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SPRING 2016

IT'S JUST NOT CRICKET

HOW ONE CONTRACTOR HIT BACK AT NON-COMPLIANT PRODUCT

INSIDE

THE INTERNET OF OPPORTUNITY

STANDARDISING KNX

SUPPLY CHANNEL CHALLENGES

neca 100 1916-2016

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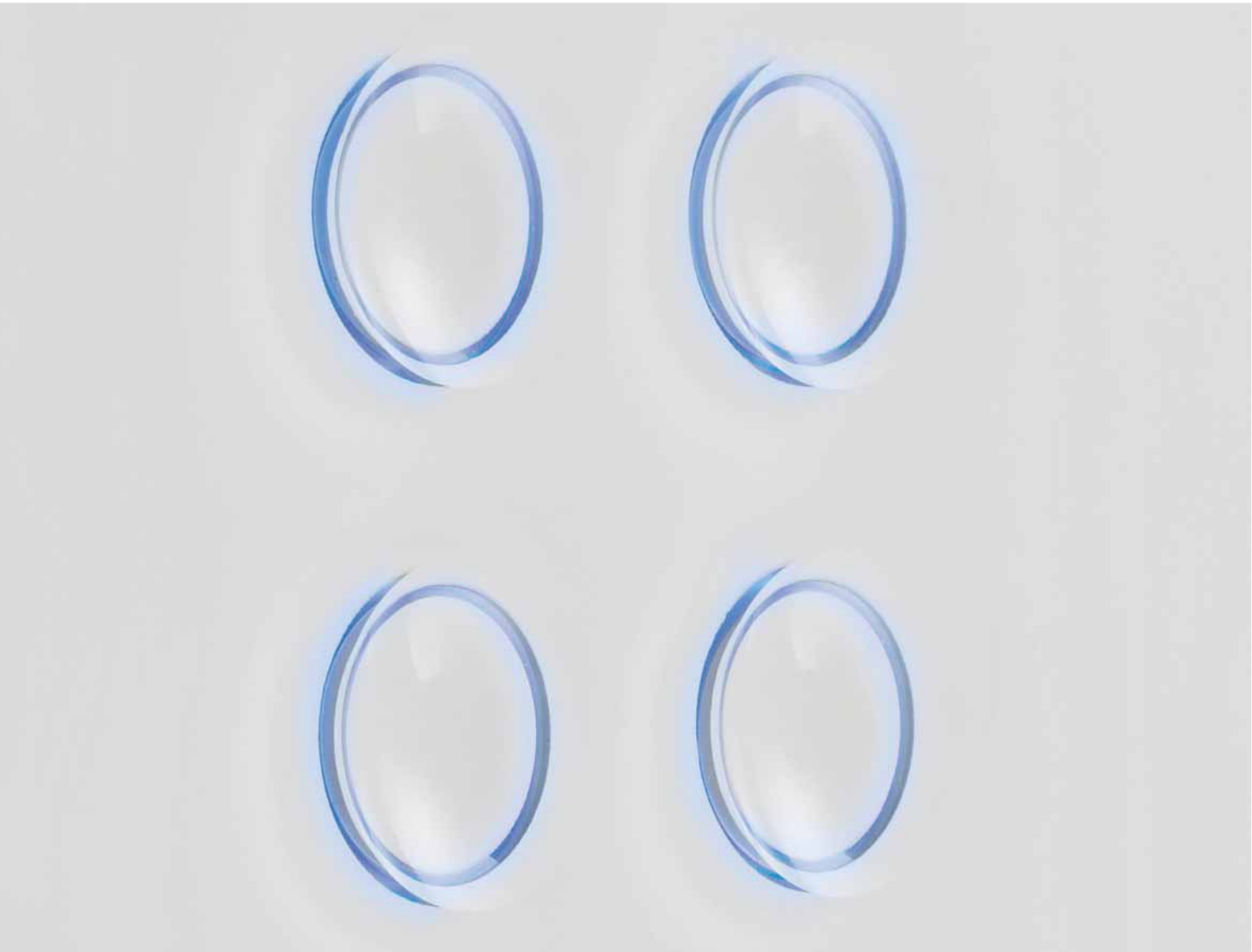

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Saturn™ OneTouch

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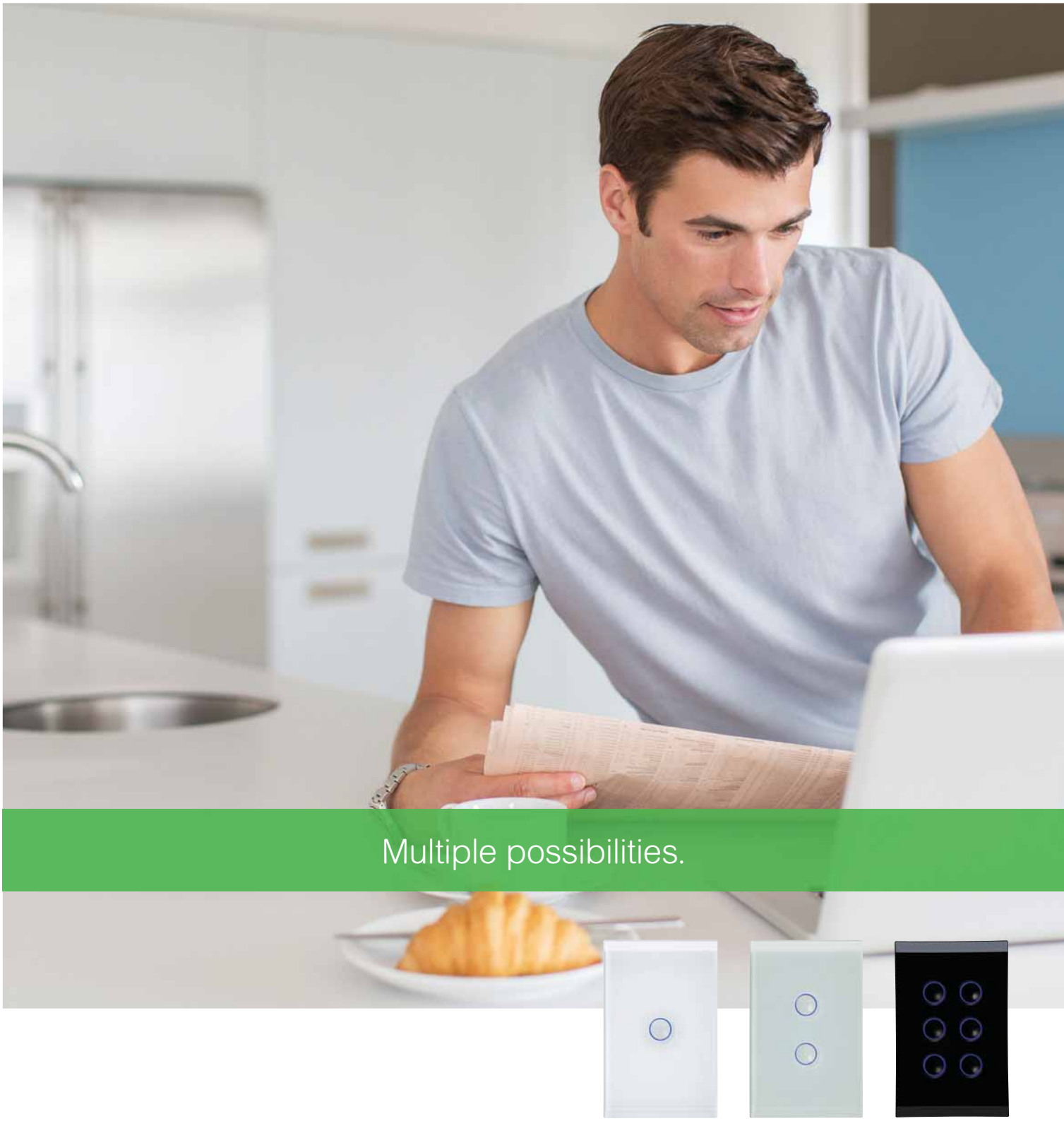
clipsal.com/onetouch



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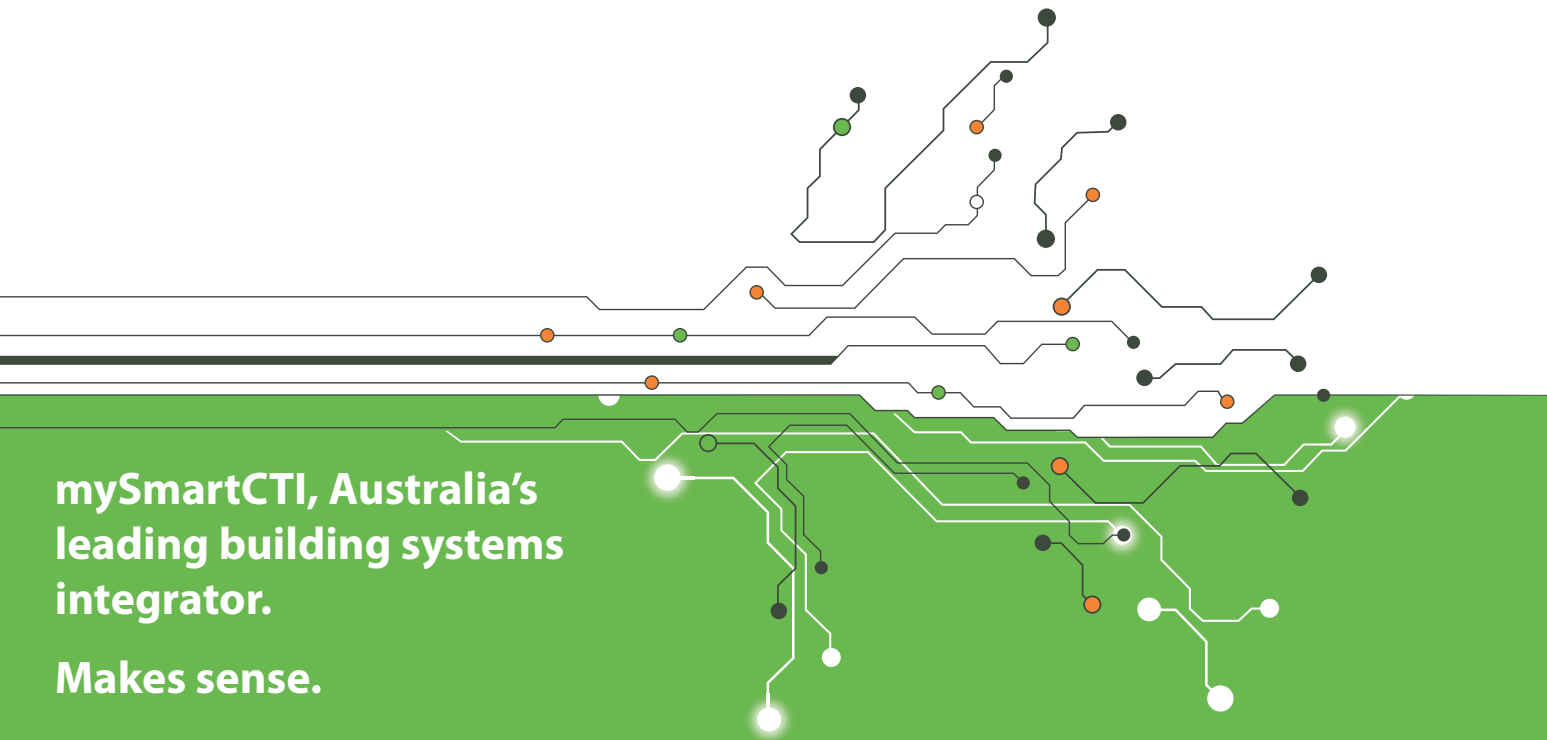

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NOT WORTH IT...

Imported electrical equipment may look good at first, but then the remedial work has to kick in. One NSW contractor tells his story of dealing with international suppliers.

22

ELECTRICAL CONNECTION

CABLING CONNECTION

Features

Regulars

ATT ACROSS THE TRADES

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A (NOT AT ALL) SELF-SERVING RANT

Over the past four months, I have attended nine NECA Tech Advantage Roadshow events all around regional Victoria. It's involved a lot of driving but since April I have met some very interesting members of the industry.

There have been plenty of questions from contractors about stories we've run and some good suggestions for future stories they'd like us to research. Undoubtedly it has been a very valuable exercise, to talk to the people who actually read the magazine and get an understanding of what we're doing right and where we could improve.

I have also handed out several hundred magazines (*Electrical Connection*, *Connected Home+Business* and *ManSpace Magazine*) to members of the industry who are taking an active interest in the industry in which they work.

To many, it's surprising that not every electrician gets to read *Electrical Connection*. Fortunately, NECA had the foresight to arrange a bulk subscription for its members. Beyond that, we have amassed a hefty database of contractors around the country over the past 20-odd years who subscribe to the mag.

But I was surprised by how many contractors had never heard of us, or any trade publication for that matter.

On a number of occasions I was asked why the licensing organisations no longer distribute *Electrical Connection* as a service to the industry – a good point if ever I've heard one.

In truth, we get very little support from such organisations (groups that you might think would see this magazine as a pretty effective and simple way of providing a recognisable form of CPD!)

Alas, we're not politically correct enough and we carry adverts to help pay for the writing, producing, printing and mailing the magazine. (This is commonly called a 'business model', but people in the public sector don't have to worry about.)

There was a time (dare I say nearly 15 years ago) when all contractors around Australia received *Electrical Connection* as part of their licence. It would be great if this was to occur again.

Knowledge has a significant value for this industry – but licensing authorities these days choose to keep you in the dark!

HOT AND STEAMY

The story on page 50 gives you an in-depth look at three-in-one heat, light and ventilation systems for bathrooms and laundries. We sourced this information from Sampford IXL, an Australian supplier (which makes a nice change), that is based in Geelong, Victoria. The article points out a few common issues that electricians may be unaware of, so make sure you bone up on the subject.

PINK BATTS 2.0

Columnist Wes McKnight puts forward the suggestion that LEDs might soon be the next home insulation stuff up. Let's hope we don't lose any lives over this technology or associated poor practice. At best the LED market is out of control and from there only worse things can unfortunately occur.

Until next time,

Paul Skelton

ELECTRICAL CONNECTION

MANAGING DIRECTOR
Jeff Patchell
jeffpatchell@build.com.au

GENERAL MANAGER
Jeremy Sweet
jeremysweet@build.com.au

EDITOR
Paul Skelton
03 9542 9016
paulskelton@build.com.au

EDITOR – ACROSS THE TRADES
Jacob Harris
jacobharris@build.com.au

STAFF WRITERS
Jacob Harris, Joe Young

GRAPHIC DESIGNER
Elizabeta Todorova

PRODUCTION TEAM
Sam Elliott, Gail Dwyer

CONTRIBUTORS
Phil Kreveld, Rebecca Mair, Wes McKnight, George Georgevits, Gary Busbridge, Steve Arthur, Brian Seymour

ADVERTISING **1800 063 371**
Simon Clark
0428 733 248

TO SUBSCRIBE
Australia Freecall 1800 623 214
New Zealand 613 9542 9000
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The new silhouette range

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www.hagerelectro.com.au/silhouette

hager

CONTRIBUTORS

GARY BUSBRIDGE

The Buzz

Gary Busbridge has been with Clipsal for more than 40 years. Since 1997 he has been involved with Standards Australia and has held memberships in several Standards committees.

> See page 60

BRIAN SEYMOUR

Estimating

Brian Seymour MBE, industry consultant, author of ***Electrical Estimator's Labour Unit Manual*** and ***Starting Out***, conducts regular industry training programs throughout Australia.

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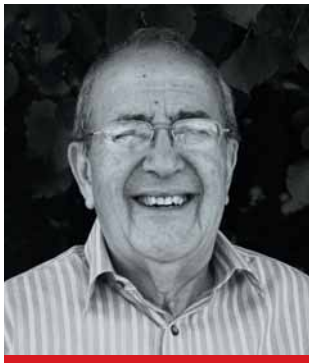

PHIL KREVELD

Let's Get Technical

Phil Kreveld is an electrical engineer with broad experience in electrical and electronic instrumentation, including relay testing power and power quality analysis.

> See page 38

WES MCKNIGHT

McKnight On The Town

Wes McKnight has over 31 years of experience as an electrical contractor under his belt. From 2008 to 2013, he was also the president of the National Electrical and Communications Association (NECA).

> See page 58

PRYSMIAN

Unexpected performance.

Our new Flat Xtra Cables – pure magic.

Why lay a separate earth cable when you can do the job with only one flat cable? The new Flat Xtra™ cables allow you to cover up to 60 %* longer runs in comparison to standard designs. This obviously means savings on labour and cable wastage. Available in 4 mm^2 and 6 mm^2 – Xtraordinary cables that will do the trick.

* certain conditions apply.

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NECA VICTORIA ROLLS INTO TOWN

Over the past four months, electricians and contractors from around Victoria have had access to the latest electrical products and technologies on offer thanks to the NECA Victoria 2016 Tech Advantage Roadshow.

Already, the show has made its way to Bulleen, Rowville, Taylors Lakes, Bendigo, Altona, Echuca, Shepparton, Albury-Wodonga and Morwell, giving local contractors the opportunity to speak to around 20 leading electrical suppliers, wholesalers and NECA itself. (Of course, the smartest contractors also took the time to introduce themselves to *Electrical Connection* editor Paul Skelton and picked up complimentary copies of our sister publications *Connected Home+Business* and *Manspace Magazine*.)

In addition to speaking with the various exhibitors, contractors were then invited to a short conference that looked at the latest happenings in the market and how to use the information in their businesses.

"For NECA, holding events like the Tech Advantage Roadshow is important because it helps contractors in regional areas to get together and share," NECA Victoria's newly-appointed executive director James Keegan told a crowd of contractors in Albury-Wodonga.

"Yes, you may be competitors during the day but you probably have a lot of common issues that are unique to your region, so talking at events like this may help to solve some problems."

If you're a contractor in Victoria but haven't made it to one of the events yet, rest assured there is still time.

Specifically, future dates include:

- 17 August – Gippsland-Wonthaggi
- 7 September – Croydon
- 5 October – Ballarat
- 12 October – Dingley
- 19 October – Frankston

"It's pretty clear from the contractors I have spoken to at the previous nine events that the benefit of attending these shows is almost unquantifiable," Paul Skelton says.

"From contractors who are looking for new products to those networking with other contractors in the area, to those who are there stuffing their showbags with every possible freebie they can get their hands on, there really seems to be something for everyone."

While the event has been organised by NECA it is open for all contractors to attend. To find out more details, visit http://neca.asn.au/vic/content/industry-information-roadshows.

RITTAL REACHES MILESTONE, SIGNS NEW DISTRIBUTOR

Rittal Australia has signed a new national distribution partnership with Ramelec, a specialist industrial electrical equipment distributor.

Founded in 1991, Ramelec has since evolved into a strong industrial distributor with a nation-wide network of offices.

Rittal A/NZ managing director Michael Mallia says: "This partnership will broaden our distribution network, particularly bringing additional market coverage in WA and Queensland. Our range of industrial enclosures, climate control units and power distribution systems perfectly complements Ramelec's range of motor control, power distribution and quality, instrumentation and connectivity products."

The announcement came just a few weeks after Rittal's AE compact enclosure passed the 25 million units installed mark.

The enclosure's high corrosion resistance remains one of its unique selling points. This is made possible by a three-stage surface treatment and paint process, which provides optimum corrosion protection and is resistant to mineral oils, lubricants, machining emulsions and solvents such as those used in cleaning.

WIND AND SOLAR STEP UP TO INCREASE AUSTRALIA'S RENEWABLE POWER

Continued growth in wind and solar power picked up to cover lower-than-average production from Australia's hydro power plants last year, delivering an increase in the amount of Australia's electricity coming from renewable energy, according to the *Clean Energy Australia Report 2015*.

Clean Energy Council chief executive Kane Thornton says although 2015 was a tough year for the Australian renewable energy industry, it ended with a lot of optimism as the sector turned its eyes towards the future.

"Even though hydro power was down, largely as a result of the historically low rainfall in Tasmania, the proportion of Australia's electricity provided by renewable energy increased in 2015 due to a good boost from wind and solar power. Renewables delivered 14.6% of our electricity, enough to light up the equivalent of approximately 6.7 million average homes," he says.

"Eight major solar farms and five new wind farms became operational last year. Two of Australia's three largest solar power plants at Nyngan and Broken Hill became operational in 2015, while the other at Moree in northern New South Wales was officially launched in the early part of 2016.

"The industry is just under halfway towards meeting the 2020 RET. We will need a lot more projects to move forward during the rest of this year to meet the 2020 Renewable Energy Target (RET), a $40 billion economic opportunity that has the potential to create more than 15,200 jobs.

"The good news is that investment confidence continues to grow in 2016 and there are more than enough projects either under construction or with development approvals to meet the target.

"Rooftop solar power continues to shine on, as homes and businesses recognise its potential to reduce energy costs. With the continued reduction of state feed-in tariffs, solar power sales have dropped to lower but more sustainable levels.

"More activity is expected throughout this year and the future for Australian renewable energy looks bright."

GSES ROLLS OUT MOBILE TRAINING FACILITY FOR PV SYSTEMS

GSES has fitted out a purpose built trailer with the equivalent of two working systems for grid-connect solar and grid-connect solar with battery storage, to help its students understand the growing market.

The trailer has also been fitted with additional components that must be used repetitively by students as part of their practical training and assessment.

The GSES trailer has been equipped to be able to demonstrate both standard grid connected PV systems as well as AC- and DC-coupled, grid connected PV systems with battery storage. The trailer has been equipped with lithium ion and lead acid gel batteries, grid-connect and multimode inverters, switchgear, PV module system, ballasted system and clip-type roof mounting systems, etc.

Now that the GSES trailer is temporarily based in Brisbane, these courses will be regularly offered for the next six months. In early 2017, GSES will announce the expansion of its grid connected PV, and grid connected PV with batteries, mobile practical training sessions to other locations around Australia.

ESC LAUNCHES BATTERY GUIDE

The *Australian Battery Guide*, prepared by the Australian Energy Storage Council (ESC), is a framework designed to provide guidance to the energy storage industry and consumers while formal Australian Standards are being developed for the sector.

A spokesperson for the group says it has to "manage energy storage products and materials to reduce their impact on the environment and manage any risks they may pose to human health and safety."

ORIGIN LAUNCHES SAAS

Origin's new Solar as a Service allows companies to enjoy the benefits of low cost solar energy without having to make the capital investment in the solar system.

According to the general manager of Origin's Solar and Emerging Business, Phil Mackey, the company's Solar as a Service offering "provides business with a simple way to save money on their energy bills by providing them with access to low cost solar energy at a lower price than they are presently paying for their grid energy.

"Plus the business does not have to pay for the system or worry about ongoing maintenance as Origin owns the system and looks after all this. This option is ideal for companies with unshaded roof space, who plan to be in their premises for the long term and operate during the day."

Under Solar as a Service businesses can keep the same solar electricity rate for up to 15 years, protecting them against any possible future electricity price hikes, or they can choose a CPI indexed rate.

PRODUCT RECALL: I WANT ENERGY—DC ISOLATING SWITCH

On 18 May 2016, a product recall notice was issued for a DC isolating switch from I Want Energy. The switch has been identified as a possible fire hazard.

Product description
DC isolating switch used in solar installations.

Identifying features
HGN4-32DC

What are the defects?
Faulty contacts.

What are the hazards?
Possible fire hazard.

Dates available for sale
7 October 2012 - 1 March 2014

Where the product was sold
Tasmania

Traders who sold this product
I Want Energy

Supplier
I Want Energy

Supplier's web site
http://iwantenergy.com.au

What should you do?
You should contact I Want Energy on 03 6234 7009 if they suspect they have this switch installed.

BICSI SOUTH PACIFIC CONFERENCE COMES TO A CLOSE FOR 2016

BICSI recently concluded its 2016 South Pacific District Conference and Exhibition. The three-day event took place at the Dockside Pavilion in Darling Harbour, Sydney, where hundreds of delegates took in education, exhibits and networking.

The overall theme of the conference was 'Trust Your Connections' with an emphasis on how ICT infrastructure is expanding into more and more business applications and building services.

Local and international subject matter experts presented on key issues that ICT industry professionals need to understand to service this burgeoning migration. Technical presentations, case studies, workshops and seminars throughout the event focused on future-proofing ICT infrastructure; mitigating business risk; accommodating network migration; the unique needs of data centres; future technical and industry trends; and more.

A highlight of the conference was the annual South Pacific Cabling Skills Challenge. Modelled after the US-based competition, eight participants challenged each other in industry tasks, scored by a panel of judges. For the second year in a row, Cameron Rolfe of Datatel in Western Australia emerged as the champion. Cameron will go on to represent the South Pacific and compete in the 10th annual US BICSI Cabling Skills Challenge at the 2017 Winter Conference & Exhibition in Tampa, Florida, in January.

Another exciting aspect of the South Pacific Conference was the BICSI South Pacific 2016 ICT Infrastructure Awards

Three awards were presented, including:

- ICT Infrastructure Design Award, presented to Datatel for Wesfarmers Court, Curtin University Business School, Western Australia
- ICT Infrastructure Installation Award, presented to DESA Australia for MCG Smart Stadium – ICT project, Victoria
- BICSI South Pacific Member of the Year Award, presented to Peter Guenther, RCDD, of Rhumb Consulting, South Australia

"It's wonderful to see such fantastic accomplishments made by our BICSI Members on a truly global level. I hope they are all proud of their achievements," says BICSI president Brian Ensign, RCDD, NTS, OSP, RTPM.

ELECTRIC SHOCK RISK – UNTERMINATED LIVE CABLES

Of the more than 300 electrical shocks reported to the Electrical Safety Office in Queensland over the past 12 months, around 10% relate to unterminated cables.

A live unterminated cable is an electrical safety risk to anyone who comes into contact with it. To manage this safety risk you should:

- Ensure that a thorough verification test has been performed on the whole electrical installation. This will identify unterminated cables and joints before the installation is energised. It is also required by law and Australian Standards (See AS/NZS 3000:2007, Section 8: *Verification*).
- Always treat unterminated cables as potentially live and isolate and test them before you touch.
- Ensure that safety switches are installed on all required circuits and consider installing safety switches on other circuits.

When pre-wiring an electrical installation you can avoid the risk of electric shock from an unterminated cable by:

- Using a reliable marking system to correctly identify the location of cables.
- Using insulation tape or junction boxes to enclose the exposed ends of conductors.
- Twisting the conductors of each cable together.

Are you monitoring your energy consumption?

As the importance of energy conservation continues to grow, monitoring your energy consumption is the first step in reducing your carbon footprint.

If you cannot measure it, then how can you improve on it? The key is a complete energy management system to help understand, tune and track your sustainability initiatives, ultimately improving efficiency.

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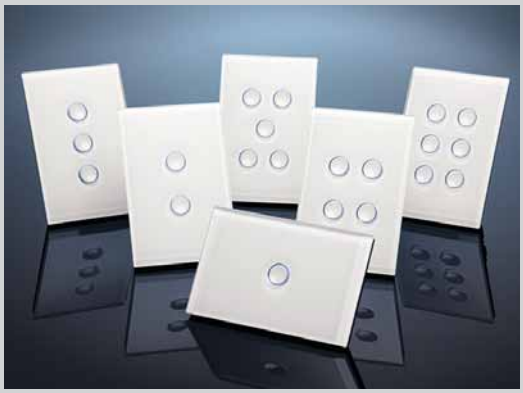


The Saturn OneTouch range was first launched to market in 2012 and allowed electricians to easily achieve multi-way switching and dimming of Clipsal LED loads. Over the past few years, Clipsal by Schneider Electric has taken the time to review and update the product to ensure it operates to the best standard possible.

Designed for universal load compatibility, Saturn OneTouch products use powerful and sophisticated microcontroller-based universal dimming technology to provide full control of almost any type of load.

With a full 6AX rating, the Saturn OneTouch switch mechanism provides unprecedented switching capability in a tiny switch mechanism while offering dynamic multi-way control. When coupled with Saturn OneTouch secondary units, up to three-way switching and dimming can be achieved while using traditional multi-way wiring standards.

COMPACT ENCLOSURE

Rittal
www.rittal.com.au

Rittal has released a range of standard electrical orange-coloured mild steel enclosures to complement its comprehensive AE Compact Enclosure system.

The X15 coloured enclosures, designed particularly to suit applications in the mechanical services market, are manufactured using a multi-stage surface finish which includes a nanoceramic primer, electrophoretic dip-coat priming and a textured powder coating. The surface finish provides optimum corrosion protection and is resistant to mineral oils, lubricants, machining emulsions and solvents.

TOWEL RAIL TIMER KIT

Legend Corporation
www.sclick.com.au

The new HNS710RT-2 S-Click towel rail timer can be adjusted to an individual's routine with a single two-second press of a button. It's convenient and saves energy by powering the rail only for the interval time and then automatically switching off.

The S-Click towel rail timer is backed up by batteries and will retain routine times even after a power loss of over 24 hours.

The S-Click towel rail timer comes in a kit comprising the timer, CABAC wall plate, cable clamp, push button, insulation breakdown sticker, instruction sticker and instruction manual.

HIGHBAY LED

Osram
www.osram.com.au

The LEDVANCE HighBay LED is just one product from the new LEDVANCE luminaire range.

The LEDVANCE HighBay LED range comprises three luminaires with 120W, 150W (90° beam angle) and 200W (70° beam angle), achieving a luminous flux of 12,000 to 20,000 lumens and a luminous efficacy of 100lm/W (operating temperature from –40 °C to +60 °C). The LEDVANCE HighBay LED has a colour temperature of 6500K and an IP65 rating, with aluminium housing and a lens made from robust plastic (PC).

SURGE PROTECTION DEVICE

ABB
www.abbaustralia.com.au

ABB has launched the next-generation QuickSafe surge protection device (SPD). The device combines the company's patented thermal disconnection technology with its new integrated safety backup system to ensure electrical equipment is continuously protected from damage otherwise caused by surges in the power supply.

An indicator shows which component needs replacing, enabling maintenance personnel to easily identify and safely replace the damaged component, while the second component continues to protect the equipment.

ROBOT CABLE

Treotham Automation
www.treotham.com.au

Treotham is now supplying a new igus chainflex cable that increases process reliability and safety by warning users against upcoming failures.

As smart factories are becoming more popular, so are intelligent monitoring systems. To increase reliability and reduce the threat of downtime, igus has released an intelligent robot cable that predicts the future and warns users before failure occurs.

The cable triggers a warning if certain limits are exceeded. This indicates that the cable must be replaced within the next four weeks.

HIGH ACCURACY CURRENT SENSORS

SATEC
www.satec-global.com.au

SATEC's range of current transformers, or High Accuracy Current Sensors (HACS), is designed for new and retrofit applications in energy metering.

The HACS can be extended up to 200m from any SATEC meter using 1.5mm^2 cable providing solutions where restrictions to access to loads is difficult due to installation problems.

The SATEC HACS have an accuracy Class 0.5 per AS/IEC610044-1, providing readings as low as 0.1% of the current range. HACS are available in 100A, 200A, 400A, 800A, 1,200A, 2,000A and 3,000A current ranges.

