

50 years Electrical Business

Also in this issue...

- Airborne ultrasound & IR switchgear inspection
- How does wind's *energetic cost* compare to solar PV?



The family is still a standard.

Details on page 5.



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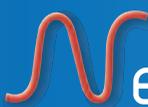


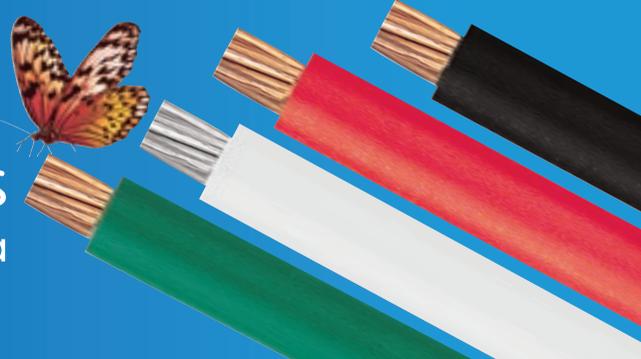
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EBMag is featuring a different guest editor on this page every issue during our 50th anniversary year. You can always reach the editor at acapkun@annexweb.com.

David Pilon has been an electrical inspector with SaskPower since 2000, and is currently the vice-chair of the Canadian Certified Electrical Inspector (CCEI) committee of the International Association of Electrical Inspectors (IAEI), Canadian Section. David can be reached at dpilon@saskpower.com.

Electrical inspectors: why do we do what we do?

As a member and past-president of the International Association of Electrical Inspectors (IAEI) Canadian Section, this should be an easy question to answer. While training as an electrician, I fell in *like* (not in *love*) with the code; in truth, it was more of a Like-Hate relationship. While at trade school, my roommate and I would often try to stump each other with various code questions from the rules we stumbled upon.

On one of my first jobs as a new journeyman, my boss asked me why I was pulling a bond conductor in every conduit. I looked at him and said, "Because it is code!" and he said, "Prove it!". That was when I learned the difference between the code and specs, and the code book became a tool I used constantly.

As the son of a long-time contractor, I learned early that it is always cheaper to do it once correctly than to redo it even once. The old mantra "measure twice, cut once" was pounded into me by Dad as a child, and this respect for doing it right stayed with me for years. When the time came for me to decide between inspecting and contracting, the inspecting had the stronger draw.

A respect for the rules was an important driver. I learned a lot from the folks who taught me what I know, and that learning continues. I learned that some of the most important words in the code are the small ones, such as *may*, *shall*, *and*, *or*. Most importantly, I learned that the code is written in blood... that the deaths of unfortunate souls lead directly to code changes.

So, at the end of the day, Section 2-200 is the main reason I do what I do: protection of people and property. Sometimes it is a struggle to make people see the hazards in their homes and businesses because, to them, "It's working fine!". My job is to help ensure the electricity in homes and businesses is just that: working fine.

We are currently operating at a 3% unemployment rate in Saskatchewan. Businesses are expanding, industries are strengthening and we are continuing to diversify. It can be a struggle to keep up with this growth, but with training, experience and dedication from contractors, electricians and inspectors, Saskatchewan continues to be a safe province in which to live and work. **EB**



On the Cover and Page 15

Highlights from The Work Truck Show 2014

With the goal of getting you to work in the right truck, we attended the 50th annual Work Truck Show to learn about and share the latest in vocational chassis updates, accessories and storage solutions.

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Solar PV has emerged as a commercial adjunct to serve some of Canada's energy needs, but the industry has not come into its place in the sun (so to speak) without a few hiccups along the way.

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Store sales have dropped by over 50% at this supermarket. Intermittent failing computerized checkout cash register systems have created long lineups, with frustrated customers leaving their items behind and stomping out.

21 Using airborne ultrasound & IR technologies for switchgear inspection

Not to be confused with an obstetrician's equipment, airborne ultrasound and infrared (IR) technologies are a perfect match when conducting inspections of switchgear over 1000 volts.

25 How is wind's energetic cost better than solar PV?

Wind turbines and solar PV installations produce more energy than they consume, but how much additional grid-scale storage can these industries afford and still remain net energy providers?



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NAIT expanding essential programs to meet industry demand



As a result of provincial funding announced in Budget 2014, seven high-demand programs at the Northern Alberta Institute of Technology (NAIT, www.nait.ca) will be expanded between now and 2017 to accommodate additional students; among them, Electrical Engineering Technology and Instrumentation Engineering Technology.

“NAIT is pleased the government has allocated additional funding for programs in high demand,” said NAIT president and CEO Dr. Glenn Feltham.

The programs were chosen by the provincial government based on graduate employment outcomes, employer support, labour market demand and student enrolment, explained NAIT.

“These additional spaces are aligned directly with industry’s needs,” added Feltham.

WARNING: Counterfeit UL Mark on ASP photovoltaic panels - 14PN-02

UL (www.ul.com) is notifying authorities having jurisdiction, distributors, installers and users that the photovoltaic panels identified below bear counterfeit UL Marks for the Canada and the United States. The panels have not been evaluated by UL to the appropriate standards for safety.



The warning involves Advanced Solar Photonics (a.k.a. ASP, a trade name for the parent company, Bluechip Energy LLC) models:

- AP-240PK • AP-245MK
- AP-250MK • ASP-390M

N.B. This notice is the same as the notice issued in April 2013, except for the addition of Model AP-250MK.

The products bear a counterfeit UL Mark and one of the markings shown in the photo.

The panels are known to have been sold by SunWorks Solar, but may have been sold by other distributors.

GE opens Global Wind Turbine Drivetrain Repair Innovation Lab

GE (www.ge.com) announced the opening of its Global Wind Turbine Drivetrain Repair Innovation Lab at the site of GE’s Power Generation Repair Technology Center in Albany, N.Y.

The facility is equipped with advanced technologies to support fast development and innovation for repairs to the wind turbine’s gearbox and rotor, says GE, creating a lab environment to simulate and solve problems that previously had to be worked on more than 100 metres in the air and at remote sites.

Technical capabilities of the lab include:

- Rapid prototyping tools, such as 3D printers and computer numerical control machines.
- Robotic welding and advanced machining tools.
- Repair of various gearbox models.
- Turbine generator repair.

“This is the first facility of its kind dedicated to developing repair technologies and capabilities that reduce the life cycle cost of wind turbines,” explained Andy Holt, general manager of global wind projects and services. “Albany was an ideal location for the facility with its close proximity to GE’s renewable energy headquarters, the GE Energy Learning Center, as well as the existing Repair Technologies Center.”

Mitsubishi facility produces its millionth medium-voltage breaker



Mitsubishi Electric Corp. (www.mitsubishielectric.com) says its Power Distribution Systems Centre (PDSC) located in Marugame, Kagawa Prefecture, Japan, has reached a milestone this month with the production of its

one millionth medium-voltage circuit breaker. Congratulations!

The PDSC facility was established as the Marugame Factory in 1979 to produce medium-voltage circuit breakers, such as vacuum breakers and gas circuit breakers. The PDSC’s cumulative shipments of circuit breakers units exceeded one million units in March 2014, the year marking the facility’s 35th anniversary. The one millionth unit was a VF-8/13 model 7.2kV vacuum circuit breaker, Mitsubishi’s main model.

ELECTRICAL BUSINESS is the magazine of the Canadian electrical community. It reports on the news and publishes articles in a manner that is informative and constructive.

Editor
Anthony Capkun - acapkun@annexweb.com

Group Publisher
John MacPherson - jmacpherson@annexweb.com

Account Manager
Scott Hoy - shoy@annexweb.com

Associate Editor
Alyssa Dalton - adalton@annexweb.com

Art Director
Svetlana Avrutin - savrutin@annexweb.com

Production Manager
Kathryn Nyenhuis - knyenhuis@annexweb.com

Subscriber Customer Service Representative
Marie Weiler - mweiler@annexweb.com

President
Mike Fredericks - mfredericks@annexweb.com

 Published by Annex Publishing & Printing Inc.
222 Edward Street, Aurora, Ontario L4G 1W6
Tel. 905-727-0077 • Fax 905-727-0017

Publication mail Agreement #40065710
Return Undeliverable Canadian Addresses to Circulation Department
P.O. Box 530, Simcoe, ON N3Y 4N5
e-mail: mweiler@annexweb.com

United States Second Class Postage paid at Lewiston, NY
(USPS-741-470) US POSTMASTER: Send address changes to ELECTRICAL BUSINESS, P.O. Box 8145, Lewiston, NY 14092

Printed in Canada
ISSN 0013-4244

CIRCULATION: Marie Weiler
e-mail: mweiler@annexweb.com
Tel: 1-866-790-6070 • Fax: 1-877-624-1940
Mail: P.O. Box 530, Simcoe, ON N3Y 4N5

SUBSCRIPTION RATES:
Canada: Single issue \$7.00
12 issues: \$35.00 (includes tax)
USA: \$59.00 (US)
International: \$75.00 (US) per year

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We acknowledge the financial support of the Government of Canada through the Canada Periodical Fund of the Department of Canadian Heritage.





EB letters

 **Handy portable wire pull caddy**

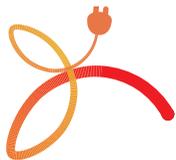
In our December 2013 edition, David Herres presented some neat ideas in his article “Electricians’ tools you can make” (p.22), and we asked you to share your own clever idea for a labour-saving tool or device.

Mark H. from Saskatchewan answered the call with his submission below, so we’re sending him a prize pack that includes a Professional 25-ft FatMax auto-locking tape rule from our friends at Stanley (www.stanleyblackanddecker.com) as well as assorted swag from our friends at GM Fleet & Commercial (www.gm.ca).



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Legrand launches foundation to combat electricity poverty



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legrand

Legrand announced the launch of the Legrand Foundation (www.fondationlegrand.org): a registered non-profit organization that aims to combat exclusion related to a “loss of independence and electricity poverty” while promoting education and employment in the electrical sector.

“The Legrand Foundation represents an initiative that fits perfectly with our responsibility as a company,” said Gilles Schnepf, Legrand Group chair and CEO, and foundation chair. “We wish to contribute to sustainably reducing energy inequality, and to play a driving role for the electrical sector as a whole.”

The foundation is already committed to several initiatives, such as the “Growing old happily at home” project (a pilot scheme intended to support social housing authorities in the field of loss of independence) or the “Impact” program, which is designed to support social entrepreneurs with projects in the field of energy efficiency.

Nova Scotia's COMFIT renewables program undergoes changes

After releasing a review in March, the Nova Scotia government is adjusting the Community Feed-In-Tariff (COMFIT, www.nsrenewables.ca/comfit-review) program.

