EESA
THE ELECTRIC ENERGY SOCIETY OF AUSTRALIA
ENGINEERS AUSTRALIA

The Electric Energy Society of Australia

www.eesa.asn.au

A word from your president

When Electromagnetic Compatibility turns into Incompatibility

I'm seeing more cases of customers suffering from problems due to electrical interference associated with a lack of electromagnetic compatibility (EMC). So what are the symptoms? In general, there will be some maloperating sensitive electrical equipment such as a 20ma current loop transducers feeding a PLC, computer or SCADA system. The maloperation is often intermittent making it difficult to identify and causing unwanted disruptions.

The electromagnetic incompatibility issues can affect transmission and distribution networks and all installation types including industrial, commercial and domestic. The source of EMC problems are often difficult to identify and expensive to rectify. There are however some basic low cost good practice installation tips that can be implemented as new wiring and equipment is installed.

1. Earthing – providing earthing based only on the 50Hz requirements of your sensitive industrial and commercial installation will most likely not give you the EMC requirements that you need. Meshbonding is useful for critical and sensitive equipment.
2. Segregation – MV cables, noisy LV cables and sensitive LV cables need to be separated to minimise cross coupling.
3. Send & receive current paths should be brought together as close as practical to minimise their magnetic field effects.
4. VSDs need input filters, output filters and screened output cables to the motor.
5. Purchase electrical equipment with good EMC and power quality immunity.

In my own home I have seen the effects of 2 way light switching creating a current path where the active and neutral conductors travel 15 metres with a separation of about 4 metres. The resulting magnetic fields can make hearing aids unusable in many parts of the house.

Variable speed drives without shielded cable between the drive and the motor and/or a lack of input and output filtering can render nearby sensitive electronic equipment unusable.

High current widely spaced LV and MV cables emanating from substations or switchboards can also have very adverse effects. Wide cable spacing can cause poor current sharing in parallel cables. The result can be overloading in some cables and underloading in others.

I've had experience with an undervoltage relay maloperating due to the presence of 5th harmonic voltages. The result was unwanted standby generator operation and great customer disruption.

EMC issues are all around us. Many ongoing EMC problems go undiagnosed and cause many detrimental customer effects. EMC problems are more widespread than most people realise. The challenge for all of us in the electricity industry is to understand the issues and get the EMC basics right with all our projects. The other challenge is to identify EMC related problems when they occur and come up with economic and viable solutions.

So the next time your computer locks up, your digital clock goes haywire, your hearing aid makes funny noises, your SCADA system doesn't work properly or your protection relay operates for no logical reason, think of the EMC possibilities.

Dr Robert Barr
EESA National President

News and Issues from around the Industry

Australia drafts first cyber white paper

The federal government has announced it will develop Australia's first Cyber White Paper to provide a comprehensive blueprint to help Australians connect to the internet with confidence.

It will be a comprehensive review of how governments, businesses and individuals can work together to realise the full benefits of cyberspace while at the same time ensuring current and emerging risks can be managed.

The paper will examine what Australians need to do to protect themselves online, the role of government, industry and the public in protecting interests, and priorities in the cyber environment.

It will also cover a broad range of areas including consumer protection, cyber safety, cyber crime, cyber security and cyber defence.

The paper will be built on the government's 2009 Cyber Security Strategy and the establishment of the Cyber Security Operations Centre (CSOC), CERT Australia, the Cyber Safety Plan and the Digital Economy Strategy.

The announcement comes shortly after the high-profile cyber-attacks on three US defence contractors – Lockheed Martin, L-3 Communications and Northrop Grumman – which ironically occurred during or shortly preceding Australia's national Cyber Security Awareness Week. All three defence contractors provide services to Australia.

The paper will be led by the Department of Prime Minister and Cabinet and is expected to be completed in the first half of 2012.

