IEEE Canadian Review

La revue canadienne de l'IEEE

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Welcome Windsor Section!

IEEE Canada's Young Professionals

IEEE Women in Engineering

Profiles in Progress

Smarter Grid

Part 2

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IEEE Canadian Review
La revue canadienne de l'IEEE

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To inform Canadian members of IEEE on issues related to the impacts of technology, and its role in supporting economic development and societal benefits within Canada. To foster growth in the size and quality of Canada's pool of technology professionals to serve our increasingly knowledge-based economy.

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Every Editor-in-Chief of this venerable publication has brought particular insights and areas of expertise – plus a whole lot of dedication! In acknowledging the many contributions of outgoing Editor-in-Chief Wahab Hamou-Lhadj, it is his vision that most stands out. Under his leadership, the *IEEE Canadian Review*'s focus has shifted to covering technology primarily in terms of its relationship to broad issues of policy and public debate, within both Canada's engineering community and society at large.

In this issue we complete our two-part Special Focus on Smart(er) Grid, a theme well-chosen by Dr. Hamou-Lhadj. Many thanks to Special Focus Editor Maike Luiken for framing the topics addressed, and sourcing the contributions of such a diverse range of perspectives. In this rapidly changing field, it's hard to be exhaustive. So if you have suggestions for a follow-up article, please let Maike or me know.

We also give in-depth coverage of some of the activities of our Women in Engineering and Young Professionals affinity groups. Although developed independently of each other, the two pieces have a key commonality: the need that members of each group see for collaboration with the other. There certainly is overlap in demographics. But I don't think that explains it all.

Perhaps the links we see establishing between Women in Engineering and Young Professionals can be in part credited to IEEE culture: A free exchange of ideas and information is encouraged between organizational levels, and also between peer "nodes." Sort of like a network. Also, groups are encouraged to take initiatives in a semi-autonomous environment, seeking support when needed. Maybe similar to a micro-grid. Might we call the financial contributions to IEEE Canada operations from its myriad conferences distributed generation? One can take such analogies too far, but the parallels between effective organizations and sound engineering system design give me, for one, satisfaction. ■

Chacun des rédacteurs en chef ayant dirigé cette vénérable publication y a apporté sa propre perspective et sa propre expertise… tout en s'y investissant corps et âme! En saluant les nombreuses contributions du rédacteur en chef sortant Wahab Hamou-Lhadj, nous voulons souligner sa vision incomparable. Sous sa direction, la couverture de la technologie par *La revue canadienne de l'IEEE* s'est tournée en grande partie vers les grands débats publics et politiques, tant dans la communauté des ingénieurs que dans la société canadienne en général.

Le présent numéro présente la conclusion de notre dossier spécial sur les réseaux électriques (plus) intelligents (Smart[er] Grid), un thème judicieusement choisi par M. Hamou-Lhadj. Nous remercions chaleureusement Maike Luiken, conseillère éditoriale de ce dossier, d'avoir défini les sujets traités et trouvé des collaborateurs apportant des points de vue si variés. Dans ce domaine en profonde mutation, l'exhaustivité est difficile à atteindre. Par conséquent, n'hésitez pas à nous proposer, à Maike ou à moi, un article de suivi.

Nous posons aussi un regard très attentif sur certaines activités de nos groupes d'affinité Femmes en génie et Jeunes professionnels. Bien que rédigés séparément, les deux articles tendent vers une même conclusion : le besoin de collaboration entre les deux groupes. Évidemment, les effectifs des deux groupes se recoupent, mais je ne crois pas que ce soit là la seule raison.

Les liens qui se tissent entre les Femmes en génie et les Jeunes professionnels découlent peut-être de la culture de l'IEEE : on y prône le libre-échange d'idées et d'information entre les niveaux organisationnels et entre les « nœuds » de pairs. Comme un réseau. En outre, les groupes sont invités à prendre des initiatives dans un environnement semi-autonome, en demandant de l'aide au besoin. À l'instar peut-être d'un mini-réseau. Serait-il opportun de renommer les contributions financières aux activités de l'IEEE Canada de sa myriade de conférences, une production décentralisée? Sans pousser les analogies trop loin, en ce qui me concerne, les parallèles entre les organisations efficaces et les systèmes d'ingénierie bien conçus me donnent satisfaction. ■

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Amir Aghdam, Ph.D., P.Eng., FEIC, SMIEEE
2014-2015 IEEE Canada President and Region 7 Director

With spring arriving soon, we're all reminded of nature's cycles. IEEE Canada's leadership renewal cycle is just beginning as well. Within a few weeks, two nominees for IEEE Region 7 Director-Elect/IEEE Canada President-Elect will be announced, as selected by the IEEE Canada Nominations and Appointments committee. Over the next few months, the credentials and position statements of each of the candidates will be made available through this publication and the IEEE Canada Newsletter.

Also as we approach spring, the hours of sunlight grow noticeably longer each day. The working day of many of our IEEE Canada volunteers is long too at this time of year, with May and June the most popular months for conferences and other special events.

The annual IEEE Canadian Conference on Electrical and Computer Engineering (CCECE) will be held this year in Halifax, May 3 to 6. Jason Gu and the rest of the Organizing Committee have a terrific line-up of symposia, workshops and tutorials (see pages 12 and 63). Last year's CCECE conference was held at Ryerson University in Toronto, in early May. The Organizing Committee, led by Xavier Fernando, put together an excellent program, attracting hundreds of researchers from all over the world. An added element last year was a special full-day workshop and a mini student-paper competition on Humanitarian Initiatives.

Every spring, the IEEE Canada Awards & Recognition Committee honours outstanding technical achievements and volunteer service through its major awards program. The citations and full biographies for our 2014 recipients are found in a special Awards section beginning on Page 41. We are also pleased to announce therein the names and citations for our 2015 recipients. The medals are presented at the annual IEEE Canada Awards Banquet, a highlight of each CCECE. Our appreciation for a highly successful event last year goes to Aziz Rahman and Geza Joos, Chair and Vice-Chair, respectively, of the 2014 Awards and Recognition Committee. We thank Aziz for his leadership of that committee for the last two years, and welcome Geza as the 2015 Chair. In addition to individual awards, IEEE Canada annually recognizes two of its outstanding sections. The 2014 Exemplary Large Section Award was received by Ottawa Section, while Peterborough Section was the recipient of the 2014 Exemplary Small Section Award.

Another spring-time IEEE Canada-sponsored annual event is the International Humanitarian Technology Conference (IHTC). This year's conference will be held in Ottawa, May 31- June 3 with a focus on building resilient communities through innovative technologies, policies and practices. Organizing Committee Chair Maria Rey and her team are assembling workshops and panels that will fascinate and inform. One example is a panel discussion exploring the use of technology in the humanitarian assistance operation in Haiti by the Canadian Forces. The inaugural mounting of IEEE Canada's IHTC was just last year, held in early June in Montreal. The Organizing Committee of IHTC 2014, led by Ferial El-Hawary and Raed Abdullah, devoted their many talents, as well as hours of time, to this conference — with great success (see Page 61).

The IEEE Electrical Power and Energy Conference (EPEC) is the third IEEE Canada-sponsored conference, mounted annually each fall. It will be held this year in London, Ontario, October 26-28. Led by Maike Luiken, the Organizing Committee is structuring the conference into 18 mini-symposia along the theme of "Smarter Resilient Power Systems;" see Pages 49 and 68 for details. The highly successful 2014 Conference took place in Calgary in mid November, with an organizing committee led by Bill Kennedy. Of particular interest to our members in industry, it focused on strengthening this country's increasingly important partnerships between industrial users and power providers.

Improving the responsiveness of IEEE to its member needs is the goal of the Recommendations Development aspect of IEEE Sections Congress, held

Le cycle de Dame Nature nous amènera bientôt le printemps. En même temps s'amorcera le cycle de renouvellement de la direction de l'IEEE Canada. En effet, le Comité des candidatures et des nominations annoncera d'ici quelques semaines les noms des deux candidats aux postes de directeur désigné et de président désigné de la Région 7 de l'IEEE Canada. Au cours des prochains mois, nous vous présenterons dans la revue et le bulletin les antécédents et les énoncés de position de chacun des candidats.

À l'approche du printemps, nous voyons les jours s'allonger de plus en plus. Pour bon nombre de nos bénévoles, les journées de travail s'allongent également à cette période de l'année : en mai et en juin se tiendront de nombreuses conférences et activités spéciales.

Cette année, c'est la ville d'Halifax qui sera l'hôte de la Conférence canadienne de génie électrique et informatique (CCGEI), du 3 au 6 mai. Jason Gu et les autres membres du comité organisateur ont créé un programme prometteur de colloques, d'ateliers et de tutoriels (voir pages 12 et 63). L'an dernier, la conférence s'est tenue à l'Université Ryerson, à Toronto, au début de mai. Le comité organisateur présidé par Xavier Fernando avait concocté un excellent programme, qui avait attiré des centaines de chercheurs venus des quatre coins du monde. La conférence offrait pour la première fois un atelier d'une journée entière et un concours d'articles étudiants sur les initiatives humanitaires.

Chaque année, au printemps, le Comité des prix et de la reconnaissance de l'IEEE Canada rend hommage aux réalisations techniques et aux activités bénévoles dans le cadre de son important programme de récompense. Vous pourrez lire les distinctions et les biographies complètes des lauréats de 2014 dans la section spéciale à la page 41. C'est avec plaisir que nous publions également les noms et les distinctions des lauréats de 2015. Les médailles seront décernées à l'occasion du banquet annuel de remise des prix de l'IEEE Canada, un moment fort de chaque conférence. Cette année, nous récompensons Aziz Rahman et Geza Joos, respectivement président et vice-président du Comité des prix et de la reconnaissance de l'IEEE Canada en 2014, pour l'immense succès de l'événement l'an dernier. Nous remercions Aziz pour ses services à la présidence du comité ces deux dernières années et souhaitons la bienvenue à son successeur en 2015, Geza. En plus des prix individuels, l'IEEE Canada récompense chaque année deux de ses sections les plus remarquables. Le Prix 2014 pour la grande section exemplaire a été décerné à la section d'Ottawa, tandis que le Prix 2014 pour la petite section exemplaire a été remis à la section de Peterborough.

Le printemps sera le théâtre d'un deuxième événement annuel parrainé par l'IEEE Canada : la Conférence internationale de la technologie humanitaire (CITH). Celle-ci se tiendra cette année à Ottawa du 31 mai au 3 juin et portera essentiellement sur l'utilisation de technologies, de politiques et de pratiques innovantes en vue de renforcer la résilience des collectivités. La présidente du comité organisateur, Maria Rey, et son équipe planifient une série de tables rondes et d'ateliers à la fois fascinants et informatifs, entre autres une discussion sur l'exploitation des technologies dans le cadre de la mission d'aide humanitaire des Forces canadiennes en Haïti. Montréal était l'hôte de la toute première édition de la conférence l'an dernier, en juin. Le comité organisateur de la CITH 2014, présidé par Ferial El-Hawary et Raed Abdullah, a déployé ses multiples talents et travaillé de longues heures afin d'assurer l'immense succès de l'événement (voir l'article page 61).

La Conférence sur l'énergie électrique (CEE) est la troisième conférence annuelle parrainée par l'IEEE, qui a lieu à l'automne. Cette année, elle se tiendra à London, en Ontario, du 26 au 28 octobre. Sous la présidence de Maike Luiken, le comité organisateur a conçu un programme composé de 18 mini-colloques axés sur le thème de la résilience des réseaux électriques; consultez les pages 49 et 68 pour en savoir plus. En 2014, c'est Calgary qui avait accueilli la conférence à la mi-novembre, couronnée de succès grâce au travail du comité organisateur présidé par Bill Kennedy. Elle portait sur la consolidation des partenariats de plus en plus importants entre les utilisateurs industriels et les fournisseurs d'électricité du pays, un sujet d'intérêt particulier pour nos membres.

Mieux répondre aux besoins des membres : voilà l'objectif du volet Élaboration des recommandations dans le cadre du congrès trisannuel des sections de l'IEEE. La dernière édition a eu lieu à Amsterdam en août 2014. Chaque région énonce quatre recom-

every three years; it was mounted most recently in August 2014, in Amsterdam. Every Region contributes four recommendations that are compared, as a group, to develop a combined list of about 40. I am very pleased to report that a recommendation clearly originating from IEEE Canada was ranked by the roughly 300 delegates as one of the top five. This recommendation was "Provide a tool to build, promote, record, host and broadcast technical events at the local level and make them available to IEEE members."

