming back year after year.

EXTENSIVE PRODUCT TESTING

Geotek brings nearly 40 years of pultrusion and materials science experience to the PUPI crossarm and brace manufacturing processes. Engineered specifically for the critical demands of the electrical utility industry, Geotek crossarms exhibit performance and reliability that is unmatched. Their reputation for durability is built upon years of intensive testing and application engineering. PUPI product testing includes:

- UV resistance testing;
- Strength and deflection testing; and,
- Electrical testing.

RETURN ON INVESTMENT

PUPI fibreglass crossarms will deliver a stronger return on investment (ROI) over time than wood. From the beginning, the material cost of a PUPI deadend can be less than a wood deadend assembly. When one considers the initial material cost and installation, ongoing maintenance and replacement cost, PUPI fibreglass crossarms deliver a better long-term return on investment than wood or other composite beams. PUPI crossarm size and drill configurations for tangents and transmission arms can be specified to customer's exact performance requirements.

PUPI crossarms are engineered for the unique demands of the utility industry with three levels of weathering protection and unique features like exclusive TorqueGUARD bushings, impact-resistant end caps, and beams sealed with closed-cell foam to prevent moisture contamination. Because PUPI crossarms are lightweight for easier handling, it takes less time for a field crew to install a PUPI crossarm than a wooden crossarm, all adding up to deliver an improved ROI.

BISA have been actively marketing RS Poles and the PUPI Crossarms to the power utilities in the Southern African region for the past 6 months. There has been an excellent reception thus far and it is expected that several pilot projects will be initiated in 2015. Composite products are game changers and will play a vital role in the infrastructure of the African Continent going forward. wn

ABOUT BISA

Baybridge Investments (SA) (Pty) Ltd ("BISA") is a South African-based company that invests in innovative infrastructure technologies to help fulfil the developmental needs of countries in Africa. BISA has acquired the agency and distribution rights to market, sell and supply the full range composite poles from RS Technologies Inc. of Canada, as well as the full PUPI range of composite crossarms and crossbraces from Geotek Inc. of USA. BISA has established a subsidiary company in Zambia, namely Baybridge Investments Zambia Limited ("BIZ") to address the local Zambian and surrounding territories. BISA forms part of a Group which owns investment interests in several African and European countries in:

- Oil and gas;
- Telecommunications
- Stone Crushing
- Power Generation
- Education

JOHN FARQUHAR - Director & Head of Business Development Baybridge Investments (SA) (Pty) Ltd has a Diploma in Business Administration and Marketing with 25 years' experience in Marketing and Media, working mainly in Sub-Saharan Africa setting up new businesses. John was the Deputy Managing Director of Continental Outdoor Media Africa Division.

IAN BRAID - Consultant to Baybridge Investments (SA) (Pty) Ltd. He has qualified with a BSc Eng (Elec), MBL, with 42 years experience in systems and business development in Naval electronics, telecommunications and electrical industries. Ian is a Fellow of the SAIEE, a member of the IEEE and was Chairman of the Electronics and Software Section at SAIEE.

Earn CPD Credits

Sand-based anode triples lithium-ion battery performance

Porous nano-silicon has been synthesized via a highly scalable heat scavenger-assisted magnesiothermic reduction of beach sand. This environmentally benign, highly abundant, and low cost SiO_2 source allows for production of nano-silicon at the industry level with excellent electrochemical performance as an anode material for Li-ion batteries

BY | ZACHARY FAVORS | WEI WANG | HAMED HOSSEINI BAY | ZAFER MUTLU | KAZI AHMED CHUEH LIU | MIHRIMAH OZKAN | CENGIZ S. OZKAN

The addition of NaCl, as an effective heat scavenger for the highly exothermic magnesium reduction process, promotes the formation of an interconnected 3D network of nano-silicon with a thickness of 8-10 nm. Carbon coated nano-silicon electrodes achieve remarkable electrochemical performance with a capacity of 1024 $mAhg^{21}$ at 2 Ag^{21} after 1000 cycles.

Silicon is considered the next generation anode material for Li-ion batteries and has already seen applications in several commercial anodes. This is due to its high theoretical capacity of 3572 $mAhg^{21}$ corresponding to ambient temperature formation of a $Li_{15}Si_4$ phase. However, silicon has major drawbacks stemming from the large volume expansion upwards of 300% experienced during lithiation. Depending on the structure, lithiation-induced mechanical stresses cause silicon structures to fracture when the characteristic dimension is as small as 150 nm, which promotes pulverization and loss of active material. Despite scaling the dimensions of silicon architectures below this critical dimension, the large volume expansion deteriorates the integrity of the Solid Electrolyte Interphase (SEI). Expansion upon lithiation and subsequent contraction during delithiation leads to the constant fracturing and reformation of new SEI, resulting in irreversible capacity loss. Several structures such as double-walled silicon nanotubes, porous silicon nanowires, and postfabrication heat treated silicon nanoparticle (SiNP) anodes have alleviated this issue via protecting the crucial SEI layer after its initial formation.

While a myriad of silicon nanostructures have exhibited excellent electrochemical performance as anode materials, many of them lack scalability due to the high cost of precursors and equipment setups or the inability to produce material at the gram or kilogram level. Silicon nanostructures derived from the pyrolization of silane, such as silicon nanospheres, nanotubes, and nanowires, have all demonstrated excellent electrochemical performance. However, chemical vapour deposition (CVD) using highly toxic, expensive, and pyrophoric silane requires costly setups and cannot produce anode material on the industry level. Metal assisted chemical etching (MACE) of crystalline silicon wafers has been extensively investigated as a means of producing highly tunable silicon nanowires via templated and non-templated approaches. However, electronic grade wafers are relatively costly to produce and the amount of nanowires produced via MACE is on the milligram level. Crystalline wafers have also been used to produce porous silicon via electrochemical anodization in an HF solution.

Quartz (SiO_2) has been demonstrated as a high capacity anode material without further reduction to silicon, with a reversible capacity of ~800 $mAhg^{21}$ over 200 cycles. However, SiO_2 is a wide bandgap insulator with a conductivity ~10^{11} times lower than that of silicon. Additionally, SiO_2 anodes carry 53.3% by weight oxygen which reduces the gravimetric capacity of the anodes. The highly insulating nature of SiO_2 is also detrimental to the rate capability of these anodes.

Tetraethyl Orthosilicate (TEOS) has garnered significant attention recently due its ability to produce nano-SiO_2 via hydrolysis. The SiO_2 has been subsequently reduced to silicon in such structures as nanotubes and mesoporous particles. However, examining Fig. 1a reveals the extensive production process needed to produce TEOS. Conversely, Liu et al. have demonstrated a method of synthesizing nano-Si via magnesiothermic reduction of rice husks (SiO_2), an abundant by-product of rice production measured in megatons per year.