Harmonised OHS laws to focus senior managers on safety CCH Online 21/4/2011

Commitment from senior managers is increasingly acknowledged as key to effective health and safety strategies in workplaces. And the harmonisation of OHS laws in Australia from 1 January 2012 will contribute to a shift towards greater accountability of senior managers.

"The game has changed", said Cormack Dunn, from the Freehills National Safety Team. "There's a much greater expectation of leaders of companies." Mr Dunn said the emphasis in companies must now shift toward culture, and leaders need to have "line of sight".

Safety theory has evolved from a technological focus in the 1970s and 1980s, such as on machine guarding to make equipment safe, to a systems focus from the mid-1990s with the advent of safety management systems such as AS 4801, to the current focus on leadership and safety culture.

"The new legislation will change the focus of boards from reactive to proactive", Mr Dunn said. The board will change "from passive to inquiring regarding safety matters".

"If the board gets interested, the management gets interested."

The new laws broaden the range of people who have primary OHS duties to anyone conducting a business or undertaking, extend the coverage of the Act beyond "employees" to "workers", substantially increase penalties, and create a positive duty for officers, among other changes. The emphasis moves from the current OHS governance approach to one of due diligence, according to Mr Dunn. In simple terms, due diligence includes:

- having an appropriate OHS system in place
- having up-to-date knowledge of OHS matters
- understanding operations and OHS hazards and risks
- allocating adequate resources to eliminate or minimise OHS hazards and risks
- receiving and considering OHS information.

In the lead-up to 1 January 2012, Mr Dunn said managers can prepare by reviewing safety governance arrangements, reviewing OHS information in management and board reports, checking that the OHS system addresses key risks, checking that the safety plan is updated for the harmonised laws, and improving management's safety leadership skills.

Bulletin 4, August - September 2011:
Please email submissions by 2 September to the Bulletin Editor,
Patrick McMullan on pmcmullan@energy.com.au

News and Issues from around the Industry

In Brief

Brad Page moves to Global CCS Institute

esaa Chief Executive Officer Brad Page has been appointed Chief Executive Officer of the Global CCS Institute. He is expected to take up the position during August 2011. Global CCS Institute Chairman Russell Higgins AO says Page's appointment marks the start of a new chapter of the Institute's mission to accelerate the global deployment of CCS technologies. Page has been the esaa CEO for the past seven years. He has also been an active member of the Australian Government Business Roundtable on Climate Change; the CSIRO Energy Transformed Flagship Advisory Committee; the Australian Government Energy White Paper High-Level Consultative Committee; and has chaired the CSIRO Energy and Transport Sector Advisory Council.

Loy Yang Power announces voluntary redundancies

Loy Yang Power has announced voluntary redundancies for its workforce. The company announced an organisation restructure in early 2011 in response to lower than expected electricity revenue and increased operating costs. Voluntary redundancies were first offered to Loy Yang Power's contracted employees in March. This offer has now been extended to the remainder of the workforce covered by an Enterprise Bargaining Agreement. Loy Yang Power Chief Executive Ian Nethercote says the company needed to deliver significant cost reductions and efficiency improvements across the business in the next two years. "Cost reductions and voluntary redundancies are among a range of improvements being implemented to ensure our business remains competitive in an industry that is under significant pressure," says Nethercote.

Smart Grids Roadmap developed by Standards Australia

Please see following link to a press release regarding the development of a Smart Grid Standards Roadmap by Standards Australia:
http://www.standards.org.au/LinkClick.aspx?fileticket=8PxNAr-Rcps%3d&tabid=94&mid=423

Adelaide Chapter News

Nuclear Energy Safety

The Electric Energy Society of Australia (EESA), SA Chapter hosted a very interesting event on "Nuclear Energy Safety" on Thursday 12th May 2011. A most stimulating and thought provoking presentation was delivered to a full house at the Engineers Australia auditorium by Paul Bird, Corporate Safety Engineering Manager of BAE Systems Australia.