And now for a birth announcement, of sorts. After 10 months of exploring options and hundreds of volunteer hours, formation of IEEE Windsor Section was approved at last November's meeting of the IEEE Member Geographic Activities Board. With the count of Sections in IEEE Canada now reaching 21, it has been exactly 30 years since foresighted IEEE members in Peterborough raised us to the seemingly unsurpassable number of 20.

We most warmly welcome Windsor Section Chair Esam Abdel-Raheem, Vice-Chair Kemal Ertugrul Tepe, the rest of the Section Executive, and all its members. I wish to thank the IEEE members of Windsor and surrounding area for their effort and trust in IEEE Canada; we will not let you down! Much appreciation is also due to the efforts of Murray MacDonald and Maike Luiken from London Section, and IEEE Canada Administrator Cathie Lowell, in helping present the options open to IEEE members living in Windsor area. Also in attendance at the meeting where these options were explored were IEEE Region 4 Past Director Don Bramlett and Southeast Michigan Section Past Chair Kimball Williams; their support in the process was invaluable. I also wish to extend special gratitude to then Region 4 Director, Karen Pedersen, without whose openness and generosity of spirit this could not have happened. We celebrate Windsor Section's formation in this issue with some perspectives from some of its Executive, and their ambitions for the future; please see article on page 10.

I close this President's Column with my most sincere gratitude to the innumerable volunteers within IEEE Canada who contribute on so many levels, and in so many activities. With all the areas in which our organization is growing and developing, in many ways, it always feels like spring to me. ■

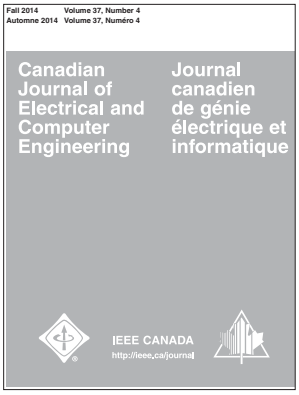
mandations qui sont ensuite comparées à toutes les autres en vue d'en retenir une quarantaine. Je suis ravi d'annoncer qu'une recommandation émanant clairement de l'IEEE Canada s'est classée parmi les cinq premières sélectionnées par les quelque 300 délégués. Celle-ci proposait de « fournir un outil permettant de créer, de promouvoir, d'enregistrer, d'accueillir et de diffuser des événements techniques au niveau local et [de] mettre celui-ci à la disposition des membres de l'IEEE ».

Voici maintenant un avis de naissance, en quelque sorte : au terme de 10 mois d'étude des différentes options et de centaines d'heures de travail bénévole, la création de la section de Windsor a enfin obtenu l'aval du Comité des activités géographiques et pour les membres de l'IEEE lors de la réunion de novembre. Le nombre de sections de l'IEEE au Canada passe ainsi à 21, exactement 30 ans après que les membres clairvoyants de l'IEEE à Peterborough nous ont fait passer le cap des 20 sections, qui semblait alors insurpassable.

Nous souhaitons très chaleureusement la bienvenue au président de la section de Windsor, Esam Abdel-Raheem, au vice-président Kemal Ertugrul Tepe, aux autres membres de la direction et à tous les membres de la section. Je profite de l'occasion pour remercier les membres de l'IEEE de Windsor et de sa région pour leurs efforts et leur confiance en notre organisation; nous ne vous décevrons pas! Nous saluons également le travail de Murray MacDonald et de Maike Luiken de la section de London, et celui de Cathie Lowell, administratrice de l'IEEE Canada, qui nous ont aidés à présenter les options offertes à nos membres vivant dans la région de Windsor. Assistaient également à cette rencontre de réflexion sur ces options l'ancien directeur de la Région 4 de l'IEEE, Don Bramlett, et l'ancien président de la section du sud-est du Michigan, Kimball Williams, dont l'appui au processus a été inestimable. J'aimerais en outre adresser ma gratitude particulière à celle qui était alors directrice de la Région 4, Karen Pedersen, dont l'ouverture d'esprit et la générosité ont été partie prenante de cette réalisation. Le présent numéro salue la création de la section de Windsor et dresse le portrait de certains de ses dirigeants, qui nous exposent leurs ambitions; un article à lire en page 10.

Pour clore ma chronique, je souhaite exprimer toute ma gratitude aux innombrables bénévoles de l'IEEE Canada qui s'investissent à de multiples niveaux et dans de nombreuses activités. Comme la nature au printemps, notre organisme connaît une période de croissance et de développement à bien des égards. ■

CJECE expands international reach



The *Canadian Journal of Electrical and Computer Engineering* (*CJECE*) is the flagship technical publication of IEEE Canada, issued quarterly since 1976. It accepts submissions in all areas within the electrical and computer engineering discipline in two formats: original research contributions and tutorial/review articles. Papers are submitted through the popular Manuscript Central web portal and go through a rigorous peer-review process in line with most other IEEE technical society publications. Accepted papers are published in the IEEE *Xplore* Digital Library and in hard copy.

Under the leadership of current Editor-in-Chief, Prof. Shahram Yousefi, the journal has targeted a first-decision timeline of three months. The vast majority of papers receive first review in less than 12 weeks. With an acceptance rate of less than 10%, the journal has raised the bar more than ever before!

"The journal owes its success to the support of the IEEE Canada executive and its dedicated team of volunteer associate editors," says Dr. Yousefi.

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Tips from translation committee

The hilarious and bizarre results often yielded by translation apps are increasingly the source of inspiration for humorous scenes in popular culture. So, would a real live translator ever go on record in their support?

None other than the Chair of IEEE Canada's Translation Committee, Amine Miled, Assistant Professor at Laval University, concedes they have their place. "Sending us a draft from Google Translate or other app is helpful," he says. "We review the text carefully and correct as needed. But this first step certainly creates blocks of useable text."

Making the translation process as efficient as possible is key to meeting the needs of IEEE Canada's many publications, groups and activities. Ongoing support has included the *IEEE Canadian Review*, the *Canadian Journal of Electrical and Computer Engineering*, the annual IEEE Canada Awards Ceremony Program, IEEE Canada Bylaws, welcome speeches, conference materials, and others assignments too!

With the many requests it receives, Miled notes his committee can fulfill more of them if those submitting follow a few other tips: If translations already exist from similar material, e.g., same conference from previous year, make sure to include the English and French versions of those. Lots of lead time helps too. For text blocks of 200 words, he advises a week's notice. An item of 500 words should be submitted several weeks ahead of its need. At the end of semester – a very hectic time – perhaps double the notice.

Miled is quick to recognize the critical behind-the-scenes efforts of the other committee members: Paul Fortier, Professor, Laval University; Jessy Mathault, Student, Laval University; and Salima Rakkay, Student, Concordia University. With a few more members on the committee, it could provide translation for other IEEE Canada publications, he says. Interested parties should contact him at amine.miled@gel.ulaval.ca, or Branislav Djokic, Publications and Communications Committee Chair, at branislav@ieee.org ■

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Biz-tech Report

by Terrance Malkinson

The C.D. Howe Institute has issued a series of reports analyzing the challenge of managing the rising cost of healthcare for an aging population, and managing it in such a way that this rapidly approaching demographic change does not compromise other government programs ["Managing the Cost of Healthcare for an Aging Population: 2014 Provincial Perspectives;" December 2014; www.cdhowe.org]. The authors: William Robson, Colin Busby, and Aaron Jacobs, report on five provinces (Alberta, British Columbia, Quebec, Ontario, and Manitoba) projecting their population growth and its impact on government programs and revenues. The common conclusion in each province's report is that their governments need to start strategic planning and setting aside money now to avoid massive tax increases or reducing services in the coming decades.

Matt O'Grady in *BC Business*[www.bcbusiness.ca] reports on "How LNG Could Shift the Fortunes of B.C.'s Northwest Cities" [December 18, 2014] According to the British Columbia government, an estimated 100,000 jobs could be created by the liquefied natural gas (LNG) industry. Another piece, "B.C. Government Greenlights Site C Dam" [Dec.16, 2014], reports that construction on BC Hydro's controversial hydroelectric dam project is scheduled to start in the summer of 2015. The $8.7-billion mega dam along the Peace River will be completed in 2024 increasing the provinces power supply by 8%.

Advanced Towers Ltd.[www.advanced-towers.com]—a Milverton, Ontario supplier of telecommunications towers—skillfully balances design/engineering, manufacturing, and installation to achieve success. Founded in 1976, the company engineers, builds, and installs towers and network systems across Canada and the United States. Customers include cellular phone carriers, government, broadcasters, railways and small contractors. Melanie Franner's profile of the organization is found in *Canadian Commerce and Industry*. 64(1):19-22. Winter, 2014. www.commerceandindustry.com

Unattended Aerial Vehicle spending will increase to $91B globally in the next decade, as described in "Rise of the Drones" [*Design Engineering* [60(4):21-25. September, 2014. www.design-engineering.com]. The piece examines the growth in Canadian unmanned aerial systems technology and indentifies as a major challenge the needed reform of regulations governing commercial UAVs, which in most nations is severely restrictive. As profiled in the same issue of [32-33]. Ontario-based Daymak [www.daymak.com] is putting the finishing touches on its Daymak Drive System, an ebike self-charging system comprised of wireless and wired controller, rechargeable batteries, solar panels and a wireless throttle. Daymak has been named one of the greenest companies in Ontario.

Alberta's 250 leading companies are listed and profiled in the September, 2014 issue of *Alberta Venture* [pp. 31-90. www.albertaventure.com]. In the November issue, "Seventeen Great Communities" for business are profiled [pp. 22-34]. In the December issue, Alberta's Business Person of the year, ATB Financials CEO, Dave Mowat is profiled [24-36]. The Glacier Skywalk [www.glacierskywalk.ca], a cliff-edged glass floored observation platform constructed 280 meters above the Sunwapta Valley in Jasper National Park is now open. The fully accessible engineering marvel gives visitors insight into a unique alpine ecosystem centering on the Columbia Icefields. The $21-million award-winning project has strong Edmonton connections in its design, engineering and construction.

Streaming imagery from its cameras in space is Vancouver-based UrtheCast Corp.'s goal [www.urthecast.com]. Targeting state agencies and commercial users, the company has a market capitalization above $150M and international offices with 65 employees. As described by Jacob Parry in his article "The Sky's the Limit" [*BC Business*. 42(4):16-18. April, 2014. www.bcbusiness.ca], Wade Larson, a former Canadian Space Agency employee "stumbled upon a $100M idea five years ago that might disrupt business models that have defined the aerospace industry for decades." The piece outlines the idea's development and gives some optimistic projections.

Canadian Business magazine provides its annual guide to "The Rich 100: Canada's 100 Wealthiest People" [87(15/16):29-57. Winter 2015. www.canadianbusiness.com]. Regrettably, the author of "Biz-tech Report" is not on this list! The in-depth report provides profiles and information on how they became rich, how they set up their succession plans, philanthropic activities, and strategies from these individuals into how to become wealthy. In its December issue, *Canadian Business* profiles its selection of the top four Chief Executive Officers of the year [pp. 39-46]. Winners' employers are: National Bank of Canada, Sun Life Financial, CGI Group and Enerplus. In another special report in this issue "Canada's Best Employers" for fifty large and fifty small and medium businesses are listed [pp. 64-70]. The April, 2014 issue of *Canadian Business* focuses on success stories in Canadian innovation [87(3):49-59]. Twenty-three important problems and Canadian-led solutions are profiled.