“We’ve received a lot of feedback on the COMFIT program and we are moving on changes as a result,” said energy minister Andrew Younger. “The program has now evolved to a point where approvals need to be limited while we assess what is technically feasible and cost-effective to integrate into the province’s power grid. We also want to maintain COMFIT’s community focus.”

As of January, 89 COMFIT projects had been approved with a total capacity of 200MW. When launched in 2011, the program’s

target was 100MW. As such, it is not expected that all approved projects will go into production.

No further applications for large biomass and wind projects of more than 500kW will be accepted. Applications already submitted must be finalized before March 21.

COMFIT is designed

for locally based renewable electricity projects, and must be community-owned and connected at the distribution grid. The government has also clarified the program’s definition of “demonstrated community support” for projects.

The next phase will focus on approving smaller projects,

supporting projects being built and developing a renewable-to-retail program.

Based on public feedback, the number of approvals per organization or private partnership will be limited. This will move the focus back to the original goal of community-based projects, adds the government.

Solutions for residential construction

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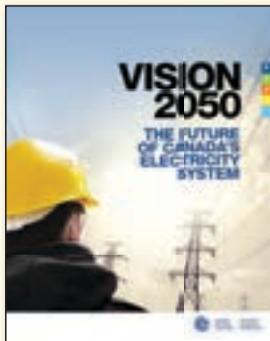
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It's decision time NOW for Canada's electricity system in 2050



The Canadian Electricity Association (CEA, www.electricity.ca) released a new report that, it says, sheds light on the “urgent need for informed decision-making both in policy development and ongoing infrastructure investment” if Canada

hopes to maintain the reliability, affordability and sustainability of its electricity system.

“Electricity infrastructure is replaced only very slowly, and the lead times for planning are long. That means decisions being made today will impact what our system will look like in 2050,” said Jim Burpee, CEA’s president and CEO.

CEA says the report, “Vision 2050: The Future of Canada’s Electricity System” (download below), offers recommendations to governments, regulators, electricity companies and the general public in four areas of opportunity that are likely to produce the greatest transformations:

- Accelerate innovation and customer management of energy
- Implement financial instruments for carbon reduction
- Enable electric vehicles
- Expand collaboration across borders

“Now is the time to act on a coordinated, proactive approach to renewing our country’s electricity grid, ensuring a safe and reliable system for our children and grandchildren,” added Burpee.

Global cartel of high-voltage cable producers nailed by European Commission

The European Commission has found that 11 producers of underground and submarine high-voltage power cables operated a cartel from 1999 onward, for almost 10 years, sharing markets and allocating customers between themselves on an almost worldwide scale. The commission has imposed fines totalling €301,639,000 (nearly \$460 million CDN).

“These companies knew very well that what they were doing was illegal. This is why they acted cautiously and with great secrecy,” said commission vice-president in charge of competition policy, Joaquin Almunia. “Despite this and through joint efforts by several competition authorities around the world, we have detected their anti-competitive agreements and brought them to an end.”

High-voltage power cable producers ABB, Nexans, Prysmian (previously Pirelli), J-Power Systems (previously Sumitomo Electric and Hitachi Metals), VISCAS (previously Furukawa Electric and Fujikura), EXSYM (previously SWCC Showa and Mitsubishi Cable), Brugg, NKT, Silec (previously Safran), LS Cable and Taihan all participated in illegal agreements.

“Nexans will review the voluminous decision in detail to determine its next course of action, which could include appeal,” said Nexans in a released statement. “The group will evaluate the consequences of the decision for possible follow on claims, as well as the impact of this decision and other recent developments in the other ongoing competition authority investigations in the same cable sector in the United States, Canada, Brazil, Australia and Korea...”

Six European, three Japanese and two Korean producers were involved in the cartel. Several companies that took part in the infringement and later merged their activities into joint ventures are also held liable, as well as parent companies of the



producers involved, because they exercised a decisive influence over them. This includes the investment company Goldman Sachs, the former owner of Prysmian.

“Prysmian believes that the decision is based on a superficial and erroneous analysis of the relevant facts and, therefore, considers the decision unlawful. Accordingly, Prysmian intends to bring an appeal before the Tribunal of the European Union,” said the company in a released statement.

The investigation revealed that—from 1999 to the inspections carried out by the commission in January 2009—these producers entered into mutual agreements according to which the European and Asian producers would stay out of each other’s home territories, and most of the rest of the world would be divided amongst them. In implementing these agreements, the cartel participants allocated projects between themselves according to the geographic region or customer.

ABB received full immunity for revealing the existence of the cartel to the commission, thereby avoiding a fine of €33 million for its participation. J-Power Systems and its parents Hitachi Metals and Sumitomo Electric received a 45% reduction of the fine for cooperating with the investigation under the commission’s Leniency Notice. This reduction reflects the timing and level of their cooperation, and the extent to which the evidence they provided helped the commission to prove the cartel. In addition, the latter three companies received partial immunity for the first two years of their cartel involvement, as they were the first to submit evidence to the commission on the existence of the cartel during that period.

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Alderville First Nation 5MW solar farm receives \$1.25M boost

The Alderville First Nation solar farm project (www.aldervillefirstnation.ca)—which claims to be Canada’s first alternative energy project fully owned by a First Nation community—is one step closer to completion after a \$1.25 million boost from the government.

Featuring 2300 solar panels on 45 acres of property, the Ontario solar farm will create 25 community jobs during its construction phase. It is estimated to generate more than \$56 million in revenue for the community over 20 years.

“We are proud of our renewable energy project, which will bring a sustainable revenue stream to our community. At the same time this project will allow this community to contribute to Canada’s

economy now and in the future,” added Chief James Marsden, Alderville First Nation.

The federal funding is part of the Community Economic Opportunities Program, which provides project-based support to “those First Nation and Inuit communities that have the best opportunities for public services in economic development”.

“From the start, I have watched with eager anticipation as the members of Alderville First Nation embarked on this tremendous journey to construct the mega solar farm, a first of its kind in Canada,” said Rick Norlock, MP Northumberland-Quinte West. “Your passion and determination to see this project through from start to finish is truly inspiring.”

Celebrating a 2-million milestone with Habitat for Humanity Canada

Schneider Electric Canada (www.schneider-electric.com) says it has reached a milestone in its relationship with Habitat for Humanity Canada (www.habitat.ca): with a recent donation of \$230,000, Schneider has donated close to \$2 million in equipment and monetary contributions since 2004.

The company has long been affiliated with Habitat, taking part in builds, and providing support with cash and in-kind donations. Watch our video at bit.ly/QAJ3f1 to learn more.



Schneider Electric Canada president Daniel Peloquin presents Kevin Marshman, president & CEO of Habitat for Humanity Canada, with a \$230,000-donation at Schneider's Mississauga, Ont., office.

Litemor client? Find a new Take Back the Light supplier!

While announcing its Fiscal 2013 full-year and Q4 results, industrial distributor HD Supply Holdings Inc. (www.hdsupply.com) revealed it has decided to dispose of its Litemor business (www.litemor.com), a specialty lighting distributor included within the HD Supply Canada business.

The Recycling Council of Ontario, however, (www.rco.on.ca) noted Litemor is a registered Take Back the Light (www.takebackthelight.ca) supplier. Through the end of May, Litemor clients can continue to obtain lighting products and Take Back the Light recycling from HD Supply by contacting lisa.wilson@hdsupply.com or (905) 850-4345 ext. 74609.

Starting June 2014, Litemor clients should visit takebackthelight.ca for a complete list of registered lighting distributors that will provide lighting products and recycling through the Take Back the Light program.

As a result of the intent to dispose of the business, Litemor is being reflected as a discontinued operation for all periods presented, explained HD Supply. The company expects to incur a charge within

discontinued operations of between \$10 million and \$25 million during fiscal 2014 for the disposition of the Litemor business.

The remaining HD Supply Canada business, Brafasco (an industrial MRO distributor specializing in fasteners, power tools and safety products), will be integrated with HD Supply White Cap, noted HD Supply.

Manitoba's new workplace health & safety protections coming into force

New protections will soon be in place to increase the safety and health of new workers and those in high-risk occupations—along with stronger penalties for employers who are found to put workers' safety at risk—said Manitoba's labour and immigration minister, Erna Braun.

"Every worker deserves to come home safe at the end of the day. These amendments will help build a stronger safety culture by providing for stop-work orders and immediate penalties for unsafe workplaces, and ensuring that new workers have the information they need to be safe at work, and understand their safety and health rights," said Braun.

The new and amended provisions of the

act and regulations came into effect April 1, 2014, and incorporate changes recommended by the Minister's Advisory Council on Workplace Safety and Health during the 2012 review of the act. They include:

- Providing immediate fines for activities presenting an imminent risk to workers or for backsliding to unsafe conditions after complying with an improvement order.
- Penalizing employers that prevent workers from exercising their legislated safety and health rights.
- Providing Manitoba Workplace Safety and Health the authority to issue a stop-work order to prevent an employer from engaging in a specific task anywhere in the province if that task may place workers at imminent risk of serious injury or illness.
- Clarifying employers' duties to provide workplace-specific safety and health orientation before a new worker begins work at a workplace, or returns to a workplace where the hazards have changed during his absence.
- Outlining the role and scope of Manitoba's new chief prevention officer position, including the requirement for an annual injury and illness report.
- Clarifying the criteria for granting an exemption from a regulatory provision or safety and health committee requirement for multiple workplaces.

Under the legislation, employers will be required to ensure that each safety and health representative or committee member is trained to competently fulfill his duties. Manitoba Workplace Safety and Health is explicitly required to take into account information provided by affected parties when making a decision with respect to appeals, exemptions and variances.