Paul Bird has twenty years experience in operating, maintaining and supervising nuclear plant operations on British Royal Navy submarines. He also worked for five years developing safety justifications for nuclear related work in Western Europe's largest naval repair yard at Plymouth, U.K.

His talk covered:

- Technical aspects; the analysis and design requirements and the many levels of redundancy in protection systems.
- The organisational culture; the need to create an environment that emphasises safety through an awareness of the
- risks posed by the plant.
- The regulatory environment; the prescriptive and goal setting aspects that are required.

Paul drew some interesting life comparisons to demonstrate that the social concerns and negative public perceptions are psychologically based.

Paul's talk emphasised the difficulties of a future involving nuclear power. The negative public perceptions, project complexity, engineering depth required, rigorous regulatory standards required and the extremely high costs all mean that the hurdles to cross cannot be underestimated.

Nominations to EESA National Council & NSW Chapter now sought

Nomination forms for positions on the National Council & NSW Chapter can be downloaded from the link below.

It is probable that all the retiring Council members will re-nominate, however others may also nominate.

Forms to be returned by fax to Jenna Zervos, at Engineers Australia, 02 6273 2358, by Friday 19 August. If required, elections will be conducted at the AGM at the NSW State Conference on 8-9 September.

To download a nomination form please click on the link below:

http://www.eesa.asn.au/sites/default/files/upload/eesa_dual_nomination_form_2011.pdf

Upcoming Events

EECON NSW 2011 Conference and Trade Exhibition
7 - 9 September 2011, Australian Technology Park, Sydney

" New Technologies in Energy Networks - topping up or tripping over? "

To register online please click here
To download the conference brochure please click here

The EESA NSW EECON 2011 Conference will again be held at the Australian Technology Park at Eveleigh on the 7-9 September 2011. The move to this larger yet still easily accessible venue allows for the larger number of participants expected and an expanded exhibition for the benefit of all in attendance.

Some 200 delegates are expected to attend the conference and the accompanying wide ranging exhibition of electrical technology employed in energy network businesses.

The conference has a number of dedicated sessions dealing with topical areas of interest to electricity industry participants.

These include:

- Recent disasters and their implications for NSW Networks
- Intelligent substation design/innovation
- Power Quality issues in the brave new world
- Smart Grid applications - update for networks
- Large ambitious projects - including carbon capture and sequestration
- Update on renewable technologies for large scale generation
- Cable and wires technologies, rating and testing
- Telecommunication and networks - convergence at last
- Operations, control and protection - a progress report
- Energy efficiency, demand side management and integration and consumers

The conference is very strongly supported by industry and utilities alike and so there is a special thanks to our sponsors, with our corporate members Ausgrid, Endeavour Energy, Essential Energy and TransGrid taking up Gold Sponsorship. Schneider Electric this year will be the host for the very popular conference dinner**.**

EESA in cooperation with Prescient Associates Ltd presents....
Electric Power Engineering Courses Switchgear Technology for Power Systems
LAST CHANCE TO REGISTER!!

Three 2-day courses in:

- ***Sydney - 18th & 19th July -*** *places still available*
- ***Brisbane - 26th & 27th July -*** *almost sold out*
- ***Adelaide - 28th & 29th July -*** *almost sold out*

To find out more information or to register your please contact The Meeting Manager on:
Email: meetings@tmm.com.au Tel: 02 9810 7322

Upcoming International Event

Electrical Arc Flash Forum: 9th & 10th August 2011
Venue: Mercure, Customs Street, Auckland

Keynote Speakers: ***Dr David Sweeting****, Director, Sweeting Consulting and* ***Hugh Hoagland,*** *Founder of ArcWear*
Guest Speaker: Peter Willis, Australian Arc Flash Expert, DigSilent

FOR MORE INFORMATION: ph (09) 263 4759 or www.idc-online.com

International Snippets from around the Industry

Scientific American July 2011, EVs and charger standardisation

To most Americans electric cars are as new a concept as the first combustion vehicles were to horse-and buggy-drivers in the early years of the 20th century. But to the organizations around the world that have been working to make modern electric cars a consumer reality, it has taken decades to get to this point. In fact, the electric car industry is old enough now that it has developed its own internal conflicts—the biggest of which centres on vehicle charging. Unfortunately, engineering groups and consortiums are developing different standards for a quick jolt, and if the differences are not resolved, the burgeoning electric vehicle industry may stumble.