The Vinyl LP record is not dead. Matt Powell in his article "Vinyl Revival" [*Plant:*72(7):14-15. October, 2013. www.plant.ca] reveals the resurging market with audio purists who prefer the unique characteristics of vinyl over digital formats. As stated in the article, record sales jumped in the US by 17.7% to 4.5 million units and analysts predict continued growth. A St-Lambert, Quebec Canadian company RIP-V[www.rip-v.com] is pressing over 2,000 LPs a day on antique presses purchased from former vinyl record manufacturers. A second article in the same issue discusses another Canadian innovation success story: Colt Hockey's super-strong hockey stick. [Kick-Starting the Stick of Steel" pp 17-18]. The Colt hockey stick is a joint effort between Colt Hockey and PowerMetal Technologies, a Division of Toronto's Integran Technologies, a developer of metallurgical nanotechnologies. [www.integran.com] ■

About the Author

Terrance Malkinson is a communications specialist, business analyst and futurist. His career path includes technical supervisor and medical researcher at the University of Calgary, business proposal manager for the General Electric Company, and research administrator with the School of Health and Public Safety at SAIT Polytechnic in Calgary. He is currently an international correspondent for IEEE-USA *Today's Engineer*, contributing editor for *IEEE Canadian Review*, and a member of the editorial advisory board of IEEE *The Institute*. He was Vice-Chair of the IEEE-USA Communications Committee (2004-2010), and editor-in-chief of IEEE-USA Today's *Engineer Digest* (2004-2008). He was an elected Governor of the IEEE Engineering Management Society as well as past editor of *IEEE Engineering Management*. He is the author of more than 500 earned publications, and an accomplished triathlete. malkinst@telus.net

N.Ed. Since 2006, Terry Malkinson's "View from the West" column has engagingly captured the latest trends in business and technology in that part of our diverse country. In "Biz-tech Report" he will continue these first-class synopses, expanding their scope to all of Canada. Our many thanks to Terry for his ongoing contributions to this publication.

By **Alexandre Abecassis**

RICHMOND, BC. Dec. 16, 2014. MacDonald, Dettwiler and Associates, a global communications and information company, has announced today that it has signed a contract amendment with the Canadian Space Agency for CA$17.7 million extending funding for ongoing support of the Mobile Servicing System on the International Space Station (ISS) through March 2016. The Mobile Servicing System is comprised of Canadarm2, the Special Purpose Dextrous Manipulator, and the Mobile Base System.

MONTREAL, QC. Dec. 1, 2014. Intel has announced the acquisition of PasswordBox, a Montréal-based provider of digital identity management services for an undisclosed price. PasswordBox employs about 50 people in Montréal and will become a part of the Safe Identity organization within Intel Security Group. Intel plans to make a long-term investment in developing its Montréal operations. PasswordBox technology enables users to log into various websites.

VANCOUVER, BC. Nov. 24, 2014. Mio Global has announced today the availability to pre-order the Mio FUSE. Mio Global is known for being the maker of the world's first heart rate monitors to provide continuous, performance-accurate data without a chest strap. The new device will combine the features of a heart rate monitor, sports watch, and all-day activity tracker. The new device uses an internal accelerometer and a user's personal settings in order to determine speed, pace, and distance.

TORONTO, ON. Nov. 20, 2014. The University of Alberta and IBM have announced that they are using advanced streaming analytics software to provide researchers with information to enable them to detect, visualize and predict subtle changes in the health of the environment in real-time. Climate change is monitored using data provided from more than 500 sensors implanted in some of the world's most remote ecosystems. The software provides real-time analysis for more than 10,000 data points per second from the sensors that are measuring carbon levels and other environmental indicators such as relative humidity, temperature, soil moisture, atmospheric pressure and ambient noise.

CALGARY, AB. Nov. 13, 2014. Solium Capital has announced that it has been named as one of Canada's fastest growing technology companies in the Deloitte Technology Fast 50™ awards for technological innovation, entrepreneurship, rapid growth and leadership. The company provides a cloud-based solution for equity compensation administration.

TORONTO, ON. Nov. 4, 2014. DreamQii has announced that, it will begin to market its PlexiDrone in the spring thanks to the stunning success of its crowd funding efforts on IndieGogo. The small drone can be operated by a smart phone or tablet and it allows users to capture aerial photography. The device is the first of its kind to be designed and manufactured in Canada. ■

About the Author

Alexandre Abecassis is a patent agent and Partner at Fasken Martineau DuMoulin LLP, Lawyers and Patent and Trademark Agents. Send via e-mail any news clippings you would like to contribute to alexandre.abecassis@ieee.org

Alexandre Abecassis est agent de brevets associé chez Fasken Martineau DuMoulin S.E.N.C.R.L., s.r.l., Avocats et agent de brevets et de marques de commerce. Veuillez faire parvenir les coupures de presse proposées par e-mail à alexandre.abecassis@ieee.org

The IEEE Engineering in Medicine and Biology Society Mentor Program

The IEEE Engineering in Medicine and Biology Society Mentor Program www.embs.chronus.com provides mentees access to experienced mentors who can contribute to their professional and personal development. The program provides a platform for mentees to realize their potential by enabling personal and professional relationships with mentors, who act as role models and provide guidance to them. It offers opportunities to develop business contacts, access industry information, and gain valuable insights from experienced and successful professionals.

Terrance Malkinson and Chuan He

THE MENTOR

Terrance Malkinson
malkinst@telus.net

The mentor is a guide who paves the way to success, inspiring, encouraging, and supporting the mentee, contributing to their professional and personal development. The reward for the mentor is the satisfaction from helping others succeed. As the mentor to Dr. He this has certainly been the case and my hope is that our mutually beneficial professional relationship will continue well into the future as he secures employment in his chosen field of interest. I would highly recommend that experienced IEEE members take advantage of the opportunity and professional responsibility to allocate a small portion of their time to become a mentor to the next generation. You will find it to be a personally energizing and a mutually beneficial experience.

THE MENTEE

Dr. Chuan He
chuan.he@ualberta.ca

In July of 2013, I received an email from IEEE Engineering in Medicine and Biology Society (EMBS) about the introduction of their mentorship program. At that time, I was near my completion of graduate study in the University of Alberta, specializing in ultrasound biology and gene delivery. I was still exploring options for my next step, and my curiosity directed me to browse through the program. I was very pleased to find there were already lots of experienced professionals registered on the website. Their backgrounds ranged from device manufacturing to theoretical simulation, from academic institutions to R&D departments in the world-renowned companies. No matter what your expertise or interest is, you can find at least one senior expert waiting there to help you. After careful consideration, I chose Mr. Malkinson as my mentor and that started my extraordinary mentorship experience.

Mr. Malkinson has rich experience in both academic and industry. He is also a correspondent author for IEEE USA *Today's Engineer*. Mr. Malkinson is a strong believer of the impact of today's advanced technology could have on people's everyday lives or activities. Our discussions focused on the emerging technologies for athletics and recreation. We were also trying to bring the awareness of sports on the enhancement of global citizenship. Although all the projects were not technical-based, this mentorship broadened my eyes in a new applied research area that I never considered before. As part of our work together, we have successfully submit-

continued on page 9 >

continued from page 8 >

ted three manuscripts to world-renowned conferences and one article on the IEEE USA *Today's Engineer* website.

As the mentorship went on, I consulted with Mr. Malkinson on broader topics. In addition to his expertise, I was also impressed by Mr. Malkinson's active participation in the Ironman Triathlon tournament after his retirement. His lifestyle, positive living attitude and, most importantly, willingness to help young people to grow are precious lessons to me. Since the EMBS program links mentors and mentees for 12 months, Mr. Malkinson had no obligation to continue with his invaluable guidance and support past last summer. I am most grateful he has continued to mentor me informally.

Last July I was thrilled to be hired by a globally recognized scientific instrumentation company. I believe the insights and confidence I grained through my relationship with Mr. Malkinson gave me an advantage over other applicants.

I really appreciate that EMBS provided such a good opportunity for me to know Mr. Malkinson. This mentorship program is far beyond my original expectation. If you have any question on the communication or cooperation with your mentor, the program website also provides detailed online guidelines to help you. I would encourage all the IEEE student members in this IEEE field of interest to participate in this program. ■

N.Ed. The IEEE Mentor Centre offers similar mentor/mentee opportunities to members in other technical fields of interest.

See http://mentoring.ieee.org/eMentor/

CJECE

continued from page 5 >

"IEEE Canada President, Prof. Amir Aghdam, has been instrumental in making sure we have what it takes to deliver a set of high-quality technical papers in a timely manner for the entire readership, which now goes way beyond Canadian borders," he adds. *CJECE* also receives a large percentage of submissions internationally, Yousefi says.

As part of its mandate to support the Canadian research community, the *CJECE* accepts papers in both English and French; published manuscripts include titles and abstracts in both official languages. Publication of accepted papers is handled by IEEE Publishing in Piscataway, New Jersey.

The journal aims to further increase its impact, influence, and readership in a sustainable fashion. There is an open call for highly-qualified and established researchers to serve as associate editors in all areas, and particularly in software engineering, power systems, communications, and algorithms. Please refer to the *CJECE* website for more information. http://journal.ieee.ca/ ■

Conferences

IEEE Canada & Collaboration 2015–2016

West

2015 Annual IEEE Systems Conference (SysCon)
2015-04-13…16, Vancouver, BC
http://www.ieeesystemscouncil.org/

2015 IEEE 23rd Annual International Symposium on Field-Programmable Custom Computing Machines
2015-5-02…06, Vancouver, BC
http://fccm.org/2015/

2015 IEEE/IAS 51st Industrial & Commercial Power Systems Technical Conference (I&CPS)
2015-05-06…08, Calgary, AB
http://sites.ieee.org/icps2015/

2015 10th International Conference on Testbeds and Research Infrastructure for the Development of Communities and Networks (TridentCom)
2015-06-24…26, Vancouver, BC
http://tridentcom.org/2015/show/home

2015 IEEE 16th Workshop on Control and Modeling for Power Electronics (COMPEL)
2015-07-12…15, Vancouver, BC
http://ieee-compel.org/

2015 IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting
2015-07-17…25, Vancouver, BC

2015 USNC-URSI Radio Science Meeting (Joint with AP-S Symposium)
2015-07-17…25, Vancouver, BC

2015 IEEE 12th International Conference on Group IV Photonics (GFP)
2015-08-26…28, Vancouver, BC
http://www.gfp-ieee.org/

2015 International Conference and Workshop on Computing and Communication (IEMCON)
2015-10-05…17, Vancouver, BC
http://www.iemcon.org/

Centre

2015 IEEE International Symposium on Multiple-Valued Logic
2015-05-18…20, Waterloo, ON
http://www.mvl.jpn.org/ISMVL2015/

2015 IEEE 26th International Conference on Application-specific Systems, Architectures and Processors (ASAP)
2015-07-27…29, Toronto, ON
http://www.eecg.toronto.edu/asap2015/

2015 IEEE Conference on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB)
2015-08-12…15, Niagara Falls, ON
http://www.cibcb.org/

2015 IEEE International Conference on Smart Energy Grid Engineering (SEGE)
2015-08-17…19, Oshawa, ON
http://www.sege-conference.com/

2015 IEEE 4th International Conference on Cloud Networking (CloudNet)
2015-10-05…07, Niagara Falls, ON
http://www.ieee-cloudnet.org/

2015 IEEE Electrical Power and Energy Conference (EPEC)
2015-10-26…28, London, ON
http://epec2015.ieee.ca/

East

2015 IEEE 28th Canadian Conference on Electrical and Computer Engineering (CCECE)
2015-05-03…06, Halifax, NS
http://www.ccece2015.org/

2015 12th IEEE Conference on Software Architecture (WICSA)
2015-05-04…08, Montréal, QC
http://wicsa2015.org/

2015 Federated Events on Component-Based Software Engineering and Software Architecture (CompArch)
2015-05-04…08, Montreal, QC
http://comparch2015.org/

2015 15th IFAC Symposium on Information Control Problems in Manufacturing (INCOM)
2015-05-11…13, Ottawa, ON
http://www.incom2015.org/

2015 IFIP/IEEE International Symposium on Integrated Network Management (IM)
2015-05-11…15, Ottawa, ON
http://im2015.ieee-im.org/

8th Global Symposium on Millimeter-Waves (GSMM2015)
2015-05-25…27 Montreal, QC
http://www.gsmm2015.org

2015 IEEE Canada International Humanitarian Technology Conference (IHTC)
2015-05-31…06-03, Ottawa, ON
http://www.ihtc2015.ieee.ca/