Visit bit.ly/OFiqov for information on all of the changes. **EB**

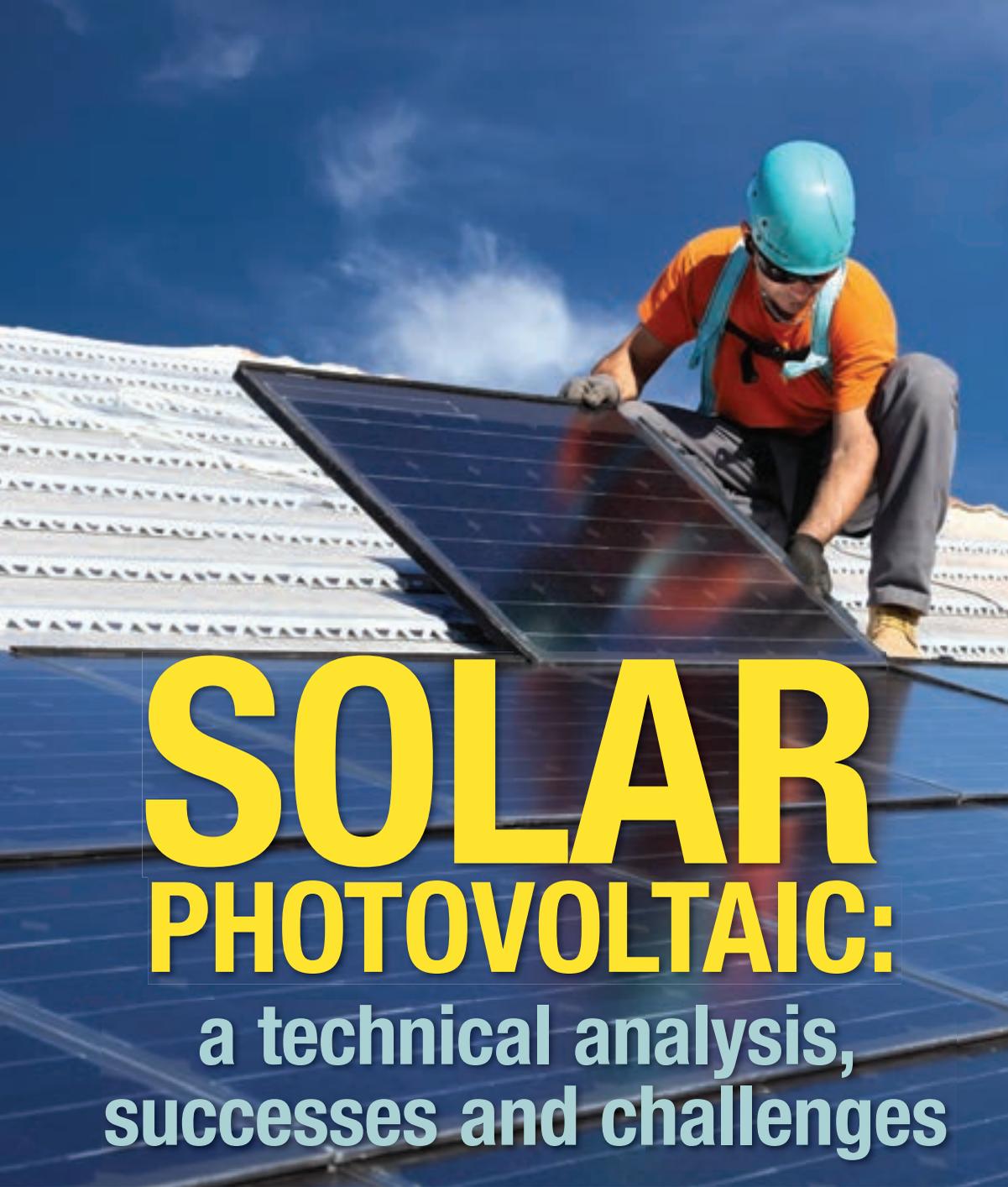
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SOLAR PHOTOVOLTAIC:

a technical analysis, successes and challenges

John Salmon

Electrical solar energy production through solar photovoltaic is said to have been invented by French scientist Edmond Becquerel in 1839. He discovered the PV effect while experimenting with an electrolytic cell made up of two metal electrodes placed in an electricity-conducting solution. He concluded that electricity generation is increased when exposed to light.

In 1876, William Grylls Adams and Richard Evans Day discovered the element selenium produces electricity when exposed to light. Although selenium solar cells failed to convert enough sunlight to power electrical equipment, they proved a solid material could change light into electricity without heat or moving parts.

From these humble beginnings, solar PV has emerged in Canada as a commercial adjunct to serve some of our energy needs.

Technical, regulatory, codes and standards challenges

In Ontario, the Green Energy Act supercharged the development and deployment of Ontario-based energy generation facilities in the forms of large solar farms and smaller micro-generation residential systems that interactively feed back into the grid... private

enterprise and homeowners were permitted to sell back energy from the sun.

The *ready-fire-aim* approach to solar PV installations was unlike anything we had seen before in the industry; it created safety issues, technical challenges and subjective wiring methods that led to—in some cases—fatalities, premature system failure, shocks, falls from heights, and fires.

Some of the technical challenges included keeping pace with solar PV hardware development and timely approval of that equipment in the Canadian Electrical Code (CEC)-Part 2 (the standard used to set the manufacturing and testing criteria for electrical products and equipment). Some of the products were from Europe and Asia, and not necessarily CSA-approved.

The direct current produced by solar PV modules, for example, behaves much differently than alternating current. As such, overcurrent devices like fuses and circuit breakers needed to be designed differently. (You can literally take the flying leads of a solar module, touch the two bare output leads and an arc will strike so long as the sun is present. By comparison, AC would create a short circuit, and current would cease to flow.)

Early in the application of hardware, new power distribution systems (now called combiner boxes) were not commercially available, and standards were not in place for their design. In some cases, devices had an AC rating but no DC rating; connections were made incorrectly and the voltages exceeded the rating of the devices, leading to fires. Some of the equipment started to fail prematurely due to arc flash and carbon tracking.

The temporary approval of cables and inverters was required to allow installations to move forward and receive acceptance from authorities having jurisdiction (AHJs). CEC-Part 1, meantime, had to develop a whole new section to deal with solar PV installation requirements: Section 50. Steve Douglas (QPS Evaluation Services Inc.) and I headed up that section's development. The subcommittee worked tirelessly to create and update the section, as field installation practices were being done on the fly, and new wiring methods were being pioneered.

There are currently discussions around the necessity of arc detection for improving the safety performance of solar PV systems. Were an arc to occur and be allowed to escalate due to the lack of detection and isolation through an output contactor, any combustible surface could catch fire. (I predict increased instrumentation and other innovative solutions will further contribute to the electrical safety and improved performance of solar PV systems.)

Manufacturers responded quickly to meet these challenges, racing to develop products that meet these technical challenges.

Meantime, Ontario Electrical Safety Authority's (ESA's) code engineers Ted Olechna and Nancy Hanna—along with input from technical advisors and inspectors—created an ESA Bulletin to communicate the burgeoning requirements to meet the explosion of work generated by the Green Energy Act.

The Bulletin was subsequently tweaked by the CEC-Part 1 Section 50 subcommittee, then sent to the CEC-Part 1 voting committee, where the language and illustrations became part of Section 50 Canada-wide. (This was a great example of the development process of codes and standards for fire, shock and property protection, and sustainability to meet the goal of protecting both workers and consumers.)

In 2013 and 2014, the CEC-Part 1 committee voted to merge Section 50 with 64 to combine solar PV with all other forms of renewable energy, thereby aligning requirements and reducing overlap (and underlap) in the rules for electrical installations. (I know this will be an interesting topic for the CEC-Part 1 committee in Charlottetown this June at the CSA annual general meeting.)



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THE SOLAR PV CHALLENGES FOR FIREFIGHTERS

In 2011, I was invited by Armen Kassabian and Eerik Randsalu (fire protection engineers at the Office of the Ontario Fire Marshall) to speak about solar PV electrical hazards to firefighting leadership from across Ontario. The potential for injury is very real, and safety countermeasures needed to be considered.

One of the firefighters' concerns was the shock hazard associated with a solar PV system on the roof of a home or farm. At best, only anecdotal information was available, and many questions needed to be answered: How do you turn the power off? Can a firefighter get shocked while spraying water directly on a solar PV module? How do firefighters cut holes in the roof to vent attic areas? Can the modules and wires be cut safely?

This was uncharted territory, and policies and procedures were either underdeveloped or non-existent. Historical incidents and near misses were discussed, and the need to develop policies, procedure and safe practices were openly debated in an effort to develop best practices.

One of the incidents discussed involved a residence that caught fire one evening (unrelated to the solar PV system). The fire was subsequently extinguished, but the wires leading from the modules had melted together, creating a short circuit. The following morning was bright and sunny, and the modules started producing current. As you probably guessed, an arc started at the point where the wires were damaged. This started a new fire, and firefighters were called out again.

The DC current produced by solar PV modules will arc indefinitely. Water will not extinguish the source of the fire. The only way to stop the arc is to cover the solar modules with a dark tarp to stop the production of energy. (I suggested we need manufacturers to provide an automatic blind to isolate energy for lockout, removal of snow, cleaning and improved safety performance but, as with all things, the cost of such a thing would have to be weighed against the purported safety benefits.) **EB**

Technical, environmental, civil and mechanical challenges

Beyond the electrical requirements, rooftop solar PV installations presented a host of new challenges—including all of the environmental, civil and mechanical requirements—that had to be considered because they were neither part of the building code nor addressed in a CSA standard:

- Structural analysis of the building itself. Could it support the weight of a solar PV system? What about the effect of wind?
- Structural analysis of the racking.
- Flammability of mounting systems.
- Preventing rooftop water penetration.
- Climbing hazards associated with the installation.
- Avalanche hazards (due to snow and wind loads).
- Safe roof access for first responders (e.g. firefighters) in the event of an emergency and maintenance personnel (e.g. electricians, window cleaners).

These were serious issues being faced by engineers and engineering firms charged with approving solar installations against the backdrop of building codes and municipal specifications.

At the CSA annual general meeting in Victoria, B.C.—with input from industry standards development experts and CSA leadership—standards volunteers were asked to develop a non-electrical best practice guideline for solar PV installations.

The result was the creation of SPE-900-13 “Solar photovoltaic rooftop-installation best practices guideline”. Its scope was predicated on the “need in the Canadian marketplace for guidance on solar photovoltaic rooftop installation, as photovoltaic modules are not currently addressed in many of the building codes”.

The challenges for trade: who should do the work?

It was “like we just invented electricity”... That’s what a colleague of mine said when the solar PV industry began to get traction, and the Green Energy Act created jobs and the trade jurisdiction hit the forefront.

The trade requirements for the electrical work became a hot topic of conversation between the solar industry, regulators and government, and licensed electricians and electrical contractors. As the codes and standards chair of the Canadian and Ontario electrical contractors associations (CECA and ECAO)—as well as chair of the Electrical Contractors Registration Agency (ECRA/ESA)—I found myself in the middle of the debate as to who is “qualified” to do the work.

On one side, Canadian PV solar supporters suggested we need a ‘new trade’ of ‘practitioners’ to handle the entire installation. On the other side, electricians and electrical contractors, ECAO, Ontario Electrical League (OEL) and others (e.g. Construction Council of Ontario) banded together to persuade the government and AHJs to recognize that solar PV installations are electrical work.

The latter camp argued electricity is not new; solar modules are simply generators and hazardous voltages can injure unskilled workers just like all the other electrical installations that fall under the Canadian Electrical Code.

Meantime, the rest of Canada watched closely to see where the dust settled on this controversial issue.

The jurisdiction dispute was jointly discussed across three ministries (Labour; Training, Colleges & Universities [MTCU]; Consumer Services), and the final result rendered the decision that most of the electrical work was to be performed by electricians, and that improved training for the trade was necessary to ensure journeypersons and apprentices were aware of the hazards associated with working with solar PV.