The goal, of course, is to enable electric-car owners to charge their vehicles as effortlessly as they would fill up at a gas pump. Common standards are what makes that possible. In the U.S. the organization tasked with developing these charging standards is the Society for Automotive Engineers (SAE). In January 2010 the SAE approved the so-called J1772 standard governing slow- to moderate-speed electric car charging. Every major electric car manufacturer, and most start-up ones as well, have committed to using J1772 in their existing and future products. In 2011 more than 15,000 of these J1772-compatible stations are planned for installation in early deployment communities around the U.S.

But the J1772 standard accounts only for charging at relatively low speeds. On a 110- to 120-volt circuit it can add about eight kilometers of driving range for every hour of charging, and on a 220- to 240-volt circuit, it can sustain between 24 and 100 kilometers of driving range for every hour of charging (depending on individual vehicle and station specifications).

To create more parity between electric and combustion engine cars, the industry has been developing so-called DC fast charging—which can nearly top off an electric car's battery pack in less than half an hour. (The typical range of a fully charged car is 160 kilometers.) This type of charging requires a gas pump–size station attached to an industrial power supply. Although the size and voltage make DC fast charging unsuitable for the home garage, it should be sufficient at commercial charging stations.

Two competing standards

A few pioneers have forged ahead with this fast charging, with Nissan and Mitsubishi taking the lead. Yet the standard they have chosen—called CHAdeMO and developed by a consortium of Japanese companies—will soon face competition from another standard under development by the SAE.

The SAE expects to have its DC fast-charging standard ready within nine months, and carmakers and station manufacturers should have equipment samples in the fall to begin their internal testing, says Peter Byk, an SAE engineering specialist. The final standard should come by the end of this year and no later than the first quarter of 2012.

It will be at least 2013 before the SAE standard starts showing up in consumer vehicles. In the meantime there will be nearly 700 CHAdeMO stations in Japan, 500 in the U.S. and 300 in Europe by the end of 2011. By the time the first SAE–compliant DC fast-charging–equipped cars hit the road there could be perhaps thousands of CHAdeMO stations in the U.S. alone, according to John Gartner, a senior research analyst with Pike Research and author of an upcoming report on the state of DC fast-charging technology around the globe.

Nissan began selling its LEAF all-electric car last November and has plans to sell more than 200,000 of them a year by 2013. Mitsubishi began selling the all-electric i-MiEV in select locations around the globe last year and will start selling it on the North American market at the end of 2011. Adding DC fast-charging capability to both of those vehicles is an extra cost option at the time of purchase, and many consumers have opted for it, especially on the West Coast where CHAdeMO infrastructure will be widespread.

Universality has its benefits

The current SAE fast-charging design calls for a hybrid combo that would be backward compatible with the J1772 standard but would also support DC fast-charging through a universal cable.

A universal charging standard has benefits in terms of cost savings and ease of engineering, and according to some, the SAE standard also has technical improvements over CHAdeMO designed to make it future-proof and safer to boot. BMW, which in 2013 will start selling their first mass-market all-electric vehicle, the i3, has been working in close collaboration with the SAE to develop the universal charging standard.

"We have a lot of problems with different standards around the world already," says Josef Krammer, team leader for charging systems at BMW. "We deliver our vehicles everywhere, and it's very difficult if we have to adapt our charging systems for each region."