2015 IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization (NEMO)
2015-08-11…14,Ottawa, ON
http://nemo-ieee.org/

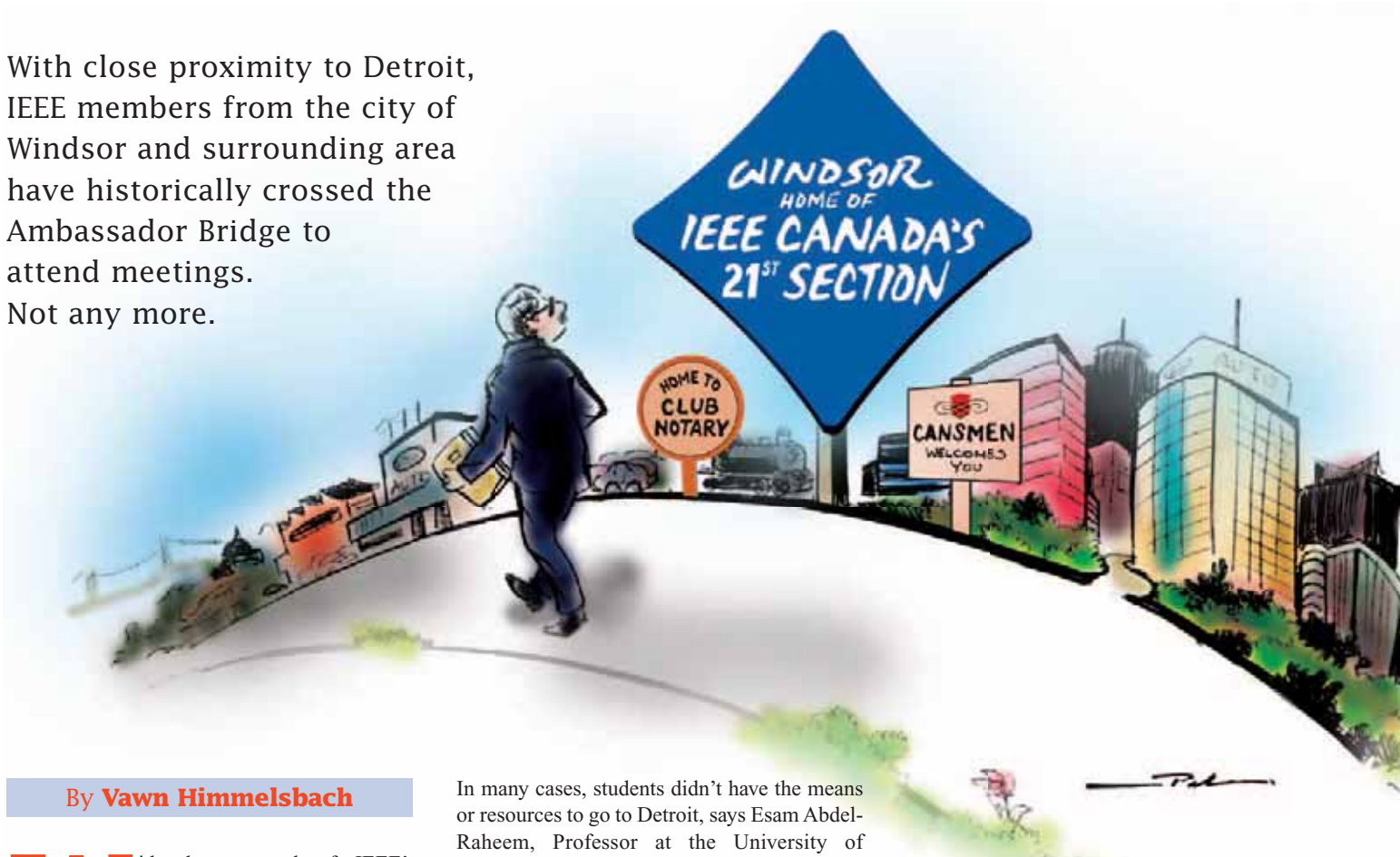
2015 IEEE Energy Conversion Congress and Exposition
2015-09-20…24, Montreal, QC
http://2015.ecceconferences.org/

2015 IEEE International Conference on Image Processing
2015-09-27…10-30, Quebec City, QC
http://icip2015.org/

2015 IEEE International Conference on Ubiquitous Wireless Broadband (ICUWB)
2015-10-04…07, Montreal, QC
http://www.icuwb2015.org/

A Warm Welcome to Windsor!

With close proximity to Detroit, IEEE members from the city of Windsor and surrounding area have historically crossed the Ambassador Bridge to attend meetings. Not any more.



By **Vawn Himmelsbach**

With the approval of IEEE's Member Geographic Activities (MGA) Board, Windsor is the newest Section to join IEEE Canada, bringing the total number of Sections to 21. Previously, IEEE members living in Windsor area were aligned with Region 4, comprising central U.S.A.

Just a year ago, IEEE Canada President/Region 7 Director Amir Aghdam started looking into how IEEE members in the Windsor area could be better served. So he initiated discussions with his Region 4 counterpart and Chair of Detroit Section — officially called South East Michigan (SEM) Section.

Historically, Windsor-area IEEE members have had to cross the U.S.-Canada border to attend meetings and events in Detroit.

"Many IEEE members in Windsor could not engage in Section activities, as the border crossing has become increasingly difficult in the past several years," Aghdam says. "We discussed this issue with Region 4 Director Karen Pedersen, who was instrumental in assessing how to best serve the needs of those members."

In many cases, students didn't have the means or resources to go to Detroit, says Esam Abdel-Raheem, Professor at the University of Windsor and Chair of the newly minted Windsor Section.

"Being affiliated with a U.S.-based Section was becoming an issue because we wanted to organize events in Windsor but we were not part of IEEE Canada," he says. "That was the main driving force behind this move."

It was also hard to convince members in southeast Michigan to travel to Windsor for an event, especially since so many were already being held at the University of Michigan. So Windsor-area members — especially students — were often missing out on opportunities. "We needed some alternative arrangement," Abdel-Raheem says.

Windsor Members Bring Tradition of Excellence

WHILE WINDSOR is a newly created Section, IEEE members from that city and its surrounding area have already garnered recognition for their achievements in related fields of interest.

DISTINGUISHED IEEE member, Dr. Reuben Hackam from the University of Windsor, was the recipient of the IEEE Third Millennium Medal in 2000, the IEEE Eric O. Foster Award in 2000 and the University of Windsor Alumni Award for Distinguished Contributions to University Teaching in 1992. His research areas include electromagnetics, polymer insulators for power devices, and gas insulating systems and devices. He has published more than 370 papers during his career.

WINDSOR area also boasts three IEEE Fellows, including Dr. Hackam (1988), "for contributions to surface technology and electrical engineering education." In 2002, Dr. Majid Ahmadi was elected IEEE Fellow "for contributions to the design of digital filters, and to pattern recognition and image restoration." Dr. Roman Grigoryevich was elected IEEE Fellow in 2010 "for contributions to high-resolution imaging, acoustic microscopy and advanced material characterization."

There was talk of becoming a subsection of London Section, but they came up against the same issues — though a border crossing wasn't involved, it was still a two-hour drive away.

"We also have our own community, with our own issues, and we would have had the same problem trying to bring our London colleagues to Windsor for events," says Kemal Ertugrul Tepe, Associate Professor at the University of Windsor and Section Vice-Chair. "That's when we realized it made the most sense to create our own Section."

Many IEEE members in Windsor are interested in issues related to automotive electronics; a lab at the University of Windsor is entirely dedicated to electric vehicles, for example.

"The main purpose of our Section is to serve our own students and members in Windsor, to discuss their ideas and invite experts related to their areas of interest," says Ertugrul Tepe. "Windsor is a manufacturing hub, so members want to learn about the latest trends and new technologies in manufacturing electrical devices or electronics. We want to organize sessions related to that."

"We have the base to build a strong Section"

- Esrafil Jedari, Academic Mentor of the IEEE Student Branch of the University of Windsor

About 40 per cent of graduates from the University of Windsor end up working in Detroit. Ertugrul Tepe is hoping that by forming a stronger IEEE community in Windsor and providing networking opportunities with industry, this might help graduates find job opportunities in Canada.

"Our first priority is to form chapters and standing committees, and from there we will start having meetings and maybe bringing some conferences here," says Esrafil Jedari, Academic Mentor of the IEEE Student Branch of the University of Windsor, who works as a Research Assistant at the university. He's also taken on the role of Secretary and Treasurer of the new Windsor Section.

Jedari played a large role in reactivating the Student Branch at the University of Windsor in May 2013, and since that time he has helped to organize several successful events, including a seminar on Electromagnetic Compatibility, a hands-on workshop on automotive networks and a session on how to apply for graduate programs (see sidebar). Support has also come from IEEE Canada, (Region 7).

"Communications to Student Branches in Canadian universities have for many years included representatives from the University of Windsor and St. Clair College," says Maike Luiken, outgoing IEEE Canada Student Activities Committee Chair, and former chair of IEEE London Section. "Student member representatives have always been invited to the IEEE Canada Student Congress, with Region 7 providing the Branches with financial support as well."

Past and future support for the Student Branch also comes from the IEEE Canadian Foundation. For example, in 2005, the Foundation awarded the University of Windsor Branch $2,000 for hosting that year's International Conference for Upcoming Engineers.

"The IEEE Canadian Foundation warmly welcomes Windsor to the IEEE Canada family," says David Whyte, president of the IEEE Canadian Foundation. "We encourage its Student Branches to take full advantage of scholarship, grant and award opportunities offered by the ICF -- in particular to establish or upgrade our uniquely Canadian McNaughton Learning Resource Centres." Whyte points out that Windsor-area members wishing to support ICF activities will receive receipts suitable for Canadian income tax purposes for their donations.

Windsor Section's 150 members give it a critical mass to form Affinity Groups, says Jedari. He would like to see the formation of a Young Professionals Group and a Women in Engineering Group, since there are a number of female graduate students and faculty at the University of Windsor.

"We have the base to build a strong Section," says Jedari. "Our focus now is to elevate our activities." He hopes this will include joint events with other Sections.

Nearby London Section is more than ready to collaborate. "We were delighted last spring to welcome Windsor area members as a London Sub-Section," says current Chair Murray MacDonald. "Now that Windsor Section has been established, we look forward to joint Section events and conference organizing."

Windsor Section's inaugural meeting was held on February 6, a very proud moment for Section Chair Abdel-Raheem and the rest of the Executive. Included in the official business was completion of petitions for an IEEE Communications Society chapter and a joint chapter involving the Circuits and Systems Society, Computer Society and Control Systems Society. Plans for the year ahead include bringing in two or three distinguished lecturers, as well as holding workshops and networking events for members. There's also talk of getting involved with local high schools to mentor students taking part in robotic competitions. ■

University of Windsor Student Branch Roars Back

THE UNIVERSITY OF WINDSOR Student Branch received a Certificate of Appreciation at the 2014 South East Michigan (SEM) Section (R4) Annual Spring Conference. Restarted in early 2013, it had been dormant since 2005.

Presented by SEM Section Chair Robert Neff, the award recognized contributions to the Section, and leadership in promoting science and technology at the University. The award was accepted by Branch Chair Hanan Mekawy on behalf of her team, including: Vice-Chair Wassim Ayache, Secretary Nyasha Kapfumvuti and Treasurer Senan Abdulghani.

Mekawy credits strong support from SEM volunteers Basil Sherlund, Kimball Williams and others in helping the Branch relaunch. University of Windsor Faculty Advisor Dr. M. Khalid and Academic Mentor Esrafil Jedari were also instrumental, she says.

The first event of the reactivated Branch was a seminar on Electromagnetic Compatibility, held in May 2013. Above, Branch Chair Hanan Mekawy is flanked by engineers Joanna Hill from Hella Electronics and Lin Li from Rohde Schwarz.

Five other successful events followed that year. Another three strongly attended events were held in 2014.