PRE-TERMINATED COPPER CABLING ASSEMBLIES

AFL Global
www.aflglobal.com

AFL has announced the release of the Owl-Eyed Identification System, which offers an easy and accurate method of identifying the connection point of your copper patchcords. The Owl-Eyed patchcord features a bright LED light source allowing technicians to visually trace individual patchcords from one end to the other without interruption or disturbance of the circuit.

LED-lit plugs are clearly visible from several metres away. The Owl-Eyed tracer tool is simply plugged in at one end and activates both boots for immediate identification of the other end of the cord.

RETROFIT ACB

NHP Electrical Engineering Products
www.nhp.com.au

Air Circuit Breakers (ACBs) are commonly used in low voltage switchboards and due to their typically passive operation, are often forgotten about until there is a trip or circuit breaker failure leading to a power supply disruption.

The consequence of ACB failure can be financially costly and dangerous. To help address this issue, NHP provides 'retrofit kit' solutions that allow end users to modernise their ACBs with minimal downtime. With a retrofit kit, the key components of the system can be quickly replaced, leaving the existing copperwork and steelwork intact.

WIRELESS NETWORK TESTER

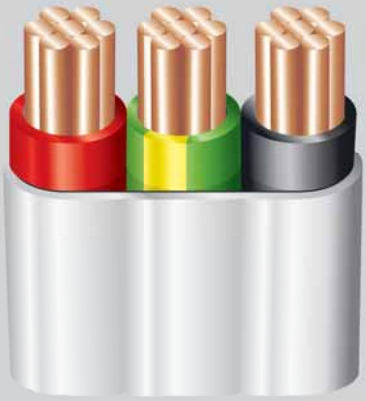
NETSCOUT SYSTEMS
www.netscout.com

NETSCOUT SYSTEMS has launched the next generation of the AirCheck handheld wireless tester. This popular tool now includes important new enhancements, such as troubleshooting and diagnosing WiFi networks built using the increasingly adopted 802.11ac standard, access point backhaul testing and free access to the Link-Live Cloud dashboard for more effective results management.

The NETSCOUT AirCheck G2 wireless tester is designed to enable front-line IT to quickly and easily identify issues responsible for spotty connections, dead zones and slow speeds, as well as locating rogue access points and unauthorised devices. This functionality is ideal to support installation and troubleshooting of IoT wireless edge infrastructure for applications, such as the testing of the wireless infrastructure that supports patient monitoring for healthcare, industrial IoT, personalised and immersive experiences for retail, smart buildings and smart homes.

SMART CONSTRUCTION CABLE

Prysmian Australia
www.prysmiancable.com.au



Prysmian Australia has introduced a new construction cable capable of increased installation lengths without the need for additional earth core installations.

This new product eliminates the need to lay down two cables to meet specific route lengths in order to comply with the fault loop impedance requirements. This obviously means savings through using less labour and generating less cable wastage as only one cable will need to be laid down.

The Flat Xtra range is currently available in the most popular sizes for Twin and Earth flats: 4mm² and 6mm². The new cable configuration allows for a 30% longer route in comparison to a standard 4mm² T+E flat and a 60% longer route in comparison to a standard 6mm² T+E flat.

Further, with no requirement for any special tooling to lay down the cable, the Flat Xtra range is even easier to install.

LED FLAT PANEL

Legrand
www.legrand.com.au

Legrand has launched its Luminess LED flat panels, providing an energy-efficient alternative to fluorescent lighting and better glare control.

The new panels feature a lifespan of 50,000 hours at L70 for improved lighting maintenance and longevity. The panels can also be integrated with Legrand's range of energy and lighting management solutions for advanced energy savings and room automation. When connected to the Legrand BUS/SCS systems, local and remote command of other devices can be enabled for further energy savings.

WIRELESS INTERLINK BASE

Maxtemp
www.maxtemp.com.au

Maxtemp now stocks the LIFWMB Wireless Interlink Base by PSA Products.

The base is compatible with the LIF5000-ionisation, LIF5800-photoelectric and LIF5800RL-photoelectric smoke alarms, and it is powered by whichever of these three models is fitted to it.

Quick to install, the base allows you to wirelessly connect up to 24 smoke alarms in a network, therefore eliminating the cost of running cables.

It operates on the 2.4GHz radio frequency band.

FLOOR DUCTS

Electrical Cable Duct Systems
www.ecd.net.au

In existing fitted out office spaces, difficulty arises when getting power/data cables to the work space.

The FFD10012 series floor duct system from ECD has been designed to enable a duct to be 'fully recessed' or 'semi recessed' into the existing floor finish or 'surface mounted' to give a low profile and unobtrusive look.

With an extruded aluminium duct body of 100x12mm deep and two compartments for power/data, this system is available with an attractive brushed stainless steel cover.

Installation is simple with 3m lengths and prefabricated bends.

SPOTLIGHT

Beacon Lighting Commercial
www.beaconlightingcommercial.com.au

The LEDlux Action LED Track Spot is a great solution for when you're looking for the versatility of being able to move the spot anywhere along the track with the option of adding extra lights.

With 600lm per light and Phillips LUMILED mid powered LEDs, it will provide excellent lighting for a range of applications, including kitchens, hallways, lounge rooms, art galleries and retail spaces. The fitting is dimmable, with a beam angle of 50º.

Available in 3,000K warm white and 4,000k cool white, the Action spotlight is available in both matte black and white finishes.

Excite an outdoor space with new exteriors in black, brass and copper from

BEACON LIGHTING COMMERCIAL

Crafted from contemporary materials such as metal, timber and copper, the **NEW Exterior range** from Beacon Lighting Commercial combines designer style with energy efficiency.

Southampton
1 light large exterior pendant in antique black with clear glass shade.

Norwest
1 light large wall bracket in aged nickel.

Docker
External light in copper finish with clear lens.

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HAVING NAAN OF IT

From non-compliant MCCs to paper-thin cable ladder that didn't have a National Electrical Manufacturers Association (NEMA) rating, the team at RIC Electrics had its work cut out to turn around a system that complied with Australian Standards.

IMPORTED ELECTRICAL EQUIPMENT MAY LOOK GOOD AT FIRST, BUT THEN THE REMEDIAL WORK HAS TO KICK IN. PAUL SKELTON REPORTS.

Product compliance is not a new issue – indeed, you may be sick of hearing about it.

However, as long as electrical contractors are being jeopardised by imported, inadequate international products it is important to keep publicising the issue.

In one case the team at a Wagga Wagga contractor, RIC Electrics, faced a series of challenges when a client building an oil seed processing plant bought the equipment from India.

RIC Electrics was subcontracted to carry out the electrical installation portion of the project.

This meant RIC Electrics had to work with the suppliers to create a solution that complied with Australian Standards. They eventually achieved their goal – and learnt several valuable lessons along the way.

"We were in town and heard there was a bit of work going on," company director Bruce Duff says.

"It was good timing on our part – the retired electrical engineer organising the installation became ill, so we were asked to assist with the design and installation of the electrical equipment portion of the project.

"But it turned out that everything, including the motor control centres (MCCs), had been procured from India.

"Initially, they were going to send a team over from India to install the equipment. Fortunately, the client's project manager (who also came on board after the items were purchased) said 'no'.

"He explained to the client that the work wouldn't comply with Australian Standards so the job couldn't be done with the use of Indian labour and electrical equipment. He'd been involved with Indian suppliers before.

"There are significant differences between Indian electrical regulations and AS/NZS 3000:2007."

The client had opted for a canola oil seed processing 'package' that included all the plant machinery and electrical components.

"RIC Electrics told the suppliers they could not provide any equipment unless it complied with Australian Standards," Bruce says.

A potential red flag was raised early in the project. Before the contract was

finalised, the client asked Bruce to go to India and audit the MCCs during manufacture.

"I politely declined and said it could all be managed through photos, Skype calls and emails. This worked reasonably well and ensured that the MCCs complied with Australian fault current requirements... sort of."

Bruce says dealing with Indian electrical engineers – and others with limited knowledge of the Australian Standards – was harder than he originally thought.

"There was a lot wrong with these products when I first saw them.

"First, we did all the proper calculations and told the suppliers they needed to upgrade all the equipment internally to achieve fault level and discrimination requirements to satisfy the Australian Standards. They did about 90%, and we had to do the rest when the boards arrived.

"Several times we stipulated shielding of live components – something that was ultimately done by RIC staff on site.

"Further, the MCCs arrived with the wrong programmable logic controllers (PLCs) installed. Our skilled instrument and control staff replaced them with the specified Allen Bradley PLCs.

"Then, our in-house programmers set up the PLCs and supervisory control and data acquisition (SCADA) system to fully operate the plant."

Bruce says the suppliers did not issue any design or engineering documentation.

"There were MCC drawings, plus some control diagrams and PLC connection plans. That's all.

"This changed dramatically as the project proceeded. We developed test and commissioning sheets or booklets for each MCC to ensure everything was suitable for the site.

"These documents were designed to help with commissioning of all motors. They were crucial – and saved time in that phase of the project."

Everything, including the motor control centres (MCCs), had been procured from India, which caused a lot of headaches for RIC Electrics' staff.

RIC Electrics was also contracted to do all the field layouts and designs, cable sizing and consumer mains sizing.

"Time management on this project was a nightmare when it came to staffing.

"Indian equipment drifted in or didn't arrive at all. So we were requested to take over the supply of electrical materials for the site to ensure a timely arrival of materials for installation and that there were no compliance issues.

"We didn't have the luxury of planning. It was very much 'design and construct' on the run. The project manager had to coordinate our works with the other contractors on site and given the delays caused by the supply of non-compliant equipment this created many problems."

In addition to sending non-compliant MCCs, the suppliers intended to provide paper-thin cable ladder that didn't have a National Electrical Manufacturers Association (NEMA) rating.

"This meant we had to redesign all cable ladder routes and runs to use Australian compliant product. Cable manufactured to Indian requirements was inadequate, so we bought from Australian manufacturers.

"As for the supplied switchboards, all the internal cabling was too small and component fault levels were incorrect. And we had to pull out aluminium busbar and put copper busbar in."

The result was an intricate system that eventually complied with Australian Standards.

"Australian and New Zealand electrical Standards are among the most rigorous in the world. We can send our products elsewhere, but people in other countries can't really send their equipment here.

"Dealing with international suppliers didn't necessarily make my job harder, but it took a lot more time."

Bruce says RIC Electrics had the necessary skills to create a high-quality, compliant electrical installation.

"Clients and procurement officers need to understand that when purchasing electrical equipment from offshore, consideration of Australian Standards is a must.

"It is not impossible to upgrade equipment to comply with Australian Standards but this is an added expense." ■

THE INTERNET OF OPPORTUNITY

THE INTERNET OF THINGS PROMISES TO USHER IN FUNDAMENTAL CHANGES IN ALL SECTORS OF THE ELECTRICAL INDUSTRY. JACOB HARRIS TAKES A CLOSER LOOK AT THE TECHNOLOGY TO SEE HOW CONTRACTORS STAND TO BENEFIT.

The Internet of Things (IoT) is coming and, whether we like it or not, this new level of connectivity is destined to make a significant impact on all sectors of the electrical industry. From residential products that perform simple remote monitoring tasks to complex industrial systems that increase productivity while reducing expenditure, the IoT is promising to be a truly disruptive technology that will fundamentally change the way we live and work.

"The overall concept of the IoT is that everything, no matter what it is, can be connected and controlled. What we are seeing residentially is an absolutely huge array of cost effective, wireless products to do home automation," says Perth-based home automation integrator Ryan De Rozario.

"These products cover what we have always been able to do with automation but at a much more accessible price point, making them attractive to a wide range of people – not just those building luxury homes."

If opportunities presented by the uptake of IoT technologies are to be leveraged effectively, contractors will need to adapt their skill-sets to include a higher level of knowledge regarding communication protocols and the like.

"Better knowledge of how IoT devices interface is going to become a key driver and a change, not just in skill-sets, but also in business approaches will be required. As these different devices become more connected, the importance of partnerships and platform approaches between businesses also becomes more important," says Schneider Electric Pacific director of process automation offer management and business development Brad Yager.

"We need these various systems to integrate. If we don't have open standards and open dialogue between the people producing these separate systems – vendors, installers, electrical contractors and asset owners – it's not going to work. So different methodologies of business practice will become a key skill-set required going forward as well as the ability to interface the physical devices themselves."

According to Brad, industry demand for contractors with IoT knowledge is there now. Demand for IoT technologies across all sectors is increasing almost exponentially although whether or not the market can accommodate that demand is yet to be seen.

"With the introduction of products that give users the ability to monitor their power consumption in real-time, consumers are going to see a baseline of electricity consumption when everything's switched off because of standby mode. This will cause people to start choosing different products based on their standby consumption – not just the consumption when they're using it – and contractors who can articulate that change of thinking to consumers are going to get more work than those

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Before we know it, the IoT will become the new normal. 20 years ago it was uncommon to see someone with a mobile phone, now almost everyone owns a smart phone.

who can't."

Before we know it, the IoT will become the new normal. 20 years ago it was uncommon to see someone with a mobile phone, now almost everyone owns not just a mobile but a smart phone. Soon enough, the IoT will be ingrained in everything. Everything we buy, produce or install will be IoT-enabled.

RESIDENTIAL

As the role of the IoT in the residential electrical industry expands, knowledgeable contractors are well positioned to take full advantage of this growing market. But in order to leverage this effectively, a thorough understanding of the IoT and the technologies that underpin its operation is of paramount importance.

Effective installation of an IoT framework hinges on a reliable network built with quality hardware. Unlike the network types most people are familiar with, such as Ethernet and WiFi, many of the major IoT players use either ZigBee or Z-Wave networks for their wireless devices. It's the implementation of these networks contractors who are interested in working in the IoT space should become accustomed to.

Indeed, a comprehensive understanding of networks is a fundamental requirement when implementing IoT technology. According to Ryan, if a contractor can't deliver on the network hardware and setup then they won't be able to deliver an IoT solution.

"We certainly wouldn't consider touching an IoT install unless we were wholly responsible for the design and implementation of all network hardware. When something falls over, the last thing the client needs is two contractors warring over where the fault lies – and it can get quite grey with networks. The best thing a contractor can do for a client is take complete ownership of the network when the provided solution relies on it."

As the number of consumers familiar with the IoT increases exponentially, so too should business opportunities for electrical contractors.

"We are finding customer awareness of the IoT is rapidly gaining traction. People are starting to ask more about what their houses are capable of. This isn't just the young tech savvy demographic either, we find baby boomers are now becoming very interested in what they can do with their new favourite, easy to use toy – the iPad," says Ryan.

Even contractors who decide that providing the IoT and network solutions isn't for them should make sure they are running hardwired data infrastructure to anywhere they have installed fixed devices and ensure they allow adequate connections for wireless access points.

"With the likes of Samsung and Apple behind it, the IoT isn't a flash in the pan; estimates on what the industry is worth globally in the next 10 years are well into the trillions. If it was my business, I would want a slice of that pie!"

COMMERCIAL

In addition to being a rapidly growing market within the residential electrical sector, connected devices are becoming big business for electrical suppliers and commercial contractors.

"Over the coming years, products that are incapable of communicating, acting on information transmitted to them or being remotely actuated will be the exception. This is set to change the landscape for electrical contractors, creating massive opportunities for those who position themselves cleverly," says Legrand Australia chief executive Tony Berland.

Tony cites the *Australian IoT @ Home Market Study* undertaken by Telsyte that forecasts spending on IoT home products and services in Australia will grow from $289 million in 2015 to $3.2 billion in 2019; an 11-fold increase.

Possibly one of the largest areas in the commercial market to be affected by the IoT is emergency lighting and energy efficiency.

The IoT will make monitoring and communicating with emergency lighting much more efficient. It is a requirement for businesses to keep records of testing of emergency lighting as per AS2293 and, according to Legrand, the IoT will provide significant advantages by

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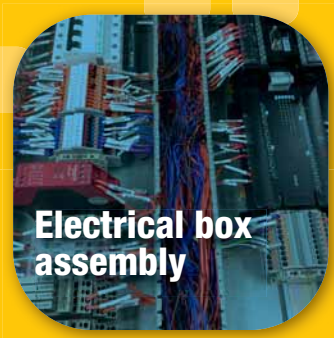

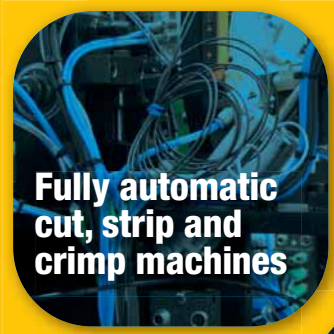

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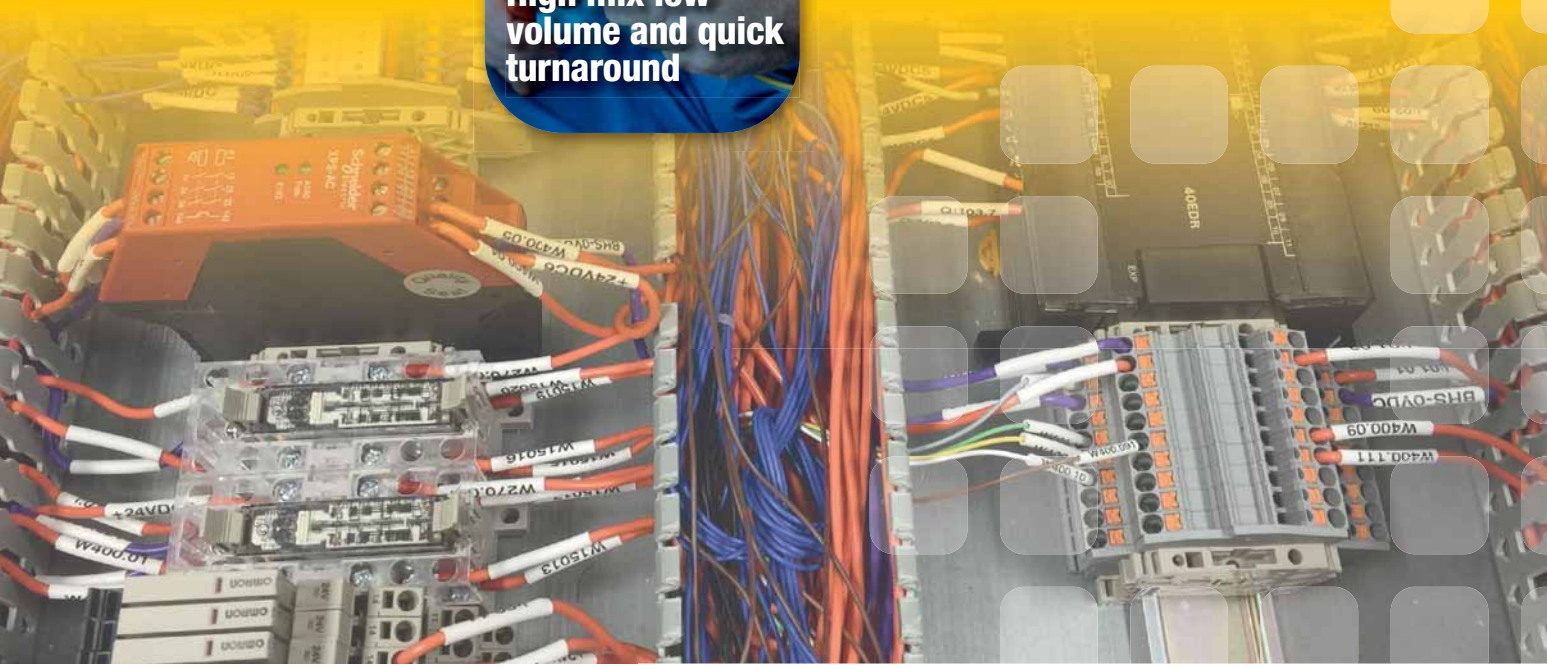

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enabling businesses to store test reports in the cloud and access them remotely from any location. Users will also be able to monitor and test their emergency lighting installation from anywhere in the world.

In the energy efficiency sector, the IoT can provide facilities managers with real-time information on total energy consumption in their commercial installation broken down into sub-categories relevant to that installation. This information can then be used to identify potential areas of further energy savings. The IoT is also powerful in the sense that it can take all these inputs and fully automate room management while allowing for manual intervention via mobile devices.

INDUSTRIAL

When the IoT is applied to industry it is commonly referred to as the Industrial Internet of Things (IIoT). It is currently making its presence felt in several industry sectors by helping to streamline operations and identify inefficiencies.

In November 2015, Schneider Electric surveyed approximately 3,000 business leaders in Australia and overseas and compiled a report named *IoT2020*.

The report identified three key areas in which the industrial processes can be streamlined by incorporating IoT functionality.

"The first area is asset performance. We talk about the IoT but, from an industrial perspective, these connected 'things' we're talking about are 'assets'. One of the big changes in perspective that will be heralded by the IoT is an increased focus on the complete lifecycle cost of assets as opposed to their immediate, up-front cost," says Brad.

In industry, buildings and even in our own homes this is becoming more and more relevant. The actual lifecycle costs of an asset can be much more (15-20 times more) than the upfront purchase cost and as things become more commodity-driven, lifecycle costs become more important.

The ability to monitor, measure and articulate what an asset's lifecycle costs are and then have a measure of control over that is what becomes really important: a specific focus around performance over the complete lifecycle of an asset.

The second key area outlined in the report is operations. The uptake of the IoT, combined with an increasingly transient workforce, is causing many businesses to rethink traditional knowledge hierarchies and operational frameworks.

"We can't rely on the models of yesteryear any longer. Businesses often used to have long-term employees who knew their company's system back to front – they were the unofficial decision makers and the people who would bring new employees up to speed – those guys are starting to leave and the new guys coming in have only been there a couple of years and will probably be moving on in a couple of years because we have a more transient workplace. This means the smarts now have to be into the systems themselves," says Brad.

Systems with built in smarts can provide automated direction to relatively inexperienced operators; enabling actionable insights to be made by delivering crucial information at a specific time and location.

"Getting the piece of information to the operator right when they need it – instructions to conduct a preventative maintenance task as they're walking past the relevant machine for example – can make all the difference on whether IIoT systems make a positive impact on processes or just generate useless data. It's not about the information itself but the actual actions the information drives," says Brad.

The third area where industrial processes can be streamlined according to *IoT2020* is the creation of an enterprise control layer that combines all the various aspects of the business.

"Previously, individual silos have all had separate supply chains – the product lifecycle people are only concerned with their department, the customer relationships department only deal with customers etc. Now we can bring all that information in and combine it at an enterprise level which is where you get some extreme value.

"An interesting example is what's happening with supermarket milk. People aren't buying the generic, home-brand milk anymore. They're all buying the branded milk and the supermarkets can't meet up with demand. However, if the supermarkets had a really smart IoT system that could have forecast that shift – if customer relationships had identified there was going to be a major shift in customer buying patterns prior and immediately, without a manual interaction, fed that information into the supply chain – there would have been milk on the shelf ready to go," says Brad.

There can be no argument that the IoT brings a lot of rewards but there is no reward without risk. Greater connectivity inevitably creates a higher level of risk in the cyber security space.

"In the industrial IoT world, it's the operations that need to be prioritised. So protecting the operations of all these connected devices is going to be something that becomes very important and certainly ingrained in our thinking," says Brad.

"I think cyber security will be the difference between those who are successful and those who just try to jump on the IoT bandwagon and leave their poor customer exposed." ■

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WHAT COMES KN-EXT?

BY NOW, ELECTRICAL CONTRACTORS ALL AROUND THE COUNTRY ARE LIKELY TO HAVE HEARD OF KNX. WHAT YOU MAY NOT KNOW IS THAT INDUSTRY IS CURRENTLY DEBATING WHETHER TO FORMALLY ADOPT KNX AS THE STANDARD IN AUSTRALIA.

In the early 1990s, three automation industry associations– Batibus, EIB and EHS – were each competing for their place in the European standardisation of home and building control. Individually, this competition restricted the growth of each system until, in 1999, they were amalgamated into one.

The result was KNX – the world's first open, royalty-free and platform-independent international Standard for home and building control.

Based largely on the EIB specification, KNX adopted the configuration mechanisms and communications media aspects of EHS and Batibus to develop a new international Standard to improve on interoperability between different countries' requirements.

In 2012, the KNX National Group Australia was established as the local representative of the International KNX Association to foster the technology locally.

The proposal to introduce the KNX Standard in Australia has been met with some opposition. One body that has voiced concerns is the Lighting Council Australia. Below, *Electrical Connection* lays out both sides of the argument in the interests of creating an unbiased commentary on the issue.

INDUSTRY COMPLIANCE

Lighting Council Australia - The KNX protocol is not the primary protocol for control and automation of lighting equipment in Australia. Lighting Council Australia estimates that KNX compliant products occupy only a small percentage of the building and home automation market in Australia. We question the need to publish an Australian Standard when the majority of the market will be non-compliant with that Standard.

Lighting Council further suggests that the limited numbers of suppliers of KNX products in Australia would likely mean there is decreased competition in the Australian market if the current majority of the Australian automation market is denied access to projects due to the specification of the KNX protocol as an Australian Standard.

KNX - The group of draft Standards known as AS/NZS 14543.3 Parts 1-6 has not been proposed to be a mandated standard. The purpose of the Standard is to define the protocol and mediums used in the communication between applications such as lighting, blinds and shutters, heating and ventilation, security, AV, etc. in order to provide a total control system. It is not the intent of these Standards to define a control system within an application such as lighting.

This can be demonstrated in the case of DALI lighting controls, where on many successful projects worldwide a DALI control system is used for the lighting system but the DALI system integrates into a total building control system along with other disciplines such as heating, ventilation and air conditioning, using the ISO/IEC 14543-3 Standards.

Many building services engineers have indicated their frustration of being tied to application-specific systems where a total building control system requires different systems (often proprietary) for lighting, heating, ventilation, blinds and shutter control.

The KNX protocol, as defined by IEC 14543-3 and the proposed AS/NZS Standard, provides a means for these services and other applications to

communicate via one protocol, allowing a simplified approach to building automation. Having a protocol defined by a standard provides security for users against changes made by manufacturers according to their will.

BENEFIT TO THE COMMUNITY

KNX -The lack of an Australian/New Zealand standard in this sector does not provide a mechanism for convergence of a variety of applications into an easily integrated system. The purpose of this draft AS/NZS Standard is to provide such a mechanism.

A major feature of this Standard proposal is that the defined protocol is non-proprietary and independent, and is freely available to all market segments and manufacturers. This will promote competition in the market between manufacturers that will benefit the Australian community.

The effect of not having a building automation standard in Australia encourages numerous protocols across the market with no compliance between them and leaves the industry subject to manufacturer's decisions on product/ protocol life cycle.

The intent of the AS/NZS 14543.3 Parts 1-6 is to provide a defined, open protocol where various manufacturers or applications can communicate effectively to allow interoperability. While standalone systems may be acceptable in domestic situations, the lack of standardisation in commercial developments can cause increased costs due to individualised control systems on various applications and duplicated resources.

Lighting Council - Every Australian Standard must demonstrate positive net benefit to the community as a whole. All Australian Standards must provide a value or benefit that exceeds the costs likely to be imposed on suppliers, users and other parties in the community as a result of its development or adoption and implementation. In this case, the lighting industry is saying that it does not use the KNX protocol in Australia now and significant costs would be imposed on lighting suppliers and installers if KNX were to become the Australian Standard.

Other industry stakeholders have not yet been consulted on whether they will be impacted if KNX were to become the Australian Standard.

ETS CONFIGURATION

Lighting Council - KNX products are required to be configured and commissioned by a software tool called ETS. ETS software is licensed and controlled outside of the standards process and offshore to Australia by a commercial entity. If KNX is published as an Australian Standard, ETS would tie the Australian Standard to an overseas commercial entity.

KNX -There is no obligation whatsoever imposed in the ISO/IEC 14543- 3 Standard to have products compliant to the Standard certified by the KNX Association, nor does the Standard mention the compulsory use of the ETS Software tool for configuration of ISO/IEC 14543-3 compliant products.

In 2012, the KNX National Group Australia was established as the local representative of the International KNX Association.

It is fully left up to the manufacturer to decide whether or not the company would wish to join the KNX Association and/or whether the company wishes to label the product with the KNX Trademark (only then requiring certification of the product by KNX Association).

However, many of the manufacturers who have ISO/IEC 14543-3 compliant products have opted to ensure that their products are configurable by the ETS, as the ETS software is used by many thousands of system integrators around the world. Such manufacturers provide their own application software that is incorporated by the integrator into their project. The application software is offered as a free download by the manufacturer ensuring no additional cost burden is placed on the system integrator.

The reason for embracing the ETS software as a manufacturer for the configuration of ISO/IEC 14543-3 compliant products is the advantage for integrators to use one single common software tool across multiple vendors and applications. The software is essentially a commissioning tool with a single licence for the integrator. No additional licence is required for the project, irrespective of the project size, products used or manufacturers supplying the equipment. There are also no on-going licence or royalty requirements for the integrator or for the project.

FREQUENCY

Lighting Council - Another matter is the technical incompatibility of the KNX radio frequency with the Australian spectrum allocation (the 868MHz frequency is not allowed in Australia for low interference potential device wireless communication). This poses two issues.

Firstly, if KNX becomes the Australian Standard, global 868MHz products could inadvertently enter the Australian market under the overall KNX brand without an assessment of the radio frequency allocation and interference considerations. Wireless communication is increasingly being used in automation systems.

Secondly, the Australian automation market is moving towards wireless communication; however, this channel

will either be not available under the KNX protocol in Australia or will be proprietary, causing an inability to communicate with other brand products and defeating the purpose of an open protocol and Australian Standard.

KNX - The radio frequency section of ISO/IEC 14543-3 (Part 7) has not been proposed to be adopted as an AS/NZS standard due to technical advice from the ACMA regarding the frequency spectrum. This may be addressed in a future Standards Australia project proposal with an agreed and ACMA approved alternate frequency. To alleviate confusion of the scope of the AS/NZS Standards a comment has been inserted into the preface of Parts 1-6 as follows:

"ISO/IEC 14543-3-7 (Part 3-7) has not been adopted as an AS/NZS standard at this time due to an incompatibility with the Australian Radio Frequency Spectrum Plan 2013."

If the ISO/IEC 14543-3 (Parts 1-6) were adopted, it would still be illegal to sell radio frequency products of 868MHz even though they are outside of the scope of the adopted Standards, due to the ACM's rules and RCM product compliance labelling requirements.

Internationally, work is underway to increase the suite of Standards of ISO/IEC 14543 to include wireless, the Internet of Things and other emerging technologies. The robustness of the ISO/IEC standards has allowed new technology to be continually incorporated into the existing Standards without the need to revise these Standards.

FUTURE MANAGEMENT OF BUILDING AUTOMATION STANDARDS IN AUSTRALIA

Lighting Council - Given the diverse range of interests in the automation market in Australia, Lighting Council suggests that a standards committee that includes all relevant stakeholders should be constituted and determine the appropriate building automation standards approach going forward. We suggest that such a committee should consider the current state of the relevant Australian automation market sectors and relevant automation standards as part of such an assessment.

Product and application areas relevant to home and building automation include (but are not limited to) lighting, HVAC, security, fire alarms, white goods and appliances, EV charging, cogeneration, electrical accessories, facility management and the Internet of Things. Builders, installers, facility managers, network operators and regulators should also be included in a comprehensive constitution.