Beach Sand improves battery life

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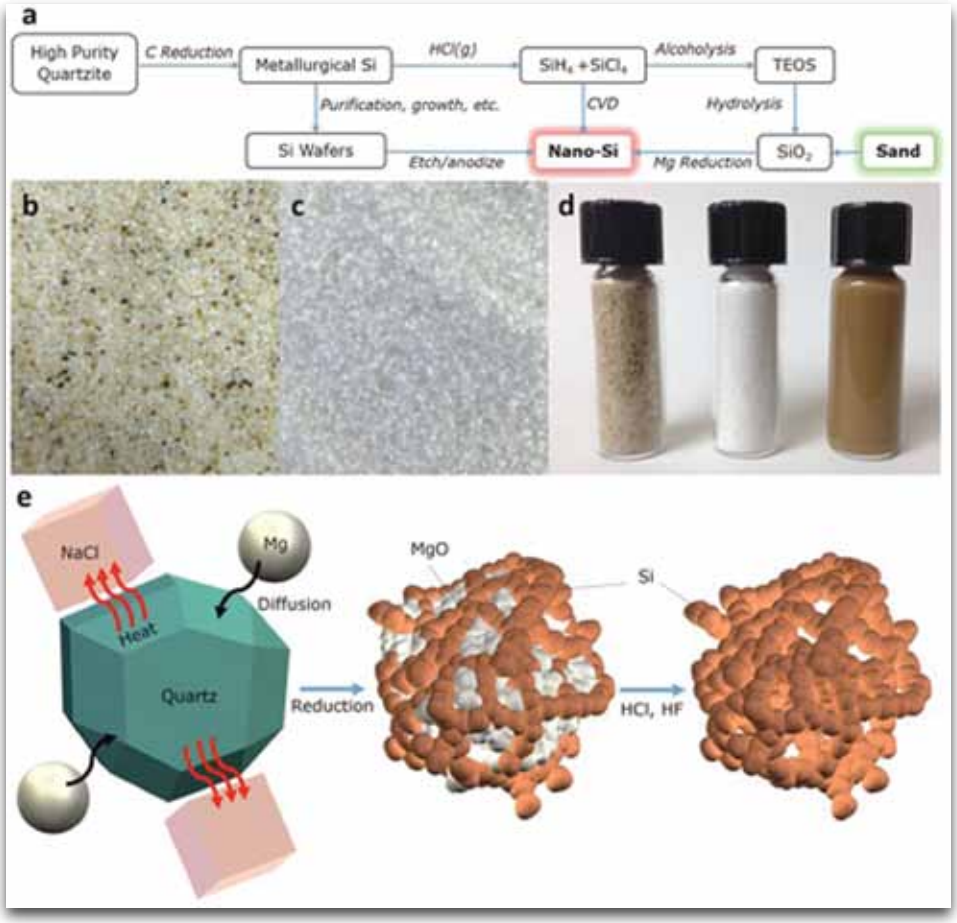

Figure 1 | (a) Flow chart showing conventional synthesis routes of nano-Si, including the introduction of our synthesis route from sand. Optical images of (b) unpurified sand, (c) purified sand, and (d) (from left to right) vials of unpurified sand, purified sand, and nano-Si. (e) Schematic of the heat scavenger-assisted Mg reduction process.

Thermic reduction of SiO_2 can be accomplished via a few well-known mechanisms including carbothermal, magnesiothermic, aluminothermic, and calciothermic reduction. Carbothermal reduction utilizes electric arc furnaces operating at ~2000uC and is the primary mode for metallurgical silicon production. However, this process is very energy intensive and liquefies the silicon, thus destroying any original morphology of the SiO_2. Recently, magnesiothermic reduction has gained attention due its much lower operating temperatures (~650uC). Typically, Mg powder is placed adjacent to SiO_2 powder and the furnace is heated until the Mg vaporizes. However, this reduction scheme produces zonal variations in composition with Mg_2Si forming near the Mg powder, Si in the middle, and unreacted SiO_2 furthest from the Mg[23] have shown that adding a relatively large amount of NaCl to the reduction process aids in scavenging the large amount of heat generated during this highly exothermic reaction. NaCl effectively halts the reaction temperature rise at 801uC during fusion, preventing the reaction from surpassing the melting point of silicon and thus aiding in preserving the original SiO_2 morphology.

Herein, we propose a facile and low cost alternative to production of nano-Si with excellent electrochemical performance using a highly abundant, non-toxic, and low cost Si precursor: sand.

RESULTS

The majority constituent of many sands is quartz (SiO_2) and sand is easily collected since it is predominantly found on the surface of the earth's crust. The sand used in this analysis was collected from the loamy surface of the shores of Cedar Creek Reservoir in the Claypan region of Texas. The soil of this region is classified as an Alfisol, specifically a Paleustalf, comprising ~90% quartz with minor amounts of feldspars and chert. The sand grains utilized herein have a grain size of ~0.10 mm, as in Fig. 1b. Further mechanical milling in an alumina mortar easily reduces the grain size to the micrometer and nanometer scale within minutes. Organic species are removed via calcining in air at 900uC, and the sand is then sequentially washed with HCl, HF, and NaOH for varying amounts of time. Unwanted silicate species are removed via the HF etch, as crystalline quartz etches much slower than other silicate species such as feldspars. After purification, the sand assumes a bright white appearance in stark contrast to the brown hue of the unpurified sand, as in Fig. 1c. The peaks associated with unpurified sand in the XRD analysis in Fig. 2a confirm that the sample comprises mostly quartz with very minor peaks corresponding to impurities. After purifying the sand, the peaks associated with quartz greatly increase in intensity relative to the impurity peaks, confirming that most of the impurities have been successfully etched away.