I worked with a team of experts to support the MTCU with the training development curriculum for apprentices and electricians. Through the National Electrical Trade Council (NETCO), CECA worked with CSA to develop a Canadian Certification for Construction and Maintenance Electricians for Solar Photovoltaic Systems. (This whole exercise was a great example of the importance of governments engaging stakeholders in an effort to render wise decisions.)

Successes and the future of solar PV

Any time we can sustainably create renewable, clean energy is an obvious success for Canada. The future of solar PV needs to be one of continuous momentum. Manufacturers, governments, media agencies, tradespersons, business and financial development organizations, and others need to work together to continually challenge themselves to discover new and more efficient ways to meet our energy needs today and tomorrow. **EB**

John B. Salmon, ME, is a licensed construction and maintenance electrician, and a master electrician. He is currently an electrical contractor and the vice-president at Electrical Contractors Association of Ontario (ECAO) and Chair of Ontario’s Electrical Contractor Registration Agency (ECRA). A voting member on the Canadian Electrical Code Part 1, John also represents both ECAO and the Canadian Electrical Contractors Association (CECA) as the Codes & Standards chair.



ONTARIO’S GREEN ENERGY ACT HITS A HURDLE

The World Trade Organization (WTO) ruled in 2013 that Ontario’s Green Energy Act—which paid lucrative prices for renewable power on the condition of 60% domestic (i.e. Ontario) content—violated international trade agreements.

One member of the WTO ruling panel believed Ontario’s FIT (feed-in tariff) and microFIT measures were, in fact, government subsidies, “because the pricing offered to relatively high-cost and less-efficient FIT and microFIT generators under the FIT and microFIT contracts enabled them to enter the wholesale electricity market when they would

otherwise not have been able...”.

That requirement was the government’s strategy for bringing manufacturing and jobs back to Ontario, saying “The requirements had been put in place as a temporary measure to help spur the growth of Ontario manufacturers and service firms in the renewable energy industry”.

The province added “Strong growth in the sector means the measure is no longer required” and—much to the chagrin of solar PV manufacturers who located their production facilities in Ontario—said it would comply with the WTO ruling. **EB**

OTDC switches, a compact, high performance DC switch range.

OTDC is **simply optimal**.

Introduction

Renewable energies offer us infinite sources of power with minimum environmental impact. ABB, as a leading manufacturer in the energy industry, has developed several products for these applications.

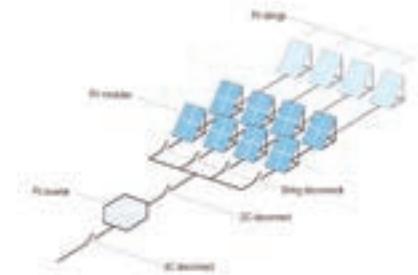
ABB's complete portfolio for the solar photovoltaic (PV) segment comprises many product lines including disconnect switches, contactors, surge arresters, and circuit breakers.

This documents outline the technical features of the OTDC disconnect switches and show why they are an optimal choice for use in PV installations.

Application description

Solar photovoltaic systems convert solar radiation into clean electricity using PV-panels. Due to the low output of a single panel, a number of PV-panels are usually series-connected for higher voltages and parallelconnected for higher currents.

Disconnect switches can be used to isolate parts of the PV-array, for system grounding or for switching possible energy-storage circuits.



System voltages

PV Systems are migrating to higher voltages in order to improve efficiencies. Higher voltages reduce resistive losses. Many systems are reaching voltages up to 1000 VDC with the trend to exceed even this in the future.

Breaking direct current

ABB switches are already widely known for their outstanding performance in AC applications. From the switch perspective, however, the DC side is more challenging.

DC by nature is generally more difficult to interrupt than AC because direct current has no natural zero crossings. Alternating current contains two zero crossings per cycle. Direct current must be artificially forced to zero. Whenever a switch is opened under DC load, the current does not stop immediately, but continues to flow over the open gap between the switch contacts via a low energy arc.

The current flow stops only when the voltage over the arc becomes high enough. Due to the extreme temperature of this arc (up to 20,000 K), it is vital to suppress the arc and break the current as quickly as possible.

The solution: OTDC

DMB© - Dual magnetic breaking

The Dual Magnetic Breaking (DMB) design breaks the circuit in two places, increasing the air gap while reducing the time to circuit isolation, enabling the high voltage rating with the smaller two pole footprint. Permanent magnets pull the arc into the arc chutes for quick extinguishing, ensuring breaking across the full ampacity range.

The ideal DC switch

Previously DC switches required up to six poles wired in series in order to break 1000 VDC. By nature, PV applications have only two wires to break. By achieving the 1000 VDC rating with a compact, two pole configuration, ABB provides the ideal switch for the solar industry: a two pole switch for a two pole application.

Fast and easy installation

Thanks to a symmetric pole design, OTDC switches are independent of polarity. This allows the user to choose the direction of the current flow and make the connections in either way.

Safe and reliable

ABB's OTDC switches are not vulnerable to transient voltages and the operation is user-independent (quick make-quick break). OTDC is the only DC disconnect switch in the market with visible contacts, giving a reliable position indication.



Ellie Radmanesh
Product Manager - Disconnect Switches
Phone: 1-514-4203100 ext. 3267
elham.e.radmanesh@ca.abb.com



Two-pole DC switches?
Absolutely.



OTDC from 100 to 400 Amperes has a two-pole construction with a rated operational voltage of 1000 V. This is possible thanks to a highly optimized design and dual magnetic breaking, which optimizes breaking power across the entire current range. UL98B versions are available and additional pole configurations are possible for more flexibility in the installation. OTDC enhances the safety and reliability of your PV system. www.abb.ca/lowvoltage

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Computerized checkout system prevents paying customers *from paying!*

Patrick J. Lynch, P.Eng.

Store sales have dropped by over 50% at this supermarket. Intermittent failing computerized checkout cash register systems have created long lineups, with frustrated customers leaving their items behind and stomping out.

This was an ongoing problem for the last six months at just one supermarket out of a chain of 700 stores across the country. What is different at this store? What could be causing this problem?

The supermarket's head office IT group had been visiting the store at least three days a week for the last five months trying to find a solution to the problem. It was the usual story: they had replaced all the major components within the system (e.g. computerized cash registers, scanners, servers, etc.) but the problems persisted.

Note: each computerized cash register system was fed from its own separate UPS (uninterruptible power supply) system and plugged into a dedicated orange insulated ground receptacle. All these cash register systems would randomly fail—'hang-up' and require a 10-minute system reboot to start working again. So what's the problem?

1. Poor power or grounding?
2. Computer component issues?
3. Computer programming?
4. Environmental?
5. System layout?

6. Industrial sabotage?
7. Combination of above?

Findings

This supermarket is located on the lower level of a very large (mega) shopping mall. There are stores on either side, as well as stores above. Could one of the adjacent stores' electrical equipment be causing these problems?

Some of the anomalies our group found during our initial survey were (refer to Figure 1):

1. ATMs and bank vault (security systems) located directly above this store (potential RF source).
2. Large, fully automated and computerized mall directional signage located directly above the store (also potential RF source).
3. Large 800A single-conductor (coreflex): 3-phase power cable feeders—for other stores—located in the enclosed ceiling space above the supermarket (potential low-frequency magnetic field source).
4. Metal Hot and Cold air ductwork in the ceiling space for the store, with about 10A of measured ground current flow on it (potential low-frequency magnetic field source and computer pin 1 ground cable interference problems).
5. Exit walk-through customer theft detection systems (potential RF source).
6. Overhead water piping system for fire sprinkler with 15A continuous 60Hz

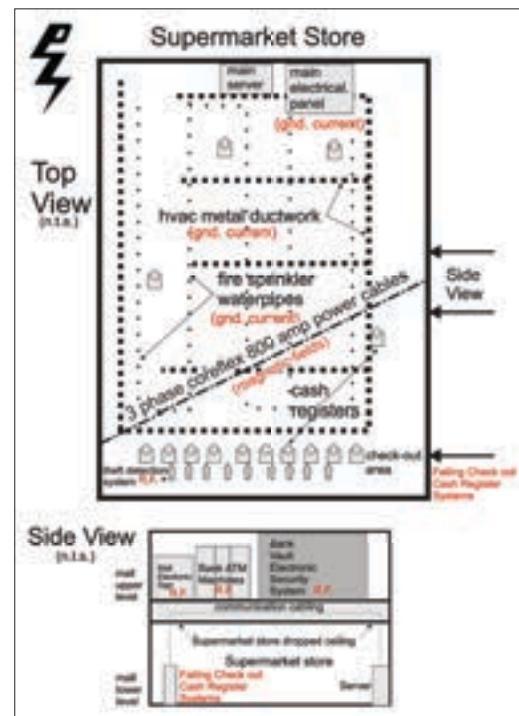


FIGURE 1

current flow on it (potential low-frequency magnetic field source and computer pin 1 ground cable interference problems).

7. At the store's main electrical service, 20A of measured ground current (potential low-frequency magnetic field source and computer pin 1 ground cable interference problems).

Is one of these the culprit, or could it be something else altogether?

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UL/CSA Listed as complete unit: box, bracket, drop wire



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F101GC Single gang



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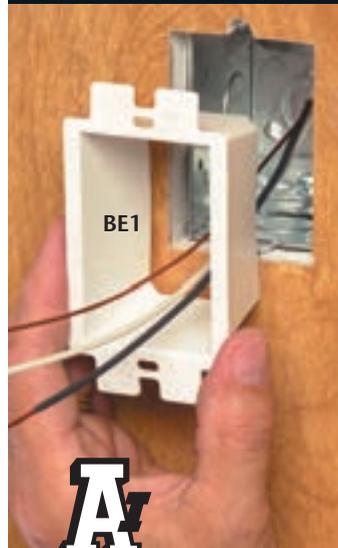
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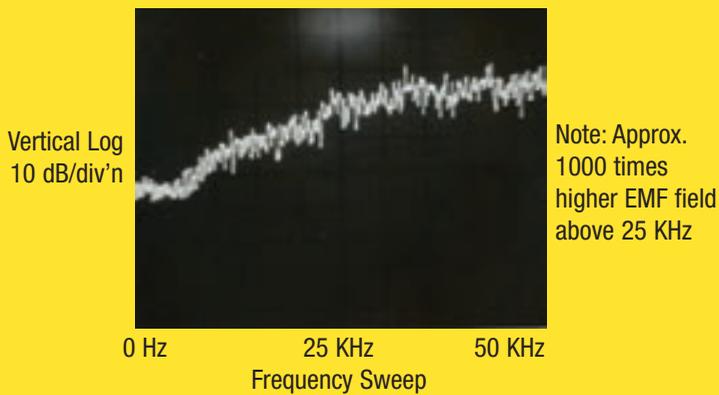


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FREQUENCY SPECTRA EMF FIELD PLOT

FIGURE 2



Consider also that some cash register systems, located in other areas of the supermarket, were not affected at all. They were 100% operational. The plot thickens!