There is also work underway at the IEC Standardisation Management Board level of which Australia is the convenor to map and review the large number of smart home/office building standards activities that are underway across the IEC, ISO, ITU, IEEE and other relevant industry bodies. The information compiled during this review will form a roadmap and could be used as part of the assessment of future Australian automation standards activities.

The ISO/IEC 14543.3 Standards will undoubtedly be included in the above mentioned IEC SMB roadmap and should be included among other relevant standards as part of an overall assessment of the approach to Australian and New Zealand building automation standards undertaken by a comprehensive building automation standards committee.

KNX - The Australian home and building automation sector has been operating for some time without a standard to work with which has seen many projects having multiple protocols operating independently of each other and creating on-going difficulties for service and maintenance of these systems. Having an open standard that crosses the boundaries of different applications allows interoperability between application and manufacturers and simplifies the overall system.

The Australian government and Standards Australia has a policy to adopt IEC standards wherever possible and the adoption of the ISO/IEC 14543-3 group of Standards that define an open protocol complies with this policy.

> The proposal to introduce the KNX Standard in Australia has been met with some opposition.

The Standard ISO/IEC 14543-3 has been proven at the international level in the home and building automation sector with worldwide manufacturers across multiple disciplines (lighting, HVAC, security etc.) embracing the Standard with their product development for many years. The strength of this Standard has seen it already adopted in other countries and successfully used for many years.

In most instances the standard is not mandated, therefore not compulsory, so the market has an option on specification of the standard, whereas currently in Australia the absence of a standard does not provide the ability to ensure complete integration and interoperability of services.

While considering the way forward in the wider space of building automation standards, development is a great concept. We should not allow such considerations to delay adoption of current proven standards in the international arena that can assist the efficiency and economic performance of the home and building automation industry right now. ■

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THE GREAT SOLAR CRACK DOWN

THE CLEAN ENERGY COUNCIL IS CRACKING DOWN ON PANEL SUPPLIERS THAT MAKE UNSUBSTANTIATED MARKETING CLAIMS AND/OR AVOID THEIR WARRANTY RESPONSIBILITIES. PAUL SKELTON REPORTS.

According to an internal review conducted by the Clean Energy Council (CEC), not all solar panels and inverters are made equal. And some international suppliers of solar equipment act questionably when it comes to honouring warranties, if they act at all.

While not at all surprising, these findings have led to the introduction of some tough (yet very welcome) new measures that aim to substantially lift the bar on the quality of solar power products sold in Australia.

CEC chief executive Kane Thornton says the changes are the latest in a series of steps designed to ensure the highest standards for people buying solar power systems.

"Solar panels and inverters already need to be independently tested and demonstrate their compliance with Australian Standards before they can be sold here," Kane says.

"These products are then included on lists of approved solar power modules and inverters, which are available from the CEC's Solar Accreditation website.

"Now, an independent testing program is being introduced for solar panels and inverters to ensure that the actual performance of products being sold in Australia live up to their marketing claims. Products that are not up to standard will be removed from the CEC's lists of approved products.

"Likewise, products can now be de-listed if suppliers breach consumer law – such as a failure to honour warranties – effectively removing their eligibility for government incentives."

Kane says these changes will improve overall product quality in the solar industry by making sure customers get what they pay for when buying panels and inverters, and by penalising companies that do the wrong thing.

"At the CEC, we don't like misleading marketing and we want to stop customers from being misled, whether deliberately or inadvertently," CEC policy manager Darren Gladman says.

"For a long time we wanted to introduce a requirement for independent testing. But in order to give us some teeth, our system had to become more robust.

"Two years ago, we were approached by an importer of inverters who had warranty issues with an overseas supplier. The company was operational but not responding to warranty claims. While we agreed that this was a very serious issue, the system the CEC had in place at the time meant we weren't able to do much in response.

"This motivated us to review our supplier agreement terms and conditions and for the first time, include mandatory requirements that would give us the power to take action against suppliers who disregard warranty applications.

"We are now able to remove suppliers who act in bad faith from our lists so they can't claim small-scale technology certificates (STCs)."

The changes to the panel listing process are as follows:

- New terms and conditions will allow products to be de-listed from the registers of approved modules and inverters if suppliers breach consumer law – such as a failure to honour warranties.
- An independent testing program will be introduced to ensure the alignment of marketing claims, product performance and safety. Products that fail this program will be removed from the CEC's list of approved products.
- An independent product listing review panel has been appointed.

From a performance perspective, the

CEC will now require module suppliers to demonstrate compliance with the international Standard known as IEC 61730-1:2004 (Amendments 1 and 2) and IEC 61730-2:2004 (Amendment 1). This will ensure that the polymers used in the modules can withstand exposure to high levels of ultraviolet light.

The Standard was published several years ago and many modules are already certified to it. Almost all of the certificates that have been lodged in the past year and the majority of certificates lodged in the past two years have been compliant. Most modules that were certified more than two years ago will not comply and will need to be recertified to avoid being de-listed.

According to the CEC, all panel suppliers will have to sign an agreement that says:

"I agree to the terms and conditions for listing a PV module on the Clean Energy Council (CEC) approved product list. As a responsible supplier of PV modules to the Australian market I will:

- *Ensure my products are compliant with all relevant requirements as specified by Australian standards, regulations and legislation;*
- *Expect that my product could be the subject of a testing program and understand that non-conformances with certification could lead to removal from the CEC approved product list;*
- *Include full disclosure of country of manufacture in my customer documentation;*
- *Provide details of my after-sales warranty process;*
- *Keep records of the serial numbers of all modules supplied to the Australian market and make this information available as required by CEC and the Clean Energy Regulator; and*
- *Comply with all of the Terms and Conditions for listing a PV module on the CEC approved product list."*

To ensure ongoing compliance, there will now be regular policing of the approved supplier list, with the CEC adopting a 'mystery shopper-style' program.

Kane says the introduction of this program in concert with other initiatives by the CEC are also helping to progressively improve standards across the industry. ■

NECA TURNS 100

NECA VICTORIA IS TURNING 100 AND TO CELEBRATE, THE ASSOCIATION IS RELEASING A BOOK THAT DELVES INTO ITS VAST AND STORIED HISTORY.

The year was 1916 and five of the most prominent electrical contractors in Victoria decided it was time to form a group of like-minded people to discuss issues of mutual interest.

The contractors had already been meeting and discussing industry concerns in an informal manner for some time, but they wanted more. They wanted something bigger that would ultimately serve the entire industry.

And so NECA was born (or the 'Electrical Traders and Contractors Association' as it was then known).

Although there are few records of the Association's activities during the early years, it is clear that the members met regularly and formed a group that was dedicated to the welfare of the electrical contracting industry.

"Our industry has changed so much. Mostly by the ability to better understand and control electricity," says former NECA National president (2013-14) and former NECA Victoria president (2003-14) Wes McKnight.

Now 100 years later, these changes and the people behind them have been profiled in a new book written by industry stalwart and *Electrical Connection* columnist Brian Seymour. Set to be released in August to coincide with the NECA Victoria Excellence Awards, the book is an extensive study of how the electrical industry's peak association has grown over the past 100 years and the role it has played in the wider market.

"In the winter of 2012, I was invited to lunch by the then-NECA Victoria president Wes McKnight and -chief executive Phil Green, and thinking back on that very pleasant sojourn I am unsure whether I was conned, cajoled, shanghaied or sweet-talked into writing the history of the association," Brian says.

"In the euphoria of the moment I agreed and then in the aftermath asked myself: "What have I done?"

"There is very little information on companies and people prior to WWII and it has been a painstaking task to unearth details of many of the pioneer companies that no longer exist.

"But it has been such rewarding experiences to conduct face-to-face interviews with the people who were the captains of our industry in their day and helped shaped the association and establish it as a representative organisation in its own right, rather than the poor cousin of other industries."

Brian explains that information for the book has been gleaned from references in association minutes, newsletters, odd bits of memorabilia and face-to-face interviews with the most elderly of our industry who had entered the workforce by the late 1930s.

"Just as important as the technical advances we have made, the people the electrical industry attracts is what I really hope we would record with this book - for future generations to reflect on and understand how, when, why and where it all started," Wes says.

"Ours is one of the most diverse and important trades still in existence. This needs to be understood, communicated and recognised.

"Reading through this book, I hope you get the sense that the ideal of keeping the public and our customers safe and satisfied has long been the driver of the electrical installation industry.

"When it came to finding someone to write this book I could only think of one person who could capture the personalities, collate the stories and cajole the information out of individuals who thought their history wasn't worth repeating or recording.

"The industry owes a huge thank you to Brian all of his work." ■

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ONLY FOOLS RUSH IN

THE TRIPPING OF HIGH-EFFICIENCY MOTORS ON START-UP NEEDS A BIT MORE THAN A SIMPLE SOLUTION. PHIL KREVELD EXPLAINS IT ALL.

High-efficiency motors are one contribution to saving the planet.

Their use can save money by reducing electrical energy consumption per kilowatt of mechanical power output.

Clever design has created motors in which maximum energy is transferred across the air gap between stator and rotor (we are mainly concerned here with induction motors).

Rotor electrical losses have been reduced as far as possible; windage and bearing losses have been shaved to the nth degree.

This is obviously a great thing, and many readers will be familiar with Minimum Energy Performance Standard (MEPS) requirements for motors.

In Australia we are a little behind Europe, where MEPS has been replaced by 'ie' classifications. It started there with ie1, then ie2, is now ie3 and ie4 is about to happen. With each new step efficiency has been increased.

Of course, not all applications demand the use of high efficiency motors, but in the review of requirements in Table 1, you'll see that most applications are captured in ie3.

The Standard is not enforced in Australia; however, that is not very important because most of our motors are imported and can be expected to accord with the higher efficiency of ie3.

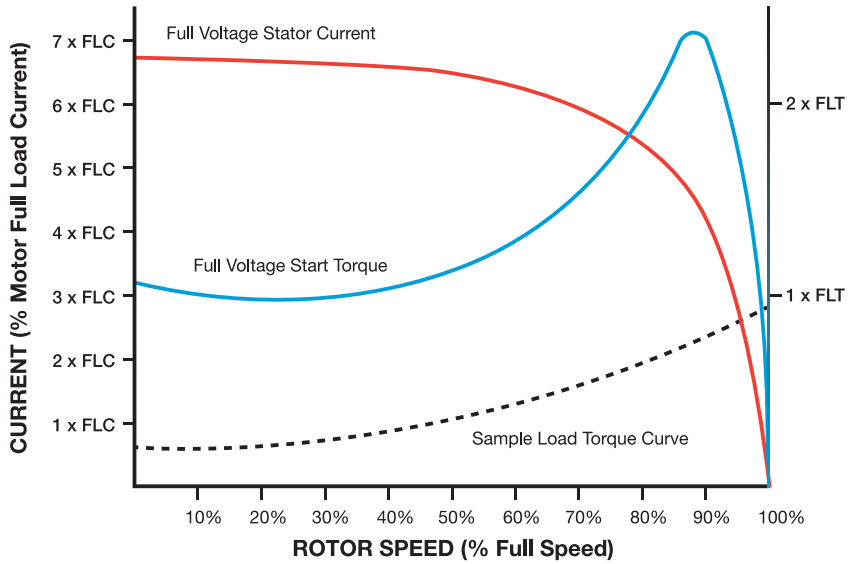

Figure 1: Characteristics of a typical induction motor.

So why devote an article to this? In short, because some things have to be taken into account for motor control.

The price paid for having a high-efficiency motor is that it draws an inconveniently high inrush current compared with lower-efficiency units.

The tacit assumption is that motors are started direct on line (DOL). So we are talking about lower-rating motors running at low voltage (LV) distribution level.

It is not a rare application area, and motors for a variety of tasks from air compressors, injection-moulding machines, bottling lines, pallet wrapping, CNC machines, many conveyor belts, etc, fall in into the 2kW or more range, and perhaps as high as 30kW.

When ie3 motors are employed in DOL mode, for example, unless the protection level is chosen wisely there is a chance that the protective device will be tripped on starting the motor.

(It is assumed that the rated current

TABLE 1

The ie3 regulation affects all standard applications for three-phase motors with the following criteria:

- two to six poles;
- rated voltage up to 1,000V;
- rated output power from 0.75kW to 375kW; and,
- rated on the basis of continuous-duty operation.

The following motors are not affected:

- motors designed for multiple speeds;
- motors that are completely integrated into a machine (pumps, fans, compressors);
- motors with integrated frequency converters (compact drives) if the motor cannot be tested separately from the converter;
- brake motors if the brake is an integral part of the internal design of the motor;
- specially designed submersible motors; and,
- smoke extraction motors with a temperature class above 400°C.

BY
PHIL
KREVELD

of the motor falls somewhere within the protection range of the overload device.)

Suppliers of motor starter and protection control gear claim that, because of such tripping, higher-rating protective devices are chosen rather than devices based on the specifications.

This is not a smart way to deal with false tripping, because the higher-rating protective device will probably affect the tripping characteristics of the thermal overload. It is difficult to gauge how often this scenario plays out, but the engineering literature yields enough examples of starting problems to merit alerting our readers.

Figure 1 shows the familiar torque versus speed characteristic of a typical induction motor. The current graph is superimposed.

The zero speed torque or locked rotor torque and current are high, in particular the current, which will be six or eight times the rated current flowing at rated speed.

It is often thought that the locked rotor current is in fact the inrush current, but that is not the case. When a motor is connected to supply, the first aspect is that the stator magnetic field has to be established.

The stator winding does not yet represent a sort of transformer with fairly substantial leakage inductance – everything is in 'flux' – until the magnetic flux is present in the air gap between stator and rotor.

During this time, which lasts less than one cycle but could stretch to several cycles, the current looks like a sine wave stuck on top of an exponentially decaying DC component (see Figure 2).

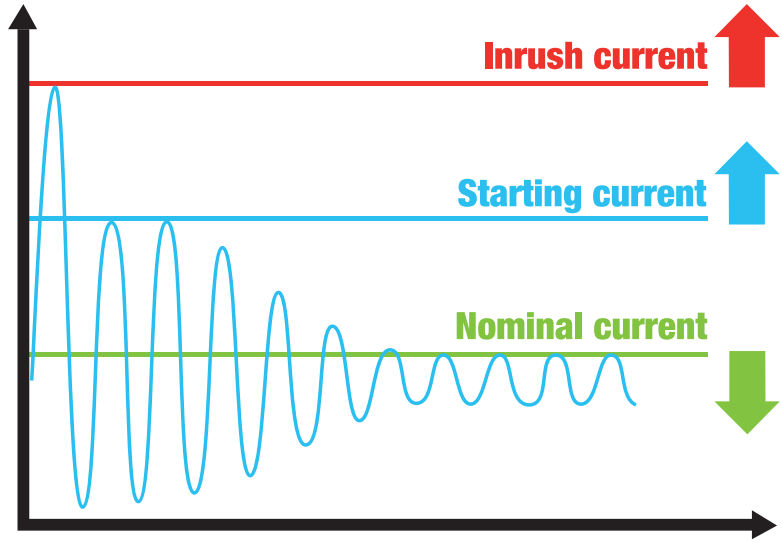

Figure 2: The difference between inrush current and starting (locked rotor) current. The current looks like a sine wave stuck on top of an exponentially decaying DC component.

For your 'common or garden' induction motor of yesteryear, the inrush current (the current flowing before the locked rotor current level is reached) might typically be eight to 12 times rated current.

The ie3 motors have much higher inrush currents, lower locked rotor torque and, for the same kilowatt rating, a lower rated current.

This latter feature stands to reason, because kilowatts are equal to power factor multiplied by voltage and line current.

It is fair to assume that power factor is more or less the same for motors of low and high efficiency at rated speed and load, so line current must be lower.

Building high-efficiency motors in the first place involves reducing rotor resistance to reduce I^2R losses. The magnetic design also has to be somewhat different, resulting in a different input resistance to reactance ratio at the stator terminals.

This all sounds scientific, but we can leave that – save to note that the higher resistance is relative to reactance the sooner the DC component decays.

However, for high-efficiency motors, resistance is lower and therefore the peak value of current and the decay time are higher.

As can be seen in Figure 3, the ratios of inrush current to rated current go up as we climb the efficiency scale. In fact, a level as high as 20 times rated current is not uncommon.

As stated, rated current is lower for high-efficiency motors. As you would expect, this accentuates the ratio of inrush to rated current.

So what are the implications for motor starter and protection gear?

Manufacturers with a European bent, so to speak, claim to have made accommodations in their designs.

At the protection level this is

> Unless the protection level is chosen wisely there is a chance of tripping on starting the motor.

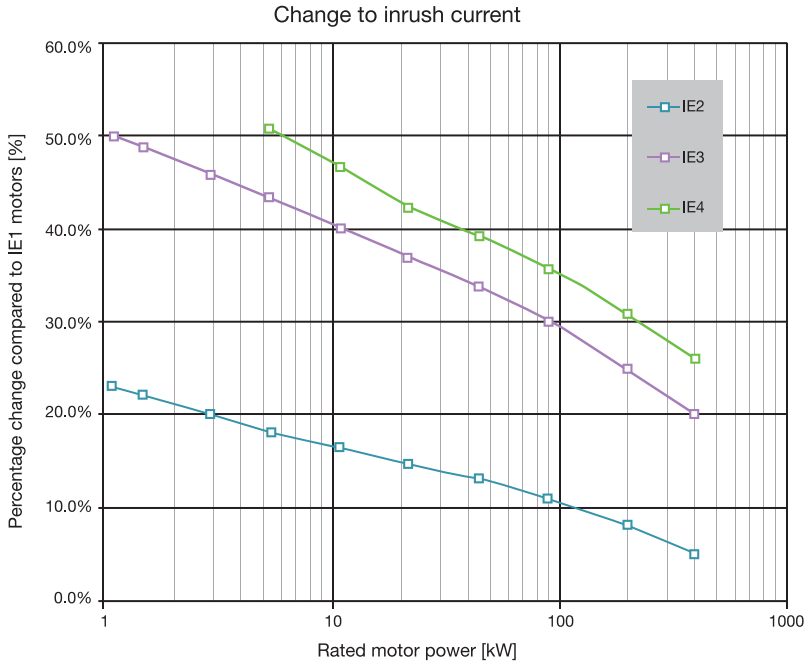

Figure 3: Inrush current as a percentage of in-rush current in ie1 motors.

basically to provide a wider selection of rated current with a large degree of overlapping.

At the contactor level more attention is claimed to have been focused on contact design and physical layout.

The latter is important, as high currents can cause repulsion forces and chattering, with deleterious effects.

According to some manufacturers the thermal protection area (not usually considered a challenging area) is best served by electronic rather that the usual bi-metallic relays. It is hard to argue with this concept, as the use of I^2–time algorithms is hard to beat in terms of repeatability and lack of memory effect.

The use of overlapping current ranges allows a designer to pick a range in which the rated current of the motor is in the lower quartile of the rated current range of the protection device – it being assumed that the 'instantaneous' trip is an integral part of the protection circuit.

It can also be provided by a moulded-case breaker. By picking the low end of the protection range, the maximum multiplier available is likely to cover the inrush current.

To further explore this, consider the situation in which the upper quartile of the protection range has been selected. The inrush current is now likely to cause a false trip.

Take this example of two motor starter protectors for a 15A rated motor:

> A – setting scale 10; 16A, multiplier of 13.
> B – setting scale 14; 20A, multiplier of 13.

Motor starter protector B is recommended, as its power loss is lower and it has a 5A clearance to the top protection setting. Protector A has a 1A clearance.

The power loss of B is about 35% lower than that of A. This is because the latching current of the starter coil is proportionally smaller.

> For A the response value of the short-circuit release is 208A (13A x 16A). With a rated motor current of 15A, the short-circuit release is 13.86 times the setting current (208A/15A = 13.86).
> For B, the response value of the short-circuit release is 260A (13A x 20A). With a rated motor current of 15A, the short-circuit release is 17.33 times the setting current (260A/15A = 17.33).

Because the ratio of inrush current to rated current is substantially increased for B, it is the better choice for an ie3 motor.

As a final word, measurement of the inrush current is highly recommended when critical applications are involved. It removes to a large extent a 'guesstimation' element.

Inrush current for high rating DOL starts is best measured before selecting motor protection.

The instrumentation involved need not be highly complicated. Clamp-on testers are available that can record the inrush peak.

As ratings increase, some form of soft starting is likely to be used.

On the other hand, when full power has to be close to instantaneously available, and in particular if high inertia loads are involved, a waveform recorder is the best analytical device to determine the motor starter and protection requirements. ■

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BY
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ARE APPRENTICES IN UNSAFE HANDS?

WITH NEWS OF ACCIDENTS AND FATALITIES FEATURING ELECTRICAL APPRENTICES SEEMINGLY ON THE RISE, REBECCA MAIR EXPLAINS THE DOS AND DON'TS OF APPRENTICE SAFETY.

In May of this year an apprentice electrician was taken to hospital after falling 5m at the Barangaroo construction site in Sydney. According to the Electrical Trades Union, the first-year apprentice was working with another apprentice when he fell through a temporary floor cover over one of the service risers.

Thankfully, the man will make a full recovery; however, this terrible accident highlights two truths. The first is the dangerous nature of electrical jobs and the second being the vulnerability of apprentices, especially those in the early stages of training.

An electrical apprenticeship is one of the only jobs where you can get killed in the first few days of work and that's why apprentice safety is something I'm so passionate about. While I believe on-the-job training is the best training, I want employers across the industry to recognise the need to increase safety measures to protect those who are most vulnerable; our apprentices.

Unfortunately though, many employers have adopted bad practices as a means of saving time and money. This means apprentices are often not adequately supervised on the job. In my own career, I've seen cases where fourth year apprentices take on the supervision role for second year apprentices. This is not only illegal but dangerous. Fourth year apprentices aren't qualified electricians and, generally speaking, are less likely to be strict with peers or to check their work thoroughly - creating a risk for everyone involved.

Direct supervision should be undertaken with a qualified electrician for a minimum of 12 months for absolutely everything. As time goes on, of course it's natural to give the apprentice more and more responsibility but not complete independence.

The reality is that even a simple job can take unexpected turns which apprentices aren't always prepared for. This is particularly true with the rise of the DIYer which means a simple

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residential job might actually have mixed circuits or mixed actives and neutrals which can be dangerous for anyone, let alone someone who hasn't had much experience. One wrong move can put an apprentice in immediate danger, cause a fire, or result in injury or death.

Undoubtedly the best training is one-on-one, which not only gives apprentices the best chance of developing skills to assist them in their career but also ensures safety measures are understood and followed. If you're working one-on-one with an apprentice you know what they're capable of and can more easily make a judgement as to whether they require direct or general supervision. With the benefits of direct supervision and training clear, it raises the question of whether direct supervision should be more than recommended, but a legal requirement.

According to the new requirements for the Effective Supervision of Apprentice Electricians, released by Energy Safe Victoria (ESV), direct supervision is necessary for third year apprentices carrying out basic fault finding and fourth year apprentices carrying out advanced fault finding and confirmation of isolation. It's worth noting here that in all cases, the supervising electrician shall be responsible for carrying out isolation procedures, confirmation of isolation, compliance testing and commissioning/energisation.

The ESV standards are a great initiative and I'd like to see them become national. It makes sense for employers to make a judgement about whether direct or general supervision is needed on other tasks as you can have some apprentices who are a lot savvier and competent who can be trusted to do certain activities once they've demonstrated the task over and over again.

The new standards then of course raise questions of competency. In addition to ESV, Queensland standards also reference competency levels stating that the level of supervision required depends on the work, level of training, and competence of the apprentice. However, in my experience apprentices are prone to overestimating their capability and as an employer it's our role to give constant feedback to manage expectations of what they are and aren't capable of achieving.

There are a whole host of competencies that need to be checked off before someone can 'graduate' and the big theory test is the capstone which a lot of apprentices fail. With this in mind, the best way to see if an apprentice can move from direct to general supervision is to check and monitor their work. Some apprentices make the same mistakes over and over again so it's really important to keep a close eye on their activity and constantly review it to make sure bad habits don't set in.

The way I was taught, and have seen others taught, is through observation. I remember that during my first six months I was bored, because I wasn't allowed to get in and do stuff! But ultimately given the consequences of a basic mistake it's important to take a 'better safe than sorry' approach.

If you give an apprentice too much responsibility and freedom too quickly, that's when accidents happen. Particularly in the early years it's a good idea for apprentices to stand back and observe as it's a great way to learn, and later in their career they'll think so too.

Another key component in ensuring apprentices are as safe as possible is ensuring the right person is supervising their activity.

Determining who the best person is to supervise an apprentice should always be done on a case by case basis. According to the regulations, once you have your electrician's ticket you're able to supervise an apprentice. On large jobs, recently fledged sparkies often supervise the first years and in some cases it's perfectly ok for someone who's just finished to look after a younger apprentice. What troubles me though is when an electrician who has only just passed their exams has the sole responsibility of mentoring a younger student one-on-one. Personally, I'd like to see a few years' experience before and newly qualified sparky can undertake an apprentice.

> An electrical apprenticeship is one of the only jobs where you can get killed in the first few days of work.

Overall, safety standards are changing and that's a good thing. While a lot of the responsibility sits with the supervisor, the apprentice also has a role to play in developing their skills and their safe practices. My advice to apprentice electricians who want to stay safe while progressing as quickly as they can is to test, test, test!

The first thing we're taught is test your tester and test again. Even when you have tested a circuit and it is testing dead, still assume it could be live and treat it as being a live circuit.

Don't ever trust your sparky when they tell you a circuit is dead – test! Combining this approach with the change in the industry, we should start to see safety practices improve across the industry. ■

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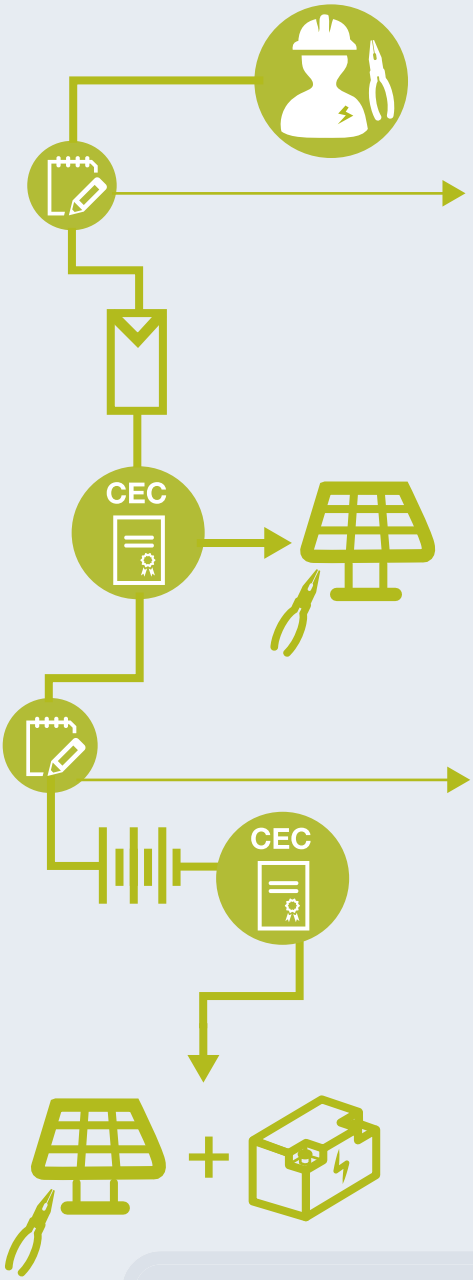

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I WILL ALWAYS REMEMBER HUE

Lighting could play a role in the onset and treatment of dementia and clinical trials are underway, say German scientists.

A MEDICAL FACILITY IN GERMANY IS UNDERTAKING TRIALS ON THE EFFECTS OF LIGHTING ON PEOPLE SUFFERING DEMENTIA.

In December 2015, Osram supplied the St. Augustinus hospital (AMZ) memory centre in Neuss, Germany with state-of-the-art lighting and control technology that is reported to create the best conditions for new research dedicated to biologically effective light.

With the aid of cutting-edge LED luminaires and control systems (i.e. e:cue and Lightify), Osram developed a lighting concept for the memory centre of the St. Augustinus hospital to enable the biological effects of light at the location. Put simply, the solution creates the right light at the right time, promotes well-being and health and also supports the circadian rhythm.

Professor Dr Ulrich Sprick, the chief physician at the AMZ day hospital in charge of the surveys for biologically effective light, says: "With Osram control technology we're able to check whether we can generate the effects of daylight that we have outside here in the hospital as well. We're aiming to carry out a total of three surveys."

The first survey section is dedicated to the factor of wellness with an analysis of which light temperature is most pleasant for older people. In the second section it's a matter of using the effects of light for synchronising the day-night rhythm. The third survey focuses on the factor of safety.

"For older people it's highly important to clearly identify certain objects, and this is achieved by having a higher intensity of light. In fact it's why we're hoping to reduce the number of falls thanks to the corresponding light intensity, or even avoid them completely," Ulrich says.

The Osram Lightify system was installed in the patient rooms. Lightify enables simple and user-friendly lighting solutions to be realised with modern LED luminaires and control components as well as with today's common smart devices. One advantage of this system is that individual components wirelessly communicate with each other via ZigBee signals. When used in domestic surroundings, each Lightify user can program and manage light scenes using

an app. It's possible for example to individually modify colour temperature (e.g. warm white or cool white) according to individual wishes with the tunable white function.

A human centric lighting solution was developed for the relaxation and dining area based on various LED luminaires – a daylight ceiling for example with Siteco Mira luminaires and tunable white functionality enables activating or calming light scenes. The professional e:cue light management system also allows lighting to be individually controlled, e.g. using a time and calendar function for supporting the day-night rhythm.

The memory centre managers are hoping for concrete benefits for the treatment of dementia – one problematic symptom of dementia is often a shifted day-night rhythm due to the biological effect of light not being adequately processed, resulting in the need for higher light intensities. The aim is to re-stabilise the day-night rhythm, i.e. more light during the day should extend the daytime activated phase so that patients can sleep throughout the night.

Cutting-edge lighting installations from Osram Lighting Solutions provide the right light at the right time in the memory centre. This in turn creates the preconditions for analysing the biological effectiveness of light, and for contributing to essential treatment success. The showrooms of the memory centre demonstrate to relatives or other health providers what can be achieved in total with modern lighting technology. Professor Sprick is sure that corresponding solutions will also be used in the future in other sectors, such as depression stations or pain clinics.

Osram senior product manager Andreas Pickelein summarises: "Human centric lighting solutions from Osram basically focus on people and their needs for light. The advanced solutions installed by us in the memory centre support everyday activities, but also the circadian rhythm that we all need to achieve biological effectiveness. As a consequence, we've got solutions here that have positive benefits for the human organism and far exceed standard visual effects." ■

DON'T LET POOR CHOICE PUT LIVES AND PROPERTY IN DANGER

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These days it seems everyone is on the lookout for clever ways to save a few dollars.

That includes of course the construction and electrical industries, and mostly it makes good business sense. However in isolated cases it can be tempting to go too far and to cut corners. If, say, there are some 'el cheapo' electrical fittings that need to be used up – perhaps a job of non-certified links and connectors – the attitude is "she'll be right, no one is watching".