International Snippets from around the Industry

May/June 2011 Technology Review.
Solid State Batteries - High-energy cells for cheaper electric cars by Kevin Bullis

Ann Marie Sastry wants to rid electric vehicles' battery systems of most of the stuff that doesn't store energy, such as cooling devices and supporting materials within the battery cells. It all adds up to more than half the bulk of typical lithium-ion-based systems, making them cumbersome and expensive. So in 2007, she founded a startup called Sakti3 to develop solid-state batteries that don't require most of this added bulk. They save even more space by using materials that store more energy. The result could be battery systems half to a third the size of conventional ones.

Cutting the size of a battery system in half could cut its cost by as much as half, too. Since the battery system is the most expensive part of an electric car (often costing as much as $10,000), that would make electric cars far cheaper. Alternatively, manufacturers could keep the price constant and double the 100-mile range typical of electric cars.

The limitations of the lithium-ion batteries used in electric cars are well known. "Most liquid electrolytes are flammable. The cathode dissolves," says Sastry. Keeping the electrolyte from bursting into flames requires safety systems. And to extend the electrode's lifetime and prevent heat buildup, the battery must be cooled and prevented from ever fully charging or discharging, resulting in wasted capacity. All this adds bulk and cost. So Sastry wondered if she could make a battery that simply didn't need this much management.

Sastry's solid-state batteries are still based on lithium-ion technology, but they replace the liquid electrolyte with a thin layer of material that's not flammable. Solid-state batteries are also resilient: some prototypes demonstrated by other groups can survive thousands of charge-discharge cycles. And they can withstand high temperatures, which will make it possible to use materials that can double or triple a battery's energy density (the amount of energy stored in a given volume) but that are too dangerous or unreliable for use in a conventional lithium-ion battery.

Although it may be several years before the batteries come to market, GM and other major automakers, such as Toyota, have already identified solid-state batteries as a potentially key component of future electric vehicles. There's a limit to how much better conventional batteries can get, says Jon Lauckner, president of GM Ventures, which pumped over $3 million into Sakti3 last year. If electric vehicles are ever to make up more than a small fraction of cars on the road, "something fundamental has to change," he says. He believes that Sakti3 is "working well beyond the limits of conventional electrochemical cells."

Smart Transformers
Controlling the flow of electricity to stabilize the grid
By David H. Freedman

In a lab wired up to simulate a residential neighborhood, Alex Huang is working to revamp aging power grids into something more like the Internet—a network that might direct energy not just from centralized power stations to consumers but from any source to any destination, by whatever route makes the most sense. To that end, Huang, a professor of electrical engineering at North Carolina State University, is reinventing the transformers that currently reduce the voltage of the electricity distributed to neighborhoods so that it's suitable for use in homes and offices.
His new transformer will make it easier for the grid to cope with things it was never designed for, like charging large numbers of electric vehicles and tapping surplus electricity from residential solar panels. Smart meters in homes and offices can help by providing fine-grained information about the flow of electricity, but precise control over that flow is needed too. Not only would this stabilize the grid, but it would better balance supply and demand, reducing spikes so that fewer power plants would be needed to guarantee the electricity supply.

"We need a radically new device to sit between homes and grid to provide a buffer, so that the grid will remain stable no matter what is going on in the homes," Huang says. Conventional transformers handle only AC power and require manual adjustment or bulky electromechanical switches to redirect energy. What he wants is a compact transformer that can handle DC as well as AC and can be electronically controlled so that it will respond almost instantaneously to fluctuations in supply and demand. If one neighbor plugged an electric car into an AC charger, for example, it could respond by tapping otherwise unneeded DC power from another neighbor's solar panels.