Problem solved?

After reviewing all this preliminary information, we decided to perform a complete low- and high-frequency scan of this entire store and plot the results. Low-frequency scan plots at the 3-ft level (cash register height) were found to be at relative low

levels. High-frequency scan plots were 1000 times higher near the store's front checkout registers, as well as at other points within the store.

Using RF triangulation techniques, we narrowed down the primary high RF source to one of the refrigerated cooling systems within the store.

Turning off this cooling system completely eliminated the high RF levels and returned all the cash register systems to 100% operational status.

The problem was solved... but only temporarily. Further investigation revealed the store's IT group had specified this computerized cash register system be interconnected using Cat 5 unshielded communications cabling.

We suspected this unshielded cabling in the enclosed dropped ceiling space was laid out "at some point" alongside the power cabling feeding this 'noisy' refrigeration system. High-frequency RF electrical interference generated by this refrigeration system power cabling was then 'capacitively coupling' into the unshielded Cat 5 communications cabling. This 'coupled' electrical interference on the communications cables then caused these computer systems to randomly crash.

As a temporary stop-gap measure, this refrigeration system was re-fed power and energized with new power cables separated from the communications cabling system. As anticipated, all the computerized systems remained 100% operational. This complete refrigeration system will eventually be replaced with a new one.

The end result

All cash register systems are now 100% operational, and the store is attempting to recover its lost customer base. A few action items remain, and the client has asked us to provide additional assistance to their groups in resolving the following issues:

1. While they weren't the cause of the computer problems, stray low-frequency ground current issues still need to be sorted out.
2. The IT group will be changing their communications cabling specification/installation and site inspection protocols.
3. Corporate head office will be adding a very comprehensive electrical disturbance specification for any future chain store equipment purchases. **EB**

Patrick J. Lynch, P.Eng., has been the president of Power Line Systems Engineering Inc. since 1986. He graduated Electrical Engineering from the University of Waterloo in 1975, and has successfully directed Power Line's completion of over 1100 complex electrical engineering site disturbance investigations around the globe. Visit www.powerlinesystems.ca.

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INNOVATION HITS THE ROAD

Vehicle highlights from The Work Truck Show 2014

Alyssa Dalton

Bold and powerful—the work truck is more than a simple truck.

Transporting products, tools, safety equipment and documentation, it has become a primary office for many workers on the move. Customization options are endless—with a plethora of warning lights, security locks, caps or tonneaus, storage systems and towing accessories to choose from. Trekking through any environment to get you where you need to be, this trusty vehicle is an integral member of the team.

It is also the largest expense your business will take on.

With the goal to help you and your crew get to work with the right work truck, we attended the 50th annual Work Truck Show earlier this year. We visited dozens of industry heavyweights who showed off new trucks, the latest in truck accessories, chassis updates, new vehicle storage solutions and more on the bustling show floor. Here is a roundup of the news you need to know.

PHOTOS COURTESY MERCEDES



2015 Sprinter 4x4 van gears up for North American market

Showing off its 3.0-liter Bluetec V6 diesel powertrain with 188 hp and 325 lb-ft of torque, the Mercedes 2015 Sprinter (www.thesprinter.ca) 4x4 van made its North American debut at Work Truck Show 2014. While the 4x4 is not officially considered an off-roader, the all-wheel

drive system can be activated at the push of a button—distributing torque at a ratio of 35:65 between the front and rear axle. The standard load-adaptive ESP that is unique to the Sprinter is always active when all-wheel drive is engaged, says the automaker, noting that an optional low range gear makes the van even more sure-footed in difficult terrain. Both 144-in. and 170-in.

wheelbases will be available in low and high roof configurations for passenger, crew and cargo van specifications. New safety features such as Collision Prevention Assist, Blind Spot Assist, Highbeam Assist and Lane Keeping Assist, as well as bi-xenon headlamps, fog lights, a headlamp cleaning system and a heated windshield boast improved driver safety.



PHOTO COURTESY RANGER DESIGN



PHOTO A. DALTON

Ranger's Max Rack drop-down ladder system boasts single-motion operation

Ranger Design (www.rangerdesigninc.com) debuted its Max Rack drop-down ladder rack for cargo vans. The solution features single-motion operation that promises to protect the operator and the vehicle—lowering up to 50 in. in a single motion with the operator out of the path of the descending ladder. The standout feature of its design is its ease of operation, says the company, adding that no secondary motion is required to lower the rack.

Watch a demo video of the drop-down ladder rack here: bit.ly/RruJGA. *continued on page 18*

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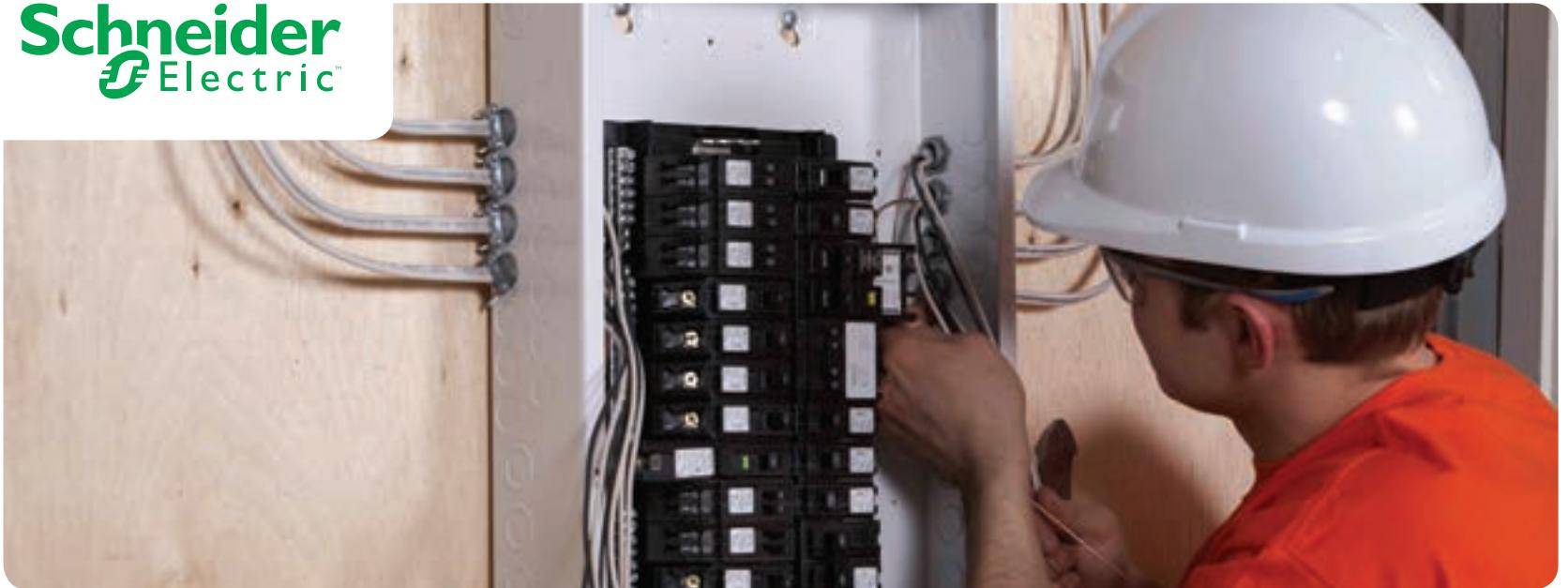
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PHOTOS A. DALTON

Ford kicks off commercial truck refresh with all-new F-650/F-750

Ford (www.ford.ca) said it has set a new standard in commercial work trucks with the new F-650/F-750, which claims to be the toughest and most work-ready Ford medium-duty trucks ever. The 2016 model will anchor the automaker's commercial truck lineup, which will see a complete refresh of every truck and van over the next 18 months, says Ford in our video: bit.ly/RrnuOM.

"Every day, we're thinking of new ways to better serve our hard-working customers," says John Ruppert, general manager, commercial vehicle sales & marketing. "The same Ford engineers who developed the best-selling F-Series have designed this all-new medium-duty lineup that can meet the demands of our toughest customers with trucks

that are cost-effective, ready for work, and, most importantly, can help keep them going on the job."

Available in three cab styles—Regular Cab, SuperCab and Crew Cab—and three models—straight frame, dock height and a new dedicated tractor model for heavy towing—users can choose between the 6.7-liter Power Stroke V8 diesel with 6-speed TorqShift automatic transmission or a gas-fueled 6.8-liter V10 with a 6-speed automatic. According to Ford, the engine's compacted graphite iron engine block and so-called reverse-flow layout—which places the exhaust inside the engine's V-shape while the air intake is positioned on the outside of the V—helps improve turbo responsiveness, isolate the engine's hottest temperatures, and reduce noise, vibration and harshness.

A new mesh grille framed by hallmark Ford

nostrils helps improve airflow for optimal cooling performance, says the automaker, adding that it also features new sharp fenders and aerodynamic headlamps. PowerScope trailer tow mirrors offer standard and spotter mirrors, and power telescoping and folding design. The area behind the cab was also redesigned to more easily accommodate custom work bodies, such as tow truck bodies.

New interior features include a 110V power outlet, multifunction steering wheel and optional Crew Chief fleet management telematics.



Mitsubishi Fuso Canter FE130 sports increased 700-lb GVWR

Mitsubishi Fuso Truck of America (MFTA, www.mitfuso.com) introduced its Canter FE130 work truck—its new entry into the Class 3 segment boosts GVWR and body/payload capacity 700 lb over the previous FE125 model.

According to the company, the boost in GVWR is actually the second part of a program to expand the utility and versatility of its Class 3 offering. In making the introduction, Todd Bloom, president and CEO, says, "Strategically, this new truck is a direct result of our continuing efforts to improve and refine our products to provide increasing value to Fuso owners." Watch more in our video: bit.ly/1eNkdE4.

The FE130 boasts a 13,200 lb GVWR, while individual axle ratings are 5360 lb front and 9880 lb rear. Describing the additional 700 lb as the "single greatest advantage" of the FE130, Bloom says the increase in body/payload capacity allows the operator to carry more in each trip, thereby reducing overall transportation costs.

"While the horsepower and torque rating of the engine haven't changed, MFTBC [Mitsubishi Fuso Truck and Bus Corporation] engineers have been able to make refinements to the programming that manages the complex interactions among engine operating



PHOTOS A. DALTON

parameters, transmission shift points and emissions control system behaviour," adds Leighton Good, manager of product and application.