Mm, not so clever. Sure, no one may initially notice that non-compliant products have been installed, but that won't be the case when they later fail, even burst into flame or explode. That's when scrutiny intensifies and the legal ramifications, for example, can become very public and very expensive. The few dollars originally saved are soon forgotten.

Fortunately, these days Australian electrical standards are improving, specifications are more exact, and dangerous non-compliant products are gradually being squeezed out of the market.

The Australian and New Zealand Standard and specifications for lugs, links and connectors, unique in the world, were developed to protect lives and buildings. Other International standards, for example UL 486 A-B, are not appropriate for Australian Market conditions. Australian Standards have been developed specifically to address Australian conditions and application of the product. Non Australian Standard compliant products, unaccompanied as they are by valid test certification or any clear, distinctive branding, can be potentially lethal and may cause legal liability issues if installed.

In any event, avoiding their use is the best choice; no matter whether anyone is watching. Installing products that are fully certified and tested to high Australian standards shows professional integrity.

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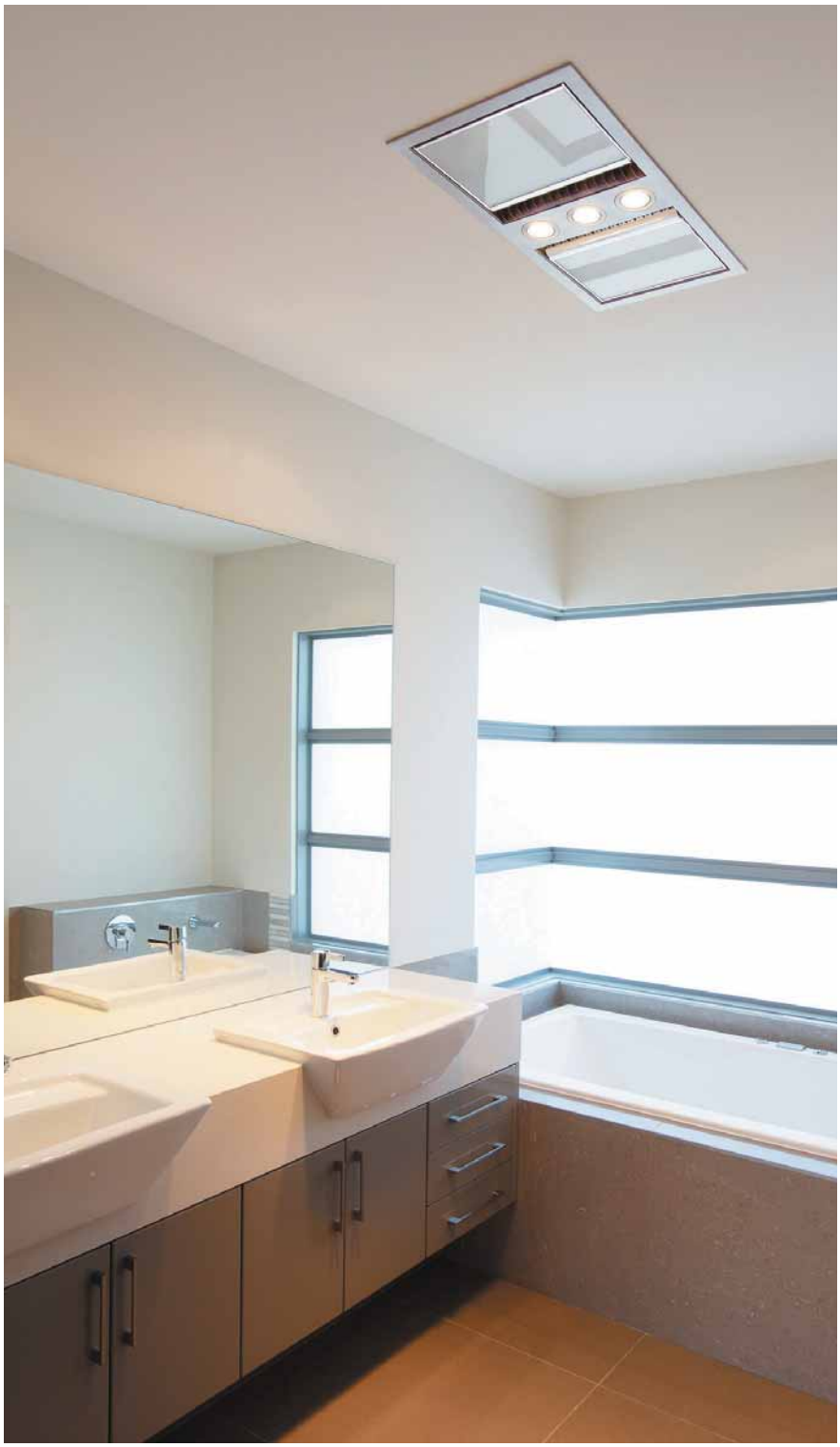
A BATHROOM'S NUMBER ONE FAN



THINGS ARE FULL STEAM AHEAD IN THE HEAT, LIGHT AND VENTILATION SECTOR BUT ARE ELECTRICIANS FALLING BEHIND? PAUL SKELTON LOOKS AT THE HUMBLE THREE-IN-ONES AND WHERE THE MARKET IS HEADING.

There would be very few residential sparkies who haven't installed a heat, light and ventilation unit in a bathroom or laundry at some point in their career. It's pretty straightforward stuff, right?

Well there may be a few things that you're doing that are negatively impacting the unit's performance.

For example, are you aware of the challenges raised by having LEDs in the unit? Do you know how important it is to size a room before purchasing a unit? Do you know how to properly install the ventilation ducting? And do you know where to place the unit for optimum performance?

IXL Appliances, which was established in 1858 in Geelong, Victoria, and first introduced the iconic IXL Tastic range 30 years ago, is on a mission to better educate sparkies about the dos and don'ts of heat lamps.

The first hurdle for some sparkies may be as simple as understanding exactly how a heat lamp works.

"Heat lamps aren't actually designed to 'heat' a bathroom; rather, they use infrared (IR) waves to warm the moisture in your body," says Sampford IXL brand

FIGURE 1

Application Description	Air Changes Per Hour
Bathrooms (without shower)	6-8
Bathrooms (with shower)	15-20

manager Libby Strong.

This means heat lamps, like the IXL Tastics, have no warm up period because the IR lamps provide instantaneous heat.

Further, new technologies are changing the way in which end users use the product. And what is the big development in bathroom lighting? Unsurprisingly, it's LED.

Of course, given that LEDs offer very little heat output it is unlikely they will ever replace tungsten halogen as a heat bulb. But they are finding a home as a replacement for CFLs.

However, this has lead to an unexpected problem.

"If you haven't got enough air flowing around the LEDs then the heat lamps can degrade the life of the diodes. This is because of the sensitive electronics used in LEDs. So, in the Tastic Neo range from IXL, you can't run the LEDs at the same time as the heat lamp – they'll automatically turn off when the heat lamp is on.

"In some of the cheaper copy products coming in from China, the manufacturers are just putting a heat lamp in with the LEDs and hoping everything will be fine, but that's not the case."

Where most sparkies go wrong with choosing a heat, light and ventilation system is properly sizing a room to determine the space's needs.

"Sparkies don't always size up bathrooms correctly. If you want the best result for your customer, you really need to provide a quality product that has the extraction capacity required for the size of room you're venting," Libby says.

"You really need to do your homework."

According to IXL Appliance's *Ventilation Selection Guide*, selecting the right fan is easy.

First, you have to select your required application. The size or capacity of the exhaust fan you need is determined by the type of room it is to be installed in, as different rooms require different rates of air flow.

The rate of air flow is the number of times the total room volume of air is changed per hour (measured as 'ACH' - see Figure 1).

From there, calculate the room volume in cubic metres (m^3) by multiplying the length by width, by height (L x W x H). For

FIGURE 2

Convert from	x or ÷ by	Convert to
l/s - Litres per second	x 2.119	cfm - Cubic feet per minute
l/s - Litres per second	x 3.6	m^3/h - Cubic metres per hour
l/m - Litres per minute	x 0.0353	cfm - Cubic feet per minute
m^3/h - Cubic metres per hour	x 0.5885	cfm - Cubic feet per minute
m^3/h - Cubic metres per hour	÷ 3.6	l/s - Litres per second
cfm - Cubic feet per minute	x 1.699	m^3/h - Cubic metres per hour
cfm - Cubic feet per minute	x 0.4719	l/s - Litres per second
cfm - Cubic feet per minute	x 28.316	l/min - Litres per minute

example, a small bathroom that is 2.2m x 2.2m x 2.4m is 11.6m^3 so would require a fan that is designed for a room volume greater than 12m^3.

Bathrooms with high ceilings, are larger than average or have an open shower may all require additional ventilation.

To ensure adequate ventilation, include in your calculations spaces that flow directly into the bathroom, such as open plan bedrooms, laundries or walk in robes.

Remember to always round up when calculating the room volume.

After that has been determined, you have to calculate the ventilation performance requirements.

Do so by multiplying the room volume by the recommended air changes per hour for that room. Always use the higher limit.

The result is the total performance required in cubic metres per hour. So, a bathroom with shower (which requires 15-20 air changes per hour) that is 12m^3 needs 240m^3/hr.

Now that you know the performance requirement of your ventilation product, use the conversion table and comparison chart (Figures 2 and 3) to work out the right exhaust fan and convert different measurements.

"To make this process easier, IXL has put an easy-to-use calculator on its website, in a section called 'Help me choose'," Libby says.

"All you need to do is punch in type of room (e.g. bathroom, laundry, etc) and the room's dimensions, and it will tell you the capacity you need."

Libby says this then goes hand-in-hand with placement.

"Three-in-one units are ideally installed directly above the area where you dry yourself after showering, not above the shower itself. And they work by drawing steam-laden air from the room so it is essential that sufficient air inlets exist through windows, vents or under doors," she says.

"New homes that carry a 5-star rating are often so well sealed that the fans don't work very well because there is no airflow coming into the bathroom. They're going to cause negative pressure if the window or door isn't open a little bit. You need that extra airflow so it can draw the air up and out.

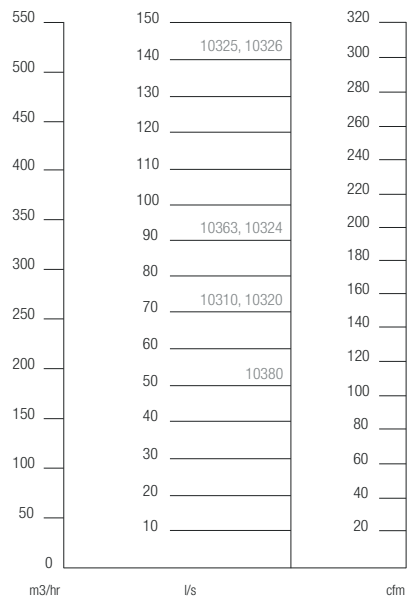
"Sparkies need to know this so they can let customers know how to use them properly. They also need to pull ducting taught. If you're not doing that, performance is hugely impacted. Because the ducting is foil, it can collapse in on itself if not installed properly. Being taught will ensure there is no way the air will get trapped. And it needs to be as straight as possible – so avoid bends."

It's not just bathrooms that can benefit from a properly installed heat, light and ventilation unit. In fact, Libby says, IXL Appliances will be releasing some new Tastic products later this year for new applications.

"For example, keep an eye out for some new outdoor products that are coming at the end of the year. I can't say much more at the moment, but it's very exciting.

"At IXL, we are always looking at new applications for our Tastics, so stay tuned." ■

FIGURE 3



DRYING OFF IN THE LAUNDRY

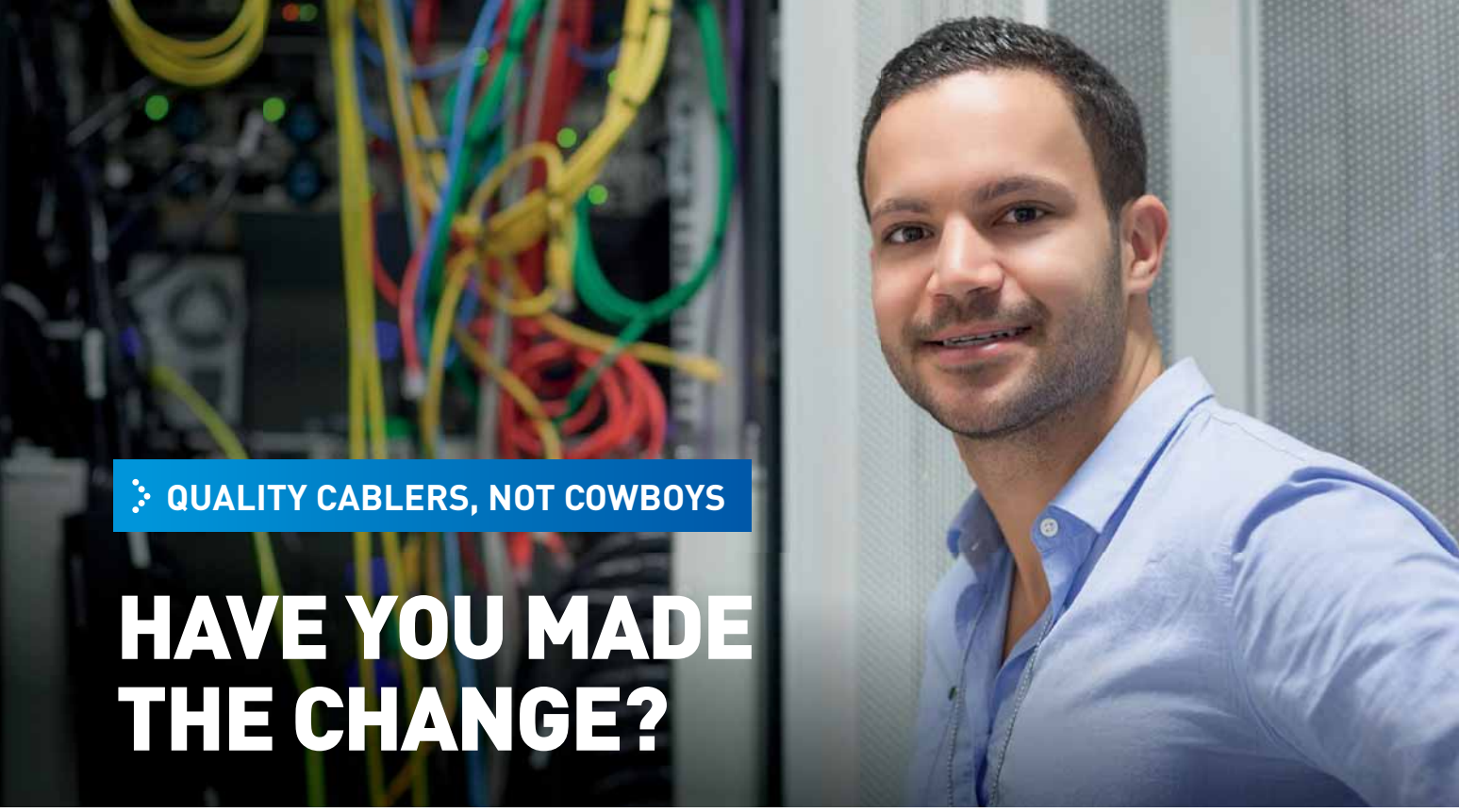
Heat, light and ventilation are often found at the bottom of the list when it comes to creating a practical environment for laundry day. But damp clothes, dryers filling the room with humid air and even a lack of windows can all mean this vital engine room of the home often suffers.

If a laundry has a dryer, you can combat the humidity with a Ventair 250 exhaust or the Classic Tastic Silhouette 3-in-1 to keep the room ventilated and free from damp odours.

For laundries that are dryer-free, and therefore less prone to trapped humid air, the Tastic Neo Vent n Lite Module is an ideal solution.

If you're not quite sure how to best meet your customer's laundry ventilation needs, IXL offers a handy 'Help me Choose' online tool to remove the guess work for you. Simply calculate your extraction requirements in two easy steps on the IXL website – first, choose the type of room, such as a laundry with a dryer or a laundry without a dryer, then add the room's dimensions to see which appliance will meet your requirements.

> **IXL Appliances**
> **www.ixlappliances.com.au**



QUALITY CABLERS, NOT COWBOYS

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DEVICES WITH BYTE

THE INTERNET OF THINGS REPRESENTS A REVOLUTION IN HOW WE MONITOR AND CONTROL A BEWILDERING ARRAY OF ELECTRONIC EQUIPMENT. GEORGE GEORGEVITS EXPLAINS.

Bluetooth was named after Harald Blåtand, a Swedish king in the Middle Ages.

Smart electronic devices have made inroads into many aspects of daily life and also the industrial sphere.

Some of them gather data about the surroundings and others help us to control things or communicate. To maximise convenience, they usually employ some form of wireless technology to transfer information.

Bluetooth has become a popular form of smart wireless technology for fast short-range data communication between devices. And with the advent of the Internet of Things (IoT), the need for such a capability is about to expand rapidly.

ORIGINS

Bluetooth was developed in 1994 by Dr Sven Mattisson when working for the Swedish company Ericsson Mobile Communications.

It was named after Harald Blåtand, a Swedish king in the Middle Ages who had the nickname Bluetooth. The original specification was developed by Dr Jaap Haartsen.

Ericsson has been in the telecommunications business for more than 100 years, supplying telephone handsets, small private telephone exchanges (known as PABXs) and large telco exchanges and networks.

The company was preferred supplier of telephone exchanges to Telstra and its predecessors for many years.

With the advent of mobile phone technology, Ericsson quickly became an important player in the sector. It produced not only mobile phone networking equipment but also a large range of mobile handsets.

The original aim of Bluetooth was to provide a short-range wireless link between mobile phones so as to avoid the need for a cable connection when transmitting data – such as provided by slow and cumbersome RS-232 serial cabling technology.

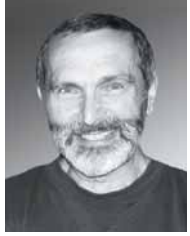
However, it was soon realised that this technology could be used for communication between all sorts of devices that required connecting cables.

BLUETOOTH TECHNOLOGY

Ericsson set up a joint development group with several manufacturers with a view to creating an open Standard for a short-range wireless communications system operating in the 2.45GHz radio frequency band.

This was known as the ISM band – for industrial, scientific and medical – and is also used by many other low-power devices. These include cordless phones, wireless local area network (WiFi) devices, model control, garage door openers, home detention monitors, point-of-sale terminals and even the domestic microwave oven.

Part of the conditions of using this band is that devices must radiate low power, typically about 1W or less, depending on the type of equipment. Such equipment is covered by an LIPD class licence (low interference potential device), and does not require



BY
GEORGE
GEORGEVITS

a separate radio transmitter licence.

The ISM band is used by a range of electronic devices operating with a variety of protocols. Another of the conditions of use is that services must accept any harmful interference that may be caused by other nearby ISM applications.

Bluetooth makes use of frequency hopping spread spectrum technology. This was designed to minimise the effects of harmful interference from nearby devices, particularly those operating in the same band. By and large, it works very well.

> Bluetooth capability in one form or another is already in billions of electronic devices in everyday use.

A basic Bluetooth network (known as a piconet) is a decentralised type of wireless computer-to-computer network commonly referred to as an ad hoc network. It employs a master/slave configuration, and the master is able to communicate with up to seven slave devices on the same piconet.

Bluetooth network devices are smart, and by suitable negotiation, the role of master can be passed from one device to another in the same piconet. One example of a piconet is the hands-free operation of a mobile phone through the entertainment device in a vehicle.

Piconets can connect to and communicate with other piconets to form what is known as a scatternet.

In all wireless devices, the range is governed by several factors, including output power of the transmitter, distance between transmitter and receiver, antenna type, obstructions along the path, background interference, and so forth.

The output power of a Bluetooth

device is set by its class specification. There are four Bluetooth classes, ranging from 100mW for a Class 1 device down to 0.5mW for a Class 4 device. The corresponding typical range varies from ~100m for a Class 1 device down to ~0.5m for a Class 4.

CORE SPECIFICATIONS

Bluetooth specifications are created by an organisation known as the Bluetooth Special Interest Group (SIG).

SIG was formed by five companies in 1998, and it now has more than 30,000 members.

> Bluetooth has become a popular form of smart wireless technology for fast short-range data communication between devices.

In 1999, Version 1.0 of the Bluetooth Core Specification was released by SIG and gained the 'Best of Show Technology' award at COMDEX that year.

It operated at a maximum throughput of ~700kbps using frequency shift keying modulation, and the range was up to 100m.

To put this into perspective, a typical digital photo taken at that time would have been about 70kB in size, so it would take ~10 seconds to send it over a Bluetooth link. Today, photos can be 10MB and more, and Bluetooth has had to evolve to remain useful.

By 2001, laptop, PC card, keyboard, mouse, printer, headset and car hands-free mobile implementations had appeared. By 2002, the number of Bluetooth qualified products had exceeded 500.

In 2004, SIG adopted Core Specification Version 2.0 Enhanced Data Rate (EDR) with a link speed of 3Mbps, and Bluetooth had an installed base of 250 million devices.

By 2009, SIG had 12,000 members, the Bluetooth installed base had reached two billion devices and SIG had adopted Version 3 of the Core Specification with a link speed of 24Mbps.

In conjunction, SIG adopted low-energy wireless technology and implemented it the following year in Version 4 of the Core Specification.

Known as Bluetooth Smart (or BLE – Bluetooth Low Energy), it was intended to offer a similar range as Bluetooth Classic but with much reduced power consumption and somewhat lower application throughput speed. And all at a much lower cost.

Typical applications include sport and fitness devices, location beacons, security and home entertainment equipment and smart phones. Most major mobile phone operating systems support Bluetooth Smart.

Bluetooth Smart has been aimed specifically at the IoT – a proposed development in which new devices such as sensors and other common objects have network connectivity, allowing them to send and receive data. The IoT will depend on cloud-based applications to collect and process data from the sensors and other devices and send it to the end user.

Bluetooth Smart is not backwards compatible with Classic Bluetooth. However, support for both can co-exist in the one device, and such dual-mode devices have been marketed as Bluetooth Smart Ready.

Because Bluetooth Smart operates on the same ISM band as Classic Bluetooth, dual-mode devices can share an antenna.

One of the first products to implement Bluetooth Smart technology was the iPhone 4S (2011). Unlike Classic Bluetooth, Bluetooth Smart does not support voice capability, so dual-mode capability is a must for applications when power consumption is important (e.g. devices such as mobile phones).

Finally, in June 2016, SIG announced the next release of the Core Specification Version 5, due later this year or early in 2017. It promises to substantially increase range and speed, and vastly increase broadcasting messaging capability – a feature not well used to date.

FUNCTIONALITY AND APPLICATIONS

Bluetooth Smart Ready low-power devices have their functionality defined in SIG Bluetooth profiles.

A profile is a specification for how a particular type of device should work in a particular application, and a device may contain more than one profile.

The profiles are intended to be Standards, and manufacturers of devices must comply to ensure that their devices will function correctly.

Groups of profiles are classified according to their application. For example, sets of profiles exist for health care, sport and fitness, proximity sensing, alerts and time, generic sensors, etc.

Bluetooth capability in one form or another is already in billions of electronic devices in everyday use. The new Bluetooth Core Specification Version 5 is aimed at meeting the future needs of devices designed for the IoT.

George Georgevits, BE (Hons), manages his engineering consultancy Power and Digital Instruments. PDI was established in 1980 and specialises in lab and field testing, troubleshooting of electrical systems and components, and consulting engineering. Contact PDI on +61 2 9411 4442.

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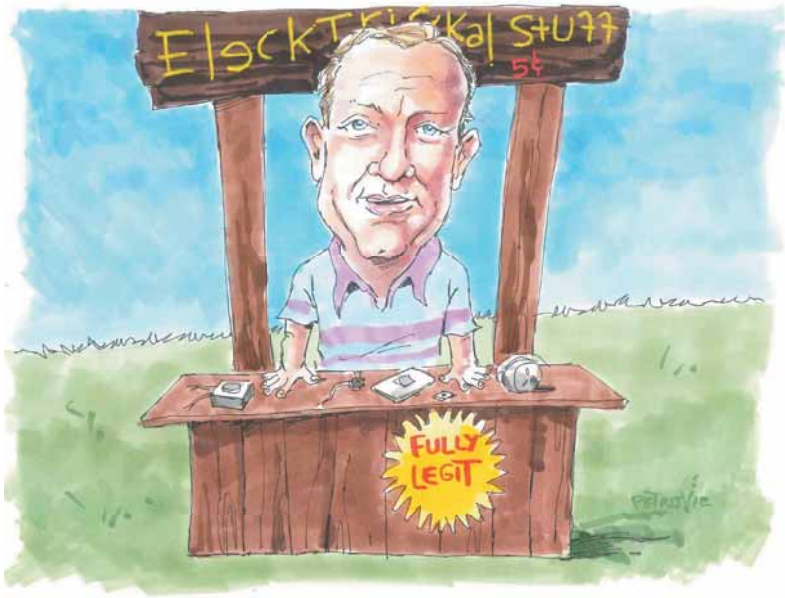
THE NEXT PINK BATTS?

SUPPOSEDLY CHEAPER MATERIALS CAN LEAD TO TECHNOLOGY RISK, WARRANTY ISSUES AND FINANCIAL PROBLEMS. WES MCKNIGHT POSES THE QUESTION: SHOULD WE CONTINUE TO SUPPORT THE ESTABLISHED SUPPLY CHANNELS?



The manuscript of a new publication on the 100-year history of NECA Victoria makes for interesting reading.

It contains many references to how our forefathers accessed product and material, and it solidified thoughts I've had for many years.

Our industry began with electrical contractors buying and sourcing material direct from manufacturers and some 'appointed' distributors throughout the country.

But over time the industry grew. So did the number of suppliers, and direct contacts were lost.

Today, the way we source product is something of a free-for-all, and the role of the industry wholesaler is being challenged as never before. However, there seems to have been a change in the past two years.

Over the past 10 years there's been a substantial increase in contractors sourcing their own product from hardware stores or through direct importation from Asia, made easy by the internet. NECA research has proved it. Technologies such as solar have only increased this trend.

This attempt by contractors to bypass a step in the established channel has had added substantially to the risks involved in running a contracting business. It opens up the potential for non-conforming product, financial problems when dealing with an unknown entity, warranty issues, product training and many other pitfalls.

In an attempt to counter direct purchasing many wholesalers introduced 'private label' product under their own brands. Perhaps this is why some importers and manufacturers put more emphasis on marketing directly to contractors. So it became a 'chicken and the egg' situation.

In any event, contractors seemed to win in this race to the bottom of the price curve. Yet after the price bottoms out the only thing that can move is the quality.

The established channel via wholesalers and manufacturers or importers provides levels of protection that cannot be argued against.

Some in the industry contend that they have enough experience to handle the risks in sourcing product, that they can control quality and that certification is correct and will be maintained.

However, the evidence of the past few years has shown that management of these issues is difficult even for wholesalers (who do this for a living), let alone contractors.

For instance, the entire industry has made headlines because of faulty cable. The product in question was not only sold by non-mainstream wholesalers but also by a limited number of established wholesalers. And it was also imported directly by contractors.

This particular issue is ongoing, and will be for years.

In another instance NECA research found that circuit breakers from different suppliers were stamped with the same certification approval number. Which one was correctly tested and approved? How would a contractor know?

LED lighting has the potential to be this industry's 'pink batt' moment. The amount of LED product flooding our market is phenomenal.

It's impossible for individual contractors to manage, test and monitor each product's certification. Why would

BY
WES
MCKNIGHT

anyone take that risk? Importing the fittings directly leaves contractors completely exposed. Insurance can be obtained for this risk, but the supposed economic benefit is lost once the cost of a policy is added.

Tracking the original manufacturer for a warranty claim has proved difficult for the most experienced operators. Imagine telling customers you can't find the company from which you sourced the product. It isn't a good look for your company or the industry.

New market opportunities that appear regularly provide an entry for new suppliers. Solar and batteries are current examples. But think broadly about the future, and some of the technologies that will be introduced by new and existing players:

- diesel and natural gas generators small enough for homes to go off the grid;
- voltage optimisation devices;
- Integration systems; and,
- extra low voltage lighting.

There are almost 10,000 electrical contractors in the country. How will these suppliers reach them: through the wholesale distribution model or direct marketing?

We need to be aware of the supply of technology direct to end users. For example, they are major purchasers in the domestic plumbing sector. Builders in the United States are the major purchasers of switchboards and lighting for large commercial projects.

Our industry needs to determine its preferred method of delivery of material and technology to end users. Do we have a role? Do we want one? How important is it to have less technology risk, less product warranty risk and less financial risk?

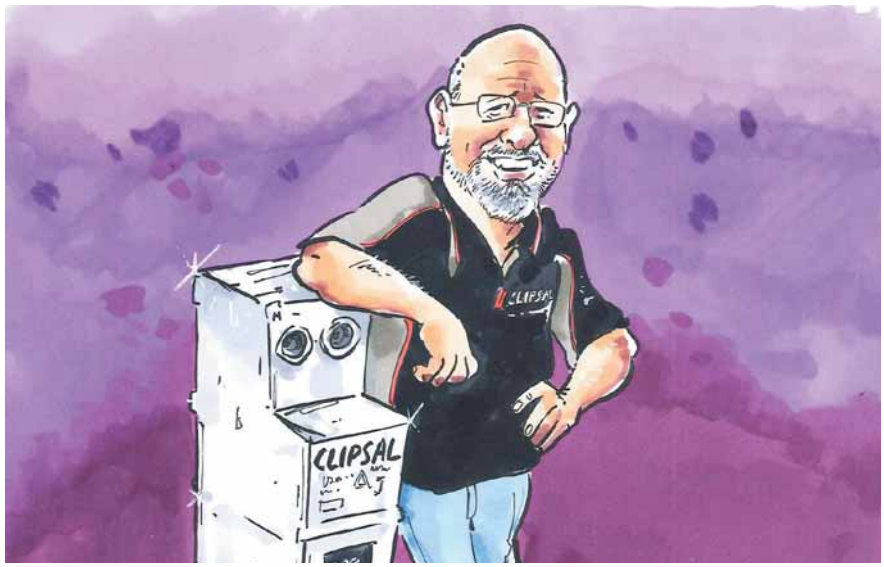
We are the best people to advise our customers. We are responsible for their property. Why would we leave the crucial matter of supply up to websites, overseas traders and importers?

The old supply channel will never be the same again, and we will be dealing with this issue for a long time to come.

However, as long as electrical contractors understand the risks and concern themselves with protecting customers' assets, we will be able to maintain our standards. ■

A CHANGE THAT WON'T SHOCK

GREATER RCD PROTECTION IS NOT THE ONLY CHANGE COMING TO THE WIRING RULES, BUT IT HAS BEEN CONTENTIOUS FOR MANY YEARS. GARY BUSBRIDGE EXPLAINS.



By now the importance of residual current devices, or RCDs, should be gospel for the industry.

Along with my compatriots on the EL001 committee I have been conducting business forums on the changes to AS/NZS 3000 Wiring Rules for the next revision. The main change relates to RCDs – and with good reason.