After purification, quartz powder and NaCl

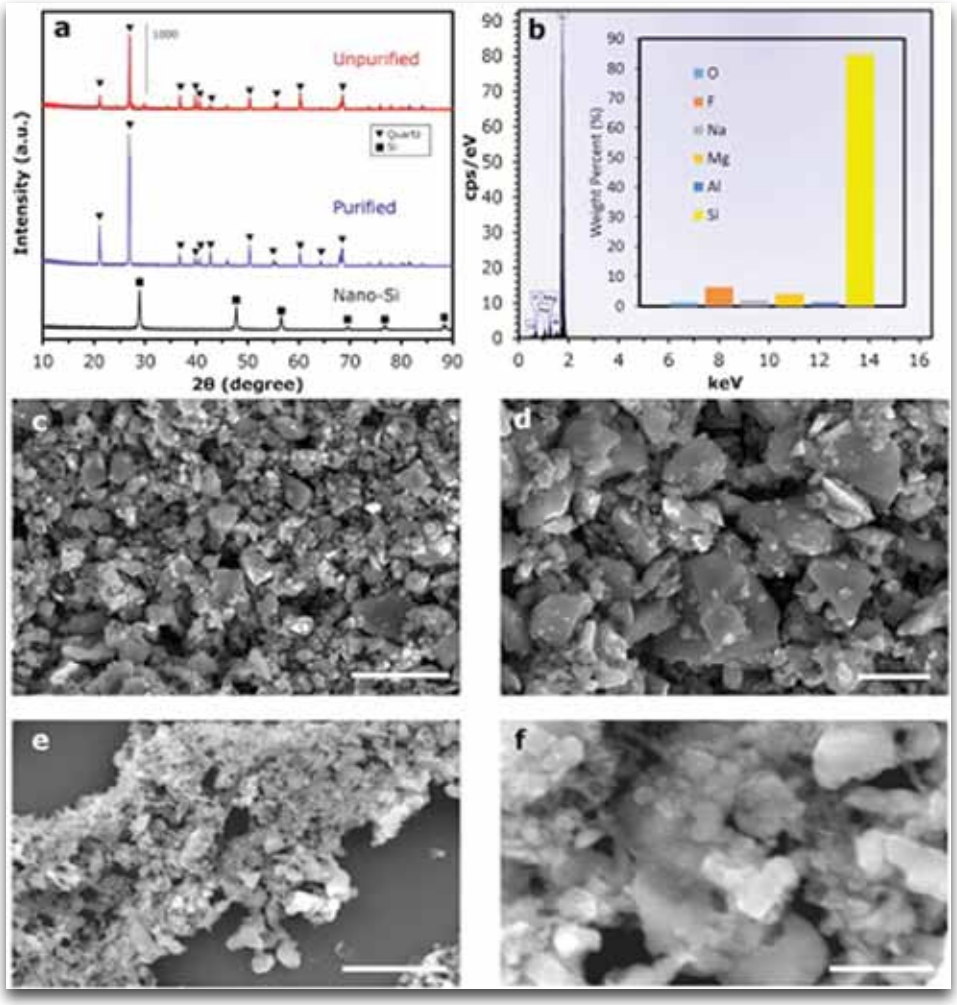

Figure 2 | (a) XRD plot displaying characteristic peaks of quartz in both pre-reduction samples and Si peaks in the post-reduction nano-Si. (b) EDS analysis with inset displaying weight percent of elements in nano-Si after HCl and HF etching. Low magnification (c) and higher magnification (d) SEM images of quartz powder after purification and milling. Low magnification (e) and higher magnification (f) SEM images of nano-Si after reduction and etching. Scale bars for (c),(d), (e), and (f) are 5mm, 2mm, 2mm, and 500 nm, respectively.

is ground together in a 1510 SiO_2:NaCl weight ratio and ultrasonicated and vigorously stirred for 2 hours. After drying, the SiO_2:NaCl Powder is ground together with Mg powder in a 150.9 SiO_2:Mg weight ratio. The resultant powder is loaded into Swagelok-type reactors and sealed in an argon-filled (0.09 ppm O_2) glovebox. The reactors are immediately loaded into a 1 inch diameter quartz tube furnace purged with argon. The furnace is slowly heated at 5uCmin to 700uC and held for 6 hours to ensure complete reduction of all SiO_2. After reduction the resulting brown powder is washed with DI water to remove NaCl and then etched with 1 M HCl for 6 hours to remove Mg, Mg_2Si, and MgO. The $MgCl_2$ that is produced via HCl etching of MgO can be easily recycled back to Mg via electrolysis, which is the predominant industrial synthesis route for Mg production. The powder is washed several times with DI H_2O and EtOH to remove the etchant and dried overnight under vacuum. A visual comparison, without magnification, of unpurified beach sand, purified quartz, and nano-Si stored in glass vials can be seen in Fig. 1d, and the entire synthesis process can be visualized in Fig. 1e.

SEM imaging in Fig. 2 reveals the broad size distribution and highly irregular morphology of the milled quartz powder before and after reduction. For the milled quartz powder, the particle size ranges from several microns to 50 nm, as in Fig. 2c and 2d. The quartz powder and nano-Si reduction product are both highly irregular in shape as expected. After reduction, the nano-Si is absent of particles with dimensions in excess several microns and has a much smaller size distribution than the quartz powder, as in Fig. 2e and 2f. We can attribute this to the breakdown of relatively larger particles during reduction and ultrasonication, which is due to the reduced mechanical integrity of the porous 3D nano-Si networks in comparison to the solid pre-reduction quartz particles.

In lieu of the solid crystalline particles found in the quartz powder, the nano-Si powder is composed of a highly porous network of interconnected crystalline silicon nanoparticles (SiNPs). HRTEM in Fig. 3a and 3b reveals the interconnected SiNPs that comprise the 3D Si networks, and the diameter of the SiNPs is ,8–10 nm, with larger particles existing sparingly. This high porosity can be attributed to the selective etching of imbedded MgO and Mg2Si particles after reduction.

Beach Sand improves battery life

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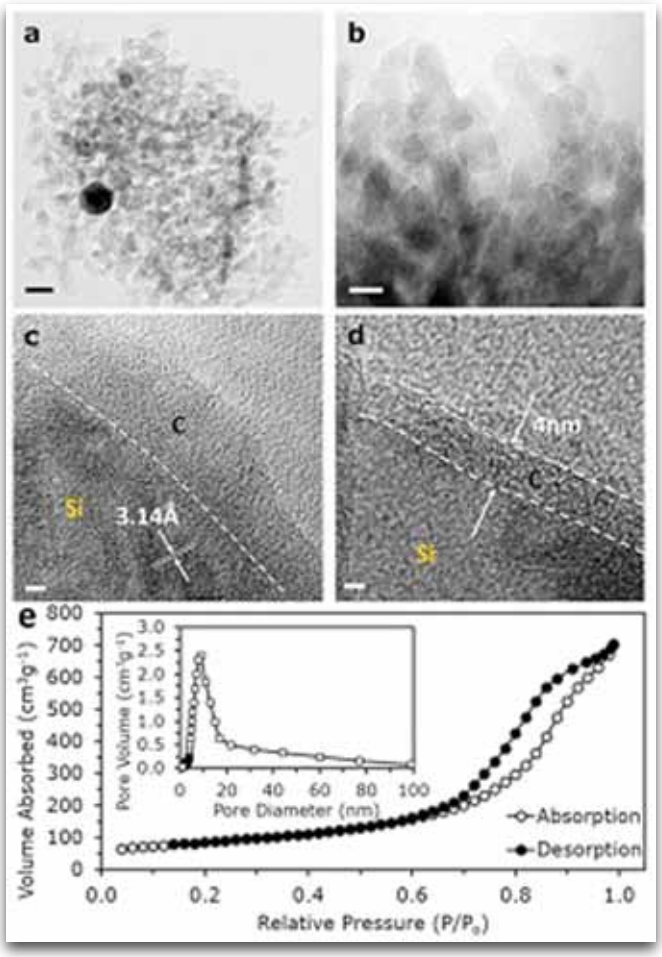

Figure 3 | Low magnification (a) and high magnification (b) TEM images of nano-Si. (c) HRTEM image of nano-Si showing the conformal carbon coating and characteristic lattice spacing of Si(111). (d) HRTEM image of C-coated nano-Si showing thickness of the carbon layer. Scale bars for (a), (b), (c), and (d) are 20 nm, 10 nm, 2 nm, and 2 nm, respectively. (e) BET surface area measurements of nano-Si with type IV N2 sorption isotherms and inset showing pore diameter distribution.