The 28th IEEE Canadian Conference on Electrical and Computer Engineering

May 3-6, 2015 Halifax, Nova Scotia Canada

Photo: HPA/Nova Scotia Tourism

Celebrating 30 Years of Ocean Frontiers

The 2015 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE 2015) will be held in **Halifax, Nova Scotia Canada**, **May 3-6, 2015**, offering a medium for researchers and practitioners to exchange and explore the issues and opportunities of electrical and computer engineering research and development from Canada and around the world.

http://www.ccece2015.org

KEYNOTE SPEAKERS

Feridun Hamdullahpur
President & Vice-Chancellor, University of Waterloo
Passion for Learning - From Research to Impact
To fuel economic growth, graduates of STEM disciplines are being called upon to give our national economies an innovative edge

John Leonard
Professor, Dept of Mech. Eng. and CSAIL, MITA
Long-term View of Simultaneous Localization and Mapping for Mobile Robots
Solving issues with navigation, mapping and persistent autonomy will transform the mobile robotics industry

James McFarlane
President, ISE, O.C., C.D., P.Eng. FCAE
The Evolution of Underwater Work Capability in British Columbia
The province looks at using robotic manipulators and submersible vehicles to conduct its underwater research

Doug Wallace
Chairholder, CERC.OCEAN
The Next 30 Years of Ocean Frontiers
New tools and technologies will allow researchers to accurately measure changes in the world's oceans and make informed decisions

Power Electronics and Energy Systems
Chairs: **Magdy Salama**, University of Waterloo
Xiaoyu Wang, Carleton University

Communications and Networking
Chairs: **Cheng Li**, Memorial University of Newfoundland
Anader Benyamin-Seeyar, Concordia University

Signal and Multimedia Processing
Chairs: **Gary Kenward,** Dalhousie University
Ling Guan, Ryerson University

Biomedical and Health Informatics
Chairs: **Hamid Mcheick**, Université du Québec à Chicoutimi
Jeremy Brown, Dalhousie University

Modeling, Simulation & Analysis
Chairs: **Adel Merabet**, Saint Mary University
Yuanlong Yu, Fuzhou University, China

Ocean Engineering and Marine Technology
Chairs: **Ferial El-Hawary**, Dalhousie University
Michael Benjamin, MIT, USA

Circuits, Devices and Systems
Chairs: **Kamal El-Sankary**, Dalhousie University
Jie Chen, University of Alberta

Computers, Software and Applications
Chairs: **Man Lin**, St. Francis Xavier University
Danny Silver, Acadia University

Control and Robotics
Chairs: **Howard Li,** University of New Brunswick
Greg Dudek, McGill University

Systems, Man, Cybernetics
Chairs: **Sidney Givigi**, Royal Military College
Yajun Pan, Dalhousie University

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IEEE CANADA PRESIDENT
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Introduction to the Smarter Grid – Part 2

Maike Luiken, Associate Editor

In the last issue we identified a number of issues and opportunities associated with the "Future Electrical Grid" as in the "Smarter Grid."

The Bigger Integrated Energy Picture

The trend towards an integrated systems approach to supply electricity, heating, cooling, steam and transportation fuels from various energy sources using different technologies is strengthening, e.g., Combined Heat and Power (CHP) is gaining more traction.

An integrated systems approach is also necessary. A case in point is the experience in New England during the very severe 2013-2014 winter. Like other jurisdictions, that state's interdependency of gas and electricity has risen steeply. The competing high demands for space heating and electricity during that harsh cold season challenged the energy supply system, which was limited by the gas pipeline capacity. How would an actual local gas shortage be managed?

At the local level: communities have generated or are generating integrated energy and water management plans, e. g., Guelph, Ontario.

At the Canadian federal and interprovincial level: discussions about interconnects (Quebec-Ontario) and large hydro projects (see Page 36 in this issue) are gaining attention.

The Canadian Academy of Engineering's Energy Pathways Task Force ("Canada: Becoming a Sustainable Energy Powerhouse," July 2014) proposes NINE BIG Projects – to substantially increase energy production and reduce the carbon content of the energy input from 86% to 61%. Some of these are focussed on Canada's Electric Power potential:

- A high capacity national interconnected electrical grid with regional hubs
- Realization of the hydroelectric potential from 73,000 MW currently installed to potentially 163,000 MW
- More large nuclear generation sites for bulk electricity and process steam production (CANDU), such as Bruce Energy Centre in Ontario.

Internationally: Each year the World Energy Council (WEC) poses the question: What is keeping energy leaders awake at night?

Globally,

- Energy security in all regions
- Energy prices and associated volatility—"the new normal?"
- Lack of climate framework
- Commodity prices
- Electricity storage driven by the increasing reliance on intermittent sources
- Renewable energies and energy efficiency
- Access to capital for more sustainably energy infrastructure
- Political and regulatory risk
- China/India drivers for global demand for energy

Canada (In addition)

- Regional interconnection
- Carbon capture and storage — world's first commercial-scale carbon capture coal plant (Sask Power)
- Unconventional fossil fuels
- Talent shortage

(From the 2014, 2015 World Energy Issues Monitors, WEC)

Back to the Smarter Grid

Today's energy systems must function reliably in an ever-more interdependant world. Read on to learn some of the ways these challenges might be met. ■

Evolution of Smarter Grid

Om Malik
Professor Emeritus at University of Calgary

Since the establishment of the first public supply system in New York, USA, in 1882, power systems engineers have always been on the forefront of exploring and utilizing latest technologies to meet the challenges in achieving their goal of ensuring a reliable and uninterrupted supply of electricity. As new enabling technologies become available, they are embraced to improve the operation of the power systems. Despite the use of the term "Smart Grid" to represent advances having become ubiquitous recently, its definition is flexible. Engineers well appreciate the need for a well defined problem before tackling it. So let us start first with the definition of the term "Smart Grid."

1. Definition

The first-ever reference to the term "Smart Grid" in the technical literature appeared in an article in the September/October 2005 issue of the IEEE PES 'Power and Energy' magazine [1], referring to some existing programs such as: Electric Power Research Institute's (EPRI) IntelliGrid program, EPRI's Fast Simulation and Modeling program, and continued >

Contents

the US Department of Energy's GridWise program, a self-healing infrastructure being considered by the White House's Office of Science & Technology. The term was possibly in use internally in EPRI. It was later enshrined into law in the U.S. 2007 Energy Independence Act. There was also a commercial newsletter called "SMART GRID NEWS.COM" established around 2005 devoted to "News and analysis for the modernization and automation of electric power." (The term "SMART GRID" is a registered term of this newsletter).

So far there is no standard definition for 'smart grid' even though the term is in common use throughout the power system literature. It means different things to different people. As an illustrative example, a list of 'smart grid' pilot projects under execution in India includes automatic metering, peak load management, outage management, power quality, renewable integration, micro grids, distributed generation [2]. A look at the literature shows that the term smart grid is now applied across the entire spectrum of the power systems as it meets the fancy of the writer and everybody is free to join the bandwagon. In view of this, a generic definition, as good as any, is:

"*A smart grid is a digitally enabled electric grid that gathers, distributes and acts on information about the behavior of all components in order to improve the efficiency, reliability and sustainability of electricity services*" [3].

2. Vision

A generic vision of smart grid is to provide enhancements to ensure:

- High level of security, quality, reliability and availability of electric power
- Improve economic productivity and quality of life
- Minimize environmental impact while maximizing safety and sustainability.

However, to determine the specific vision it is necessary to see "whose vision", as again every user/country has its own vision.

3. Development and Progress

The desired characteristic of an electric power grid is high reliability of supply of electricity. It requires monitoring and quick reaction to changes in the delivery system and quick power restoration. The operator also tries to realize energy and cost savings for the customer. Every aspect of electric power systems, be it planning, infrastructure design, operation including measurement and control, protection, has made tremendous advances since 1882 to match the desired characteristics.

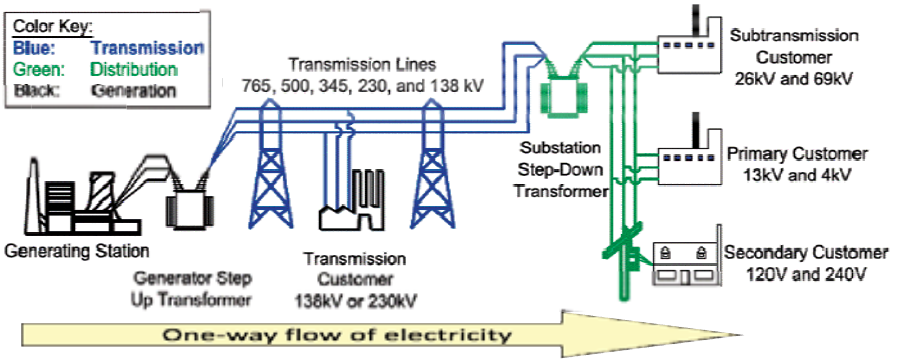

Figure 1. Flow of electricity in a traditional power system [4].

Technology level and operational requirements in power systems are a moving target as evidenced by new significant developments over the recent past, such as:

- Increased demands of a digital society
- Increased renewable power generation, energy storage and electric vehicles
- Restructured electricity marketplace
- Vulnerability to security threats.

They affect power system operation, control and protection. In response, power systems have continued to evolve in to smarter systems with the deployment of ever advancing techniques to cater to the continuously evolving requirements.

The traditional electric power system infrastructure, designed on the proviso that "electricity flows primarily in one direction" as shown in Fig. 1, [4], is not suitable under the new conditions. However, new developments in the electric power systems area and continuous technological advances in other relevant technologies in the recent past have become major catalysts for advances in power systems. These developments have given rise to new advances that are being pursued.

4. Future – A Smarter Grid

The grid of the future will be based on each and every aspect of the grid being monitored constantly using sensors specially designed to deliver and perform at high speed. It will require the integration of a communications network with the power grid that will enable power grid operators to collect data from the entire electric delivery network, about power generation, transmission, distribution and utilization – all in near real-time – so that advanced controls and intelligent information management systems can be applied to improve power system operation and continuity of electricity supply.

A lot of new research is in progress on all fronts in generation, transmission and distribution. Also, deployment of new technologies, some under the umbrella of 'smart grid', has occurred in all areas of power systems in recent years. However, deployment of new technologies is not without its associated costs. Estimates of cost by EPRI, consultants, International Energy Agency vary from US$ 165 billion to US$ 10 trillion over the next 20 years.

Although there is a lack of consensus as to how to define the smart grid, it is generally agreed that the definition and elements of a smart grid are evolving. Many of the tech-

nologies now being touted as smart grid have been in use and deployed long before the term "smart grid" became common. Considering that, one may ask the question:

Is "smart grid":
- A buzzword?
- Old wine in new bottles?
- Expected to contribute something substantial?

The answer to all these questions is, Yes. Much lies ahead for the smarter grids in the future encompassing studies on cyber security, self-healing networks, renewable energy, smart appliances, electric vehicles and policy issues involving data privacy, dynamic pricing, customer behavior, economics and regulation. ■

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Smart Grid For Canada; Regulatory Reform

A. Sajadi and M. Komaki
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The smart grid is associated with maintenance of environment, economy, and resources and is not defined by "what technologies it incorporates" but rather by "what it can do" [1]. Although more than 16 years has passed since the term was first coined, and over $10 trillion dollars of public and private funding related to research on this area has been dedicated, its implementation has not been as widespread as would be expected. Why? Looking today, the major roadblocks are not unsolvable technical problems, but largely regulatory issues.

In Canada, regulatory reform will be a key enabler for transition from the current power system towards an actual smart grid. This means regulatory laws will need to be modified, completely rewritten, or in some instances created. For example, the Electricity Act, 1998 was amended in 2006 to mandate installation of smart meters in Ontario. It was a good step, but not enough.

Regulatory reform requires a transparent mechanism and easily accessible public reporting. Further development of smart grid in Canada is feasible following more government initiatives and committed investments by national and international consortiums. The investment should focus on expansion of both transmission and distribution systems to ensure they technically are able to accommodate the new stochastic-based generation capacity and implementation of ancillary services. This could be in the form of a temporal matching program to provinces, cities, regional utilities and individual private companies to take steps towards grid modernization.

Another key element is customer buy-in. There is a direct link between a customer's awareness and engagement, and their willingness to accept renewable energy tariffs. Reluctance to absorb additional cost can hold even though the customer may genuinely care about their environment [2]. Tariffs and billing systems must be amended in such a way that mitigates customer confusion and concern about energy bills, transactions, and energy offerings.

The Canadian Electrical Codes are provincially and territorially regulated and are not unified all across Canada. Any given electrical device requires an approval certificate based on these codes to interconnect into the Canadian electricity system [3]. As a result, this lack of uniformity in standards across Canada might cause an obstacle to projects.

In general, in smart grid projects, regulation on the requirements of battery storage and distributed-generator-unit interconnection points, as well as building codes, are imposed. These regulations may also stifle progress in implementing smart grid technologies [4]. In many cases, installation of storage and generation units is subject to a special inspection process to acquire an approval certificate; this is a costly and time-consuming procedure. Essentially, such barriers make the investment unattractive.