In the past couple of years there have been several electrocutions and accidents in the electrical trade, and it is hard not to be touched by every one.

We all probably know someone who has been affected by the experience, from minor shocks to fatalities, and in extreme cases those left behind suffer terribly.

We should be able to work safely and return safely to the family at night.

Very serious accidents have occurred while electricians were working with distribution and switchboards; however, many of the fatalities in domestic and commercial environments might have been avoided if RCDs had been fitted.

Of course, we all know that circumstances play a big part. If you touch active and neutral together, an RCD will not help at all.

But if an RCD has been fitted you would have to be extremely unlucky to touch both at once. Even the slightest delay in touching both will provide a path to earth from active or neutral, and the RCD will trip.

It might be stating the obvious, yet many cases of electrocution could have resulted from installations not being fitted with RCDs.

Think of working in a ceiling space, where there is usually minimal room to move and poor light. Perhaps a sparky occasionally feels too old and wise to climb into those spaces – and the thought occurs to let the apprentice do it.

Of course it is crucial to provide appropriate training on the hazards of the work environment, and most of you do it on a regular basis.

Yet accidents keep happening, exposing all of us to the risk of serious injury or death.

So what can be done? One very simple procedure is to fit RCDs in all installations. This is a requirement for new installations, but spare a thought for the number of homes that still don't have this protection. The estimate is 35% of Australian residences, or about 3.5 million.

From a Wiring Rules perspective, clauses dictate the installation of 30mA RCDs for most circuits in the home. Bear in mind that each state has legislated that AS/NZS 3000 be mandatory for electrical installations, and failing to follow the Wiring Rules is a legal offence.

Commercial spaces also have requirements for RCD protection. However, the main driving force is workplace safety legislation, which has been adopted nationally with ongoing test and tag requirements for appliances and RCDs.

Some jurisdictions have a requirement for RCD protection before a home is sold or rented, with Western Australia and Queensland leading the way. This should be uniform across the country.

Most old installations without RCD protection in most states just stay that way. Considering the improved safety when an RCD is installed, this is a sorry state of affairs for the home owner and people carrying out maintenance.

With this shortcoming in mind, the EL001 Wiring Rules committee has tried to provide some retrospectivity in relation to fitting RCDs in older refurbished residences.

Previous articles covered the inclusion

BY
GARY
BUSBRIDGE

of two rules (relating to alterations, additions and repairs) that should help to reduce the number of homes without RCD protection:

- where there is a replacement of the whole switchboard and its circuit protective devices due to alteration or repair then it shall be upgraded to the latest requirements of RCD protection; and,
- where more than 20% of the existing circuits are added to an installation then all circuits have to be upgraded to reflect the latest requirements of RCD protection.

In the second case, for example, if the existing residence has two power circuits and one light circuit (both without RCDs) and you add a new power and light circuit then you have exceeded the 20% requirement.

What I like about these rules is that they put every electrician on the same page when quoting for a refurbishment. If either of these rules applies then the whole switchboard needs to be upgraded.

Spare a thought for electricians working on rural properties, with the installation of pumps and the like.

In recent times there have been electrocutions down on the farm. After inquiries were held, it seems that RCDs could have prevented the fatalities.

One point here is that the motors involved were up towards the 32A mark. Until now there has been a requirement to use 30mA protection on circuits up to and including 20A.

The biggest upheaval in years for the installation of RCDs is pending – and that is for all final sub-circuits up to and including 32A to be RCD protected. Yes that's right, in residential and non-residential installations.

This has not been overwhelmingly agreed, but the thought is there and it does make good sense. The EL001 committee wants greater penetration of RCD protection in homes, but the commercial space is equally alluring.

The new revision of AS/NZS 3000 is nearly upon us. RCD protection is not the only change, but it is the biggest and most contentious for many years. Don't be shocked when the Wiring Rules are published at the end of this year. ■

CLEANING UP WITH SOLAR

SOLAR PANELS CAN REPORTEDLY LOSE UP TO 40% OF THEIR EFFICIENCY SIMPLY BY BEING DIRTY. NOW, ELECTRICIANS CAN CASH IN ON THE RISE OF PV MODULE CLEANING COMPANIES WITHOUT LIFTING A FINGER. JOE YOUNG REPORTS.

Most solar cleaning companies train staff to identify potential issues that would require maintenance from an electrician, which is then reported back to the panel installer.

Did you know that one of the biggest threats to the efficacy of solar panels is dust? Airborne algae, pollen and dust can settle on PV panels over time, leaving a darkish film that covers the modules.

It's a bit like leaving a car outside for a long time; it accumulates a thick layer of dirt, which negatively affects the efficiency of solar systems.

Now installers can form partnerships with specialised panel cleaning companies, which will lead to extra income without any extra work.

Already solar installers work seriously hard for their money. Working on sloped roofs and in cramped spaces, and constantly going up and down ladders getting the job done, is no mean feat. So earning a few extra dollars without the extra hard labour is an enticing thought.

> Earning a few extra dollars without the extra hard labour is an enticing thought.

The process is simple. As part of the initial sale, an electrician sells their customer an ongoing panel maintenance package, to be carried out by a solar panel cleaning company that the sparky has previously established a relationship with. The cleaning contractors will then carry out the job and pay the electrician every time said panels are cleaned.

Generally, the contract will dictate a clean every six months, so the electrician will receive ongoing payments for the life of the partnership.

Solar cleaning company Green Unicorns founder Brett Jones says his company partners with a number of electricians and installation companies to do everything from small residential jobs to large scale utilities.

"We have partnerships with electricians who have only done one or two installations right through to companies who have done upwards of 10,000," he says.

"By using a service like ours, sparkies don't have to get bogged down doing small $89 jobs and can focus on the bigger picture."

Brett says electricians will generally receive around $15 per clean, which may not seem like a lot but with ongoing payments on many contracts it can add up, particularly when the income is passive.

While Green Unicorns licensees undergo intense training they aren't qualified electricians, so they can't do any electrical maintenance during a clean and are therefore no threat to a contractor's business. In fact, most solar cleaning companies train the staff to identify potential issues that would require maintenance from an electrician, which is then reported back to the installer of the panels.

In other words, using a solar cleaning service could lead to new

business opportunities.

"If one of our licensees identifies an issue, they take a photo of it, we put it into our system and the report with the photos is sent straight to the installer. They can then follow-up with the client and carry out any necessary maintenance work," Brett says.

While it's true that some panels can go for years without needing a clean, it's almost impossible to tell how dirty the panels are going to get over time, so selling a cleaning contract is still a viable prospect. If it's a coastal house, a farmhouse or if it's in close proximity to a main road, dirt will accumulate more rapidly. It can also depend simply on whether there is high bird traffic in the area.

Should your customer forego a cleaning contract, you can always recommend that if they notice a decrease in the energy output of the panels or if they can physically see a build up of dirt on the panels, they can contact a solar panel cleaning company directly. It's a good idea to tell customers to take note of the energy output during the first week after installation, that way they can use it a future reference point.

Brett explains that using a specialist cleaning company will also reduce the risk of damaging solar panels with incorrect chemicals or scratching the panels, which could also result in a loss of efficacy.

Solar panel cleaning companies avoid using many chemicals to avoid leaving a chemical film on the panels and they use soft non-abrasive equipment to avoid scratching.

"We use de-ionised water and the brush agitation removes all the grit and grime off the panels leaving them in brand new condition," Brett says.

"Ultimately, if your customers are already investing a significant amount of money on solar panels they want a good return. A cleaning contract is such a small part of the overall cost that many clients will see it as common sense." ■

> **Green Unicorns**
> **www.greenunicorns.com**

LIGHTS, CAMERA, ACTION!

A good eye for lighting is crucial when creating the environment the director of photography is after.

YOU NEEDN'T BE A SPARKY TO WORK AS A GAFFER, BUT A STRONG UNDERSTANDING OF ELECTRICAL EQUIPMENT IS VITAL. JOE YOUNG FINDS OUT MORE ABOUT THE FILM INDUSTRY FROM TWO GAFFERS.

Creating lighting for the film industry can be a thankless job.

Get it perfect and no one bats an eyelid; get it wrong and you will have a whole crew of people breathing down your neck.

Despite the high pressure and long hours, gaffers perform a role many electricians are envious of due to the excitement the industry generates.

The gaffer, sometimes going by the fancier title of chief lighting technician, is responsible for taking a lighting plan, as envisioned by the director of photography (DOP), and bringing it to life. This means managing a truckload of lighting and power equipment, understanding electrical devices, overseeing a team and often using a bit of creativity.

Con Mansuco grew up down the road from an independent theatre in Coburg, a suburb in Melbourne's inner north.

"I used to go there all the time to watch movies and I developed a fascination for the making of film – from lighting and sound production to how the projector worked," he says.

When Con was 14 he followed his brother's rock 'n' roll band on tour and helped out where he could. It's how he initially got into lighting. This led to him setting up and operating lighting for a number of rock bands on tour.

Then in 1986 he stumbled upon a newspaper ad for a job as a technical assistant at Channel 7.

After some time at Channel 7, the then 18-year-old Con was asked to go to Queensland to work on the US TV series *Mission Impossible*.

He found the prospect daunting but exciting.

Now, after 30 years in the industry, Con has built an impressive CV. His freelance business, Film Electrix, is well respected in the Australian film industry.

At 24 he tried to get his electrical licence, but at the time he was considered too old for the apprenticeship scheme.

"A strong understanding of electrical power and of how to balance a generator is highly beneficial. A big advantage of having electricians on set is that you can have things repaired on site."

Con says a good eye for lighting is crucial when creating the environment the DOP is after.

"It's one thing for DOPs to know what they want, but it's another thing to achieve it. That's where we come in, and it's where a gaffer needs to be creative.

"When I was young my dad bought

a video camera. Shooting videos on holiday made me realise I had a creative side, which added to my interest in the film industry. A great thing about the job is being surrounded by wonderfully creative people who are producing something new."

The DOP generally designs the lighting plan, but they often look to the gaffer for advice on what would work best.

Jobs in the film industry are highly sought after, and the role of gaffer is no exception. Most gaffers work freelance and have to 'do their time' to become established.

"When big US productions come to town, it's a great time to get in because they employ a large number of people," Con says.

"You generally have to start as an assistant on set then work your way up, teaming with as many gaffers as you can to learn the craft and become capable and efficient. Then you will be ready when an opportunity comes along.

"When I started at Crawford Productions I was a transport driver, then I became a runner, then an assistant to a grip and eventually a gaffer."

Thom Holt of 3 Point Lighting also became a gaffer in the 1980s, although he worked in HVAC for eight years before moving into the film industry.

"In 1985, a mate who works in film lighting had just started his own lighting truck business and invited me to have a look at what he was doing.

"Early in 1986 I went with him to some TV commercial jobs – no pay, just to learn the ropes. Five months later a big car commercial needed lighting staff and that was my first paid gig."

Thom didn't set out to be a gaffer and admits to being a bit jaded while changing over to the role. But once on his feet he never looked back and found his previous experience in HVAC to be a big help.

"Being able to work with, understand and manage electrical equipment, systems and power infrastructure is highly valuable. Lighting is not just about pointing lights around; it's about the power supply and infrastructure that supports a film set.

The gaffer, or 'chief lighting technician', is responsible for taking a lighting plan, as envisioned by the director of photography, and bringing it to life.

"You also need to have some understanding of cinematography, cameras, lenses and how light reacts in different situations. You must know how to use light – manipulate and control it – and how that relates to the camera."

Thom says a typical day as a gaffer involves a meeting with the DOP to put a basic lighting and power plan into place, while the lighting team is unloading equipment and setting it up.

"When the actors are rehearsing in the space, the team fine-tunes the lighting. You should get information from the DOP for the next shots and angles so you can start to prepare for the next moves. The challenge is to get ahead but remain flexible, because it's a creative environment and things are always changing."

Due to the constant changing, efficiency and safety are crucial.

"When changing locations five times a day, the time pressure is on and logistical management is paramount," Thom says.

"Then there's team management – knowing your team's skills and getting the job done on time. Then when the director calls 'wrap', you pack it all up and put it all back in the truck."

Thom says the volatile industry requires a big financial commitment.

"If you like reliability and security, it's probably not the game for you. On the other hand, you end up in a lot of different places, working with a lot of weird and wonderful people. That is hugely rewarding and enriching, more so than most jobs I've seen.

"I've had a lot of fun moments along the way. I worked with Buzz Aldrin and I've worked on *Lord of the Rings* and on *Robinson Crusoe* in New Guinea.

"I've had the privilege of working with many great people, and that's the best reward." ■

INDOOR POSITIONING SETS UP SHOP IN AUSTRALIA

A NEW RETAIL POSITIONING SYSTEM BASED ON VISIBLE LIGHT COMMUNICATIONS IS MAKING SHOPPING AN EVEN MORE PERSONALISED EXPERIENCE.

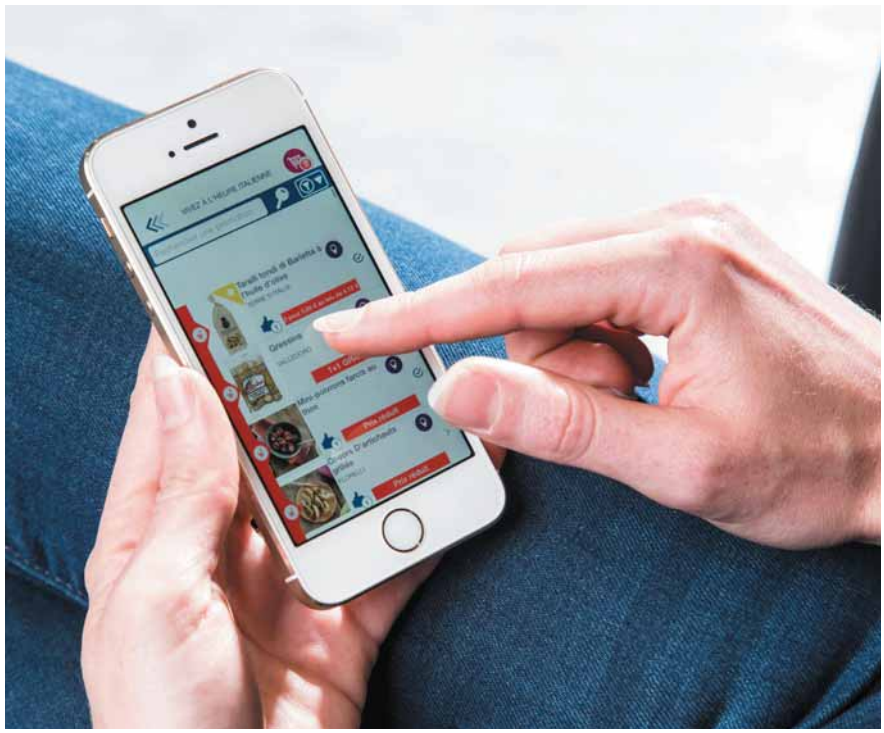
Lighting is one of the more important factors in creating the ideal retail experience. And when it comes to retail lighting fitouts, it is important for electrical contractors to strike a balance between creating ambience and promoting a positive in-store experience that will drive traffic to the till, as well as reducing energy consumption and costs.

With online shopping challenging the way consumers shop, retailers are acutely aware that the in-store shopping experience is increasingly important and that this experience is largely impacted by lighting.

As a result, Philips Lighting is piloting a lighting system that uses intelligent LED in-store lighting to communicate location-based information to shoppers via a smart phone app they can opt to download.

The lighting communicates with the app via visible light communications (VLC) to send special offers and information to the shopper, relevant to their location in the store.

"Retailers are showing a growing interest in bringing indoor location services into stores to engage with customers in a meaningful way. Retailers are looking for a system that performs and is stable, and is too difficult to install and maintain. This is where lighting comes in," says Philips indoor positioning business leader Gerben van der Lugt.



Philips Lighting is piloting a lighting system that uses intelligent LED in-store lighting to communicate location-based information to shoppers via smart phone app.

"The replacement of a conventional lighting system to an LED system makes a lot of sense for retail investments. So if you're going to go to the trouble of installing new lighting infrastructure, why not use the same system for indoor location as well?

"Our light-based indoor positioning system brings together a retailer's lighting infrastructure with a super accurate platform for indoor location services that is accurate to 30cm."

Philips' connected retail lighting system will benefit retailers by helping them to build customer loyalty and sales by providing targeted information and discount coupons at their precise position in the store, when shoppers need it most and are

> The in-store shopping experience is increasingly important and that this experience is largely impacted by lighting.

most receptive.

The system works by using lighting fixtures that form a dense network that not only provide high quality light but also acts as a positioning grid. Each fixture is identifiable and able to communicate its position to an app on a shopper's smart device. This enables the shopper to get information related to their position in the store as they move around the store.

"The beauty of the system is that retailers do not have to invest in additional infrastructure to house, power and support location beacons for indoor positioning," Gerben says.

"The light fixtures themselves can communicate this information by virtue of their presence everywhere in the store."

And according to Gerben, the retail positioning system is not difficult to install.

"Philips has now rolled out quite a few lighting designs for large retailers around the globe that included indoor positioning. We have found that a 'typical' lighting design that works from a lighting design perspective is actually good enough for indoor location too.

"You just need to make sure that you have an even coverage of light so the visible light communication technology works seamlessly."

For now, Philips directly manages the installation of its indoor positioning system as it is still developing the tools for venue enablement, but as soon as that is stable, Gerben says it will move firmly into the scope of the electrical contractor.

"When it comes to the installation and commissioning of a lighting system control system, the contractor plays the central role. We see the initiation of indoor positioning systems as a role for contractors in the future, too."

This latest connected lighting innovation illustrates how Philips is taking light beyond illumination, underlining its commitment to deliver meaningful innovations that improve both business value and people's lives. ■

> **Philips Lighting**
> **www.lighting.philips.com.au**

THE PROFESSIONAL WAY

A QUALIFIED, EXPERIENCED ESTIMATOR CAN HELP AN ELECTRICAL CONTRACTOR TO STAY IN BUSINESS AND MAKE A PROFIT. YOU CAN QUOTE BRIAN SEYMOUR ON THAT.

Registered electrical contractors often ask about the value of an estimator.

They are usually thinking of employing their first full-time person in that role.

Up to this point the owner/manager or the supervisor has performed the estimating tasks, but if the business is to expand then it requires someone dedicated to the task.

The old 'price per point' or 'price per square metre' has no place in tendering a serious bid for a project.

Businesses considering a full-time estimator need to be aware of the qualities estimators need and what they are expected to do. This is central to achieving quality service at a reasonable price.

As one of this country's leading electrical contractors has said: "Why would you be concerned about paying top dollar for a competent estimator ... an inexperienced cowboy could cost you your business."

APTITUDES

Estimating personnel should be selected for their practical background and personal qualities.

The estimator needs to be a self-starter with good planning skills and able to make assessments regarding budgets and workforce capacity.

People with trade backgrounds in project management and speciality supervision are often suited to become competent estimators. They must be able to confer with suppliers, architects, developers, builders and sub-contractors.

DUTIES AND RESPONSIBILITIES

Many contractor personnel think estimators are purely 'count and measure' clerks.

However, the duties and responsibilities of estimators are many and varied, and it is their task to ensure that all material and associated labour is included in the final price.

Further tasks include:

- sourcing suitable tender documents;
- assessing client needs;
- taking off (count and measure) total materials, labour and special services;
- obtaining the most economical prices for materials and equipment from suppliers;
- applying the company's labour units to the installation;
- gathering quotes from sub-contractors;
- assessing risk levels;
- ascertaining expected profit margins;
- accounting for preliminaries such as site facilities, transport, site storage, equipment hire, walking time, site allowances, accommodation, etc;
- ensuring the workforce has the capacity to complete the project within the time frame;
- preparing and submitting the final tender;
- following up tender results;
- completing a post-tender analysis for research; and
- if successful, monitoring the stages progressively to ensure the project stays in line with the estimate.

Of the above, the take-off is the easiest part of the job (although it is the most time consuming). Any competent tradie should be able to accomplish it.

Materials pricing is reasonably straightforward when using reliable suppliers. Calling quotations for light fittings, sub-contracting and special equipment is fairly routine.

The labour aspect is the most difficult to predict due to the many factors that can affect the installation. These include:

- type of building
- weather
- site access

BY
BRIAN
SEYMOUR

- lifting facilities, material handling
- building schedule
- completeness of documentation
- distance from site shed (or truck) to the workface
- height, depth, confined space, heat, cold
- stacked trades.

ESTIMATING MANUAL

A labour unit manual is an invaluable tool for assessing labour in a variety of situations.

The manual's data indicates the average time (in staff/hours) it takes for the average worker to install a unit of material under average conditions.

The first distinction an estimator must realise is that a labour unit is not absolute: it is a benchmark, a starting point.

There are basically two ways of determining expected labour hours and related costs: personal work experience or an industry researched labour unit manual.

The labour unit, whether from a manual or calculated by the estimator, is a cost/data figure, indicating the cost (in hours) for installing a given item of material or performing a given labour operation.

Experience is the greatest resource in understanding the conditions that affect labour cost. Regardless of the size or scope of the installation or service, a successful tender depends on the estimator's knowledge of the company's cost factors gathered from its history.

THE ESTIMATING DEPARTMENT

Whether the department consists of one person or several, it needs to be organised and take into consideration the company's range of work.

Does it operate in a specialised sector or is it diversified? The more specialised the work, the more that current and previous cost experience will apply. This increases the prospect of accurately estimating new business.

As the estimating department increases in size, specialists develop in various functions to handle sections of the estimate.

There is no hard and fast rule for setting up the estimating department – it's a case of horses for courses, and some people are just better at some functions.

A senior estimator who can recognise various skills will have an efficient estimating team.

However, establishing standard procedures to guide the whole team will save time and money through even greater efficiency, and the senior estimator will spend less time overseeing the day-to-day running of the department.

NEW CONTRACTORS

Having conducted contractor training programs for more than 20 years, I am still amazed by trainees who don't understand the cost of electrical contracting.

It's no surprise that 55% of new contracting businesses fail within the first 18 months..

Many new contractors, when determining their charge-out rate, believe that 20% above their wages when working for a boss will see them right.

It comes as a shock to learn about the 'loaded on-site rate', which is generally 62% above their pay slip figure.

The loaded rate includes the often hidden costs paid by a company on behalf its workers, such as travel time, fares, superannuation, annual leave loading, long service leave, payroll tax and workers' compensation.

This loaded rate pays only the cost of putting someone on site. There are also business overheads, including motor vehicles, telephone, insurance, advertising, stationery, computers, depreciation and fees – just to name the basics.

Then there has to be a profit margin if the contractors want to stay in business.

The new contractor calculating a charge-out rate may need professional help to assess the cost of overheads and determine a profit margin to arrive at a realistic figure.

The calculation needs a formula similar to this:

Expected wage + 62% (loaded wage add-ons) + overhead + profit = charge-out rate

However this rate is based on 1,621 chargeable hours per annum (38-hour week less holidays, etc). It is not much of a problem to work that number of hours per year, but the charge-out rate needs to be calculated on what is achievable.

For instance, if the new contractor can achieve only 1200 chargeable hours, then the rate needs to be increased by 35% to maintain the expected return.

EDUCATING ESTIMATORS

The education of estimators never ends – they must school themselves to meet new problems and explore new methods.

Whether the business specialises in industrial, commercial or residential projects, new materials, equipment and methods emerge as technology improves and customer requirements change.

New contractors are able to draw on a multitude of accountants, lawyers and bookkeepers to assist in unfamiliar areas of the business, but there will be a distinct lack of assistance from such professionals when it comes to estimating.

It is therefore advisable to enrol in an estimating course.

The estimator is constantly investigating opportunities to offer alternatives and so increase the chances of winning a tender. This comes with experience and, as some unknown sage said, experience is a wonderful teacher. ■

Brian Seymour, MBE, is an industry consultant and author of Electrical Estimator's Labour Unit Manual, Starting Out and Electrical Contracting in Australia. *He conducts regular industry training programs throughout Australia on behalf of the electrical and air-conditioning sectors.*

THE ROAD FORWARD

PUBLIC LIGHTING HAS ALWAYS BEEN A PRACTICAL MATTER, BUT NOW IT HAS THE POTENTIAL TO DEFINE AND REDEFINE URBAN SPACES. STEVE ARTHUR REPORTS.

In recent years the role of public lighting has changed dramatically.

Technological advances have brought about change, but so has a shift in the mindset of councils and designers when it comes to the application of light and its effect on the urban environment.

Susanne Seittinger, global sub-segment manager for professional systems at Philips Lighting, is researching the effect of light in public spaces. Susanne is exploring the economic, social, environmental and cultural aspects of lighting – all of which will inform approaches to this aspect of urban design for lighting professionals.

Light is used in several ways, with an emphasis on its relationship with a city and its population in addition to its technical characteristics. As the landscape around lighting continues to evolve due to urbanisation, so too will the role light has to play in public spaces – from parks to roads, and footpaths to public squares.

We already see this in forward-thinking municipalities. One of the main trends has been a shift away from lighting for cars towards lighting for people – more than that, a shift away from street lighting specifically.

Public lighting has generally been synonymous with street lighting, its main function inadvertently defined as providing visibility for drivers. This resulted in a uniform approach.

Now there's a trend towards accommodating pedestrians and cyclists alongside drivers, an approach that achieves better lighting outcomes for the public and local governments.

Although it has yet to gain widespread acceptance, particularly in Australia, this modern approach to lighting presents an opportunity for electrical professionals. The public sector is starting to take note of digital lighting, and there's potential for an overhaul of legacy lighting in public spaces.

DIGITAL LIGHTING BENEFITS

Bespoke lighting aids CO_2 emission reduction targets by replacing a uniform approach with tailored lighting that is fit for use and cuts unnecessary energy output.

Programmable lighting systems give local governments better control over the use of light across their municipalities. This allows flexibility in lighting that has not previously been achievable. With a programmable lighting system local governments are able to adapt lighting in the event of an emergency or accident, to assist in a swift resolution.

Contemporary pedestrian nightlife is affecting the design of lighting, allowing it to embrace, mirror and encourage a vibrant urban atmosphere.

HOW IT IS ACHIEVED

The new wave of lighting designers have different views about lighting a public space, and they are equipped with the technology to better realise their visions.

The introduction of light-emitting diodes has made it possible to be more precise in lighting design, abandoning the method of 'bathing' areas in light in favour of focused lighting for specific areas and users.

Digital technologies in lighting allow for user-centric, responsive and adaptable designs in the public realm and offer a chance to engage the public in new ways.

BY
STEVE
ARTHUR

LIGHT FORMS

Ambient lighting doesn't often operate in the foreground of an environment, but is rather a supportive infrastructure.

The light naturally present in the environment should inform the lighting technology applied to a space.

A wealth of research is now highlighting the detrimental implications of light pollution on natural cycles. As more of this research is conducted, the role of ambient light will probably become more integrated with public lighting design.

Dynamic lighting, which features integrated data, allows for predetermined patterns or effects to fill public spaces.

This allows lighting to assimilate to the space, whether based on the specific site or seasonal changes. It offers a chance for engagement with the public and an improved user experience. This form of lighting can also create place-based story-telling spaces.

Responsive lighting can evoke a visual experience using movement, colour and timing without intervention by users. It takes cues from the environment, and how the public is using it, to adapt the provision of light. These systems allow for long-term and short-term feedback, so that public spaces become intrinsically linked to the life of the city.

Interactive light lets users affect the output with direct input mechanisms. The public can modify their urban environment by controlling the light installation via sensors, mobile devices or other interfaces.

THE OPPORTUNITY

The applications of digital lighting technologies are far-reaching, from social engagement to energy efficiency.

They affect all lighting specialists, from planners and urban designers to electrical professionals. All can make substantial contributions to the future of urban lighting and make public spaces adaptable and interactive.

With the rapid technological evolution of lighting and the prospects these advances present, local government will look for continued efficiency when it comes to lighting.

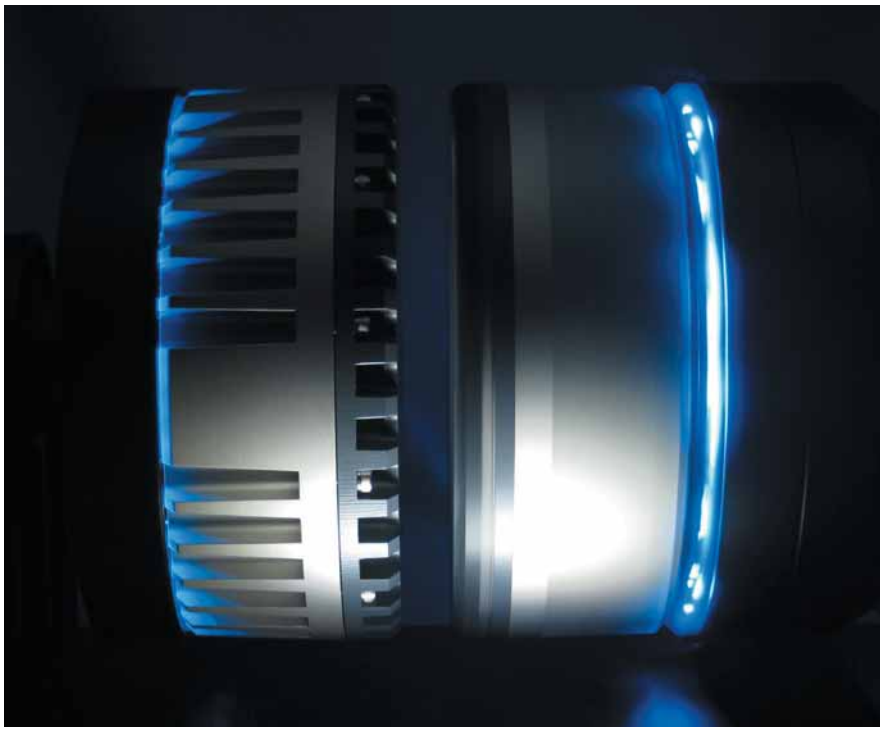
Also, we expect to see more dynamic, responsive and interactive solutions applied across cities, as municipalities realise the full potential of lighting. This new era looks like producing a more user-centric public lighting experience than ever before.

Digital lighting is in a strong position to deliver on both fronts.

The best results from the age of digital lighting will be gained via a collaborative approach to design and implementation across all facets of public lighting design. ■

MIND THE GAP

IN 1894, NIKOLA TESLA USED RESONANT INDUCTIVE COUPLING TO WIRELESSLY LIGHT UP PHOSPHORESCENT AND INCANDESCENT LAMPS. NOW AN AUCKLAND COMPANY IS TAKING THE CONCEPT TO NEW LEVELS, AS JOE YOUNG REPORTS.



Using wireless connectors provides numerous advantages over standard cable connections and mechanical slip rings in a wide range of industrial applications.

Engineers, instrumentation technicians and electricians often have to find the best way of transmitting electrical signals, charging energy or motive power between two points.

One solution is to simply run a power cable between the points; however, complexities arise when machinery or appliances have moving parts that separate or rotate while in use, when components are exposed to harsh environmental conditions, or when working in tight spaces or with thick obstructing materials.

These complexities could be the downfall of conventional wired systems and mechanical slip ring solutions. The cables can wear relatively quickly or can be easily damaged if connected to a moving part – likewise with mechanical slip rings and their brush contacts.