Through the use a NaCl as a heat scavenger during the reduction process, we are able to synthesize a highly uniform porous structure throughout the width of the particle by avoiding localized melting of Si. This uniform 3D network is achieved via removal of oxygen (53.3% by weight) from the original quartz particles through reduction and a conservation of volume via the heat scavenger (NaCl). The XRD peaks in Fig. 2a indicate a successful reduction to silicon after Mg reduction.

Energy Dispersive X-ray Spectroscopy (EDS) in Fig. 2b reveals the weight percentage of elements present in the nano-Si powder. The quantitative analysis shows Si is the predominant element present with non-negligible amounts of F, Na, Mg, Al, and O. The F and Na peaks may be due to the existence of Na_2SiF_6, which is produced via a reaction between residual NaCl and H_2SiF_6 produced during HF etching of SiO_2. The existence of Al may be derived from the original sand or from the alumina mortar. While the existence of metallic contaminants at these levels may present deleterious effects for some applications, for battery applications these metallic impurities may increase the conductivity of nano-Si. Despite silicon's relatively high surface diffusion capability with respect to bulk diffusion of Li, silicon has relatively low electrical conductivity. Thus, nano-Si powders were conformally coated with a ~4 nm amorphous carbon coating to enhance conductivity across all surfaces, as in Fig. 3c and 3d. Briefly, nano-Si powder was loaded into a quartz boat and placed in the center of a quartz tube furnace purged with an H2/Ar mixture. After heating to 950uC, acetylene was introduced into the tube to produce a conformal C-coating. The weight ratio of Si to C was determined to be 81519 after coating. Brunauer-Emmett-Teller (BET) surface area measurements were performed for nano-Si before C-coating yielding a specific surface area of 323 m^2g^{21}, as in Fig. 3e. The inset in Fig. 3e reveals a pore diameter distribution with a peak centred at 9 nm. The pore diameter is in good agreement with the TEM images of porous nano-Si. This high surface area confirms that NaCl effectively scavenges the large amount of heat generated during Mg reduction, preventing agglomeration of nano-Si. The high surface area and pore volume distribution also confirm the existence of large internal porosity available for volume expansion buffering and, thus, minimal capacity fading due to SEI layer degradation and active material pulverization.

Nano-Si@C derived from sand was electrochemically characterised using the half-cell configuration with Li-metal as the counter-electrode. Electrodes comprised nano-Si@C, acetylene black (AB), and PAA in a 75152 nano-Si@C:AB:PAA weight ratio. Fig. 4a demonstrates the rate capability of the C-coated nano-Si electrodes up to the C/2 rate, with additional cycling up to 1000 cycles at the C/2 rate. Initial cycling at C/40 is necessary for proper activation of all Si and development of a stable SEI layer. This activation process is confirmed via cyclic voltammetry measurements, as in Fig. 4b. The peaks corresponding to the lithiation (0.22 V

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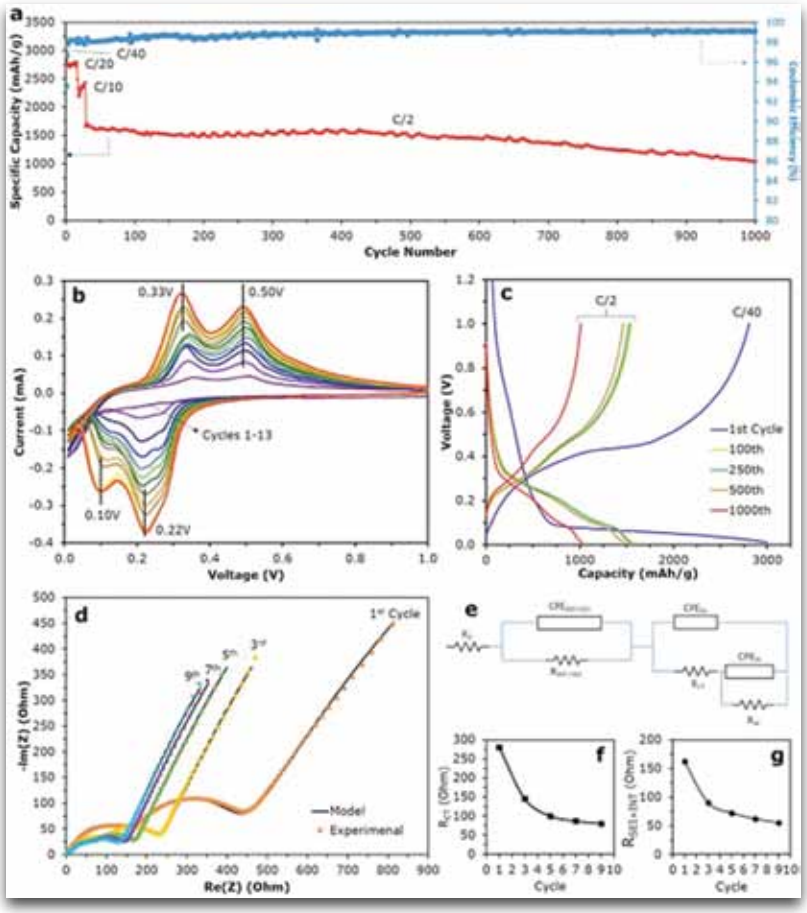

Figure 4 | (a) Cycling data of nano-Si@C anodes with selected C-rates (C ≤ 4Ag[21]). (b) CV plot of the first 13 cycles using a scan rate of 0.02 mVs[21]. (c) Charge-discharge curves for selected cycles. (d) EIS curves for selected cycles showing both experimental and fitted-model data. (e)Equivalent circuit of nano-Si@C electrodes used to produce fitted-model data. Extracted resistance values from the EIS curves for (f) charge transfer resistance and (g) SEI 1 INT resistance.

and 0.10 V) and delithiation (0.33 V and 0.50 V) grow in intensity over the first 12 cycles before stabilizing, which suggests a kinetic enhancement occurs in the electrode. After a kinetic enhancement is achieved via this low current density activation process, the electrodes are cycled at much higher rates. Even at the C/2 rate the nano-Si electrodes demonstrate a reversible capacity of 1024 mAhg[21] and a Coulombic efficiency of 99.1% after 1000 cycles. We attribute the excellent cycle stability of the nano-Si@C electrodes to a combination of the conformal C-coating, PAA binder, and the porous 3D nano-Si network.

The addition of a C-coating alters the makeup of the SEI layer and may also partially alleviate the lithiation-induced volume expansion effects in nano-Si[32]. The use of PAA as the binder also greatly enhances the cyclability of the electrodes. Magasinski have recently reported on the improved cycling performance of PAA-bound electrodes relative to conventionally used binders such as polyvinylidene fluoride (PVDF) and carboxymethylcellulose (CMC). The improved stability is attributed to PAA's similar mechanical properties to that of CMC but higher concentration of carboxylic functional groups. The mechanical properties of PAA prevent the formation of large void spaces created during lithiation and delithiation of Si. The higher concentrations of carboxylic groups form strong hydrogen bonds with hydroxyl groups on C and Si, minimizing separation of binder from active material during cycling. The porous nature of the nano-Si is also partly responsible for the good cyclability due to the internal void space available for the inter-connected network of Si to expand. Despite the fact that some of the 3D nano-Si networks have diameters of several hundreds of nanometers, the SiNPs that comprise these networks are only 8–10 nm in diameter.