Canadian energy policy reform requires strategic planning to ensure the progress of smart grid development in Canada. This will facilitate achievement of the long-term targets of a sustainable low-carbon economy, and energy security and independence. ■

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[4] National Building Code of Canada

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The Smart Grid Gets Competitive

Timothy Wilson
T. Wilson & Associates

The race is on for global leadership in Smart Grid technology, and though Canada has a shot at being a major contender, it's not in the pole position. The reasons are simple enough: we don't invest enough in research and development, we aren't graduating sufficient skilled engineers to fill demand, and capital investments from the private sector are modest. There has been some progressive government policy, but more needs to be done if we are going to be a player on the world stage.

"Federally, Canada has had a good push toward Smart Grid, though growth has been uneven," says Ravi Seethapathy, Director, Smart Grid Canada and Adjunct Professor at the University of Toronto. "Ontario, for example, is already at essentially 90% smart meter coverage, but if we look across Canada overall coverage is about 55 percent."

In the Canadian context, Ontario's notable leadership role could position it well to compete in the global market. The province's smart meters, time-of-use rates, and its feed in tariff (FIT) program has given a boost to solar and wind, despite the fact that the program is not necessarily built to reward more efficient technologies, or to address dynamic pricing. But that will come.

"Now with time-of-use data we can work on real-time demand management," says Seethapathy. "By getting off of flat rates, the consumer is likely more engaged, and we can begin to have a discussion of consumer choices, with an understanding of what they want, and how, and what kinds of changes are painful for them."

At present, Canada is in the Smart Grid delivery stage, with a focus on intelligent load management, renewables, distribution automation, conservation, and distributed sensors. The next stage – and this is where the country could really position itself as a global competitor – is in smart infrastructure. That means micro grids, visual realization and smart analytics, as well as more advanced energy storage. The problem is we aren't there yet, and we risk losing out on significant opportunity if we don't move fast.

"Federally, Canada has had a good push toward Smart Grid, though growth has been uneven."

– Ravi Seethapathy, Director, Smart Grid Canada; Adjunct Professor, University of Toronto

Publicly Funded Smart Grid Demonstrations & Pilots in Canada

$386M	$114M	37	24	24	24	1
in demo projects	invested	projects	companies	utilties	institutions	First Nations

- **ecoEII** NRCan – ecoEnergy Innovation Initiative
- **CEF** NRCan – Clean Energy Fund
- **SDTC** Sustainable Development Technology Canada – SD Tech Fund
- **GMF** Fedration of Canadian Municipalities – Green Municipal Fund
- **ICE** BC – Innovative Clean Energy Fund
- **CCEMC** Alberta – CCEMC
- **SGF** Ontairo – Smart Grid Fund

EV Integration

Storage

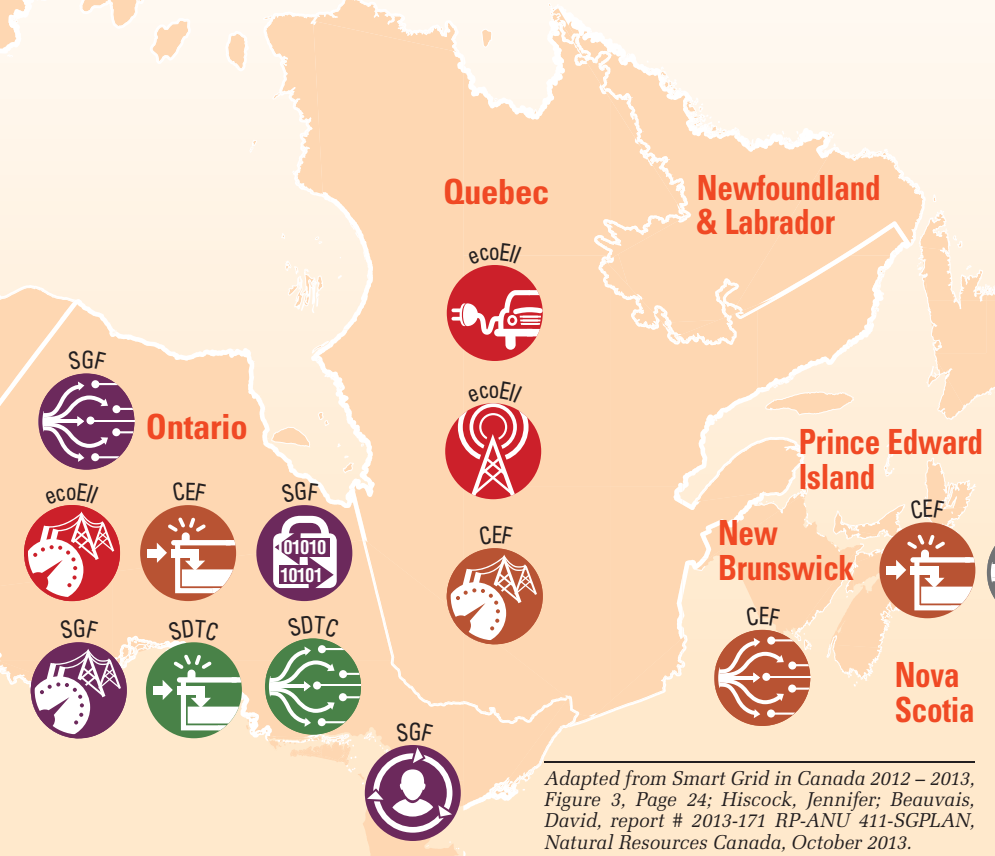
Customer Enabling

Micro Grid

Grid Monitoring and Automation

Demand Management

Data Management, Communication and Security



Adapted from Smart Grid in Canada 2012 – 2013, Figure 3, Page 24; Hiscock, Jennifer; Beauvais, David, report # 2013-171 RP-ANU 411-SGPLAN, Natural Resources Canada, October 2013.

Competing for customers

A smart infrastructure would give Canada a decent shot at being a global leader in the emerging customer-focused energy market. There is some good news here, with utilities like Toronto Hydro moving toward a 21st century grid, embracing innovative solutions like community energy storage and power line and transformer monitoring. These initiatives, and others like them, will drive an immense amount of data, which could bode well for the development of technologies that would serve distinct marketplaces around the world. The problem is, we aren't that good at product development, as is, say, China, Taiwan or Germany.

"In Canada, we have invested in many commercial innovation hubs that look at the business side of things," says Seethapathy. "However, we don't have much bench strength when it comes to deeply rooted experience in technology development, or 'product polishing'."

From a Smart Grid public/private partnerships (PPP) funding perspective, British Columbia and Ontario, followed by Quebec, are clearly the leaders, with the highest value projects being in grid monitoring/automation and energy storage. Dr. Warren Mabee, Canada Research Chair in Renewable Energy Development and Implementation at Queen's University, has pointed out that electricity is now energy's common currency, with use options increasing all the time. That should result in more renewable options, as well as more innovation in managing and storing power.

"Micro-generation, data management and energy security are just beginning to grow now," says Seethapathy. "I would not be surprised if in the next five years investment here would be similar to that in energy storage.

Data management, communication and security have little public funding at present. However, given Canada's desire to compete by developing technologies for the consumer-centric Smart Grid, that scenario is likely to change.

" After nearly 80 years, the Medium and Low Voltage Network is seeing rapid technological transformation," Seethapathy says. "Central control is giving way to semi/near autonomous local smart controls that can operate much faster than today's central systems to manage local power quality as a result of two-

way power flows. We are just seeing the beginning of this transformation."

Export challenges in a fragmented market

The slowdown in 2008 hit Canada's Smart Grid exports hard. They have barely returned to pre-recession levels, and are not on a strong growth trajectory. According to a McKinsey Technology Assessment in 2012, Wind and Smart Grid were assessed as "highly attractive" markets by 2020, but were also deemed to be areas where other countries have a clear competitive advantage over Canada.

"Canada needs more 'backbone' product and systems engineers, and to make sure they are utilized well," says Seethapathy. "These are the people that will provide the core support to an export-driven market for Smart Grid products and services."

The good news is that although research and development investment in Canada could be better, it is the small to mid-sized enterprises (SMEs) that see the opportunity and are making a difference. One excellent example is Solantro, which has its headquarters in Ottawa and another office in San Jose, California. The company makes chips for distributed energy sources, and is aggressively pursuing global opportunities, with a keen focus on research and development. (See sidebar)

"At any instant we are developing new integrated chipsets, planning future ones, and working on expanding our firmware releases," says Ray Orr, Solantro's CTO. "We continue to work on system solutions in off-grid applications and for grid support."

Solantro is making a splash around the world, including in developing markets where off-grid solar represents immense opportunity. Powering up underserved areas, and getting that energy onto a distributed network, could transform many economies. And though that change is certainly due to Smart Grid technology, it also indicates how the move from a singular grid with a few centralized, large-scale power sources – and a utility-based view of a single consumer – can be a challenge. The Smart Grid market is, almost by definition, a fragmented one.

"'Smart Grid' is one of those ill-defined terms that means many things to many people," says Orr. "Canada has a suite of companies that do 'Smart Grid'-like activities. Temporal Power, Triacta, eCAMION, Eguana Technologies and Electrovaya are a few examples. If we include renewable energy in the definition of smart grid, this list expands considerably."

This market challenge is complicated by a Canadian engineering cohort that, when compared to other professions, tends to have a lower level of employment in their field of expertise. With that in mind, Canada's Smart Grid companies also clearly need help from the engineering and academic community to address the challenge of an aging workforce.

"There is real opportunity here, a perfect storm of sorts, but it is also true that Canada could lose out on all the investments it has already made," says Seethapathy. "Hence the need for more – or perhaps the better utilization of – engineering talent to support this. We need to look at companies that are providing leadership, like Opower."

Opower, which is headquartered in Arlington, Virginia, has a Software-as-a-Service (SaaS) platform that can deliver/analyze energy information directly to customers and utilities. Technology like

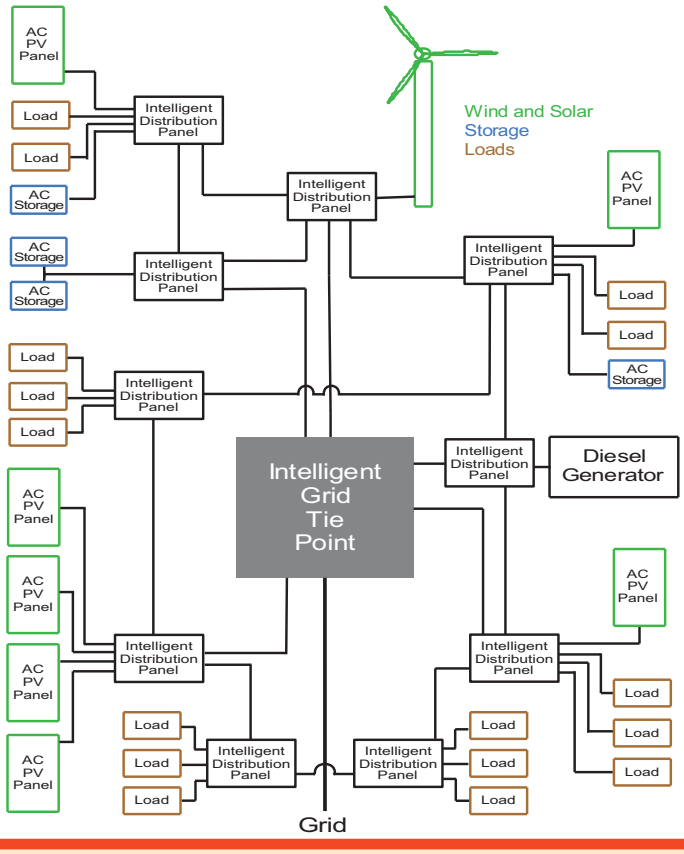
The sun rises on Solantro's global vision

When it comes to seeking business opportunity in alternative energy, it is only logical that companies big and small would want to look beyond Canada's borders, and be careful about their market selection. That is certainly the case with Ottawa-headquartered Solantro Semiconductor Corp., which develops customized chipsets and firmware for power conversion applications.

"In the short term, our market opportunities lie in solar," says Ray Orr, Solantro's CTO. "Applications include inverters, optimizers, safety disconnect functions and arc fault detection. In the longer term the broader renewable energy market, including storage and grid support functions, will be the greatest opportunity."

Founded in 2009, Solantro is a fabless semiconductor company active in both grid-tied and off-grid renewable energy installations. This is a complex business requiring significant technical expertise, but that is only part of the battle. The best people, and the best products, won't succeed globally unless a company has market access.