If the surrounding environment is wet or dirty the connections can soon be compromised and will break down.

However, these connection inefficiencies and areas of unreliability are elegantly overcome through wireless power connection systems being developed by the New Zealand based company PowerbyProxi.

Aussies sometimes regard New Zealand as a younger under-achieving sibling, but the company based across the ditch is quickly becoming known as a world leader in wireless power innovation.

In 1995, professors John Boy and Grant Covic of the University of Auckland developed connectors that use resonant inductive coupling to transfer relatively large amounts of energy across small air gaps (or across any non-metallic/non-conductive gap of solid, liquid or gas).

PowerbyProxi was established in 2007 in a bid to commercialise this technology.

After gaining tens of millions of dollars from investors, the company developed a range of industrial wireless connector components ranging in power transmission from 12W to 240W.

PowerbyProxi also develops inductive slip rings to allow connection across rotating machinery components.

Using wireless connectors provides numerous advantages over standard cable connections and mechanical slip rings in a wide range of industrial applications. These connectors increase reliability, minimise downtime and reduce maintenance and repairs at connection points.

Mark Flickinger is director of customer applications at PowerbyProxi. He says the ability to be hermetically sealed and the IP67 rating (resistant to dust and water) make these connectors ideal for obscure and harsh environments.

"If you need to do connections underwater or in dirty sites, or even if you need to make a connection in high-temperature metal environments,

wireless power excels."

PowerbyProxi spokesman William Pryde says the signage industry can also benefit.

"When providing power to signage in difficult locations, wireless connecters can eliminate the drilling of holes through obstructing materials for cable feeds."

Sensors are present in many operating environments. However, they are generally small and placed inside or on moving equipment, so delivering power and data to them reliably is often challenging. The wireless connectors obviate many design constraints.

They are now sold all over the world, using converters to solve any voltage mismatch issues.

In the past five years wireless phone charging has taken off in a big way, which is reflected in the interest in the company's consumer line.

PowerbyProxi has developed solutions in consumer electronics that include prototypes for wirelessly chargeable AA batteries and a 3D wireless power transmitter. To understand how the 3D transmitter works picture a box in which you simply place batteries, remotes and phones for charging, again using resonant inductive coupling.

Wireless power is relatively new, and people are still discovering how it can be used – and its full potential. The company aims to make the connectors more affordable so that more people can experiment with them for smaller applications.

William says there are many possibilities – automated charging of batteries for robotic vehicles or electric lift trucks, hermetically sealing and waterproofing delivery of power to marine sensors, transferring power to rotating machinery in forestry harvesters and flexible reconfiguration of LED lighting.

"We are continually gaining an understanding of how this technology can be used more extensively. It's about getting information out there so people can think of different applications. There are endless opportunities." ■

> **PowerbyProxi**
www.powerbyproxi.com

AFL GROWS IN AUSTRALIA AND NZ

AFL DESIGNS, MANUFACTURES AND INTEGRATES FIBRE OPTIC AND COPPER COMMUNICATION SOLUTIONS. IT PROVIDES INDUSTRY-LEADING PRODUCTS AND SERVICES TO AN EXTENSIVE RANGE OF MARKETS INCLUDING AEROSPACE, DEFENCE BROADCAST, EDUCATION, ENTERPRISE, GOVERNMENT, MINING, RAIL AND TRANSIT, ROAD AND INFRASTRUCTURE, TELECOMMUNICATIONS AS WELL AS UTILITIES – OIL, GAS, WATER AND POWER.

AFL is proud to offer engineering expertise, exceptional products and reliable services that help our customers improve their critical fibre optic and communication infrastructures.

The company is headquartered in Spartanburg, South Carolina, and is a wholly owned subsidiary of Fujikura Ltd of Japan, with operations in the US, Mexico, Canada, Europe, Asia, Australia and New Zealand.

In Australia and New Zealand, it has its head office in Melbourne and two manufacturing facilities including fibre optic cable production, fibre optic patchcord assembly and mechanical production. With additional offices and warehouses located in Sydney, Brisbane, Canberra, Perth, Adelaide and Auckland, the company has more than 160 people servicing its customer's needs. What's more, AFL has a highly trained Technical Support team that repairs and services Fujikura splicers and arrange for test equipment to be calibrated.

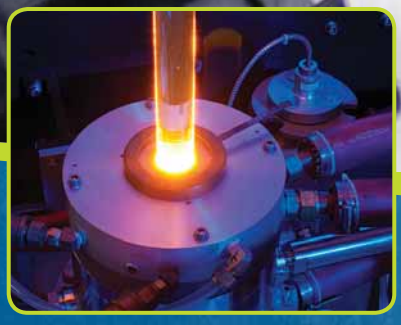
The AFL story began in 1984 with origins that stem from two companies, each with a rich heritage that began in the 1880s. Alcoa, the world's leading producer of primary aluminium and fabricated aluminium; and Fujikura, a global leader in fibre optic technology. A joint venture between the two companies was formed to supply optical ground wire for utility and telecommunications providers, which formed the beginning of Alcoa Fujikura Limited. Within the venture Fujikura provided the technical know-how, while Alcoa contributed a proven reputation of providing conductor products and accessories to the utility industry. That was the beginning- one product that helped customers across North America.

Since then, AFL has never looked back, adding products and services that have fuelled the company's growth and positioned it to provide truly integrated solutions. Its product portfolio caters to service and content providers, energy projects, enterprise data centres and for industries with harsh environments. From fibre optic cable, enclosures and racks, MTP cabling systems to fibre termination and splicing and copper cabling systems, AFL provide quality products to meet customer's needs.

In 2005, Fujikura assumed 100% ownership of AFL. AFL has continued to grow through acquisitions over the years. In 2013 AFL acquired Optimal Cable Services, beginning its in-region presence in both Australia and New Zealand, and then added AFC in 2015. The company is now simply known as AFL and has a large presence in the Australia and New Zealand region.

> **AFL**
> **www.aflglobal.com/au**

We connect.™



At AFL, we make connections possible through the latest communications cabling technology. Using fibre optics we integrate voice, data and video applications into solutions that keep our customers connected. We develop solutions that solve our customers' unique technology and application challenges.

AFL

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A word from the CEO

By the time you read this issue of *Electrical Connection* the Federal election will be behind us, the UK has voted to leave the European Union and the race for the White House will be well under way. So change is certainly in the air as I write this update.

Key to us at NECA is that our policy issues remain top of mind when our politicians return to Canberra in July, post-election. We have used this opportunity to remind all major parties that we have updated our policies to reflect the current issues our industry is facing. (Please see the story on the following page which lists both the existing policies and the additional policies we have added to the 2016 summary – which you can also find on our website under Advocacy.)

As we move into the new financial year there is another landmark we are celebrating. It's 100 years now since the first NECA entity opened its doors to members, in Victoria. The following year, 1917, our first President was appointed. As a result we are celebrating our centenary over the financial year 2016/17.

We kick-off the party at our Excellence Awards in Melbourne – which is always the first of the state- and territory-based events, and plan to conclude things with a President's dinner at our industry conference in 2017 – in Australia this time, given this landmark event in our history.

On the topic of industry conferences, the 2016 conference in Stellenbosch, South Africa, in April of this year was a huge success. We had 260 delegates and a very full agenda. Our two keynote speakers – Glenn Platt from CSIRO and Martin van Rensburg from CISCO both gave thought-provoking presentations on the challenges the industry is facing. Particularly with respect to innovation. And the closing presentation from local TV personality, and medical doctor, Michael Mol left everyone feeling totally committed to achieving a better work/life balance.

The selection of photos in this update will give you a taste of the fun had by all!

In September we will be kicking-off the next Market Monitor industry research. Given the success of the 2015 study, this will once again be available to everyone in the industry and conducted exclusively online.

And so, as we head into the final quarter of what has definitely been an interesting year for us at NECA, I wish you well.

Best regards,

Suresh Manickam ■

A new industry information portal

CSIRO recently announced its acquisition of the Centre for Liveability Real Estate and the intellectual property for its sustainability framework from the Hooker Corporation. The Banksia Award-winning platform was developed in collaboration with sustainable design and construction industries and provides training, research, strategy and communication services to the residential real estate industry. NECA is one of the founding content partners.

The site helps real estate agents to promote properties with the potential for reduced running costs and increased comfort in a way that is more easily recognised at point of sale or rent. While buyers, or tenants, can easily see if a residence has enough bedrooms and/or a well-designed kitchen, it's not as easy to determine if it will be warm in winter, cheap to run, or if it has a large impact on the environment. Liveability aims to bring these features to the forefront of any real estate transaction and potentially influence property values.

"It's all about delivering a better experience for buyers, sellers, tenants and investors by empowering them to find or create their 'best home': healthy, efficient, comfortable and connected to their community," adds NECA CEO Suresh Manickam.

Liveability adds to CSIRO's existing research in residential energy efficiency and aligns with its wider climate change mitigation work. Their work in this area is enhancing sustainability awareness within the 9.6 million Australian residences that are responsible for approximately 11% of the nation's greenhouse gas emissions.

"CSIRO is at the forefront of research into our impact on the planet and what we can do to live more sustainably – through Liveability, it's possible to identify the best ways to be eco-friendly and be comfortable in our homes," CSIRO research director Dr Stephen White says.

For more information check out the NECA website Consumer section. ■

NECA 2016 INDUSTRY CONFERENCE, SOUTH AFRICA

African dancers welcome our guests.

Dave & Cindy McInnes.

Dr Michael Mol.

The partners' panel (Gerard Lighting & Clipsal) with CSIRO's Glenn Platt (left).

The drums night.

The entertainers.

The gala dinner.

The partners' panel (NHP & L&H) with CISCO's Martin Janse van Rensburg.

NECA Policies 2016

As the peak industry voice for Australia's electrical and communications sector that employs 145,000 workers and delivers an annual turnover in excess of $23 billion, the National Electrical and Communications Association (NECA) continues to engage with our key stakeholders, to identify key policy positions across a range of industry forums.

In this context, our 2016 Policy Statement has built upon our organisation's first document in 2015, having been formulated as a result of an internal process of engagement with NECA members, state chapters and councillors.

This year's statement outlines 12 key policy themes and makes 42 specific policy recommendations, building upon 2015 by adding five new policy themes following the ratification and adoption by NECA's National Executive in November 2015. These five new themes are:

Renewable Energy;
Security of Payments;
Building & Contents Insurance;
Home Safety and Energy Audits; and,
Competency Based Wage Progression

These themes reinforce key topics from our original statement including national licensing, the reform of the Vocational Education and Training (VET) sector, support for small business including company tax reductions and enhanced product quality assurance.

If actioned by Government, NECA strongly believes these recommendations will deliver a more prosperous and effective electrical contracting sector through the creation of new employment opportunities, increased safety and compliance standards and a boost in growth for our national economy.

We clearly hold the view that the ongoing advocacy of the electrical contracting sector, through discussions with Parliamentary representatives and the submitting of policy options to parliamentary inquiries and departmental workforces and forums are critical to effecting positive change for our industry.

For more information visit the Advocacy area on our website.

Industry profile

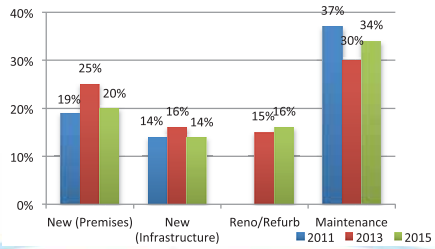
Australia's electrical contracting industry accumulates an estimated annual turnover in excess of $23 billion and in many ways, is a measurement yardstick for the performance of Australia's economy.

In 2015, the largest source of revenue continues to be derived through the ongoing maintenance of residential and commercial property (34%), followed by new premises (20%). Revenue derived from renovation and refurbishment of property (16%) has overtaken new infrastructure (14%) over the past two years.

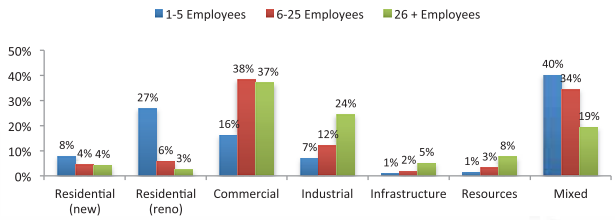
Revenue from commercial projects is the main source for businesses with six or more employees, whilst a mix of revenue sources is the main stay of businesses with less than five employees.

Over the past two years, many businesses have experienced a rise in costs. However, significantly, the serious cost pressures over the last four years have appeared to have eased.

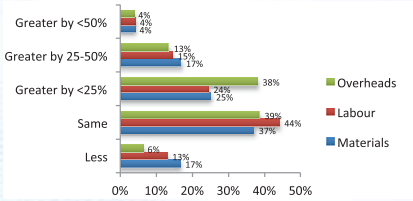
Source of Revenue >50%



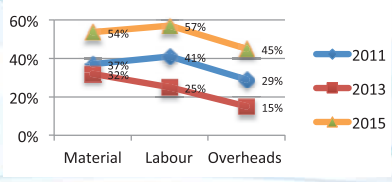
Primary Revenue by Company Size



Cost Increases



% same or less cost comparison



national electrical and communications association

1916-2016

Celebrating 100 years and beyond...

Over the next 12 months we will be celebrating our centenary. Our first chapter opened its doors to members in 1916, in Victoria. And the first President was appointed in 1917. Over the next two decades we opened our doors to members in all states and territories across Australia.

Our celebrations officially kick-off on 1 July – as we head into a new financial year, and the first major event will be the Victorian Excellence Awards.

The story of NECA's evolution has been captured in a wonderful book written by Brian Seymour – a NECA Life Member, and prolific writer on industry developments. It charts our history and reminds us of just how much has changed over the past century. We are very proud of our history and our contribution to the industry. And we look forward to the next 100 years with great anticipation.

We hope you will join us in our celebrations over the next 12 months – which will culminate with our 2017 Industry Conference Gala Dinner.

To find out more visit www.neca.asn.au/100years

NECA ACT
Ph: (02) 6280 5580

NECA NSW
Ph: (02) 9744 1099

NECA QLD
Ph: 07 3276 7950

NECA SA/NT
Ph: (08) 8272 2966

NECA TAS
Ph: (03) 6234 3464

NECA VIC
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NECA NATIONAL
Ph: (02) 9439 8523

ELECTRICAL
CONNECTION

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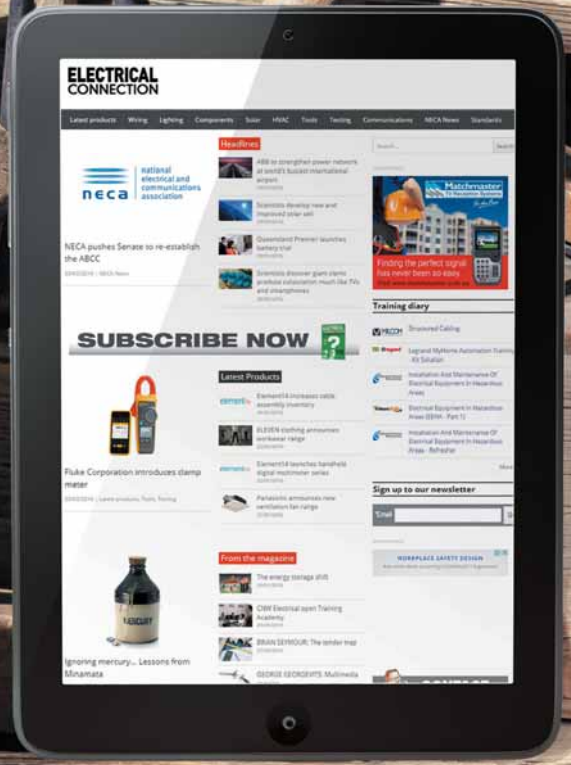


WWW.ELECTRICALCONNECTION.COM.AU

ATT
ACROSS THE TRADES
SPRING 2016

FORECASTING CHANGE

AN INDUSTRY BODY TAKES A LOOK INTO THE FUTURE

INDEPENDENT CONTRACTOR OR EMPLOYEE?

The debate over how to differentiate between an independent contractor and an employee has raged long and hard. Gadens partner, **Ian Dixon** takes a closer look at the issue and outlines some common misconceptions.

One would have hoped that after all the test cases, court judgments and definitions set out by Parliament in statute, there would be a simple answer as to whether a person is an employee or an independent contractor.

The debate over 'sham contracting' and whether a person is, in reality, an independent contractor or an employee has continued to receive legal and political attention. This can cause confusion for working people and often results in errors which can have financial and legal consequences.

Personnel engaged by a company can be put at a disadvantage by being described as independent contractors as this enables the company to avoid paying employee entitlements such as sick leave, annual leave, superannuation and workers' compensation insurance. Additionally, employee numbers and employment opportunities are lost when a company engages independent contractors in place of employees.

Some companies mistakenly believe that with one or two small steps they can avoid many employment obligations. To counter this misconception, the Australian Tax Office (ATO) has issued on its website a series of tests to be considered when differentiating between the two types of engagement.

Included in its advice is a list of common myths which the ATO believes have led people to form the view that any one of the steps is sufficient to make a person a contractor. That includes, for example: a contract between the parties asserting that it is an independent contractor relationship; or that the person doing the work has an ABN; or a registered business name; or is engaged only in short-term work or extra work for busy periods (the last could also be an example of a casual employee).

The matter is further complicated by the fact that various statutes (such as tax) often deem parties to be employees for the purposes of imposing statutory obligations, or impose these obligations on personnel whether they are employees or independent contractors, such as superannuation, thereby blurring the lines further.

COMMON LAW TEST

There are a number of recent leading case law authorities one can look to for guidance in assessing a relationship. It is unfortunate that in each of the cases, the facts or criteria which appear to point to one form of relationship or the other are often given different weight within the different cases by different judges, which could lead to a conclusion other than what might be anticipated.

There is a criticism that this may be because a court instinctively forms a view of the nature of the relationship and then simply arranges its interpretation on all the different facts to support that conclusion. This is not helpful to the working person trying to decide if theirs is an employment or independent contractor relationship.

Courts over the years have tried to express or create a simple overriding test or question to be answered when undertaking the analysis of a relationship. Some examples are:

- The 'control' test: can the company tell the other party not only what to do but how to do it?
- The 'four corners' test: can the other party be said to be within the boundary of the company's operation?
- The 'organisation' test (closely allied to the four corner's test):is the other party really a part of the organisation?

However, a leading court has cast doubt on the validity of such attempts and indicated that they are simply one part of all the matters a court has to take into account when coming to its decision

(which does not assist in achieving greater certainty for the worker).

A more recent attempt has indicated that what is now important to be looked at is the 'totality of the relationship' (whatever that may mean). What has also been said is that the parties should look at what is the 'real substance' of the relationship in question.

Yet another expression which has gained some support is that the distinction between the employee and the independent contractor is 'rooted fundamentally in the difference between a person who serves his employer in the employer's business and a person who carries on a trade or business of his own'. Such expressions do not necessarily aid in providing a clear answer.

AN ASSESSMENT OF ALL INDICATORS

What is universally acknowledged is that there is a considerable number of criteria which have evolved to assist in the interpretation of a relationship but none of which can ever be said to be determinative. The object of the exercise, according to one court, is to paint a picture from the accumulation of detail. However, another said it is not to be regarded as a mechanical exercise of simply considering each of these factors as a checklist to see whether they represent one classification or another, as the factors may vary in the weight or importance to be given in any situation.

No matter which overall test or question is used, it is still necessary to consider all the individual circumstances and indicators. This has been described as a multi-factorial approach.

In one recent case Justice Bromberg of the Federal Court had to consider whether 2,500 interpreters and translators were employees or independent contractors of the On Call Agency.

He found it troubling that there was an absence of a simple and clear definition which explained the distinction. He noted that it was a matter of an evaluation of the overall effect of the detail, which is not necessarily the same as the sum total of the individual details.

Every few years a judge attempts to summarise previous tests and come up with a definitive answer.

Bromberg's test was:

- Is the person performing the work an entrepreneur who owns and operates a business?
- In performing the work is that person working in and for that person's business as a representative of that business and not of the business receiving the work?

In another recent case, the Federal Court was asked to decide whether Ace Insurance agents were independent contractors. Each agent was paid commission on the premiums they collected, each used his own vehicle, did not have income tax deducted from their earnings and issued tax invoices to the insurer for the services each provided.

Conversely, the tax invoices were generated by the insurer and issued to itself, the agents accrued no goodwill in their own business, they were unable to work for any other insurer, sold only the insurer's policies to the insurer's customers and were trained by the insurer in the system of business devised and maintained by the insurer.

Perhaps not surprisingly, they were found to be employees and were owed annual leave and long service leave entitlements.

In the On Call Agency case, Bromberg made reference to approximately 22 criteria in two different sections to help make his decision. Those criteria ranged from: who provides the equipment, the tools and the car; what logo is on the shirt or uniform, or on the business card; who hands out the work; does the person have to do the work themself or can it be subcontracted; do they get paid for their time or only on result; who pays PAYG and workers' compensation insurance; what advertising does the person do and who gets the profit from the work.

I add two more general questions which may give guidance:

1. What is the strength of the independent contractor's trading?

If the contractor is no more than a company in paper and name, the engagement is more likely to be regarded as that of employer/employee. It will go against a subcontractor claim if the contractor does not have separate company accounting; OHS and HR policies; Schedule of Rates; other employees, or subcontractors engaged in the business or if the contractor does not undertake any other work for other principals.

Clearly, a well-established company engaging casual, part-time employees or other subcontractors, advertising and promoting itself in the area and undertaking other work with established accounting, invoicing and other incurrent operational systems is preferable.

2. Who has ultimate control?

Reference has been made above to the traditional test of 'control' (who determines not only what has to be done but how it is to be done). This remains a significant influence even if only one of many. In modern analysis, this may relate to matters of performance, compliance and discipline.

At present, many historical criteria pointing one way or the other are under legal review. For example, the ability to delegate work tends to suggest against an employment relationship but some cases note that the mere right to delegate, in the absence of a likelihood or actuality of delegation, may be of little consequence.

Further, the fact that the contractor can work for others and not exclusively for one person again usually tends against an employment relationship. Put in another way however, the absence of some provision requiring exclusive service can also be a feature of casual employment.

In the On Call Agency case, Bromberg went so far as to question the strength of the indicator as to whether the person was paid for the work done (traditionally regarded as pointing to a contractor) rather than on a time basis indicating an employee. He noted there were many examples of employees being paid on a 'piece rate', such as seasonal fruit pickers.

If you feel all of the above appears conflicting, contradictory or just too hard you are not alone. The ongoing debate is the reason even judges complain about the lack of a simple and clear test which would show the difference between an employee and an independent contractor.

In any case you are involved in, look at all the circumstances, weigh them all up and know that no one feature gives the answer. ▲

> **Gadens**
www.gadens.com

MAGNETIC LOCATOR

Ridgid
www.ridgid.com
The **Ridgid MR-10 Magnetic Locator** will quickly locate buried iron or steel objects such as: valve/curb boxes, manhole covers, cast iron pipes, steel enclosures, well casings, reinforced septic tanks and survey pins.

Part of Ridgid's commitment to continual development of technological precision products, this highly sensitive instrument provides both audio and visual feedback. The AutoNull feature blocks out nearby metallic interference

such as an automobile or chain link fences to ensure an accurate reading. The tool has an ergonomic, rugged design and comes complete with carrying case and batteries.

NAIL PULLING PLIERS

Crescent
www.crescenttool.com
It is the speed, strength and function of the **Crescent Code Red Nail Pulling Pliers** that makes them soar above their competitors. With the curved foot of the nail pulling pliers and quick grip parallel jaws preventing slippage, you can apply maximum force simply by leveraging weight onto the curved foot. The ergonomically designed grip allows one hand operation so your work will be done as quick as a flash.

No matter the degraded state of the nail head, how stubbornly fixed it is or where the staple or fastener is located;

the Crescent Nail Pulling Pliers will work first time and with less damage and marring than traditional nail pulling pliers.

WELDING MACHINES

Welding Industries of Australia
www.welding.com.au
Welding Industries of Australia has expanded its **Weldmatic range** of MIG and multi-process welding machines, to include three new inverter models; the 250i, 350i and 500i.

All three machines use inverter technology, feature sophisticated electronic controls, high frequency switching and high frequency transformers to achieve consistent and controlled weld output.

The Weldmatic 250i is a 240V multi-process industrial welder, suitable for everyday use by vehicle smash and exhaust repairers, fencing contractors and general maintenance applications in workshops, factories, construction sites and mine sites.

Capable of handling MIG, Stick and Lift-TIG welding, the 250i is a versatile machine capable of gas shielded welding of aluminium, mild and stainless steel and gas shielded cored wires and gasless flux-cored wires.

STEP DRILL BITS

Milwaukee
www.milwaukeetools.com.au
Milwaukee Tools' new **Metric Step Drill Bit** line provides solutions for various applications across the electrical, plumbing, mechanical, HVAC, MRO and remodelling trades. Made in the USA, these new step bits are designed for use with cordless drills at high speed for increased efficiency on the jobsite.

Unlike traditional drill bits specifically designed for corded drills with low RPM and high torque, Milwaukee has provided a solution that allows step bits to do it all, deliver fast starts, more life and holes per charge across the cordless platform.

POWER TOOL LEASING

Hilti
www.hilti.com.au
Hilti's **Fleet Management** scheme allows contractors to lease tools rather than purchase them outright. The only tool manufacturer that offers its customers the option to use its tools in such a way, Fleet Management is already drawing praise from numerous sections of the construction industry.

Traditionally speaking, most contractors only think of tools in terms of the initial price rather than the long-term costs associated with tool ownership. This is an unfortunate

mistake – not least because of the various 'hidden' costs that inevitably attach themselves to tool ownership. Instead of inopportune secondary issues, tradespeople can now dedicate all of their attention to the most important task at hand: the build.

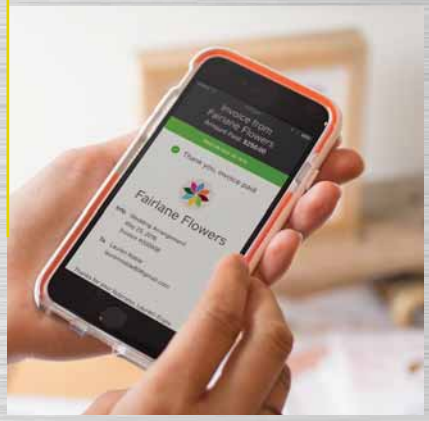
RECIPROCATING SAW

Worx
www.worx.com
Reciprocating saws perform easily through labour-intensive applications and can cut just about anything. Worx has released its **20V Max Lithium-ion Reciprocating Saw WX508.9** to join its ever expanding Powershare Range.

Working with multiple materials and applications can be a drag but with a no-load speed of 2,900rpm and a pendulum function, you will benefit from improved cutting efficiency when sawing through wood, PVC pipe, and steel materials. The saw is simpler thanks to the tool-less blade change system, time will be efficiently spent on the jobs that matter.

INVOICING APP

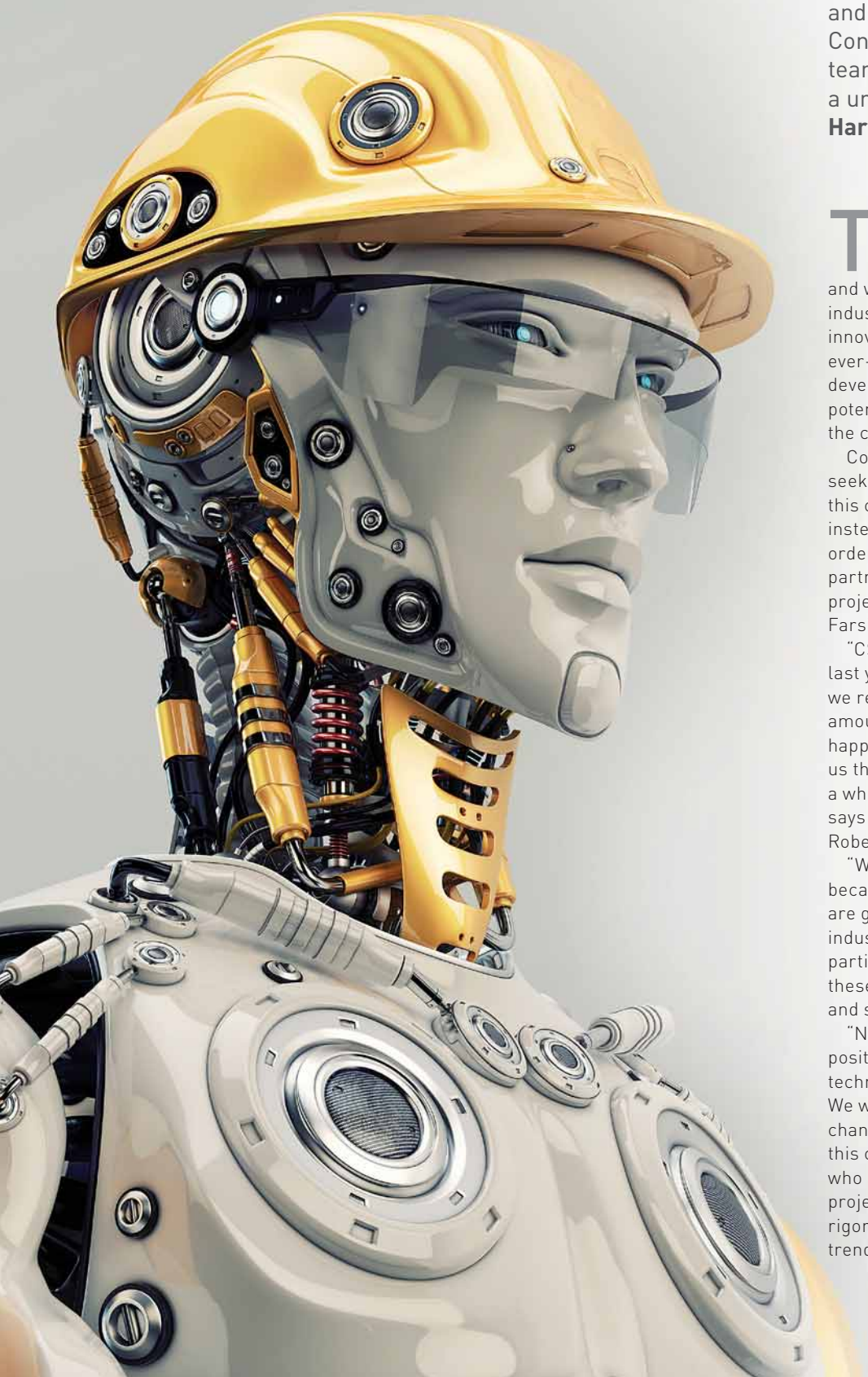
Square
www.squareup.com
Square has announced the availability of **Square Invoices** in Australia, adding to its already powerful Register ecosystem. Square Invoices allows sellers to create, customise and issue invoices directly from the Square Register app on a smart phone or tablet, or from Dashboard on their desktop. Invoices are emailed directly to customers, who can then select to pay online securely with Visa, MasterCard or American Express credit or debit cards.
With the simplest and most accessible pricing in market, sellers can send unlimited invoices and access all of the features of the Square platform for free, and are only charged 2.5% when an invoice is paid online with Square.