To build such a transformer, Huang started developing transistors and other semiconductor-based devices that can handle thousands of volts, founding the Future Renewable Electric Energy Delivery and Management Systems Center at NC State in 2008. His first transformer had silicon-based components, but silicon is too unreliable for large-scale use at high voltages. So Huang has pioneered the development of transformers with semiconductors based on compounds of silicon and carbon or gallium and nitrogen, which are more reliable in high-power applications. He expects to have a test version of the silicon-carbon transformer ready in two years and to have a device that utilities can test in five years.

Huang's transformers would make connecting a solar panel or electric car to the grid as simple as connecting a digital camera or printer to a computer. That would reduce our reliance on fossil fuels by making it easier for small-scale sources of cleaner energy to contribute to the grid. He says, "The real benefit to society will come when there's an aggregate effect from many, many small generators, which we hope will be renewable and sustainable energy sources."

International Snippets from around the Industry

HVDC Transmission Link Between Britain and the Netherlands Goes into Operation
Siemens Energy

Together with the operating company BritNed Development Ltd., Siemens Energy has placed the BritNed HVDC transmission link between Britain and the Netherlands into operation. BritNed is a joint venture of National Grid, the international electricity and gas company and one of the largest investor-owned utilities in the world, and TenneT, the Dutch grid operator based in Arnhem. The 260-km-long subsea cable connection with a transmission capacity of 1000 MW links the 400-kV grids in southern England and in the south of the Netherlands. The HVDC transmission system's converter station in the UK is located on the Isle of Grain in Kent in southeastern England, while the Dutch station is situated in Maasvlakte near Rotterdam. Besides ensuring greater stability in the European integrated network, BritNed will also serve as an energy trading hub and thus bring more competition into the grid.

Starting on April 1, current will flow through the new "interconnector" with low-loss transmission, with the electricity markets of both countries setting the price for the electricity as well as the transmission direction. The HVDC transmission connection will thus meet the European Commission's requirements to interconnect power grids to a greater extent.

In BritNed, Siemens was responsible for the design of the complete HVDC transmission system and installed both turnkey converter stations. The order's scope included the supply, installation, and commissioning of core components such as converter valves with directly light pulse-fired power thyristors, converter transformers, smoothing reactors, protection and control systems, and AC filters.

Ultracapacitors to Boost the Range of Electric Cars
New energy-storage technology could surpass today's batteries in capacity and durability.
By Kevin Bullis

A startup called Nanotune says its ultracapacitor technology could make electric cars cheaper and extend their range. The company, based in Mountain View, California, has developed a way to make electrodes that results in ultracapacitors with five to seven times as much storage capacity as conventional ones.

Conventional ultracapacitors, which have the advantage of delivering fast bursts of power and can be recharged hundreds of thousands of times without losing much capacity, are too expensive and store too little energy to replace batteries.

Nanotune, however, which has raised $3 million from the venture capital firm Draper Fisher Jurvetson, says its ultracapacitors are close to competing with batteries in terms of energy storage, and could soon surpass them. Using a conventional electrolyte, the company has demonstrated energy storage of 20 watt-hours per kilogram, as opposed to roughly five watt-hours for a conventional ultracapacitor. Using a more expensive ionic-liquid electrolyte, it has made ultracapacitors that store 35 watt-hours per kilogram. By the end of the year, the company hopes to approximately double this storage capacity, says Nanotune CEO Kuan-Tsae Huang. At 40 watt-hours per kilogram, the ultracapacitors would be an improvement over the batteries used in some hybrid vehicles.

Nanotune isn't the first company to claim it can make ultracapacitors with very high energy storage. Others have found this promise hard to deliver. Increasing surface area can improve storage capacity only so much, since at some point the storage is limited by the ions in the electrolyte. Ionic liquids help with this, but they have significant shortcomings, says Joel Schindall, a professor of electrical engineering and computer science at MIT. (A company called FastCap Systems, which is developing ultracapacitors using carbon nanotubes, was spun out of his lab.) They're very expensive, for one thing, and some operate well only in a limited temperature range, making them impractical for cars.