Complex impedance plots for nano-Si@C anodes obtained via electrochemical impedance spectroscopy (EIS) are shown in Fig. 4. The equivalent series resistance (ESR), or high frequency real axis intercept, decreases for the first 5 cycles and stabilizes thereafter. The high frequency semicircle also decreases in diameter with cycling, represented by $R_{SEI\ 1\ INT}$. This is the resistance representing the SEI layer and resistance resulting from imperfect contact between current collector and active material. This contact impedance decreases with cycling, as in Fig. 4g. The mid frequency semicircle representing charge transfer impedance decreases sharply for the first 5 cycles, and stabilizes thereafter, as in Fig. 4f. Interfacial impedance remains fairly constant with increasing number of cycles. Therefore, contact impedance among the active particles and the current collector is not affected by cycling. Evidently, the nano-Si@C anodes are not drastically affected by the volume expansion of a typical Si-based anode. The (EIS) measurements performed after 1st, 3rd, 5th, 7th, and 9th cycles show two distinct arcs. The high frequency semicircle corresponds to SEI film and contact impedance while the mid frequency semicircle corresponds to charge transfer impedance on electrode-electrolyte interface. wn

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Recycling, it can't be fun... Right?

In a country where recycling has become the poor man's job of the private sector, a group of students set out to prove that recycling can be fun in an attempt to create recycling awareness.

BY | LUAN SWART | BSC STUDENT | UNIVERSITY OF JOHANNESBURG

It is funny how, when the issue of recycling is raised, people switch off faster than high-speed logic gates. It is highly probable that most readers would read the heading of this article and immediately page on, just because they are not interested in the topic of recycling. And this is all due to one simple reason: there is almost no incentive to perform recycling.

Thus a group of 4 students from the University of Johannesburg set out to develop a system that will provide the incentive for stimulating recycling awareness. They decided to build a tank, but not just any tank, a Recycling Electric Tank known as the RET.

The project found its origins by the Volkswagen "Fun Theory Initiative", which is basically an initiative for making positive types of behavior more fun. The fun factor serves as the incentive for performing the specific behavior. In the case of the RET the fun incentive is the mobility of the tank and the aerial launch of a projectile.

The RET had the main capability of being able to launch cans or bottles into recycling bins by intelligently calculating the distance and adjusting the elevation of the turret accordingly. The system consisted of four sub projects, which formed final year projects for 2014.

These four projects were; a visual laser targeting and distance calculation system (Zandalee B. Blignault), variable speed propulsion and RF control (Marnus Marais), battery charge and power management system (Kalinka Faul) and finally a turret consisting of an electromagnetic launching mechanism and RF control (Luan Swart). The last named project will form the main topic of this article.

Each of these projects was constructed as prototypes, and then a final system incorporating all four systems was constructed. Figure 1 shows the prototype of the electromagnetic launcher and turret setup.

Now with some background information we can delve into the design and construction of the turret. In order to understand the full process of how the electromagnetic launcher and turret were constructed, it is useful to use a flow diagram shown in figure 2.

Starting with the stepper motors. The turret was capable of changing the elevation angle as well as the azimuth (horizontal) angle. Using a Sentry remote and Sentry gate remote receiver in conjunction with a PIC

From the left: Marnus Marais, Kalinka Faul, Zandalee B. Blignault and Luan Swart

microprocessor changed the azimuth angle. As soon as a remote button was pressed, the PIC entered a sequence of code allowing the stepper motor to step either clockwise or anti-clockwise.

The elevation angle was changed on the prototype by using a sliding pot resistor. This resistor modeled the process of receiving a distance to target input and changing the angle according to the specified distance. On the constructed tank this was replaced by using an interface between the laser triangulation PIC and the turret elevation PIC. The laser triangulation system would calculate the precise distance and then relay this information via USART (Universal Synchronous Asynchronous Receiver Transmitter) to the elevation PIC, which would then change the elevation accordingly.

The prototype and the tank turret setup was powered off a 12V battery whose voltage was stepped up to 300V using a center taped converter (commonly known as a push pull converter). An SG3525A chip was used as controller for the center tapped convertor. This had the capability of receiving feedback and allowing the user to vary the voltages. The converter charged a capacitor bank of 6.6mF, 350V capacitors. This was used as the energy storage component for the electromagnetic launcher.

A thyristor was used as the switching mechanism for the induction coil, and was switched using the Sentry remote control. The turret cylinder contained the induction

Recycling can be fun... right?

continues from page 51

Figure 1

coil, as well as a piston, with a piece of aluminum attached to the base. As soon as the thyristor was switched open, the current pulse in the coil would cause eddy currents in the aluminum plate, which lead to opposing magnetic forces, launching the piston forward to strike the projectile.

Laws on electrcity can be used to explain the electromagnetic launch. Ampere's law, any moving electrons will induce a magnetic field, thus the current in the induction coil caused magnetic fields. This magnetic field will then induce an electric field in the aluminum plate at the base of the piston, by Faraday's law. The electric field will cause electrons to move (eddy currents) and these currents will produce their own magnetic fields but will directly oppose the magnetic field of the coil, by Lenz's law. These opposing magnetic fields caused required opposing force to accelerate the piston away from the induction coil and strike the projectile. In layman's terms Lenz's law can be thought of as the Newton third law equivalent for electricity in the sense of, 'for each action there is an equal opposing reaction'.

Most of the components for the turret were designed in SolidWorks and 3D printed (shown in white and green in figure 1). This was done for the simple reason that the system is quite complex to construct, especially with gears being involved. Also since the setup was built twice it needed to be easy to replicate the design.

As with all projects, some experiments were conducted yielding some interesting results.

At maximum charge (292V limited by a safety circuit) the projectile achieved a maximum distance of 5.1m at 45° elevation angle. This result did however vary when the experiment was repeated; this is mostly due to poor magnetic coupling between the aluminum plate and the induction coil. The poor coupling causes varying amounts of eddy current generation, which leads to a loss of power and efficiency since the magnetic opposing forces are not at the maximum amount.