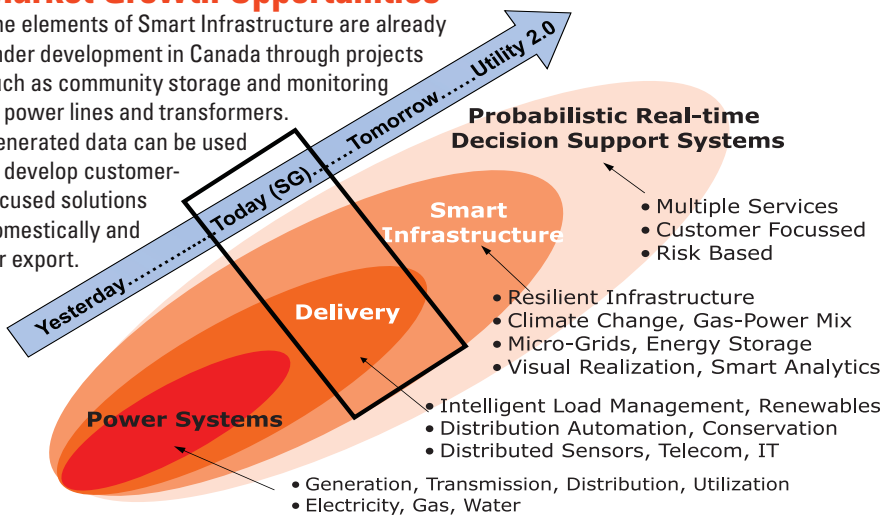
"Partnerships are paramount," says Orr." Small start-up companies do not have the resources to enter large global markets without partners. This comes in the form of co-marketing, strategic alliances where the business aligns well,



Solantro's bottom-up electrification. The company's vision is built on dynamic scaling, beginning with various t wes of power conversion units connected to local loads through intelligent distribution panels. These units can be then be networked for massively distributed intelligent power generation.

Market Growth Opportunities

The elements of Smart Infrastructure are already under development in Canada through projects such as community storage and monitoring of power lines and transformers. Generated data can be used to develop customer-focused solutions domestically and for export.



Source: Ravi Seethapathy presentation at the IEEE Toronto Section AGM, Oct. 25 2014

this, which can personalize consumption by putting data and analytics into the hands of the consumer, is the future of smart grid technology.

"Opower is ahead on this, but even they are only scratching the surface," says Seethapathy. "There will be a transactional feedback loop where customers will be able to see and analyze their data – perhaps using third-party services. This kind of ubiquitous data automation will have to address customer segmentation and cyber security."

It will also mean a bigger role for the private sector, which will then ideally result in technologies that can sell into the global marketplace. More generation and distribution will be in private hands, with an increase in self generation. Many new technologies and software will be transaction-based. They will be sold either directly to utilities or to consumers, and will be delivering analytics off a wealth of data. Ultimately, this technology will be serving a market in which individual customers want to be participatory, and to have service more accurately reflect their needs and habits.

"There is no longer one ubiquitous small customer, as in the past," says Seethapathy. "Customer expectations have changed, and utilities need to reflect that."

Whoever capitalizes on this reality has a good chance of doing very well in the global smart grid market. Some of the technology will be tailored to solar – which has come a long way in the past five years – and some to wind, hydro or even biomass. Juggling these sources with nuclear and fossil fuels to optimize cost-effective delivery, and to make the grid as smart as possible, is a big job. It is also a big opportunity. ■

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and with strategic investors who can make connections in international markets."

Solantro is going after solar for the simple reason that it is the fastest growing new source of power generation in the world. Solar is driven by advances in chip technology, a belief that storage innovation is on the threshold of some major breakthroughs, and a clear understanding that there is a huge untapped global opportunity. Approximately two billion people are on unreliable, aging grids, and another three billion have only partial grid access.

"That's a lot of people living in areas that don't have a reliable grid," Antoine Paquin, Solantro's CEO, told the IEEE Toronto Section AGM last October. "For us, the applications that matter are those that can dramatically affect their quality of life."

Solantro's goal is to be a major worldwide supplier of electronic solutions for distributed generation. It's already on its way, with solutions today in major advanced markets as well as India, the Philippines, and parts of Africa. Off-grid technologies in these markets – such as irrigation pumps in India – are a perfect opportunity for the company, which has solar technology that offers a clean and reliable alternative to expensive diesel generators.

And as Solantro seeks out new markets, it is keeping its eye on its longer strategic vision of being a company that positions its technology to support networked micro- and nano-grids. That's a vision that is particularly well-suited to those parts of the world that have poorly developed central grids, and high solar insolation. But you still need to get to market, and to address that challenge Solantro has put all hands on deck.

"How we sell is dependent on the market," says Orr. "In Asia we have manufacturer's representatives, and we form strategic alliances. We also have people in Europe and companies we partner with."

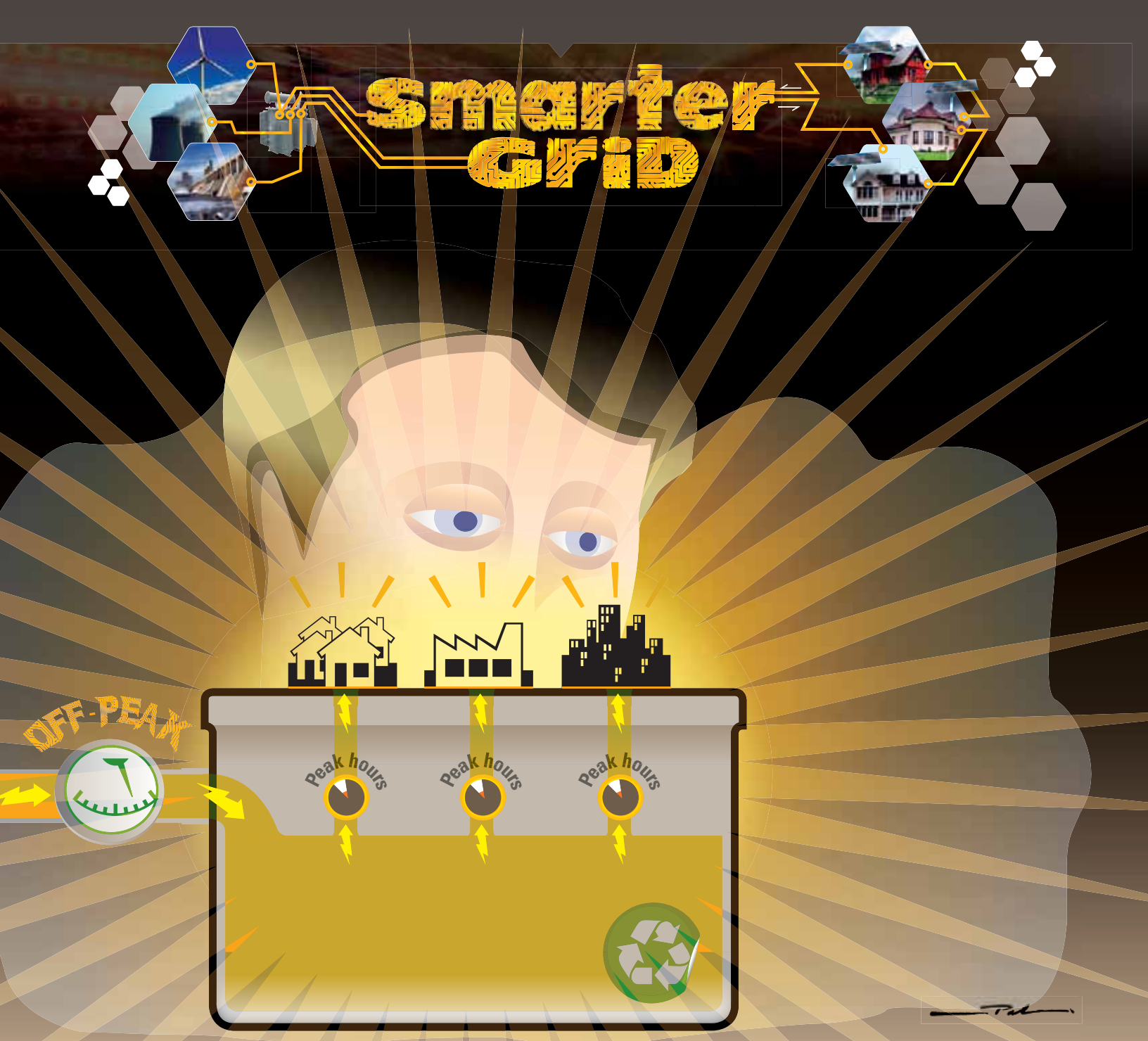
Solantro acknowledges the importance of government support, too. The company accepted a $3.8 million grant from Sustainable Development Technology Canada (SDTC) in 2013 to assist with the development and commercialization of its nano-grid technology. That kind of help can make a big difference for a small company trying to extend its footprint to global markets.

"SDTC has been instrumental in enabling strategic development activities," says Orr. "As a start-up, there is always a tension and a balance between short term execution and strategic developments. The STDC programs have enabled us to reach further towards our strategic goals. This has allowed us to develop system experience and product solutions ahead of a very dynamic market."

And a dynamic market it is: the International Energy Agency (IEA) anticipates that upgrades and extensions to the worldwide electricity distribution network will require $6.8 trillion in investment by 2035. That simply cannot happen without the participation of renewables, with solar photovoltaic technology playing an important role. The fastest movers with the best reputations will be the winners. Fortunately, some Canadian initiatives have helped lend credibility to Solantro.

"The Ontario FIT program has made Ontario a known entity in the solar world," says Orr. "This has contributed to the recognition. As well, our consulates and trade commissioners have been helpful in some markets."

But Orr is also quick to point out that there is "an amazing amount of investment globally." That means sitting still is not an option. In order to keep up with this market you don't lie back and watch the sun set. Instead, you follow it wherever it goes. ■



Repurposing Electric Vehicle Batteries for Energy Storage to Support the Smart Grid

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The increasing popularity of electric, hybrid electric vehicles, and plug-in hybrid electric vehicles (EVs, HEVs and PHEVs) is changing the automotive industry and creating a new stream of automotive waste: used EV batteries. Given that they still have approximately 80% of their power capacity after automotive use, it may be feasible to repurpose EV batteries for use in energy storage and peak-shifting. Such repurposed batteries could be employed in a single home, an office building, a factory or a power plant. The integration of these energy storage systems into commercial and domestic applications would help support the efficient operation of the Smart Grid.

An energy storage system of properly configured repurposed Li-ion batteries provides potential cost savings for business and homeowners by shifting electricity purchases to off-peak times. For utilities, such a system can support an integrated system of renewable energy and help regulate demand. At the same time, it can provide environmental benefits, e.g., improved use of renewables and increasing the lifespan of Li-ion batteries. Our research program considers the capacity, degradation and overall performance of repurposed EV batteries, in addition to the development of business and policy strategies for their use in Canada.

Previous vehicle-to-grid (V2G) models [1]-[3] consider using a battery while it is still in the vehicle to return energy to the grid and suggest that PEVs may profitably provide power to the grid/home when vehicles are parked and connected to an electrical outlet [4]-[6]. In these studies, the economic potential of V2G from PEVs is typically considered to provide power for base load and peak load, as well as electric grid services known as ancillary services, considering energy storage of renewable energy sources. However V2G requires complex power electronics and control systems. Most importantly while the battery pack is in the automotive application it is a 'high value' asset and cycling the battery will degrade its performance and shorten its useful life in the vehicle. Alternatively, in a repurposed remanufactured battery system, storage could be online 24 hours a day to provide energy and storage for the Smart Grid, an advantage over V2G, where power from EVs can be accessed only when attached to the grid for charging. Whereas V2G conceives vehicles attached usually during times of lower energy demand, repurposed batteries can function for peak shifting, that is, contribute to the grid times of peak cost and demand.

Similarly the use of new batteries for load shifting has been studied in a number of demonstration projects [7]-[9]. However, the high cost of new Li-ion battery packs makes this option restrictive. Repurposed packs will be available at low cost, making the potential battery energy storage option economical. Incentives may be initially necessary to encourage users of reused battery systems, but are a positive policy measure because of potential environmental benefits. To encourage homeowners to use repurposed EV battery storage systems, decreases in energy transfer fees and a higher payment for feeding into the electrical grid might be considered. Commercial companies have an added incentive for storing power purchased off-peak, because they can benefit directly from unregulated energy prices. Also, note that with energy storage onsite there is a more effective use of the electrical transmission assets which are congested in some zones at peak hours, and there would be less loss of energy through the transmission system.