To simplify daily checks, the company said it will make a running change early in the model year to relocate the engine oil dipstick to the driver side, allowing the oil to be checked without tilting the cab. The new dipstick location is intended to encourage Canter owners and operators to perform regular pre-trip fluid checks as an integral part of a professional maintenance program.

The DEF tank cap colour will also be changed to bright blue to reduce the risk of something other than diesel emissions fluid being added to the DEF tank.





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PHOTO COURTESY SORTIMO BY KNAPHEIDE



PHOTO A. DALTON

Sortimo unveils Exxpand storage solution for mobile workers

Describing it as a premier van storage solution for mobile technicians, Sortimo by Knapheide (www.sortimo.knapheide.com) launched Exxpand to help workers organize their vans and operations.

Shelf Staxx van shelving units boast flexible configuration and layout, and feature pultruded composite end panels which are lightweight but still maintain solid strength to weight ratio. Boxxes help organize work equipment and transport it to your worksite in the most efficient way possible, says Sortimo. As the core of the Exxpand system, all Boxxes are interchangeable and lock into Shelf Staxx for secure transportation. Axxessories allow storage space customization and create a personalized work environment, describes Sortimo, adding that Axxessories have a vocational focus and each one has a specific function to make storage solutions easy. Protexx partitions divide the van into two separate zones: the passenger area, which doubles as a mobile office, and the cargo area for storing parts and tools. According to Sortimo, they also offer an extra level of safety and security in the event of an unplanned stop. Roof Raxx secures ladders, conduit, and other long materials on the roof of the van. Constructed primarily of aluminum extrusions, Roof Raxx boast a lightweight design in a range of offerings to suit different vehicle and storage needs.

Watch our video of the Exxpand debut here: bit.ly/P8aoUz.

XL Hybrids debuts XL3 hybrid electric powertrain

XL Hybrids (www.xlhybrids.com) unveiled what it says is the first upfitted hybrid Ford E-350 cutaway chassis. Now available for Class 1 to 4 commercial fleets up to 14,500 GVW—such as van body, utility and walk-in vans—the system installs in just five hours, says XL Hybrids, and has zero impact on fleet operations because there are no special plugs, charging or fueling infrastructure, driver training, or maintenance requirements. “This opens up opportunities for fleets operating cutaway and strip chassis vans to get a 25% increase in miles driven per-gallon, reduce carbon dioxide emissions by 20%, and see an attractive return on their investment,” says Tod Hynes, president and founder. It is now available on the Ford E-350 cutaway and Ford E-450 cutaway, and is coming soon to the E-350 and E-450 stripped chassis and GMC 3500/4500 cutaway chassis, says the powertrain manufacturer.



PHOTOS A. DALTON

Customize upfits with Weather Guard van configurator

Werner Co. showcased its Weather Guard Custom Van Configurator (www.weatherguard.ca), an online interactive tool that both consumers and distributors can use to build custom

van upfits. Using integrated intelligence, the configurator ensures the accuracy of each vehicle and product placement for proper fit, it says. To create a configuration, the user selects a vehicle make and model from a list of van offerings—including Chevrolet, Ford, GMC, Mercedes-Benz, Nissan and Ram—and places the desired partitions, racks and bins, shelving and ladder racks for a personalized quote. Popular van packages can also be saved for future reference and quoting.



PHOTO A. DALTON

Freightliner named first NA OEM to offer Allison's FuelSense package

Freightliner Trucks (www.freightlinertrucks.com) announced it will be the first North American OEM to offer the new Allison Transmission FuelSense package in medium-duty trucks—boasting up to 20% less fuel consumption. Its features include: 5th generation smart controls, acceleration management, and a precision inclinometer; EcoCal shift technology to help keep engine speed efficient; Dynamic Shift Sensing to automatically sense when low-engine speed shifts can be made; and Neutral at Stop to save fuel and reduce emissions when the vehicle is stationary. “We value our relationship with Allison and have a common commitment to maximizing the performance of work trucks and the profits of the businesses that depend on them,” says Mary Aufdemberg, director of product marketing for Freightliner. Available in late 2014, the new package will be featured in Freightliner M2 chassis equipped with Allison 2000 and 3000 series transmissions. **EB**



PHOTO COURTESY ALLISON TRANSMISSION



Using airborne ultrasound & IR technologies for metal-clad switchgear inspection

Sean Miller

Airborne ultrasound and infrared (IR) technologies are a perfect match when conducting inspections of switchgear over 1000 volts. At this voltage class and higher, thermal anomalies—as well as corona and tracking conditions—can occur, all of which threaten the reliability of the equipment being inspected. Typical switchgear at this class include load interrupter switches, breakers, transformers, motor starters and terminal transition cabinets.

This article presents case studies highlighting over 10 years of switchgear inspections performed by Jim Brady of Brady Infrared, including thermal images. Fast Fourier Transform (FFT) and time waveform screenshots of recorded sound files of corona and tracking will be integrated into this article to show their relationship in problems that occur in this type of electrical equipment, and how the use of ultrasound (hereafter meaning 'airborne') and IR



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FIGURE 1
Corona activity advancing to the tracking stage on insulation board resting on 13kV bus. Notice the carbon deposits and light brown discoloration of the insulation board on the right.



FIGURE 2
White powder and discoloration on cables.

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When ultrasound and infrared are used together, an inspector is given a greater chance of detecting anomalies that could potentially be missed when relying on just one single technology.

technologies together can help identify potential failures in metal-clad switchgear before they become catastrophic.

Electrical equipment

Metal-clad switchgear can be seen as all live electrical parts enclosed in grounded metal compartments. Traditional inspection of metal-clad switchgear is performed by non-contact IR cameras.

In recent years, ultrasound instruments have been added to these inspections for use on energized



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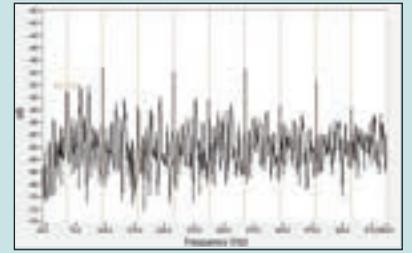


FIGURE 3
Recorded ultrasound of corona as seen in an FFT spectral view.



FIGURE 4
Undetected corona can lead to a further deterioration of the insulator, then to tracking and, eventually, flashover.



FIGURE 5
Ultrasound inspection in progress.

electrical components on low-, medium- and high-voltage systems. Corona is easily detected with ultrasound, yet may go undetected when using only an IR camera.

Corona

Corona refers to the ionization of air surrounding an electrical connection. By its very nature, corona does not produce significant heat that could be detected by an IR camera. When left undetected—and should it should continue to occur—corona can lead to more severe problems in metal-clad switchgear. By-products of corona include ozone, electromagnetic emissions, nitric acid and ultraviolet light.

More prominent signs of corona include a smell of ozone in the area of electrical gear, unusual weathering patterns on bus, an accumulation of white powder and dust on insulators, carbon tracks on insulators, and discoloration and deterioration of insulated conductors.

Although corona produces little to no heat, it does produce

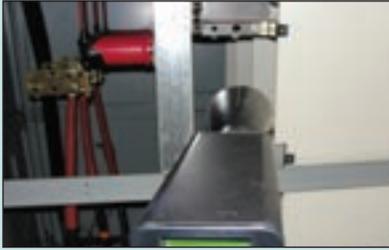


FIGURE 6
Limited direct line of sight ultrasound revealed noise originating from B-phase fuse stall.



FIGURE 7
De-energized switch, open front of cabinet for visual inspection.



FIGURE 8
Further investigation noted the B-phase top fuse holder touching insulation board.

ultrasonic emissions. When the inspector's ultrasound instrument has onboard sound recording capability, the ultrasound emission from corona can be recorded and further analyzed for a correct diagnosis.

(It's important to note that corona is only present in voltages above 1000. At 1000 volts and greater, air becomes a conductor and, hence, the ionization of air surrounding a connection can occur. When inspection is being done on voltages below 1000, and an ultrasound is heard, the inspector can rule out corona as a possible diagnosis.)

When the recorded ultrasound of corona is analyzed in spectrum analysis software, very prominent 60Hz harmonics can be noted. (When the sound recording is done outside of North America, one would see very dominant 50Hz harmonics.) Additionally, in between the 60Hz harmonics, you would see what is referred to as 'frequency content', which is basically harmonic activity between the more dominant harmonics. As the condition

worsens, there will be a loss of the dominant 60Hz harmonics, and uniformity in the amplitude of the recorded ultrasound will decrease.

Tracking

Tracking occurs when there is a low-current pathway to ground across an insulator. Many will refer to tracking as 'baby-arcing'. This event is common where there is severe breakdown of the insulating material and loose connections. Tracking can occur in low to high voltages, and

is characterized as a steady buzzing sound with periodic crackling and popping sounds. Further damage is done when tracking is not corrected, and will lead to arcing.

The move from corona to tracking leads to a destructive path across the insulation, and creates pinholes and spider web-like tracking, which causes surface deterioration. When visually inspected, one can see a very obvious tracking path on the surrounding surfaces. Also, a conductive cloud of ionized air surrounds the connections. Flashover

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can now occur once a tracking path is complete from phase-to-phase or phase-to-ground.

Figures 5 through 9 show findings from an ultrasound inspection on a metal-clad piece of switchgear. Ultrasonic noise was detected from the B-phase and further investigated.

Arcing

Finally, arcing happens when there is a discharge to ground across an insulator. Arcing causes severe damage to equipment, plant/facility operations



FIGURE 9

Tracking with early stages of arcing discovered.



FIGURE 10

Arcing as seen in the time waveform. Notice the lack of uniform harmonics and the sudden starts and stops of the discharge.

and people. Melting connectors, damage or loss of insulation, and fires usually result from electrical arcs. Arcing can be easily heard and detected with ultrasound. The sound characteristic for arcing are erratic bursts of discharges and popping sounds. These are identifiable when looking at a recorded ultrasound of arcing in the time waveform.

Conclusion

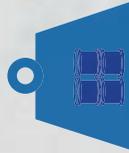
Ultrasound instruments are versatile and easy to use, and can greatly enhance the inspections of metal-clad switchgear. In the end, it's all about safety. Ultrasound inspections can be done prior to opening the energized gear to scan with an IR camera. When an ultrasonic emission is heard, then the proper precautions can be taken before opening the energized cabinet.

Also, for those that rely on the services of an outside contractor to perform infrared scans, an ultrasound scan can be done in-between the annual IR scan to see whether any emissions can be heard. When ultrasound and infrared are used together, an inspector is given a greater chance of detecting anomalies that could potentially be missed when relying on just one single technology. **EB**

Sean Miller is the manager of Canadian Operations for UE Systems Inc. (www.uesystems.com). A special thanks to Jim Brady of Brady Infrared; the photographs contained in this article, along with the captions, were provided courtesy by Jim and Brady. Jim uses an Ultraprobe ultrasonic instrument when conducting infrared inspections.