POWERED HAND TRUCK

Makinex
www.makinex.com.au
When Makinex designed and produced the **Powered Hand Truck** in 2012, its success was a given because it solved a problem that was consistently occurring within the rental industry.
The ability to pick up small plant machinery, generators, plate compactors and compressors and single handedly load them into a variety of vehicles without putting strain on the operator's back is of utmost importance within the rental industry.
Kennards Hire has seen firsthand how popular the Makinex Powered Hand Truck is, resulting in an measured improvement in staff safety. The Powered Hand Truck is a quick and easy alternative to using a forklift or tailgate loader , and can be used anywhere: workshops, warehouses, factories, depots and hire and rental yards.

20/20 FARSIGHT



The construction industry is entering into a period of technological change. To identify how this will affect jobs and their required skill-sets, Construction Skills Queensland teamed up with the CSIRO on a unique endeavour. **Jacob Harris** explains.

Technology is changing the way we live our lives; how we communicate, entertain ourselves and work. And as the construction industry has always been a hotbed of innovation, it makes sense that with the ever-quickening pace of technological development, it is a sector that will potentially undergo dramatic change in the coming years.

Construction Skills Queensland (CSQ) seeks to identify and adapt to this change before it happens – instead of trying to play catch-up. In order to do this, the organisation has partnered with the CSIRO on a research project they have aptly named the Farsight Project.

"CSQ approached the CSIRO late last year about this project because we realised there is an enormous amount of technological change happening right now and it seemed to us that the construction industry as a whole isn't really talking about it," says CSQ director of evidence and data Robert Sobyra.

"We wanted to start a conversation because we think these changes are going to hit the construction industry harder than most. We are particularly concerned about how these changes will shift job definitions and skills requirements.

"Now is the time to prepare and position ourselves – not when the technology is already on top of us. We want the industry to lead the change, not be led by it. So we put this concept to CSIRO's Futures Unit who immediately saw the value of the project and came on board to conduct a rigorous scientific study into the major trends that are afoot and how they may

(or may not) play out over the next 20 years in the construction industry."

This is no mean feat. And in order to develop a clear, accurate impression of what the future may hold, the researchers initially needed to cast a very wide net. This meant looking at all the forces that are reshaping the world as we know it – things like the exponential growth of computing power; population growth and its ageing; even climate change had a role to play in the scenarios the Farsight Project explored.

Then the project team turned its focus to specific innovations that are happening now and assessed their potential to get a foothold in the construction industry. According to Robert, this is a key point. The project's scenarios are built on actual trends that are currently developing and have a realistic prospect of going mainstream.

This isn't to say Farsight is attempting to predict exactly what the industry will look like in 20 years. Instead, they are developing multiple, plausible scenarios – each of which has the potential to become a reality.

"Trying to predict the precise shape of the industry 20 years from now is a fool's errand: the forces are too complex. That's why our project is exploring several scenarios – so that we cast a lens over a range of contrasting outcomes, all of which are plausible.

"For example, I can see a world where there hasn't been much change at all. Maybe the tools are a bit more advanced and there's more IT in and around construction sites but fundamentally the jobs haven't changed all that much. On the other hand, I can see an industry that has been significantly disrupted by very advanced technologies (like robotics and artificial intelligence), and that this disruption has rewritten the job descriptions of 75% of our workforce," says Robert.

Regardless of the degree of change we see in the industry, Robert believes it is a near-inevitability that the workforce will become more highly skilled and technically specialised. And this will see the emphasis shift from skill-sets focussed on manual dexterity and physical labour, to skill-sets focussed on the intelligent and precise use of technology.

Augmented reality glasses, exosuits and driverless robotics are just some of the technologies we can expect to see being used in the industry before long.

"This is a trend we're already seeing. The average worker will be increasingly paid according to her (there will be more women) ability to work with machines. So the challenge for the construction training system is to create workers with higher levels of technological literacy. The worker who thrives in the construction site of the future will be the one who is comfortable with using existing technologies and embraces new technologies as they come online."

Indeed, machines that can automate labour-intensive jobs traditionally undertaken by hard-working humans are already starting to gain a foothold in the industry.

Take the robotic tiling machine developed by researchers at the Future Cities Laboratory (FCL) in Singapore. It is able to lay tiles two to three times faster than a human worker while maintaining high precision and consistent quality. The FCL expects that before long 75% of tiling work will be automated.

Similarly, 'Hadrian 105' the brick laying robot developed by Perth's Fastbrick Robotics promises to revolutionise the brick laying industry in more ways than one. The machine will undoubtably send productivity levels skyward but, by taking care of all the heavy work, it is also touted to significantly improve working conditions for tradies.

"Hadrian is something that's going to improve people's lives and workplaces and allow us to do things much more safely. At the moment there aren't many brickies working until they're 70, the work's just too strenuous, but the expectation these days is that we'll work until we're that age. Most bricklayers need to find something else they can do by the time they're 50 years old. Imagine if they were just doing artisan work and there was a machine working on the same site doing all the heavy work, all the big repetitious long wall sections – no more planks, drums, mixers and shovels," Fastbrick Robotics CEO Mike Pivac told *Building Connection*.

These are just two examples but we're likely to see many similar technologies come into play. Robert gives driverless robotic technology as an example – he says it's quite possible that the same sort of systems will be used to operate both driverless cranes and earthmoving equipment.

But small, portable smart machines that accomplish fairly routine physical tasks are not the only things we're likely to see on the scene fairly shortly. Robert suggests it's also worth keeping an eye out for 'exosuits'; wearable devices that allow humans to lift much

As more and more processes in the construction industry become automated, job definitions and skills requirements will invariably change.

heavier items than they can on their own. These are already in use in the Korean shipbuilding industry.

Longer term, Robert thinks digital technology combined with prefabrication and advanced materials have the potential to really disrupt the way we build things.

"There is a plausible future where many building components are manufactured in factory conditions with extremely advanced computer-controlled machinery, working with very high performing materials. This is an industry that looks increasingly like the automobile supply chain."

It seems technology will inevitably march on. But the shape it takes and the degree to which it pervades the construction industry largely depends on how the industry reacts to these new innovations. It's not always easy to embrace a new technology straight off the bat, especially when it fundamentally changes the way a certain task is done (if it's not broken don't fix it, right?).

"Culture is an incredibly important variable. In fact, we think it could be the factor around which the whole future of the industry pivots. Regardless of the objective merits of a technology – how much it can reduce risk or increase value – if the industry doesn't embrace it, it will be difficult for the technology to get any traction.

History is littered with examples of excellent technologies that never cracked the mainstream. When you dig into these stories you find the reasons are basically cultural – attitudes, perceptions and tastes," says Robert.

"At the same time, there is a sense in which technology and change can happen to us, despite our best efforts to ignore it. Australia's manufacturing industry provides a cautionary example of what can happen if we bury our heads in the sand and hope that change will pass us by, leaving us unscathed."

If this is the case, our next big challenge will be adapting training and education models to suit. If industry professionals are to be kept up to date with technologies that are constantly evolving, education will also have to be an ongoing process. What is clear at least, is if machines are taking care of more of the heavy work, workers will have more time to devote to education and up-skilling.

"The training system we have today won't be suitable for a world dominated by technology and extremely specialised skill-sets. The construction industry still largely relies on what is effectively a one-shot training model – the apprenticeship system.

This model isn't designed for a world where technology and products evolve quickly and radically. Continuous professional development is widely accepted in many other industries but it isn't a part of our training system. This will almost certainly need to change," says Robert. ▲

> **Read the CSQ report at: www.csq.org.au/farsight**

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PRO+

Have another look. The judges did.

2015 DELIVERY MAGAZINE SMALL VAN OF THE YEAR

2016 DELIVERY MAGAZINE SMALL VAN OF THE YEAR

2015 DELIVERY MAGAZINE MEDIUM VAN OF THE YEAR

2016 DELIVERY MAGAZINE MEDIUM VAN OF THE YEAR

For the second year in a row, the judges for Delivery Magazine's 'Van of the year' awards liked what they saw. "Renault Kangoo is a great little van. It's comfortable, it's quiet, it steers, it turns. It's well equipped too."

And "After driving the Renault Trafic around Delivery's test route, I was very tempted to just keep going and take this awesome little load carrier home." Now you should take a look. Take a test drive at your nearest Renault dealer.

renault.com.au

DRIVE MY CAR

From Airbnb to Uber, the sharing economy is taking off like never before. DriveMyCar is Australia's first peer-to-peer car rental service and they have just moved into the light commercial space in a rather unconventional way.

DriveMyCar has teamed up with LDV Automotive to create a unique way for tradies to rent light commercial vans.

There can be no doubt about it – the sharing economy is booming. As testimony to this, the popular home-sharing service Airbnb has predicted it will generate over $US900 million in revenue this year alone. Alongside this, Uber is spreading like wildfire and fundamentally changing how we think about catching a taxi.

Indeed, Juniper Research has found that sharing economy platform providers are likely to reap the benefits of an explosion in service uptake by the end of the decade. The research paper *Sharing Economy: Opportunities, Impacts, and Disruptors 2016-2020*, goes so far as to predict popular platforms will see a trebling of revenues by 2020. It also found that sharing services will expand further into emerging markets such as delivery and manufacturing.

Now, a Sydney company that has been offering a sharing service for car rentals has joined forces with vehicle manufacturer LDV Automotive to apply the business model to the light commercial sector.

DriveMyCar started about six years ago when the company's founder saw an obvious gap in the market – there were a lot of cars sitting around not being used and a lot of renters who felt they were paying too much.

The idea is fairly basic: owners who aren't using their vehicle can hire it out through the company to a verified renter. In turn, the renter gets access to a wide variety of vehicles at a price that is reportedly quite a bit lower than traditional rentals.

The company's recent partnership with LDV Automotive has allowed DriveMyCar to expand its offering to include light commercial vans. This means tradies can hire a new G10 one-tonne van directly from the LDV dealer in Parramatta through an arrangement that, according to DriveMyCar CEO Chris Noone, benefits all parties concerned.

"What we were initially attracted to was the very high prices for light commercial vans, you can pay about $100 a day for an old HiAce van and we think that's ridiculous because if you look at the value of those vehicles it just doesn't justify those high prices – you could rent an Audi for that sort of price.

"We approached LDV because we knew that they wanted to make a name for the vans and we thought that one of the best ways to build the brand within Australia was actually to get the vans out on the street and allow people to try them.

"LDV just want to get people to understand what they are and how good they are and the best way to do that is get them to drive the vans around."

The service is fairly streamlined with the majority of the paperwork completed online. All payments, ID checks and an e-signed rental agreement are completed online beforehand.

"Once everything is done online, the tradie turns up to the dealer (who knows they'll be arriving). The van will be ready to drive away after an inspection report is done on the van to check for any damage and the ID of the person is checked. At the end of the rental period they bring it back and carry out another inspection report. We manage all of the billing and ID verification in the background, so it's a really light touch for the dealers," says Chris.

While currently only available in Parramatta, Sydney, DriveMyCar is in discussions with several other manufacturers and hopes to expand the service into multiple locations across Australia in the near future.

> **DriveMyCar**
> **www.drivemycar.com.au**

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ANCHORED TO BEST PRACTICE

A new certification program has been developed to ensure that fasteners for safety-critical applications are installed by competent and qualified installers. Australian Engineered Fasteners and Anchors Council training and development manager **Jessey Lee** explains.

The Australian Engineered Fasteners and Anchors Council (AEFAC) Installer Certification Program was initiated as part of the industry initiative to improve safety in anchor installation and to bring it into line with international practice. The program is based on the American Concrete Institute (ACI) and the Concrete Reinforcing Steel Institute (CRSI) Adhesive Anchor Installer certification program but extended to include mechanical anchors and adapted for Australian practice.

The Adhesive Anchor Installer program in the US was developed and made compulsory for installation of overhead chemical anchors following the failure of the Boston Big Dig Tunnel in 2006 where 26 tonnes of suspended ceiling panels collapsed; killing a motorist and causing a section of the tunnel to be closed for a long period of time.

Poor installation practice was one of the primary causes for the Boston Big Dig Tunnel failure. The following investigation found chemical in the installed anchors supporting the ceiling panels was not mixed properly; water and voids in chemical were also found, leading to unreliable performances of those chemical anchors.

In Australia, the AEFAC is being proactive by developing a safety framework: enhancing the specifications, design requirements and installation of anchors through the SA TS 101:2015 and AEFAC Installer Certification Program to mitigate potential failures.

The AEFAC Installer Certification Program was designed to equip and train installers with best practice installation. The program offers a half a day of face-to-face training where installers are introduced to the various types of post-installed anchors and their suitability for different applications.

Installers are shown the mechanics of anchors and alerted to performance sensitivity of different anchor types. For example, cleanliness of drilled holes is one of the most important considerations for chemical anchors. Generally speaking, a chemical anchor installed in an uncleaned hole may have 50% reduction in capacity.

In terms of mechanical anchors, they are very sensitive to drilled hole diameter and less sensitive to hole cleanliness than chemical anchors. Using a worn out drill bit may damage a mechanical anchor while using an oversized drill bit will result in the mechanical anchor not being able to engage the concrete effectively resulting in poor performance. Following the face to face training session, participants are required to undertake written and practical exams. The written exam has 65 multiple choice questions to be answered in 60 minutes. All questions in the written exam are covered in the training.

The practical exam has two components: a vertical down installation where participants are required to demonstrate their knowledge and skills in performing a chemical anchor installation according to the manufacturer's installation instructions and an overhead injection using piston plug method.

Participants who pass both the written and practical exams are awarded an AEFAC Certified Installer Card and are listed on the AEFAC website. Recertification is required initially after three years and subsequently every five years to ensure installers are kept up-to-date.

Proper installation practice is imperative in ensuring anchors installed in safety-critical applications can achieve their intended design performance. The AEFAC Installer Certification Program provides general instructions for commonly used products and additional product-specific training may be warranted.

> **AEFC**
www.aefac.org.au

A HOLE IN ONE

Every now and again a simple, solid solution to a common problem comes along that has everyone else in the industry asking themselves 'why the hell didn't I think of that?' **Jacob Harris** explains.

Anthony Maunder used to work as a builder who did a lot of retail fit-outs for supermarket chains and shopping centres. He got fed up with seeing core holes that had undergone dodgy patch-jobs with paper bags, old bits of ply or whatever else happened to be lying around.

"On some jobs – like if a supermarket wanted to move the fridges after the holes had been drilled – you'd get up to about 120 core holes needing to be filled. The amount of different ways I'd seen them repaired, and all the horror stories I'd heard where plugs have fallen out, made me think 'there's got to be a better way than this,'" says Anthony.

This frustration motivated Anthony to come up with a unique idea. He then took his idea to his engineer and together they designed, and later patented, a core hole repair system that is quite different from anything else on the market.

Anthony's ADM Core Hole Repair Kit, is comprised of a steel plate that plugs the bottom of the hole and a cap piece that bridges the top, these are joined by a threaded bar. The kit also includes grout to fill the plugged hole.

The kit can be installed in four steps:

STEP 1

- Place the repair kit head piece in the centre of the hole, mark a 10mm clearance and chase the marked area of concrete out .

STEP 2

- Measure the hole's depth and cut the threaded rod length before screwing the rod into the repair kit head piece.

STEP 3

- Apply a bead of silicone or similar product around the repair kit cap piece and push onto the slab with the threaded rod protruding through the cap hole. Then put the nut and washer onto the threaded rod and tighten.

STEP 4

- Mix the supplied grout wand pour into the core hole before finishing with a trowel.

The system keeps the floor surface flush and trafficable and maintains the

structural integrity of the slab and has also been fire tested to four hours by the CSIRO in accordance with AS1530.4:2005.

"Hopefully it'll keep gaining momentum. We do get a lot of cowboys who still say 'I don't want that crap. I'll just do it the old way.' But in the building industry we just can't do that anymore – things have got to be done properly," says Anthony.

Several large builders like Watpac and Hutchinson are already using the ADM Core Hole Repair Kit because, according to Anthony, they realise that any costs incurred up front are quickly offset but labour time saved and the uniformity of the end result.

> **Core Hole Solutions**
> **www.coreholesolutions.com.au**

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Commercial Vehicles

*Safety technologies are not a substitute for the driver's responsibility of the vehicle.

VOLKSWAGEN AMAROK

Volkswagen will introduce a comprehensive update for its Amarok utility towards the end of this year, headlined by a new-generation V6 turbo-diesel engine that will be unique in the segment.

Billed as the 'premium pick-up' in the one-tonne ute class – at least until the likes of Mercedes-Benz and Renault turn up with their respective all-new models – the updated Amarok has emerged overseas with other significant changes including improved steering and braking performance, front-end styling revisions and an upgraded interior that more closely aligns the workhorse with VW passenger cars.

The Amarok is currently sold with a 2.0l turbo-diesel in three states of tune: 103kW/340Nm (TDI340), 132kW/400Nm (TDI400) and 132kW/420Nm (TDI420).

The new oil-burner is a Euro 6-compliant 3.0l (2,967cc) V6 that delivers up to 165kW of power and 550Nm of torque – a substantial increase on the current range-topping TDI420, particularly in terms of pulling power. Maximum torque is also produced at just 1,500rpm (250rpm earlier than the 420).

Australian specifications are still to be confirmed, but in Europe the V6 TDI will be available in two other states of tune: 120kW and 150kW (torque figures still to be confirmed at time of writing), paired with either a manual or automatic gearbox.

The latter is an eight-speed unit that in conjunction with the 165kW engine can return fuel economy of 7.6l per 100km on the European combined test cycle. Acceleration from 0-100km/h is completed in a claimed 7.9sec, on its way to a top speed of 193km/h.

Three driveline options have been developed for the new engine: rear-wheel drive, selectable four-wheel drive and permanent 4WD with a Torsen differential.

Other mechanical highlights include a new Servotronic steering system, 17" brake discs fitted to the front axle of the 165kW version (and 16" discs at the rear), together with an automatic post-collision brake system also along for the ride. Wheel sizes have also increased across the range.

Volkswagen describes the revised front-end styling as 'more athletic-looking' and will launch the new model – in Europe, at least – with a specially developed top-spec Aventura variant, which has 20" alloy wheels, bi-Xenon headlights, a host of LED lights (daytime runners, licence plate and side sills) and a new body-coloured sports bar designed to visually shift the double cab rearwards and extend over a small part of the 2.52m3 load platform.

The Amarok's cabin has an all-new dashboard more akin to those seen in VW passenger cars and, depending on the variant, includes a new multifunction display, upgraded stereo and navigation systems, improved connectivity and reversing camera with 'park pilot' parking assistance technology.

A new multifunction steering wheel is also employed, along with new 'ergoComfort' seats promising better support and a broader range of adjustment. ▲

> Volkswagon
www.volkswagen-commercial.com.au

HOLDEN COLORADO

Holden is preparing to introduce a heavily upgraded Colorado ute range, promising improved refinement, new advanced connectivity and safety features and a distinctive new look – as seen by the Chevrolet version (known as the S10) already on the road in Brazil.

The South American country is the development hub for General Motors' one-tonne utility range, which is built in Thailand for the Australian market.

However, Australia has still played a significant role behind the scenes in terms of both engineering and design, and Holden is confident the upgraded series will take the fight up to fully redesigned and/or recently upgraded rivals such as the top-selling Toyota HiLux, Ford Ranger, Nissan Navara and Mitsubishi Triton.

The styling changes were previewed ahead of the Brazilian launch at the Bangkok motor show, where two Australian-designed concepts took centre stage – the Colorado Xtreme ute and Trailblazer Premier SUV.

While the 'Trailblazer' moniker will replace the ute-based wagon's Colorado 7 nameplate with this upcoming upgrade, the Melbourne team's work on the SUV show car is apparent on the production version of the ute.

Holden calls it a 'tough, yet refined appearance' with more angular lines (an apparent nod to its American truck DNA) and, in general, a more sophisticated look via the redesigned grille, sculptural bonnet and narrower headlight cluster with slim LED daytime running lamps.

A new range of accessories, many of which were previewed on the Xtreme concept, have also been developed, including a unique safari bar, sports bar and alloy wheels.

The Colorado's cabin has come in for a major overhaul, with a new-look dash and redesigned centre console that is said to be more user-friendly and features an 8.0" colour touch-screen housing the latest version of Holden's MyLink infotainment system, including access to Apple CarPlay and Android Auto.

Attention to detail in areas such as materials, fabrics and finishes is also apparent, particularly with new soft-touch surfaces and trim inserts that have 'tailored stitching' in an effort to improve interior comfort and classiness. ▲

>Holden
www.holden.com.au

COLORADO LS-X

While a new Colorado is on its way, Holden is working overtime to keep interest up in the current range, as demonstrated by a host of special offers and a new LS-X variant that includes higher-grade equipment such as alloy sports bar, front fog lights and 16" alloy wheels.

Priced from $37,990 drive-away and based on the mid-series LS 4x4 Crew Cab pick-up, the X factor also runs to a Colorado-branded smoked bonnet protector, unique LS-X badging and cabin carpet flooring.

A six-speed automatic transmission is included, pushing maximum torque in the (147kW) 2.8l Duramax 2 turbo-diesel engine out to 500Nm – up from 440Nm in the six-speed manual variant.

HSV MALOO R8 SV BLACK

Holden Special Vehicles (HSV) is staging one last hurrah for the natural-breathing version of its high-performance Maloo ute, bringing back the 6.2l LS3 V8 in a special new 'SV Black' edition priced from $62,990 plus on-road costs.

The lion brand's fast-car outfit promises this will be the final ute to feature its 340kW/570Nm version of the naturally aspirated bent eight, which will be retired in the lead-up to the closure of Holden's Australian manufacturing operations late next year.

This will ultimately see an end to the unique Australian Commodore-based two-door ute from Holden and HSV, following Ford's local production exit which takes place in October this year.

HSV describes the reintroduction of the LS3, which was dropped last year when the MY16 Gen-F2 range was launched with the phenomenal supercharged LSA V8 power plant (churning out 400kW/671Nm), as an offer of 'unrivalled value' and a 'final buy opportunity'.

Based on the Maloo R8, the SV Black – a moniker not seen since the 2011 E Series 3 – borrows styling elements from the LSA-equipped models, including satin black 20" alloy wheels, black AP Racing forged four-piston brake callipers, black door surrounds and lower door accents, shadow-chrome exhaust tips and black badging.

HSV says these features, which are complemented by black fender vents and mirror scalps, combine to deliver an even more distinctive and aggressive styling edge to the Maloo, which might lack in the payload department (at around 500kg) but more than makes up for it in terms of driving pleasure and presence on the jobsite.

The cabin treatment is similarly based on the supercharged models, but with leather-clad sports bucket seats and unique sill and ID plates. Each vehicle will also be individually numbered, with the build set at 100 units for Australia and just two for New Zealand.

The LS3 produces its 340kW peak power at 6,100rpm, while maximum torque of 570Nm is available from 4,650rpm. It drives the rear wheels through a TR6060 Tremec six-speed manual gearbox or, for another $2,500, a 6L80E six-speed automatic with 'active select' mode and paddle shifters.

HSV is also offering 20" SV Rapier forged alloy wheels for an extra $2,095 and an enhanced driver interface for $1,095.

>HSV
www.hsv.com.au

ISUZU NLR 45-150 SERVICEPACK

Isuzu has launched its new 'ready to work' NLR 45-150 Servicepack truck tailored specifically for tradespeople.

The N-series Servicepack has come a long way from Isuzu's first Tradepack model in 2003 but 13 years on the basic formula remains the same; combining the market-leading Japanese brand's light-duty truck series (which can be driven using a standard passenger car licence) with a comprehensive fit-out designed around the needs of a specialist tradesperson or contractor.

On-board storage is a highlight of the package, with eight lockers of various sizes, each fitted with internal LED lighting for optimum visibility day and night. All up, storage compartment volume is close to 3.0m3 and security is boosted by full integration with the vehicle's central locking system.

Between the two rows of lockers is a central storage area (measuring 2.08m long and 1.0m wide) with chequer-plate flooring and six load-rated tie-down hooks, while the integrated-step towbar assists with access. Rear grab handles and non-slip step surfaces are also provided.

Priced around $67,000 drive-away, depending on the Australian state in which it is purchased, the latest Servicepack is based on the entry level short-wheelbase NLR 45-150 which has a 4,500kg GVM, 7,000kg GCM, 1,500kg payload and a 2,500kg maximum braked towing capacity.

It is powered by Isuzu's Euro 5-compliant 4JJ1-TCS 3.0l four-cylinder common-rail turbo-diesel engine that delivers 110kW of power (150PS) at 2,800rpm and 375Nm of torque from 1,600-2,800rpm. The engine combines with either a five-speed manual gearbox or a six-speed automated manual transmission (AMT).

Standard safety equipment includes airbags and seatbelt pre-tensioners for the driver and front passenger, electronic stability and traction control and front and rear disc brakes with ABS electronics. A hill-start assist feature is also provided on the manual gearbox version.

The cab meets with ECE-R29 standards, the headlights have a cornering function and a reversing camera is also fitted on the Servicepack.

Mod-cons include Isuzu's Digital Audio Visual Entertainment (DAVE) unit with 6.2" touch-screen, DAB+ digital radio and fully integrated Bluetooth with voice recognition. There is also 4GB internal storage for music files and USB/SD card and auxiliary input connections.

The NLR 45-150 measures 5,020mm long (on a 2,490mm wheelbase), 1,925mm wide and 2,140mm high, which are relatively compact dimensions for a work truck and which Isuzu emphasises should fit comfortably into any standard driveway and garage (or a commercial car park) – an important consideration for tradies working out of home, and for enabling close access to the task at hand on domestic jobs. ▲

>Isuzu
www.isuzu.com.au

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GREAT WALL MOTORS COMEBACK

The impasse over distribution of Great Wall Motors vehicles in Australia, including the Chinese budget brand's trade-oriented light commercial vehicles, has ended, with a new factory-backed operation taking over from independent importer Ateco Automotive and confirming that a new-generation utility is on its way.

Due for release in the final quarter of this year, the new ute is still under wraps from a local specification point of view, however the vehicle – to be known as the Steed here – has received regulatory approval for Australian sales and all indications are that it will be based on the Wingle 6 already available in overseas markets.

The newly formed local distributor, Great Wall Motors Australia (GWMA), has issued photographs of the new ute and confirmed that the line-up will be headed by a 4x4 turbo-diesel variant matched to a six-speed manual transmission, Borg-Warner 'torque-on-demand' four-wheel-drive system and Eaton-sourced rear differential lock.

This indicates that an automatic transmission may not be available from launch. GWMA has, however, promised a high level of specification, including in terms of safety equipment, with electronic stability control – understood to be a comprehensive Bosch-developed system – and six airbags to be fitted standard.

Only a dual cab body style will be offered at launch, in three powertrain/driveline combinations: 4x2 petrol and 4x2 and 4x4 diesel.

Other details are still to be provided, but Great Wall Motors' global website shows that the driving force behind the new-generation Wingle is a 'GW4D20' 2.0l turbo-diesel engine producing 105kW of power at 4,000rpm and 305Nm of torque from 1,800-2,800rpm, driving through a six-speed manual transmission.

The Wingle continues to use a conventional ladder-frame chassis with independent double-wishbone-type front suspension up front and a rigid axle with leaf springs at the rear. Front disc brakes and rear drums are employed, aided by ABS brakes with electronic brake-force distribution and brake assist electronics.

Increasingly common equipment such as reversing camera, rear parking sensors, tyre pressure monitoring system, auto-dipping rear-view mirror, Bluetooth phone and audio connectivity, and six-way electrically adjustable driver's seat are also available, depending on the model variant.

While improvements in areas such as quality and refinement are still to be put to the test, there is no doubt that with the higher-grade safety equipment and more premium interior fit-out, Great Wall will have a suitable model with which to mount a fresh attack on the Australian marketplace.

GWMA has also pledged to continue to "deliver solutions to any customer and dealer issues" meaning that it is working to ensure it maintains a broad dealer network and retains as many past and present V-series ute owners, many of whom are tradies, as possible. ▲

>Great Wall Motors
www.greatwallmotors.com.au

LDV UTE COMING

After handing over the reins of Great Wall Motors to the new factory-backed distributor, independent importer Ateco Automotive is working with LDV to boost its Chinese-built light-commercial range in Australia, including an all-new workhorse utility.

The still-to-be-named new LDV ute, which will go head-to-head with other keenly priced pick-ups from the likes of Great Wall, is currently nearing the end of its development and is expected to join the current G10 van and V80 van/cab chassis on sale here in 2017.

SPOTLIGHT ON FUTURE MODELS

Nissan and Mitsubishi have only recently released their new-generation utes in Australia, but the Navara and Triton are set to be built off the same platform in future following Nissan Motor Company's purchase of a controlling 34% stake in the triple-diamond brand.

Renault-Nissan Alliance CEO Carlos Ghosn has confirmed that it would make sense for the two utilities – both crucial models in each brand's respective stable – to share underpinnings, but emphasised that a separate look and feel would be maintained.

This philosophy is already being applied to alliance partner Renault's forthcoming new ute, which was previewed by the near-production Alaskan concept and will be built on the NP300 Navara's platform.

Mercedes-Benz is also developing a ute based on the same architecture, so there's plenty of cross-pollination taking place in the automotive world that will see a variety of new utilities become available in Australia before too long.

Note that the France's PSA Group – the parent company of Peugeot and Citroen – has also recently revealed that a one-tonne utility is among a raft of all-new light-commercial vehicles currently in development and due for release over the next five years – and that the local distributor, Sime Darby Motors Group Australia, is working on a case to bring them here.

Sime Darby has also been in negotiation with the French factory to bring in the recently revealed Citroen Dispatch (also known as the Jumpy) and/or Peugeot Expert mid-size vans.

These are built on PSA's latest EMP2 platform that underpins passenger cars such as the Peugeot 308 and Citroen Grand C4 Picasso – meaning advanced driver-assist safety and infotainment technology is on board – and were developed in collaboration with Toyota, which will sell a version in Europe badged Proace.

Over at Fiat Chrysler Automobiles (FCA), there is a question mark on the future of its rival Scudo mid-size van sold in Australia following the unveiling of the Talento in Europe – Scudo's fully redesigned replacement, which also marks a shift in product-sharing partnership from PSA to the Renault-Nissan Alliance.

FCA Australia says there are no plans to bring the Talento here, but the local subsidiary has confirmed that a long-anticipated all-new Jeep ute based on the Wrangler off-road wagon is well underway and that it is working to offer it Down Under when it reaches production around 2018 – about the same time the new utes from Renault and Mercedes will be entering showrooms. ▲

MERCEDES VITO, FORD TRANSIT CUSTOM

Mercedes-Benz and Ford have both reinforced the strong safety credentials for their commercial vans with the Australasian New Car Assessment Program (ANCAP) handing down maximum five-star crash-test ratings for the Vito and Transit Custom respectively.

The Vito's five-star rating is based on the inclusion of head-protecting side (curtain) airbags, which are optional equipment. Without them, the rating falls to four stars, although Mercedes has advised that it will implement a running change to production of the Vito, with the curtain airbags fitted standard to all vehicles built from July 2016.

Standard fitment will see all Vito variants built from this date secure a five-star rating from the independent authority, which is considered the key benchmark in determining the crashworthiness and overall safety of vehicles in the marketplace.