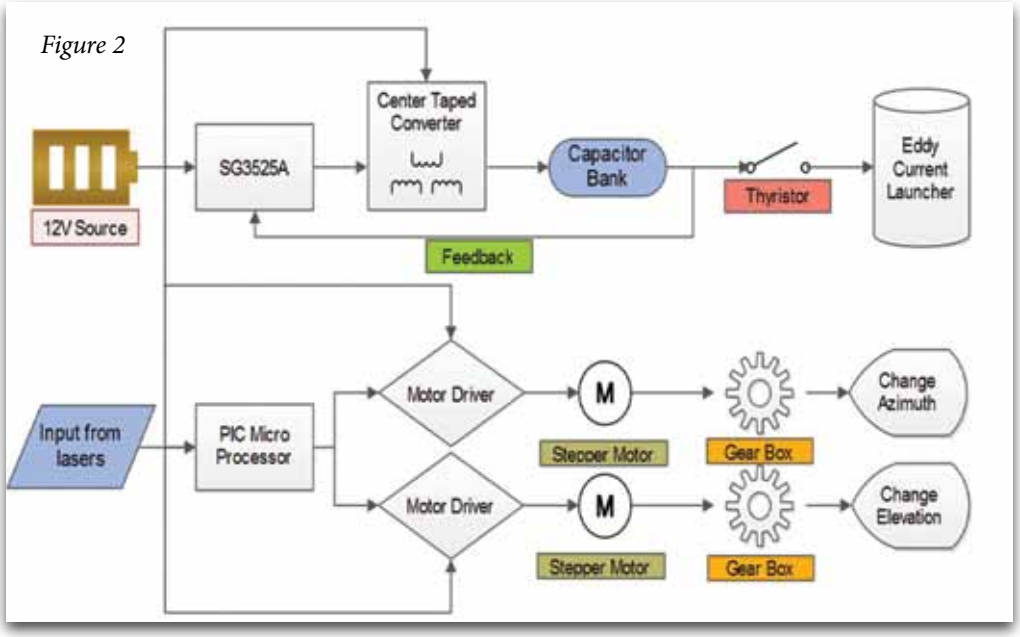
By using a high speed camera the initial velocity of the projectile was found to be close to 29 km/h. This can be increased if the magnetic coupling can be improved which will cause a higher energy transfer to the piston.

The efficiency of the launcher was found to be only 1.91%. Eddy current systems are inherently lossful due to poor magnetic coupling and harnessing more of the magnetic field generated by the induction coil can only really increase the efficiency.

This solution is however still preferred since it will predominantly interface with society and thus needs to be safe and inexpensive (if it was required to replicate the system). When compared to rail guns, the eddy current launcher is safer since there are no exposed rails that can come into accidental contact with a negligent user. When compared to coil guns the eddy current launcher is much cheaper to manufacture, since it does not require any feedback sensors.

The maximum current pulse through the induction coil was calculated using a coaxial shunt resistor (660 μΩ) and the 'run-stop' functions on a digital oscilloscope. The current peak revealed a maximum current of 2766A, where the pulse had a rise time of 228μs and a fall time of 742μs. This means that the entire energy transfer time is only 1 millisecond, and this is why good magnetic coupling is so important.

Figure 2



In conclusion it is not expected that the RET should be put into production and be used as a recycle device on the streets of our country. Instead it is aimed at creating a sufficiently high recycle awareness that the average person would become more inclined to recycle after being exposed to the RET. The system has the goal of being used more as a scientific tool to stimulate other creative ideas for recycling, much like science museums use their exhibits to stimulate interest in science and mathematics.

Who said science, mathematics and recycling could not be fun? WN

WATT?

EXPERT INDUSTRY ADVICE

WATT? is a newly established 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!

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?

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

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

We look forward to hearing from you.
- Ed

QUESTION ONE

Can South African panel manufacturers meet the latest IEC 61439 requirements?

ANSWER ONE

In answering the question consideration is given to South African panel manufacturers that manufacture their own sheet metal.

When posing this question the most common answer one receives from the industry is that it is not achievable. This stems from the enormity of the challenge that one faces in achieving the various tests required under the standard. The National Test Laboratory in South Africa is not equipped to perform all of the tests required under the standard and as such it is up to the manufacturer to source alternate organisations to fulfil these tests.

Having said this, when one unpacks the various clauses the task is in fact achievable but with one very important understanding that the client and end user have to accept that there will almost certainly be items in the final delivered product that do not meet the exact criteria of the standard. It is for this precise reason that the standard makes provision for the client and the manufacturer to carry out design verifications under certain of the clauses.

South African panel manufacturers that manufacture their own sheet metal have to perform corrosion resistance, load test and drop test testing at an accredited third party test laboratory. SABS (NETFA) has agreed to incorporate these third party test certificates into a NETFA consolidated test report, thus enabling the manufacturer to present one test report to clients incorporating all tests performed by NETFA as well as the third party test reports.

QUESTION TWO

How has this changed from previous panel requirement specifications in South Africa?

ANSWER TWO

The preceding IEC specification did not include the mechanical tests stated above. SABS (NETFA) was thus able to complete all tests required under the specification.

On another note, the previous standards did not exclude the principle of device substitution as is the case with the new standard.

Device substitution allowed independent panel builders to provide the customer with a type tested assembly including the switchgear of his choice. In this way the independent panel builder was able to offer a variety of switchgear offers with a single type test report. Prohibiting device substitution will lead to the eventual demise of the independent panel builder in South Africa.

QUESTION THREE

Is it practically possible to have type tested panel assemblies considering the many different types of components in our market?

ANSWER TWO

Type tested assemblies are practically possible and a reality in our industry, there are however limitations due to the costs of performing the tests. The main obstacle faced by South African manufacturers is that we deal with clients that have a diverse range of suppliers of electrical switchgear. This then requires the manufacturer to have type test reports for a diverse range of options which is not possible due to the high cost of performing the type test at an accredited laboratory. So yes, it is practically possible, but most certainly not financially possible unless you are part of a multinational organisation with an in-house test laboratory which can perform hundreds of tests to certify the many permutations of component selections.

Type test requirements are complex by nature and require the specification to have covered an extremely diverse range of manufacturing entities. Each of these entities is now having to interpret the specification in the context of their business and make judgement calls on which switchgear brand they will utilise in their type tests knowing that this brand will be type tested in their assemblies and that they will be bound to offer this brand exclusively under the cover of the Type test report.

Submissions have been made to the IEC technical committee requesting that the clauses regarding device substitution be reviewed. The debate goes on …….. wn

Answers provided by Zest WEG Group

April

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

April's birth flower is the daisy and sweet pea. The birthstone for April is the diamond which symbolizes innocence.The zodiac sign for April is Aries - the Ram - Aries people are creative, adaptive, and insightful.

1 April

2004 Google released their Webmail service in "Gmail". This beta version was a by-invitation only service.

2 April

1987 IBM released a "flurry" of new items on this day. The most notable of these was the IBM PS/2, their first 80386 system that used a 3.5 floppy (720kb or 1.44 MB discs), MFM hard drive, PC-DOS and OS/2.

3 April

1973 Martin Cooper, the General Manager of Motorola's communication system division, made the first handheld cellular phone call in public. It was also known as the "Brick" cell phone.

4 April

2015 Earth will experience the shortest lunar eclipse of the century, lasting less than 5 minutes. This eclipse will be visible from western North America, eastern Asia, the Pacific, Australia and New Zealand.

5 April

1887 Anne Sullivan (a teacher) made a breakthrough with Helen Keller (an American author and lecturer who was both deaf and blind from the age of two) by spelling "water" using the manual alphabet (finger alphabet).

6 April

1968 This was the date for the major theatrical release in the USA of 2001: A Space Odyssey.

7 April

1927 The first long-distance public television broadcast was aired and displayed the image of Commerce Secretary Herbert Hoover.

8 April

1983 John Sculley, who was President of PepsiCo at the time, decided to leave to become President and CEO of Apple Computer at the request of Steve Jobs.