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The worldwide demand for solar and wind power continues to skyrocket. Since 2009, global solar photovoltaic installations have increased about 40% a year on average, and the installed capacity of wind turbines has doubled.

The dramatic growth of the wind and solar industries has led utilities to begin testing large-scale technologies capable of storing surplus clean electricity and delivering it on demand when sunlight and wind are in short supply.

A team of Stanford University researchers has looked at the 'energetic cost' of manufacturing batteries and other storage technologies for the electrical grid. At issue is whether renewable energy supplies—such as wind power and solar PV—produce enough energy to fuel both their own growth, and the growth of the necessary energy storage industry.

"Whenever you build a new technology, you have to invest a large amount of energy up front," said Michael Dale, a research associate at Stanford. "Studies show that wind turbines and solar photovoltaic installations now produce more energy than they consume. The question is, how much additional grid-scale storage can the wind and solar industries afford and still remain net energy providers to the electrical grid?"

Writing in the March 19 online edition of the journal *Energy & Environmental Science*, Dale and his Stanford colleagues found that, from an energetic perspective, the wind industry can easily afford lots of storage—enough to provide more than three days of uninterrupted power. However, the study also revealed the solar industry can afford only about 24 hours of energy storage. That's because it takes more energy to manufacture solar panels than wind turbines.

"We looked at the additional burden that would be placed on the solar and wind industries by concurrently building out batteries and other storage technologies," said Dale, the lead author of the study. "Our analysis shows that today's wind industry, even with a large amount of grid-scale storage, is energetically sustainable. We found that the solar industry can also achieve sustainable storage capacity by reducing the amount of energy that goes into making solar photovoltaics."

Reducing energy inputs to battery manufacturing is also needed, he added.

Favourable winds

Over the years, consumers have learned to expect electricity on demand from power plants that run on coal, natural gas or oil. But these fossil fuels, which provide reliable, around-the-clock energy, also emit megatons of greenhouse gas.

Wind and solar farms provide emissions-free energy, but only generate electricity when the wind blows or the sun shines. Surplus energy can be stored for later use, but today's electrical grid has little storage capacity, so other measures are used to balance electricity supply and demand.

In the study, the Stanford team considered a variety of storage technologies for the grid,

including batteries and geologic systems, such as pumped hydroelectric storage. For the wind industry, the findings were very favourable.

"Wind technologies generate far more energy than they consume," Dale said. "Our study showed that wind actually produces enough surplus electricity to support up to 72 hours of either battery or geologic storage. This suggests that the industry could deploy enough storage to cope with three-day lulls in wind, common to many weather systems, and still provide net electricity to society."

The results were especially good for onshore wind turbines. "We found that onshore wind backed by three days of geologic storage can support annual growth rates of 100%—in other words, double in size each year—and still maintain an energy surplus," he said.

"These results are very encouraging," said study co-author Sally Benson, a professor of energy resources engineering and director of the Global Climate and Energy Project (GCEP) at Stanford. "They show that you could create a sustainable energy system that grows and maintains itself by combining wind and storage together. This depends on the growth rate of the industry, because the faster you grow, the more energy you need to build new turbines and batteries."

Solar industry

For the solar industry, the Stanford team found that more work is needed to make grid-scale storage energetically sustainable. The study revealed that some solar technologies, such as single-crystal silicon cells, are growing so fast that they are net energy sinks... they consume more power than they give back to the electrical grid. From an energetic standpoint, these industries "cannot support any level of storage".

"Our analysis showed that, from an energetic perspective, most photovoltaic technologies can only afford up to 24 hours of storage with an equal mix of battery and pumped hydropower," Dale said. "This suggests that solar photovoltaic systems could be deployed with enough storage to supply electricity at night, and the industry could still operate at a net energy surplus."

One advantage of wind over solar power is that it has an enormous energy return on investment, Benson explained. "Within a few months, a wind turbine generates enough electricity to pay back all of the energy it took to build it," she said. "But some photovoltaics have an energy payback time of almost two years. To sustainably support grid-scale storage will require continued reductions in the amount of fossil fuel used to manufacture photovoltaic cells."

Other costs

The Stanford team's primary focus was on the energetic cost of deploying storage on wind and solar farms. The researchers did not calculate how much energy would be required to build and replace grid-scale batteries every few years, nor did they consider the financial cost of building and installing large storage systems on the grid. **EB**

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EB personalities



Kerry Heid

Kerry Heid—a founder and president of Regina, Sask.-based **Magna Electric Corp.** (www.magnaelectric.com)—has been honoured as one of **Saskatchewan's Most Influential Men** in Saskatchewan Business Magazine March issue. “This year’s group of influencers not only exhibits the capacity to sway opinion or trajectories, they find themselves at the heart of the big-picture issues weighing on Saskatchewan these days,” wrote **Paul Martin**, reporter for Saskatchewan Business Magazine. Heid has led Magna to “a place of prominence in the energy industry”, says **Shermco Industries** (which acquired Magna), “working closely with the utility crowns and industry leaders throughout the country”. “We are proud of Kerry Heid and his influential leadership in Saskatchewan and Canada,” said **Ron Widup**, Shermco CEO. “This is a true honor, which Kerry has worked hard for many years to earn.”

Magali Depras has been appointed to the new position of chief operating officer (COO) at **CSA Group** (www.csagroup.org). Based in Montreal, she will be responsible for global business strategy, execution and profit-loss for CSA Group’s testing and certification businesses. “With Magali’s knowledge and expertise, CSA Group is well-positioned to continue our strategic growth plan and deliver efficient, highly-sophisticated testing and certification services to our customers around the world,” said **Ash Sahi**, president and CEO. Taking over Depras’ previous role as regional vice-president, Europe, is **Ralf Schunk**, who will be based in Frankfurt, Germany. Schunk joins CSA Group from TUV Rheinland.



Jack Carlson

The **Industry Data Exchange Association** (IDEA, www.idea4industry.com) has announced its 2014-2015 board, which includes eight voting directors and two non-voting observers appointed by the National Association of Electrical Distributors (NAED, www.naed.org) and the National Electrical Manufacturers Association (NEMA, www.nema.org). The board elected **Jack Carlson**, executive vice president and president, North American Business, **Southwire**, as chair and **Wes Smith**, president, **Mayer Electric Supply**, as vice chair.

Xantrex (www.xantrex.com)—a **Schneider Electric** business (www.schneider-electric.com)—says it has appointed **William Tomkinson** as part of an “aggressive growth plan” to help focus on “continued growth from existing markets while pursuing new opportunities in North America and a strategy for global expansion”. “Although we are all operating in challenging economic times, we firmly believe that the lifeline and health of any business is intrinsically tied to its people, product and how companies support their customers,”

said **Richard Gaudet**, vice president. Previously with Xantrex, Tomkinson has returned as a strategic account manager, where he will manage key aftermarket and commercial distribution customers across North America.



Joris Myny

Joris Myny has been appointed senior vice-president of the Industry Sector at **Siemens Canada** (www.siemens.ca), where he is responsible for overall strategic direction and management, including sales, marketing and service operations within the fields of automation, integrated drive systems including gear units, motion control, instrumentation, industrial control and PLM software. Myny began his career with Siemens in 1990 with the Siemens Automation & Drives Group in Belgium, and possesses extensive international management experience. He also serves as chair of Electro-Federation Canada’s 2014 Scholarship program. Visit bit.ly/1m2aUyR to watch our most recent interview with him.

Liteline Corp. (www.liteline.com) has appointed of **Jarrod Stewart** to regional sales manager for Ontario, and hired **A.M. Agencies** (www.amagency.com) as its sales agent in Alberta. Stewart joined the company two years ago as a sales rep for the Greater Toronto Area. “I am very pleased to be given this opportunity, and am excited about what lies ahead as Liteline continues to launch new and innovative products,” he said. Headed by **Doug Prusky**, A.M. Agencies has been in the business for more than 25 years, says Liteline, and has offices in Calgary and Edmonton.



Keith Nicholls

Keith Nicholls has joined **Banvil2000** (banvil2000.com)—a supplier of fan and lighting products to Canadian and American dealers and distributors since 1974—as vice-president, sales and marketing. Banvil2000 says Keith—who is based at the company’s Milton, Ont., head office—possesses “a lifetime [of] experience in the electrical wholesale community”, which originated in the United Kingdom, then led to stints with Torbram Electric Supply and HD Supply/Litemor before joining Banvil2000.

Imtiyaz Pirmohamed has joined the **SunRise Power** (sunrisepower.ca) engineering team in Canada, bringing with him 7+ years of experience in construction management and electrical engineering. “As a member of the Professional Engineers of Ontario (PEO) and a member of the Association of Energy Engineers, Imz is a valuable addition to our engineering team,” said SunRise. “We’re building a company our employees love—because its our employees that make the business. That is why we invest in our employees, providing training, and endless opportunities to grow,” it added. **EB**



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PHOTOS • At the 50th annual Work Truck Show, EBMag visited dozens of industry heavyweights who showed off new trucks, the latest in truck accessories, chassis updates, new vehicle storage solutions and more. **VISIT [BIT.LY/1IH4FQ9](http://bit.ly/1IH4FQ9).**

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WORKSHOPS #1 AND #2

Spend a day with Terry Becker, P.Eng, NFPA, CESC, and learn how to apply the CSA Z462 "Workplace electrical safety" standard in the field. Terry will review and discuss electrical hazard analysis and electrical-specific PPE, tools & equipment. Later, the workshop will review what you need to know to ensure that what you have invested in time and money so far is *actually working*. Sustainable and measurable performance is a key takeaway.

Terry is a CSA Z462 Technical Committee voting member, the first past vice-chair, and the working group leader for the CSA Z462 Annexes. Terry is also an associate member on the CSA Z463 Guideline on maintenance of electrical systems, as well as a voting member on the IEEE 1584 Technical Committee.

WORKSHOP #3

Spend a day with John Salmon, ME, and learn how to apply the CSA Z463 "Maintenance of electrical systems" guideline when designing and implementing your electrical maintenance plan.

A voting member on the Canadian Electrical Code-Part 1, John is a licensed construction and maintenance electrician, and a Master electrician. He is the current vice-president of Electrical Contractors Association of Ontario and the chair of Ontario's Electrical Contractor Registry Agency (ECRA/ESA). He represents both the Ontario and Canadian Electrical Contractors associations (ECAO CECA) as codes & standards chair.