"For commercial buyers, many of whom are now required by their employers to have a vehicle with a five-star ANCAP safety rating, these ratings open the door to a number of new vehicle choices," said ANCAP chief executive James Goodwin.

"Mercedes-Benz has taken the responsible action to work with ANCAP to improve safety and address the four-star result. This is an encouraging outcome for safety and should be commended for working quickly to implement these important safety improvements."

The latest results see Ford join Mercedes-Benz with five-star van rankings for the first time, which Mr Goodwin said was an important consideration for tradespeople.

"The Transit is a popular choice for large and small commercial operators such as tradespeople," he said. "Transit drivers will now have the knowledge their van offers the highest level of safety."

The Transit Custom's rating applies to Australian vehicles built from March 2014 onwards (or New Zealand variants from March 2016). The Blue Oval van received 84% for adult occupant protection and 90% for child occupant protection, while its pedestrian protection was less impressive, rated as 'marginal'.

Among the standard safety features on board are dual front, side chest and side head-protecting curtain airbags for the front passengers. An advanced seatbelt reminder is also fitted to the driver's seat.

Vito's top rating is based on crash-test data from the related V-Class and applies to all van and crew cab variants fitted with curtain airbags, which add to other standard safety features including dual front airbags. Its adult occupant protection rating was an excellent 93%, child occupant protection was rated at 87%, while pedestrian protection was deemed 'acceptable'.

No other rival vans tested by ANCAP have reached this level, with some achieving four stars – the Toyota HiAce, Hyundai iLoad, Renault Kangoo and Citroen Berlingo among them – while others have performed below this mark, including the LDV V80 and Suzuki APV, which have received a three-star result.

A number of one-tonne utes – including the top-selling Toyota HiLux, Ford Ranger, Holden Colorado, Nissan Navara, Mitsubishi Triton, Isuzu D-Max, Mazda BT-50 and Volkswagen Amarok – are also now at the five-star mark (sometimes only in certain variants) as manufacturers build an increasingly high level of crash performance into their commercial vehicles, and as many operators consider the top safety rating as a mandatory requirement in their purchase decision. ▲

>Mercedes-Benz
www.mercedes-benz.com.au

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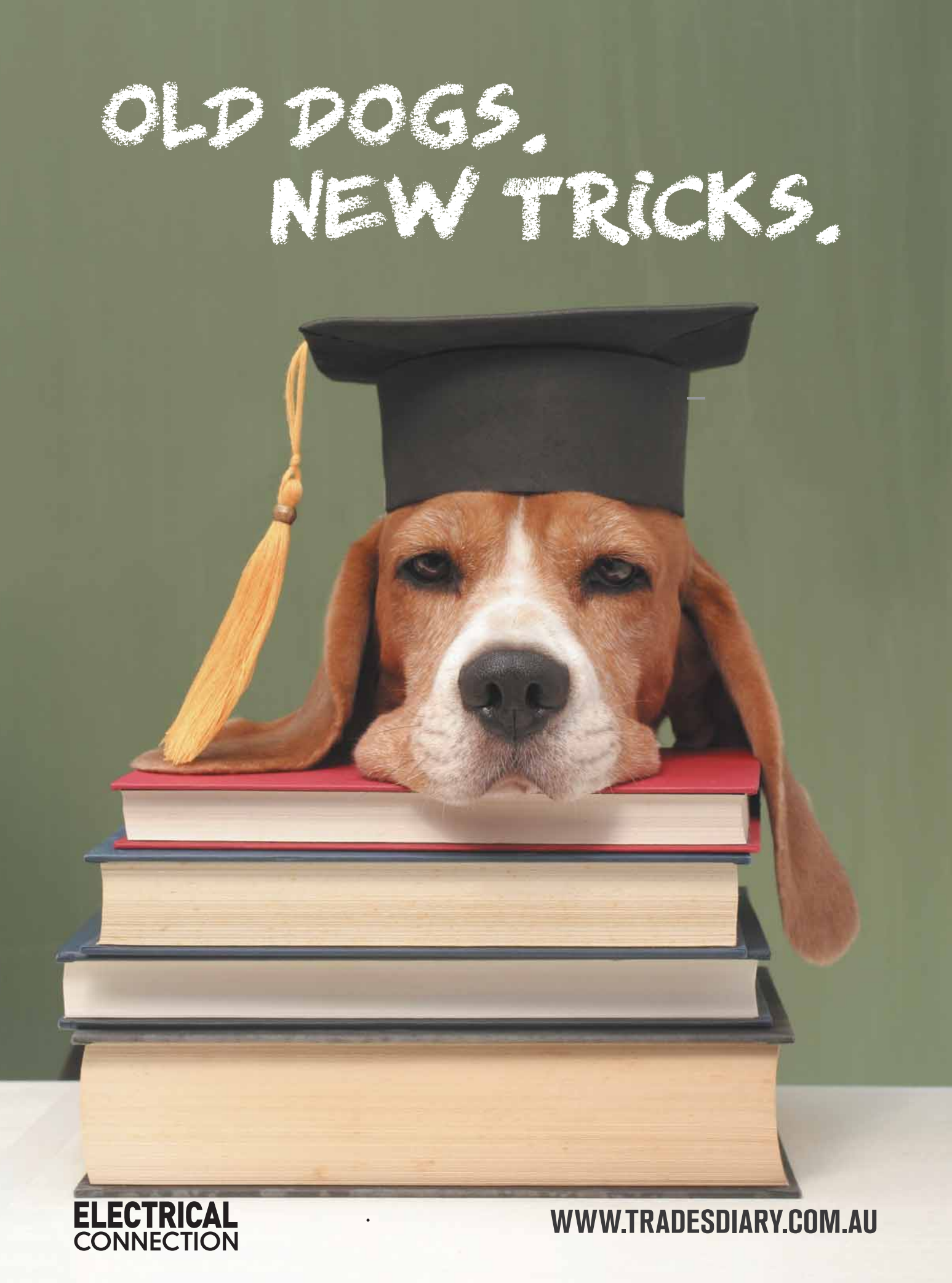

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C-BUS BASIC

The C-Bus Basic training course is an entry level training course designed for consultants, electrical contractors, system integrators and partners who wish to learn how to install and program C-Bus systems. The C-Bus Basic course will equip trainees with the skills to work with C-Bus products and become involved with the concept of commercial and residential automation. It is also the first step towards becoming an Approved Installer.

Start date	End date	Location
08/08/2016	10/08/2016	Perth
15/08/2016	17/08/2016	Rocklea
22/08/2016	2408/2016	Melbourne
29/08/2016	31/08/2016	Adelaide
12/09/2016	14/09/2016	Sydney
12/09/2016	14/09/2016	Rocklea
10/10/2016	12/10/2016	Townsville
11/10/2016	13/10/2016	Eagle Farm
24/10/2016	26/10/2016	Rocklea
24/10/2016	26/10/2016	Adelaide
31/10/2016	02/11/2016	Perth
14/11/2016	16/11/2016	Sydney

C-BUS DALI GATEWAY

The C-Bus DALI Gateway training course is designed for consultants, electrical contractors and system integrators who wish to learn the installation and commissioning of a DALI system with the integration of C-BUS DALI Gateway.

Start date	End date	Location
09/08/2016	09/08/2016	Hobart
21/09/2016	21/09/2016	Melbourne
25/10/2016	25/10/2016	Sydney
15/11/2016	15/11/2016	Brisbane

C-BUS LEARNING PATHWAY A (C-BUS BASIC + TOUCH SCREEN)

The Learning Pathway A is a training course that will provide an entry level for consultants, electrical contractors, system integrators and partners who wish to learn how to design, install and program a C-Bus system including C-Bus Touch Screen.

Start date	End date	Location
08/08/2016	12/08/2016	Perth
15/08/2016	19/08/2016	Rocklea
22/08/2016	26/08/2016	Melbourne
29/08/2016	02/09/2016	Adelaide
12/09/2016	16/09/2016	Sydney
12/09/2016	16/09/2016	Rocklea
10/10/2016	14/10/2016	Townsville
24/10/2016	28/10/2016	Rocklea
24/10/2016	28/10/2016	Adelaide
31/10/2016	04/11/2016	Perth
14/11/2016	18/11/2016	Sydney

C-BUS LOGIC

The C-Bus Logic training course is designed for consultants, electrical contractors and system integrators who wish to learn how to program the C-Bus Logic Engine located in C-Bus Touch Screen or C-Bus Pascal Automation Controller (PAC).

Start date	End date	Location
06/09/2016	07/09/2016	Melbourne
27/09/2016	28/09/2016	Adelaide
19/10/2016	20/10/2016	Sydney
02/11/2016	03/11/2016	Brisbane

C-BUS MULTI ROOM AUDIO

This course is designed for electrical contractors, consultants and apprentices who wish to learn how to program the C-Bus Multi Room Audio system.

Start date	End date	Location
08/09/2016	08/09/2016	Melbourne

CLIPSAL BY SCHNEIDER ELECTRIC
WWW.CLIPSAL.COM/TRAINING

C-BUS TOUCH SCREEN

The C-Bus Touch Screen training course is designed for consultants, electrical contractors and system integrators who wish to learn how to program C-Bus Touch Screens.

Start date	End date	Location
11/08/2016	12/08/2016	Perth
18/08/2016	19/08/2016	Rocklea
25/08/2016	26/08/2016	Melbourne
01/09/2016	02/09/2016	Adelaide
15/09/2016	16/09/2016	Sydney
15/09/2016	16/09/2016	Rocklea
13/10/2016	14/10/2016	Townsville
27/10/2016	28/10/2016	Rocklea
27/10/2016	28/10/2016	Adelaide
03/11/2016	04/11/2016	Perth
17/11/2016	18/11/2016	Sydney

C-BUS WISER HOME CONTROL

The Wiser Home Control training course is designed for consultants, electrical contractors and system integrators who wish to learn how to program the Wiser Home Controller system.

Start date	End date	Location
05/09/2016	05/09/2016	Melbourne
26/09/2016	26/09/2016	Adelaide
18/10/2016	18/10/2016	Sydney
01/11/2016	01/11/2016	Brisbane
15/11/2016	15/11/2016	Perth

DALICONTROL SIMPLE WIZARD

The DALIcontrol Simple Wizard training course is designed for electrical contractors and system integrators who wish to learn the installation and commissioning of a DALI system using user-friendly Simple Wizard software.

Start date	End date	Location
10/08/2016	10/08/2016	Hobart
22/09/2016	22/09/2016	Melbourne
26/10/2016	26/10/2016	Sydney

ECOXPERT - ENERGY EFFICIENCY GROWTH OPPORTUNITIES

This training session will give attendees the ability to acquire the know-how to successfully conduct a simplified energy audit.

Start date	End date	Location
01/09/2016	01/09/2016	Perth
29/09/2016	29/09/2016	Adelaide
06/10/2016	06/10/2016	Sydney
18/10/2016	18/10/2016	Melbourne
27/10/2016	27/10/2016	Brisbane

NETWORK CONNECTIVITY - TWISTED PAIR TESTING

The Twisted Pair Testing course provides the necessary understanding of the requirements for infield testing of high performance twisted pair telecommunication cabling to meet standards, customer and certification requirements.

Start date	End date	Location
15/08/2016	15/08/2016	Perth
22/08/2016	22/08/2016	Launceston
12/09/2016	12/09/2016	Adelaide
19/09/2016	19/09/2016	Townsville
10/10/2016	10/10/2016	Perth
24/10/2016	24/10/2016	Sydney
31/10/2016	31/10/2016	Brisbane
14/11/2016	14/11/2016	Melbourne

CLIPSAL BY SCHNEIDER ELECTRIC
WWW.CLIPSAL.COM/TRAINING

NETWORK CONNECTIVITY - ADVANCED FIBRE

The Advanced Fibre Optical Testing training course provides the necessary understanding of the requirements for infield testing LAN and DATA central optical fibre cabling systems, to meet standards and certification requirements. The course addresses the higher testing standard based requirements of high performance optical fibre systems in customer premises.

Start date	End date	Location
18/08/2016	18/08/2016	Perth
25/08/2016	25/08/2016	Launceston
13/10/2016	13/10/2016	Perth
27/10/2016	27/10/2016	Sydney
03/11/2016	03/11/2016	Brisbane
17/11/2016	17/11/2016	Melbourne

ECOXPERT - PRACTICAL ENERGY AUDIT

This training course will ensure that an EcoXpert can undertake an energy audit step by step and can generate an energy audit report.

Start date	End date	Location
13/09/2016	14/09/2016	Hobart
04/10/2016	05/10/2016	Perth
02/11/2016	03/11/2016	Adelaide
09/11/2016	10/11/2016	Sydney

COLLEGE OF ELECTRICAL TRAINING (RTO 2394)
WWW.CET.ASN.AU

CHECKING AND TESTING AN ELECTRICAL INSTALLATION

This non-endorsed course provides licensed electricians and final year apprentice electrical mechanics and electrical fitters with knowledge to visually inspect and test a LV electrical installation in compliance with the requirements of AS/NZS 3000.

Start date	End date	Location
10/08/2016	10/08/2016	Joondalup
17/08/2016	17/08/2016	Jandakot
24/08/2016	24/08/2016	Jandakot
25/08/2016	25/08/2016	Joondalup
09/09/2016	09/09/2016	Joondalup
14/09/2016	14/09/2016	Jandakot
20/09/2016	20/09/2016	Joondalup
21/09/2016	21/09/2016	Jandakot
03/10/2016	03/10/2016	Joondalup
12/10/2016	12/10/2016	Jandakot
19/10/2016	19/10/2016	Jandakot
25/10/2016	25/10/2016	Joondalup
02/11/2016	02/11/2016	Joondalup

COLLEGE OF ELECTRICAL TRAINING (RTO 2394)
WWW.CET.ASN.AU

ELECTRICAL CONTRACTOR TRAINING PROGRAM (ECTP)

This EnergySafety WA-approved course satisfies the Electrical Contractor Training Program (ECTP) and provides licensed electricians with the training, skills and knowledge rquired to identify, investigate and apply statutory and legislative requirements, manage jobs and operate a business, and inspect and test electrical installations according to regulatory requirements.

Start date	End date	Location
08/08/2016	12/08/2016	Joondalup
13/08/2016	25/08/2016	Joondalup
15/08/2016	19/08/2016	Jandakot
20/08/2016	01/09/2016	Jandakot
05/09/2016	09/09/2016	Jandakot
10/09/2016	22/09/2016	Jandakot
12/09/2016	16/09/2016	Joondalup
03/10/2016	07/10/2016	Joondalup
08/10/2016	20/10/2016	Joondalup
10/10/2016	14/10/2016	Jandakot
07/11/2016	11/11/2016	Jandakot
12/11/2016	24/11/2016	Jandakot

ELECTRICAL CORDS & PLUGS COURSE (NON-ENDORSED)

This non-endorsed course provides participants with the training, skills and knowledge required to fit plug tops to low voltage electrical cord connected equipment and to assemble low voltage cord extension sets up to 1,000V AC.

Start date	End date	Location
17/10/2016	17/10/2016	Joondalup

10146NAT COURSE IN ELECTRICIAN - MINIMUM AUSTRALIAN CONTEXT GAP TRAINING

This course provides the Minimum Australian Context Gap training to holders of an Offshore Technical Skills Record (OTSR) for the UEE308011 Certificate III in Electrotechnology Electrician qualification.

Start date	End date	Location
08/08/2016	12/08/2016	Joondalup
08/08/2016	12/08/2016	Jandakot
29/08/2016	09/09/2016	Joondalup
03/10/2016	07/10/2016	Joondalup
17/10/2016	21/10/2016	Jandakot
31/10/2016	11/11/2016	Joondalup

UEENEEF104A INSTALL AND MODIFY PERFORMANCE DATA COMMUNICATION COPPER CABLING (CATEGORY 5/6/7 STRUCTURED AND COAXIAL CABLING)

This nationally-endorsed course is an extension of the ACMA Open Cabler Registration Training Requirements course and provides open cablers with the training, skills and knowledge required to correctly install terminate category 5/6/7 structured and coaxial cabling.

Start date	End date	Location
12/08/2016	13/08/2016	Joondalup
19/08/2016	20/08/2016	Jandakot
28/10/2016	29/01/2016	Joondalup
11/11/2016	12/11/2016	Jandakot

UEE11 SUSTAINABLE—DESIGNER, INSTALLER OF GRID CONNECTED PHOTOVOLTAIC SYSTEMS SKILL SET

This skill set provides licensed electricians with the training to design, install, set-up, test, fault find, repair and maintain grid connected photovoltaic systems and associated equipment.

Start date	End date	Location
22/08/2016	26/08/2016	Jandakot
10/10/2016	14/10/2016	Jandakot

COLLEGE OF ELECTRICAL TRAINING (RTO 2394)
WWW.CET.ASN.AU

UEE20111 CERTIFICATE II IN SPLIT AIR-CONDITIONING AND HEAT PUMP SYSTEMS

This qualification provides the training and knowledge to install, commission and de-commission single head split air conditioning and heat pump systems to a prescribed routine, where the maximum plant capacity for each system does not exceed 18kWr. It includes wall hung, floor, and ceiling suspended, cassette and ducted fan coil split and water heating heat pump systems.

Start date	End date	Location
17/09/2016	25/09/2016	Jandakot
24/10/2016	28/10/2016	Jandakot

UEENEEI150A UEENEEI151A PROGRAMMABLE LOGIC CONTROLLERS

The course provides training in development, installation and testing of programs for programmable logic controllers and industrial systems requiring advanced control functions.

Start date	End date	Location
15/08/2016	19/08/2016	Joondalup
06/09/2016	13/10/2016	Jandakot

LEGRAND
WWW.LEGRAND.COM.AU

LEGRAND MYHOME AUTOMATION TRAINING - KIT SOLUTION

During this hands-on, one-day course you will learn the capabilities of a MyHOME system, how to program a MyHOME Kit and how to sell a MyHOME kit to your customers.

Start date	End date	Location
08/08/2016	08/08/2016	Prestons
22/08/2016	22/08/2016	Knoxfield
12/09/2016	12/09/2016	Osborne Park
07/11/2016	07/11/2016	Prestons

UEENEEI150A UEENEEI151A PROGRAMMABLE LOGIC CONTROLLERS

The course provides training in development, installation and testing of programs for programmable logic controllers and industrial systems requiring advanced control functions.

Start date	End date	Location
09/08/2016	10/08/2016	Prestons
23/08/2016	24/08/2016	Knoxfield
13/09/2016	14/09/2016	Osborne Park
08/11/2016	09/11/2016	Prestons

BTICINO INTERCOM SYSTEMS TRAINING - 2 WIRE AND D45

During this hands-on, two-day course you will learn the capabilities of a MyHOME system, how to program a MyHOME system and how to sell a MyHOME system to your customers.

Start date	End date	Location
11/08/2016	12/08/2016	Prestons
25/08/2016	26/08/2016	Knoxfield
15/09/2016	16/09/2016	Osborne Park
10/11/2016	11/11/2016	Prestons

MILCOM COMMUNICATIONS
HTTP://MILCOM.EDU.AU

CCTV INSTALLATION

From this course you will learn how to install and commission closed circuit TV systems from the cameras to the image processors and recorders

Start date	End date	Location
11/08/2016	12/08/2016	Salisbury
29/08/2016	30/08/2016	Granville

MILCOM COMMUNICATIONS
HTTP://MILCOM.EDU.AU/

MILCOM

COAX CABLING

Completion of this course will allow you to apply for the coax cabling endorsement on your open registration licence. This endorsement covers work with coax cabling on a domestic or commercial premises.

Start date	End date	Location
09/08/2016	09/08/2016	Clayton
09/08/2016	09/08/2016	Granville
23/08/2016	23/08/2016	Salisbury
30/08/2016	30/08/2016	Granville
06/09/2016	06/09/2016	Gosnells
06/09/2016	06/09/2016	Clayton
20/09/2016	20/09/2016	Granville
04/10/2016	04/10/2016	Clayton
05/10/2016	05/10/2016	Salisbury
05/10/2016	05/10/2016	Granville
11/10/2016	11/10/2016	Gosnells

MILCOM COMMUNICATIONS
HTTP://MILCOM.EDU.AU/

MILCOM

ELEARNING OPEN REGISTRATION

An open registration licence enables telecommunications workers to legally install and maintain telephone, security and fire alarm cabling in all types of customer premises – however, please be aware that there are further training requirements for working with data cabling, coaxial cabling, or optical fibre installations.

Start date	End date	Location
11/08/2016	12/08/2016	Gosnells
18/08/2016	19/08/2016	Clayton
18/08/2016	19/08/2016	Granville
01/09/2016	02/09/2016	Salisbury
08/09/2016	09/09/2016	Granville
15/09/2016	16/09/2016	Gosnells
15/09/2016	16/09/2016	Clayton
29/09/2016	30/09/2016	Salisbury
29/09/2016	30/09/2016	Granville
13/10/2016	14/10/2016	Clayton
20/10/2016	21/10/2016	Gosnells

MILCOM COMMUNICATIONS
HTTP://MILCOM.EDU.AU/

OPEN REGISTRATION

An open registration licence enables telecommunications workers to legally install and maintain telephone, security and fire alarm cabling in all types of customer premises – however, please be aware that there are further training requirements for working with data cabling, coaxial cabling, or optical fibre installations.

Start date	End date	Location
15/08/2016	19/08/2016	Salisbury
22/08/2016	26/08/2016	Granville
29/08/2016	02/09/2016	Clayton
29/08/2016	02/09/2016	Gosnells
12/09/2016	16/09/2016	Granville
19/09/2016	23/09/2016	Salisbury
26/09/2016	30/09/2016	Clayton
03/10/2016	07/10/2016	Gosnells
10/10/2016	14/10/2016	Granville

PIT & PIPE (MEETS TELSTRA STANDARDS)

By the end of the course, you will be able to prepare site for installation; clear a site in accordance with relevant standards, codes and legislation, and ensure all tools, equipment and clothing are used safely in accordance with manufacturers specifications; and make excavation safe through erection of necessary barriers.

Start date	End date	Location
08/08/2016	09/08/2016	Gosnells
15/08/2016	16/08/2016	Granville
15/08/2016	16/08/2016	Clayton
29/08/2016	30/08/2016	Salisbury
05/09/2016	06/09/2016	Granville
12/09/2016	13/09/2016	Gosnells
12/09/2016	13/09/2016	Clayton
26/09/2016	27/09/2016	Salisbury
26/09/2016	27/09/2016	Granville
10/10/2016	11/10/2016	Clayton
17/10/2016	18/10/2016	Gosnells

NECA EDUCATION & CAREERS
WWW.NECAEDUCATION.COM.AU

ECOSMART ELECTRICIANS

EcoSmart Electricians The EcoSmart Electrician program includes training, and an accreditation scheme enabling contractors to promote their knowledge and training in energy efficiency as a unique selling point to their customers.

Start date	End date	Location
11/08/2016	11/08/2016	Carlton North
06/10/2016	06/10/2016	Carlton North
10/11/2016	10/11/2016	Carlton North

ELECTRICAL INSTALLATION TESTING

Electricians and RECs have a legal obligation to test and certify that their electrical work complies with relevant standards. It is essential thay you or your employess have the essential testing skills so that you can test and sign of on COES with confidence

Start date	End date	Location
09/09/2016	09/09/2016	Carlton North
07/10/2016	07/10/2016	Carlton North
11/11/2016	11/11/2016	Carlton North

ESSENTIAL BUSINESS 4 ELECTRICAL CONTRACTORS

Improve your business' performance, profits and productivity by hearing from industry expert Max Rowe on developing various aspects of your electrical contracting business.

Start date	End date	Location
12/09/2016	14/09/2016	Carlton North
14/11/2016	16/11/2016	Carlton North

NECA EDUCATION & CAREERS
WWW.NECAEDUCATION.COM.AU

ESTIMATING ELECTROTECHNOLOGY PROJECTS - ADVANCED STAGE 2

Building on skills acquired in Stage 1, this course will provide you with accurate and profitable estimating skills as well as undertaking practical construction of an estimate from the receipt of the render documents, through the practical take off and pricing to final submission of the tender.

Start date	End date	Location
17/10/2016	24/10/2016	Carlton North

ESTIMATING ELECTROTECHNOLOGY PROJECTS - FUNDAMENTALS STAGE 1

Estimating is a key component in establishing a successful contracting business. Knowing what to charge is only part of the equation. Knowing how long a job will take and what is involved in developing a quotation for a job is critical. This course reviews the methods and procedures commonly used in estimating plus more.

Start date	End date	Location
08/08/2016	08/08/2016	Carlton North
19/09/2016	19/09/2016	Carlton North

NCC (BCA) LIGHTING

If you are working in the commercial or construction fields or are involved with lighting projects this course is a must for you. Working with the National Construction Code (NCC) and especially understanding the impacts of section J6 on energy efficiency requirements is critical.

Start date	End date	Location
15/09/2016	29/09/2016	Carlton North

OPEN REGISTRATION

Don't be stuck in the dark ages, Open Registration has become a necessity for all things internet. Doesn't matter what project your working on; networking, data and voice cabling will be apart of the scope of works.

Start date	End date	Location
06/08/2016	14/08/2016	Carlton North

REGISTERED ELECTRICAL CONTRACTOR (BUSINESS)

If you want to start your own electrical contractor business then this course is for you. The course sets out the knowledge and skills required to ensure regulatory, technical, occupational and workplace relation requirements are met in conducting a contracting business.

Start date	End date	Location
15/08/2016	18/08/2016	Carlton North
10/09/2016	18/09/2016	Carlton North
10/10/2016	13/10/2016	Carlton North

COMPETENCY TRAINING
WWW.COMPETENCYTRAINING.COM.AU

ELECTRICAL SUPERVISOR

This electrical supervisors course has been designed for the mining industry to cover all aspects of duties and responsibilities of an electrical supervisor, and will include detailed explanation of the requirements of the Mines Safety and Inspection Act and Regulations and the requirements of the electrical safety management systems audit.

Start date	End date	Location
27/09/2016	27/09/2016	Perth
04/11/2016	04/11/2016	Perth

CEDIA
WWW.CEDIA.NET

CEDIA

ADVANCED INTEGRATION & AUTOMATION CONTROL CONCEPTS			
Explore the advanced programming and system control concepts necessary to successfully install, configure, and troubleshoot a robust home automation system. Receive instruction on writing code, data parsing, programming languages, and user interface design.	**Start date**	**End date**	**Location**
	24/08/2016	24/08/2016	Homebush

ADVANCED WIRELESS NETWORKING			
Expand your knowledge from installation of a single wireless access point to designing and installing a multiple-point, robust network. This course covers how to use wireless spectrum effectively, specify wireless network controllers, perform and document a wireless site survey, and delve deeper into troubleshooting. Before attending this course, participants should have a working knowledge of channel placement for the 2.4 GHz and 5 GHz bands; the difference between 802.11b, 802.11a, 802.11g, and 802.11n; and why hidden SSID, WEP, and WPS are not viable security settings.	**Start date**	**End date**	**Location**
	23/08/2016	23/08/2016	Homebush

CEDIA
WWW.CEDIA.NET

CEDIA

VIDEO DISPLAY TECHNOLOGIES FOR TECHNICIANS			
This course educates participants on current display technologies with an emphasis on describing their resolution and contrast ratio, and explaining their compatibility with standard driver sources. Topics include how to account for human and environmental factors impacting the design and placement of video displays, and creative solutions to challenging video display situations.	**Start date**	**End date**	**Location**
	25/08/2016	25/08/2016	Homebush

TROUBLESHOOTING, REPAIR & PREVENTIVE MAINTENANCE			
By applying advanced troubleshooting and maintenance procedures you can save time, increase efficiency, and reduce service calls in the future. Participants will receive instruction on troubleshooting procedures including analysis, diagnostics, documentation and application of solutions. This course also discusses the advantages of routine system maintenance and remote diagnostics through the use of service contracts and recurring revenue models.	**Start date**	**End date**	**Location**
	23/08/2016	23/08/2016	Homebush

TRADESTUFF

THE ONLINE STORE FOR TRADIES

AS/NZS 3000:2007 The Wiring Rules (includes Amendment 1:2009 and Amendment 2:2012)

For electricians, the Wiring Rules are probably your most valuable tool, designed to protect you, your customers and their property – and every electrician in Australia and New Zealand is urged to familiarise themselves with the this Standard and its associated Amendments. Part 1 of this document provides uniform essential elements that constitute the minimum regulatory requirements for a safe electrical installation. Part 2 provides installation practices that achieve certainty of compliance with the essential safety requirements of Part 1. Recognised as the benchmark for safe and efficient electrical installations, this is one of the most widely used Standards in Australia and has played an important role in reducing the incidences of electrical mishaps and injuries.

$229.00 Spiral bound.....CODE 431s

Electrical Principles for the Electrical Trades

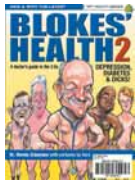
Volume 1 & 2

Volume 1:
Ideal for electrical apprentices, the 6th edition of *Electrical Principles for the Electrical Trades* is the first volume of a two-volume set. Written by two TAFE/VET teachers, the book looks at the fundamental knowledge required to become a successful electrician. A portion of the proceeds from this book will go to WorldSkills Australia.

Volume 2:
Volume 2 of *Electrical Principles for the Electrical Trades* explores the electrical applications of the principles learned in Volume 1. This is an excellent learning resource for electrical apprentices and teachers, as well as being a suitable long-term reference for tradespeople. A portion of the proceeds from this book will go to WorldSkills Australia.

$136.00 .....CODE 085

Blokes' Health 2 – Depression, Diabetes and Dicks!



Following in the footsteps of Dr Bernie Crimmins original best-seller, Blokes' Health: comes Blokes Health 2. We all want to live as long and as healthy as we can, with good quality of life. In this book Dr Bernie Crimmins outlines the main health problems that affect males and gives some simple advice on how to prevent, or detect early, those particular diseases which may lead to an early demise.

$19.95.....CODE 671

Electrical Wiring Practice

Volume 1

Volume 1 of *Electrical Wiring Practice* has been updated to provide guidance in the use of the Australian and New Zealand Wiring Rules, AS/NZS 3000:2007, including the 2009 Amendments. Taking a practical approach, this book employs clear visual tools to illustrate the knowledge and practices required by specified products and the Standards.

$89.95.....CODE 086

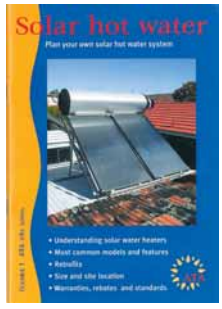
Electrical Wiring Practice

Volume 2

Volume 2 of *Electrical Wiring Practice* has been updated to provide guidance in the use of the Australian and New Zealand Wiring Rules, AS/NZS 3000:2007, including the 2009 Amendments. Taking a practical approach, this book employs clear visual tools to illustrate the knowledge and practices required by specified products and the Standards.

$95.95.....CODE 364

Solar Hot Water



This booklet gives you an understanding of solar hot water heaters and the most common models and their features. It also covers retrofits, size and site locations, including mains pressure versus low pressure, collectors, tanks, boosting and freeze protection, warranties, rebates and Standards.

$16.95 .....CODE 589

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