9 April

1963 Winston Churchill became the first honorary U.S. citizen.

10 April

2003 Sony Blu-Ray players hit store shelves for the first time. The BDZ-S77 was the first model, but didn't sell too well due to the $3800 price tag attached to it. There were also no movies available in the Blu-Ray format until June 20, 2006.

11 April

2009 Susan Boyle auditioned for "Britian's Got Talent" and sang "I Dreamed a Dream" from Les Miserables. Once she was done, the 48 year-old Scot got a standing ovation. The next day, her audition was posted and became one of the most viral on YouTube.

12 April

1981 An HP-41 calculator, introduced in 1979, was used aboard the first NASA space shuttle flight, the Columbia, to calculate the exact angle at which the shuttle needed to be to re-enter the atmosphere safely.

13 April

2005 Gmail became available in several new languages.

14 April

1986 Desmond Tutu is selected to be the Archbishop of Cape Town and Head of the Anglican Church in South Africa.

15 April

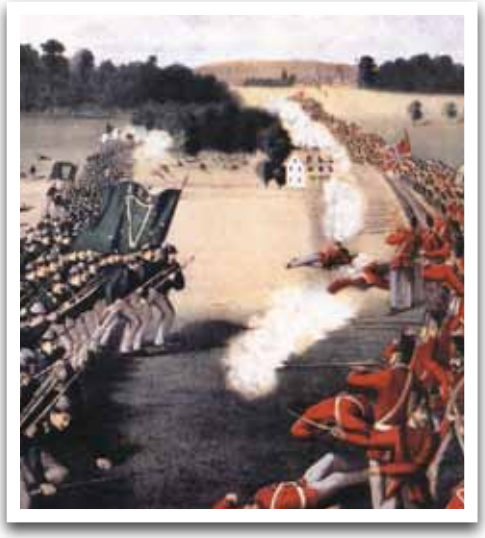
2005 The Damn Small Linux program was released. It was designed to take up as little drive space as possible – it never allowed the operating system to go past 50 MB in size.

16 April

1959 Lisp, the programming language that provided the basis for most of the significant work in the field of artificial intelligence, was unveiled.

17 April

1986 The Three Hundred and Thirty Five Years' War between the Netherlands and the Isles of Scilly (located off the southwest coast of Great Britain) ended.



18 April

1930 BBC reported that there was no news, then played out with piano music.

19 April

1987 The Simpsons premiered as a short cartoon on The Tracey Ullman Show.

20 April

1964 BBC 2 launched but unfortunately there was a power cut due to a fire at Battersea Power Station.

21 April

1997 Some of the ashes of Star Trek creator Gene Roddenberry and 22 other notables were launched into space on Pegasus XL.

22 April

1977 General Telephone and Electronics sent the first live telephone traffic through fibre optics at 6 Mbit/s, in Long Beach, California.

23 April

2009 The gamma ray burst GRB 090423 it's observed for 10 seconds as the most distant object of any kind and also the oldest known object in the universe.

24 April

1969 Paul McCartney informed the public that there was no truth to the rumors that he was dead.

25 April

Yahoo! began advertising their web-based search service on national television.

26 April

1999 On the thirteenth anniversary of the Chernobyl nuclear disaster, the CIH/Chernobyl Virus erased disk drives and hard drives throughout Asia and Europe. The virus originated in Asia during the previous summer. One woman had just completed an entire book of poetry before the virus erased it completely. This is the first known virus to target the flash BIOS.

27 April

1981 Xerox PARC introduced the computer mouse.

28 April

2003 Apple Computer launched the iTunes Music Store. The service sold one million songs in its first week.

29 April

1999 Chen Ing-hau, a computer engineering student at the Tatung Institute of Technology, was identified as the creator of the Chernobyl virus that disabled hundreds of thousands of computers around the globe.

30 April

2009 Naval engineer Marc Stephens had to deliver his wife's baby. He spent just 30 minutes watching videos on the birth process on YouTube and then successfully deliver their premature baby, Gabriel.

IN MY OPINION : BILL BERGMAN

Here Is A Challenge!

Let's face facts. ESKOM does not have enough power. People say that this is unacceptable and I agree. But, by sticking our heads in the sand by complaining will not help in any way. So let us face up to the reality that load shedding is here to stay unless two things happen, namely that ESKOM will in the near future (tomorrow) will have enough generating capacity to supply the whole of South Africa and still have some in reserve or we, the public sit up and think of ways and means to not waste what energy we have. The former is not likely to happen overnight.

BY I BILL BERGMAN I FSAIEE

Now let's look at the average household that does not have solar water heating or voltaic cells on their roof or a small generator or inverters. We are talking about the average South African house of three bedrooms which has lighting, small power for TV's, side table lamps, an electric water heater (known in SA as a geyser!) an electric stove, dish washer, washing machine and tumble drier.

Added to this list are an electric iron, electric heaters (in the winter), kitchen appliances and possibly a pool filtration plant.

Consider what takes the most power in a house. All the equipment used for heating. The biggest culprits are the geyser and pool motor which come on and switch off by themselves through the control of a thermostat or time switch. Using the stove. You are in control here. Switch plates on and when hot enough to cook, turn the power down or off. The oven is different. The temperature is set and controlled by the thermostat, but you are still in control.

So where is this leading to? Well here are some radical ideas to consider in order helping our over-extended power supply authorities albeit not of our making!

The lack of generating power is not our fault but we better face up to the fact that load shedding will be with us for quite a while. So how can Jan and Sannie Public help ESKOM?

RADICAL IDEA NO.1

During the week power is required by industry and business between the hours say 06:00 and 19:00.

This is important that industry and business can operate for the sake of our economy. This is the peak period because after about 17:00 till say 20:00 most households start to cook their evening meal.

Each household can save electricity during this period by switching off their geyser in the morning and switching it on again at 21:00. This can be done manually at the switch board or by means of a time switch installed in the main distribution board. Similarly the pool pump motor can be set accordingly.

You say this is common sense, but how many people think that way? Or as Voltaire said "Common senses is not so common"! Another household saving idea is to use a microwave oven for cooking. It uses power for a shorter period of time to cook a meal than the stove or oven.

RADICAL IDEA NO.2

Do shopping centre and office block garage lighting need to be switched on full blast after midnight? These lights need to be re-circuited so that after midnight only a few lights need to be switched on for security purposes. This should be a requirement on all new buildings being built and should be a clause in the Certificate of Compliance on completion of the building. On existing buildings, the owners can employ a well-trained electrician to re-arrange the lighting circuits to install time switches in order to comply.

It will take a bit of effort but it can be done. Those buildings which don't comply should be charged a higher rate for electricity. (Now the messenger will be shot!). Perhaps another way to encourage owners to comply is to give them a rebate on their electricity bill if they comply.

RADICAL IDEA NO 3

This will require the support and action by Jan Public. Traditionally wash days is on a Monday. This is when the washing machines, tumble driers and irons are being used. ESKOM should appeal to Jan and Sanie Public that people living in houses with even numbered address numbers do their laundry on Mondays whilst those having uneven numbers do their washing and ironing on a Tuesday. Think of the number of households in South Africa. Theoretically by splitting the wash days into two days the electrical load should also be split into half the load over these days.