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(905) 713-4334, knyenhuis@annexweb.com

*Early Bird bonus draw available

Cooper unveils Neo-Ray Index LED pendant luminaire

Cooper Lighting has introduced the Neo-Ray Index LED pendant luminaire, featuring adjustable optical panels and WaveStream LED technology. Suitable as an alternative to linear fluorescent luminaires, the optical panels—available in 15°, 0° and -15°—allow the luminaire to be



tuned precisely to the application and space, says the company. Users can choose between 2-ft, 4-ft, 6-ft, 8-ft, 12-ft individual lengths or continuous runs, as well as 3000K,

3500K and 4000K CCT in 4291 and 3196 lumen packages. It comes equipped with a 0-10V standard dimming driver but is available with an integral Fifth Light Digital Addressable Lighting Interface (DALI) driver option and daylight/occupancy sensors.

COOPER LIGHTING
www.cooperindustries.com



Standard Products boasts lamp-to-luminaire “total package” solution for any project

Standard Products has introduced its full line of fluorescent linear lighting systems with pre-wired Express Delivery stock and made-to-order options. According to Standard, the company can now provide the total package to any project, from lamp to luminaire, adding that it has “made it a priority for its luminaires to meet or exceed industry certification”.

Products include high bays, strips, wraps, troffers, industrial strips, and vapour tight models.

STANDARD PRODUCTS
www.standardpro.com

VIDEO: Parental lighting intervention via 8-year old Jill



“With her red wagon in tow, eight-year old Jill uses her lighting smarts to talk some sense into her parents, who are still using (far too many) traditional incandescent light bulbs in their home.” That’s the premise behind a new video from Osram Sylvania, which aims to help consumers learn about their lighting choices in light of North American phase-outs of popular incandescent bulbs. Visit bit.ly/1k4ytdC to watch the video.

OSRAM SYLVANIA
www.sylvania.com

Eye Lighting publishes general lighting guide

Eye Lighting International has published a guide for those involved in the specification, selection, approval, installation and maintenance of lighting products and systems. Entitled “What makes you special to your customers?”, the new guide covers Eye LED products as well as “cost-effective, modern” ceramic technology. Visit Eye Lighting online to download a copy of the guide or, to obtain a printed copy, email info@eyelighting.com (Bulletin # EQS-N-52-84-00086).



EYE LIGHTING
www.eyelighting.com

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Verify grounding with Fluke 1623-2, 1625-2 earth ground testers



Fluke has introduced its 1623-2 and 1625-2 earth ground testers to help speed verification of reliable grounding of electrical equipment, solve power quality problems and lower the risk of shock to users, it says. The new testers, according to Fluke, can save up to 50% of set up and tear down time compared to existing wire reels. They perform all four types of earth ground measurements: 3- and 4-pole fall-of-potential, 4-pole soil resistivity, selective testing, and stakeless testing. New accessories include heavy-duty stakes that can be hammered into hard ground, colour-coded wires, and a rugged carrying case.

FLUKE

www.flukecanada.ca

Monitor Silfab smart module data through smartphone, tablet



Featuring technology from Tigo Energy, the Silfab smart module claims to maximize roof space, increase power output, and enhance operations and maintenance. Through Silfab's Impedance Matching technology, the module boasts up to 20% higher power output for arrays impacted by shading and up to 8% higher output for 'perfect' installations. System owners can monitor performance at the module level, and track and compile data through their smartphone, tablet and computer. In an effort to improve system safety, the module shuts down automatically in case of electrical failures.

SILFAB

www.silfab.ca

Burndy adds WEEB DSK family to Wiley product line

Burndy has introduced the WEEB (Washer, Electrical Equipment Bond) DSK family to bond photovoltaic (PV)



modules to racking or other components of the racking system. As part of the Wiley line of products, the WEEB DSK features an innovative design which allows for a wide range of compatibility across various racking systems, specifically bottom-mount and top-clamp applications, says the company.

BURNDY

www.burndy.com

Redesigned Stanley LeverLock tape rules with write-on label



Stanley describes its redesigned family of LeverLock tape rules as "better than the original model in virtually every way". The new features include a write-on label for measurements, a non-marring base, and a non-glare blade. An auto-locking mechanism helps prevent injury and blade breakage from fast retraction speed—the blade only extends or retracts when the lever is activated by the user. The updated LeverLock line will be available in seven models: 12 ft, 16 ft, 25 ft, a 25-ft magnetic/fractional read, 25-ft centre read scale, 25-ft engineers scale, and 30 ft.

STANLEY

www.stanleytools.com

Solectria releases PVI 3800TL transformerless inverters

Solectria Renewables describes its new PVI 3800TL transformerless residential inverter as the best residential solution available in the inverter market today. The 3.8kW single-phase inverter boasts 98% efficiency, as well as a compact, lightweight design with integrated fused combiner and disconnect for easy installation. According to the company, the PVI 3800TL is the first in the new



line of transformerless residential inverters—with a 5.2kW, 6.6kW and 7.6kW inverter model in the works.

SOLECTRIA

RENEWABLES

www.solectria.com

Motion Computing's R12 aims to redefine rugged tablet experience



The Motion R12 Rugged Platform is designed "to empower the worker who moves from the field to the vehicle to the office". It includes a 12.5-in. tablet along with an array of accessories, including the Slate-Mate data acquisition module, EasyPair wireless keyboard and Secure Mobile vehicle dock. Motion's SlateMate data acquisition module can be configured with up to three I/O devices. The vehicle dock is flexible enough, says Motion, to accept multiple docking configurations, such as the tablet with attached SlateMate module, or the tablet in a carrying case.

MOTION COMPUTING

www.motioncomputing.ca

Enphase System offers Envoy Wi-Fi option, M215 microinverter

The Enphase System has been expanded with new hardware and software that aim to lower solar system installation and operations costs. There is now a Wi-Fi option for the Envoy Communications Gateway and M215 microinverter with integrated ground (which eliminates the need for a grounding electrode conductor to be attached to each microinverter). Also, all systems reporting through the Envoy are now visible in the web-based Enlighten software platform.

ENPHASE ENERGY

www.enphase.com

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Clearance between pools and overhead wiring

As the Canadian Electrical Code (CEC) exempts installations of utility systems from its scope, questions are often raised regarding the application of clearance requirements specified in Section 68, Pools, tubs, and spas.

CEC defines a “pool” as permanently installed and storable swimming pools, hydromassage bathtubs, spas and hot tubs, wading pools, baptismal pools, decorative pools, and splash pads. Rule 68-054 states no pool shall be placed under or near overhead wiring unless the installation complies with the specified requirements. Since the rule is specific to the pool, it is applicable to all wires, whether owned by consumers or utilities.

Overhead powerlines may not have an insulated covering, may contain only a weather covering, or their insulation may have deteriorated, creating the risk of any conductive object (e.g. pool slimmer, ladder) becoming energized when contacting these lines. When there is not enough clearance between pools and powerlines, contact between, say, a skimmer’s handle (e.g. a 3 metre-long handle plus the height of the person using it) and powerlines could be deadly.

Ideally, there should be no wiring above a pool or the deck surrounding it,



but it is sometimes unavoidable. In these circumstances, Rule 68-054 provides some specific exemptions to the type of wiring that is permitted to be located over a pool, provided certain clearances have been met and are maintained.

To understand the clearances, refer to Figure 1 and the associated note from CEC Appendix B (©CSA Group). In Photo A, the clearance requirements specified by Rule 68-054 are not satisfied. The conductors are within 5 metres of the pool, and the clearance between the wires and the pool is less than

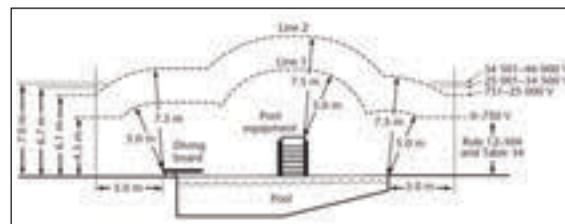


FIGURE 1
No conductors would be permitted under any circumstances in the area under Line 1. In the area above Line 1, insulated communication conductors and neutral supported cables operating at V or less are permitted. Any other conductors operating at not more than 50kV are permitted above the area outlined by Line 2. Clearances shown beyond 5 m from the pool edge are found in Rule 12-304 and Table 34.*

5 metres. (N.B. the clearance requirements specified in Rule 68-054 are harmonized with CSA C22.3 No. 1, “Overhead systems”, which many utilities reference.) **EB**

Nancy Hanna, P.Eng., is the engineering manager for Codes & Standards Department at Electrical Safety Authority (ESA) where, among other things, she participates in the development of bulletins, guidelines and technical communication concerning code interpretation and consistency issues. She is a LEED Accredited Professional, and is a member of several CSA TSCs for CEC Part 1, including Sections 24, 32, 46, 50 and 64. Nancy can be reached at nancy.hanna@electricalsafety.on.ca.

* FIGURE 1 USAGE: With the permission of the Canadian Standards Association (operating as CSA Group), material is reproduced from CSA Group standard, C22.1-12 - Canadian electrical code, part 1 (22nd edition), safety standard for electrical installations, which is copyrighted by CSA Group, 5060 Spectrum Way, Suite 100, Mississauga ON, L4W 5N6. This material is not the complete and official position of CSA Group on the referenced subject, which is represented solely by the standard in its entirety. While use of the material has been authorized, CSA is not responsible for the manner in which the data is presented, nor for any interpretations thereof. For more information or to purchase standards from CSA Group, visit shop.csa.ca or call (800) 463-6727.

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Tackle The Code Conundrum... if you dare!

Answers to this month's questions in June's Electrical Business.

How did you do with the last quiz? Are you a...

- Master Electrician ? (3 of 3)
- Journeyman ? (2 of 3)
- Apprentice ? (1 of 3)
- Plumber ?! (0 of 3)

Question 1

The metal assembly of a raised floor in a computer room must be bonded with a conductor [] copper to form an effective equipotential plan.

- a) #12 AWG c) #8 AWG
- b) #10 AWG d) #6 AWG

Question 2

What size of ground wire is required to bond a metal fence around an outdoor substation?

- a) #6 AWG c) 3/0 AWG
- b) 2/0 AWG d) 4/0 AWG

Question 3

Where receptacles of type 14-50R are installed on recreational vehicle lots, the CEC requires them to be protected by GFCI of Class A type.

- a) True b) False

Answers: EBMag April 2014

Q-1: Flexible cord type STO is suitable for interconnection of photovoltaic panels within an array.

b) False. Ref. Rule 50-018(2).

Q-2: For general power and lighting circuits, the maximum rating of overcurrent protection for No. 14AWG copper conductor is:

a) 15A. Ref. Rule 14-104(2).

Q-3: The radius of the curve on the inner edge of bends made on corrugated aluminum-sheathed cable or corrugated copper-sheathed cable shall be not less than [] times the external diameter of the sheath.

a) 9. Ref. Rule 12-712(3).



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