I am sure there are other ways that we the Public can think of ways to alleviate the present load problem.

Come on South Africa, here is a challenge let's hear your suggestions! wn

The new MODULight is a versatile, modular lighting system designed to optimise light and minimise power consumption.

New Technologies

Technique Electronics has just launched the MODULight. The MODULight is an innovative modular system for lighting that allows for broad and varied applications. For distributors, this means stocking – and selling – one light that has a multitude of uses. This lowers the need for a large inventory, and improves customers cash flow.

The basic module of the MODULight is a 50-watt LED unit. Stacking two, three and four modules give larger systems of 100, 150 and 200 watts respectively. The units are compact and lightweight. This makes installing, stacking, replacing and transporting easy.

The versatility of the MODULight is a key feature: it can be used for high-bay, mid-bay and low-bay, warehousing, parking lots, flood lights, petrol stations, cold rooms and more. For low-bay it can be used for new installations and can be retrofit. The MODULight allows for different optics and by applying optics optimally it reduces the power needed to meet the illumination specification and this in conjunction with a power factor of 0.98 also makes the MODULight extremely energy efficient. Technique Electronics is able to simulate the illumination pattern, where required.

Other possibilities for saving energy include dimmers and motion sensors. A further option for an emergency light is available.

The MODULight has lightning protection and is waterproof (IP67). It is also protected for overvoltage, as may occur when the neutral wire interrupted.

Because the MODULight is designed and manufactured locally, it comes at a competitive price. Technique Electronics calculates the return on investment for each project. In cases of high use of the MODULight, the repayment period has been shown to be reduced by as much as six months. Distributors also have peace of mind that replacement parts are quick and easy to get.

The energy efficiency of LED lights is well known, and the efficacy of 160 lumens per watt are readily available. This compared to the efficacy of 15 lumens per watt produced by incandescent lights shows the savings that can be achieved by using LED lights. However, this is not the whole story. By using optics in a hi-bay light for a warehouse the power needed to achieve the desired lighting can be reduced considerably.

Technique Electronics is involved in design and manufacture of LED products. Our philosophy is 'we sell light not watts'.

To get the technical specifications of the MODULight or to find out more about Technique Electronics, please visit www.telec.co.za.

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Just when you think you've seen it all...

In generations gone by it was likely that you might well have seen it all - in your lifetime that is. Although events such as the Industrial Revolution and mechanisation were ground breaking at the time, one thing they certainly were not was fast.

BY I ANGELA PRICE

So in all likelihood you possibly had seen it all (from a technological offering) during your lifetime.

I doubt if any of us will ever find ourselves thinking we have 'seen it all'. Heck, just blink in this day and age and a whole new technology has been birthed during your millisecond of inattention. (Blink) - yup there you go, you just missed it…

3D printers, cloning, smartphones getting to super smart levels - every day we inch closer to a reality that not so long ago would have been dubbed 'science fiction'.

It got me thinking about the items that technological developments (hopefully) just can't replace:

1. HUMAN TOUCH

Whilst many jobs are likely to be taken over by robots, the magic of a human touch (and the emotions and sensations that come with it) may never be replicated. Virtual reality could create a pretty good illusion, but a part of you would know it was not the 'real deal'.

2. REAL FOOD

Recently scientists created the first lab grown burger, hoped to be a solution to world hunger. Personally I love food, not just the taste but the colours, smells and emotions it elicits…mmm. A lab grown burger may relieve chronic hunger but sooner or later people will crave some 'real food made real good'.

3. COMMON SENSE

Sadly a sense that appears to be less 'common' and more 'non'sense in people these days. Our heavily increasing reliance on technology to answer all our questions and needs (both physical and mental) is resulting in generations that are becoming less self-reliant and possibly even lazier and more stupid.

4. GENUINE COMMUNICATION

Whilst Skype has revolutionised communication for those of us with family far afield, the use of social media, texting, and emoticons to convey our news or thoughts does little to convey true meaning. The reason facebook and other technological forms of communication thrive is because it is human nature to want to be in touch…. and yet the very nature of technology means that we are not really 'in touch' - we are just communicating. The many nuances of a simple 'how are you' are simply dead in texting when compared to a face to face query, the light touch on the arm and the concern in someone's eyes.

One might say that technological developments are wonderful - well and good as long as they assist us in our functioning but don't take over from us…. but of course they will - in time.

In the end the pendulum may well swing back to a desire for 'real' vs 'robotic'. Real experiences vs VR, real food and real conversations with real people.

Maybe 'real' things in the future will have great value - similar to the antiques of today and for the same reasons. They will be unique, have flavour, colour, depth, flaws, exhibit creativity, take time to make, be created with love and loved…..in a word - REAL. These very same characteristics are what make us human, make us real - let us just pray that we don't become the antiques of the future.

Let's aim to ensure that we don't succeed in inventing ourselves out of existence, a feat which would see us go down in history as being the single most stupid occupants of the planet - ever. All due to our eagerness to get smarter, faster, cleverer technology.

P.S - Elon Musk (a South-Africa–born, Canadian-American entrepreneur, engineer, inventor and investor) once described human beings as "the biological boot-loader for artificial super intelligence"…That makes you think doesn't it? wn

Calendar of events

If you want to see your function or event listed here, please send the details to Minx Avrabos at minx@saiee.org.za

APRIL 2015

8-10	Fundamentals Of MV Protection	Johannesburg	www.saiee.org.za
13-15	Long Term Evolution (Lte) Mobile Communication	Johannesburg	www.saiee.org.za
14-15	Microsoft Project Professional 2013	Johannesburg	www.saiee.org.za
14-15	Practical Lighting Design For Commercial & Industrial App	Cape Town	www.saiee.org.za
14-16	CSP Today South Africa 2015	Cape Town	www.csptoday.com/southafrica
21	Revision Of Power System Fundamentals	Johannesburg	www.saiee.org.za
22-23	Mastering Power System Fault Calculations	Johannesburg	www.saiee.org.za

MAY 2015

5	SAIEE Charity Golf Day	Glenvista, Johannesburg	www.saiee.org.za
6-7	Fundamentals Of Power Distribution	Johannesburg	www.saiee.org.za
6-7	New Engineering & Construction Contracts Course	Johannesburg	www.saiee.org.za
12-14	African Utility Week	CTICC, Cape Town	www.african-utility-week.com
13-14	Leadership & Management Principles & Practice in Eng	Johannesburg	www.saiee.org.za
13-14	Fundamentals Of Power System Calculations	Johannesburg	www.saiee.org.za
14-15	Practical Lighting Design For Commercial & Industrial App	Johannesburg	www.saiee.org.za
15	Annual Dinner Dance : Western Cape Centre	Kelvin Grove Club, Newlands	bruce.thomas@capetown.gov.za
27	Road To Registration	Johannesburg	www.saiee.org.za
28	Power Transformer Operating Environment	Johannesburg	www.saiee.org.za

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