80%

of original capacity, Li-ion batteries generally have remaining when they are removed from service in vehicles and as such are still useful energy storage systems.

Properly configured batteries could decrease monthly energy costs by shifting electricity purchases to off-peak times and to favour renewable sources.

The benefits of the use of re-purposed packs include cost savings for the end user, more effective use of the transmission grid, emission reductions and integration of renewable power. Because the user can purchase energy during off-peak times, they can take advantage of variable pricing to reduce energy costs. Additionally, using repurposed-packs for energy storage allows for more efficient use of the energy grid by providing constant energy reserves and storage for meeting changes in supply and demand. This can cause a reduction in emissions, for example in Ontario by allowing energy generated using base load nuclear power to be stored and then used instead of coal or natural gas when demand peaks. Finally, using repurposed energy packs for energy storage and peak-shifting makes it easier to integrate intermittent renewable energy such as wind and solar by helping match supply with demand.

A further potential advantage of using repurposed packs is to keep battery packs in service longer, thus making more effective use of the original materials and manufacturing. The effective useful lifespan of 8 years in an EV battery pack is extended by a decade when repurposed for stationary use. Repurposed batteries add a separate life cycle to the manufactured battery and battery management system. When used outside of an EV, batteries have the potential to provide a safe, stable source of energy. Because the battery is first used only to power the EV, the battery is cycled as designed, and performs at optimal efficiency while in the vehicle, increasing

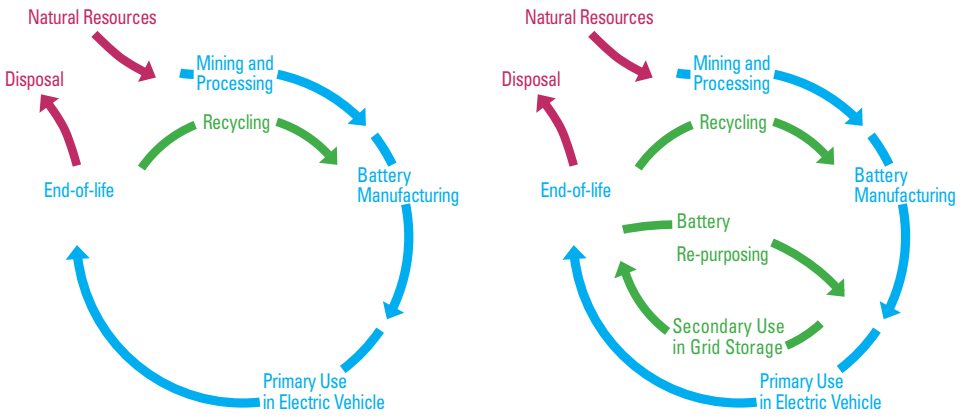

Figure 1. Existing (left) and proposed extended (right) life cycles of EV battery packs [10]

the battery lifespan. Then, the battery is reconfigured to work as a stationary system, repurposed to operate efficiently in a stationary setting. In Figure 1, the process life cycle of repurposing EV batteries for use in stationary settings is shown. Because EV batteries contain a very significant environmental and energy investment in materials and manufacture, it is important to consider the added value provided by extended use in a second life.

Challenges facing the use of repurposed battery packs include energy losses due to 'round-trip' charge efficiency fade, narrow price differentials across times of day in some jurisdictions, the reliability of reused packs and assurance of safety. A key concern with using repurposed batteries for load shifting is that a portion of energy is lost each time a pack is charged and discharged. As a packs ages, the amount of energy lost to heat increases; this is called charge efficiency fade.

For automotive manufacturers, charge efficiency fade has not been a significant concern as in EV operation the total capacity and thus vehicle range are the most important parameters. However, when the packs are being used to store and shift electrical energy, this charge and discharge efficiency critically determines whether energy storage will be cost-effective. Additionally, as energy prices vary geographically and by time of day, the usefulness of repurposed packs for energy storage also varies. There is scant information about the performance of EV battery packs at the end of their life in vehicles. This means that the reliability and future performance of the repurposed packs is also very uncertain.

A key issue facing the use of Li-ion batteries for energy storage is the risk of fire and explosion, so standards will have to be developed. Additionally, recent well-publicized fires in Tesla vehicles and the new Airbus Dreamliner, have brought to the forefront the risk of using Li-ion devices [11], [12]. In large stationary applications which call for greater numbers of battery packs, this risk could be of concern.

Continued research is needed into the technical performance of repurposed EV batteries, in addition to the development of policy strategies for their use in Canada. Future research will develop analytical models using IESO cost data to determine the feasibility of repurposed batteries to provide energy storage and for businesses that purchase unregulated energy.

Most pressingly, analyses of how batteries degrade during their life in EVs are needed to gain a clearer picture of the condition of batteries before they are used to support the Smart Grid. This would allow for better prediction of the performance and lifespan of the repurposed units in repurposed applications. Further, business models must be developed to determine how businesses and residential users can effectively obtain used EV battery systems, and to evaluate how repurposed power products may be marketed in Canada. Finally, there is a need to develop a sound policy strategy in Canada that encourages consumers to purchase the storage units to reduce their energy costs to support the Smart Grid.

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Energy Storage: Industrial-Sized

Peter Smith
Energy consultant

Power reliability is a concern for all industries. But consider the implications for Canada's refineries: An interruption or voltage reduction lasting a mere blink of an eye can be enough to trip sensitive equipment leading to a plant outage. Processing stops, feedstocks must be flared resulting in increased emissions, and even the best designed and maintained plants risk safety or more serious environmental incidents. The bill can be $millions per event.

New technologies such as large-scale battery banks or flywheels may provide the resilience needed by refineries and other large industries. Storage facilities that can meet a large load (20+MW) for a short period of time could sustain a plant during a transitory interruption, or supply essential equipment for a longer period so a plant can shut down in a safe, managed way, avoiding excess flaring caused by an emergency shutdown. Sufficient storage capacity could even aid in creating a local micro-grid island containing local generation and storage, capable of supporting the area during a major outage like the 2003 wide-scale blackout.

Much of the initial concept testing for this kind of large-scale storage has been in aid of the grid. Demand for power varies widely both seasonally and on a daily basis, and generation always has to match demand. In Ontario, the Independent Electricity System Operator (IESO) sends dispatch instructions to large generators every five minutes, and provides fine adjustments every two seconds. However even the best generators are slow to respond; conventional physical equipment just cannot increase output that quickly. Fortunately, demonstration projects with new storage technologies are starting to show promise as economic alternatives in delivering the fast adjustments required to constantly balance the system.

Feedstock flaring during the northeastern North America blackout of 2003

Commercial application of industry-sized storage will require multi-party cooperation, given the needed capacity and the potential for upstream impacts. A conference held in Nov., 2013, in Sarnia, Ontario, brought together key players to facilitate discussion of the potential benefit to local industry. Titled "Grid Resiliency Through Energy Storage in SW Ontario," presenters included: suppliers of the new technology; representatives from local industry; the province's grid provider, Hydro One; IESO; and, Bluewater Power, the Local Distribution Company (LDC). Keynote and panel speakers provided details of the capabilities of the different technologies and of the needs of industry and the LDC, providing each side with an overview of the potential opportunities and generating further discussion. http://energystorage4swontario.com/

Since much of this technology has been developed or refined in Ontario, and the suppliers are based in Ontario, it would be fitting to see Ontario benefit from the development of a full-scale project in the province. The Sarnia area contains a unique mixture of electricity generation, large industrial loads, and engineering/technical experience and knowledge. With a broad industrial base of energy companies, it provides an ideal location for the practical application of these technologies. However, emerging technologies such as this often need financial support from the government in order to become established and reach economic maturity. As the conference attendees heard, the government is presently supporting some demonstration projects and further support will probably be needed to develop an industrial application in Sarnia. A committee under the auspices of the Sarnia Lambton Economic Partnership has commissioned a study of the available technologies to determine which may offer the best fit for a demonstration project in this unique area. The committee continues to pursue every opportunity. ■

Peter Smith *is an Energy Consultant living in Sarnia, Ontario. He has 40 years of experience in the energy industry, including the design, construction, commissioning and operation of nuclear, coal fired, gas and oil fired power plants. He spent 10 years managing the commercial operations of 14 power plants in Eastern Canada, including relationship management, economic operation, commercial and government contract negotiations. Prior to this he spent 14 years in a number of roles related to energy purchasing, conservation and management for a large chemical plant in Sarnia. He has experience in purchasing and selling natural gas, thermal energy and electricity.*

Communication & Control

Om Malik
Professor Emeritus at University of Calgary

The idea of smart grid came, not because the existing grid was dumb, but because of a feeling that the grid would benefit by making greater use of communications, sophisticated sensors and controls. Three major aspects of control, to improve power system operation, security and reliability, and make power system smarter, being pursued are; control at the local level, wide area control and control of renewable sources of electricity generation.

A local controller using local information, called the Power System Stabilizer (PSS), is commonly employed on electric generating units to improve its damping and the stability of the power system. The conventional PSS, a fixed parameter controller, is designed for one operating condition using linear control techniques. Power systems are non-linear and operate over a wide range. Due to the non-linear characteristics, wide operating conditions and unpredictability of perturbations in a power system, the fixed parameter PSS generally cannot maintain the same quality of performance under all conditions of operation.

The adaptive control theory provides a possible way to solve many of the problems associated with the control of non-linear time-varying systems, such as power systems. In this approach, the parameters of the plant are estimated as the elements of a vector at any instant k, and the parameters vector of the controller is adapted based on the estimated plant vector. At each sampling instant, the input and output of the generating unit are sampled and a plant model is obtained by some on-line identification algorithm to represent the dynamic behavior of the generating unit at that instant in time. The required control signal is computed based on the identified model. Various control techniques, both analytic and artificial intelligence, can be used to compute the control [1-3]. One illustrative example of how such an adaptive device can improve the stability margin of a generator is shown in Fig. 1. These experimental results show a generator in stable operation with an adaptive PSS (APSS). At 5s, the APSS is replaced by a conventional PSS and the generator loses synchronism. When switched back to the APSS at 25s, it quickly regains synchronism showing that the generator has higher stability margin with the APSS.

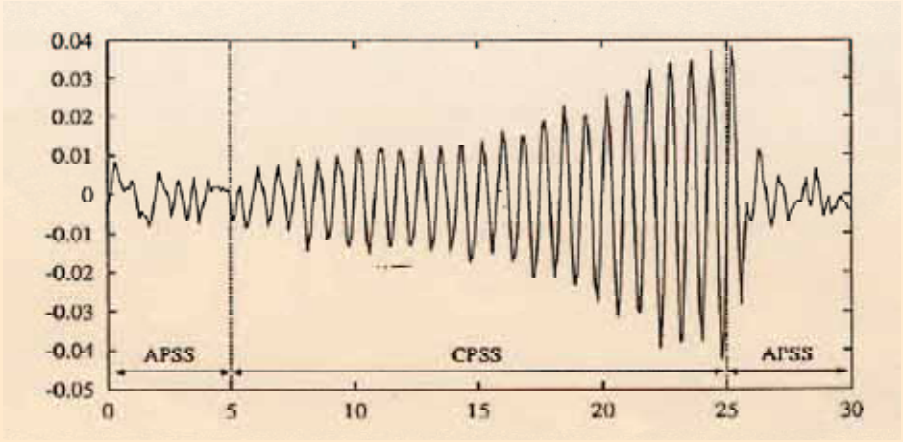

Figure 1. Dynamic stability improvement with an adaptive PSS.

Such controllers have been tested on large thermal, hydro and gas turbine driven generators in Canada and Europe, and are in active service on large hydro and nuclear generating units in Brazil and Europe.

Although local control systems can arrest the propagation of fast developing emergencies, they are not intended for arresting large-scale power system problems that require better observability of the state of the overall system for a wide area coordinated control action. Advances in technology have made possible on-line monitoring, synchronized measurements and fast communication to implement wide area control and protection of large power systems spread over vast geographical areas. A configuration of how a local control can be integrated with wide area controller is shown in Fig. 2. It, of course, can be applied only with the availability of fast communication technologies. Practical application of wide area control systems does require the consideration of a number of points and is evolving at present.

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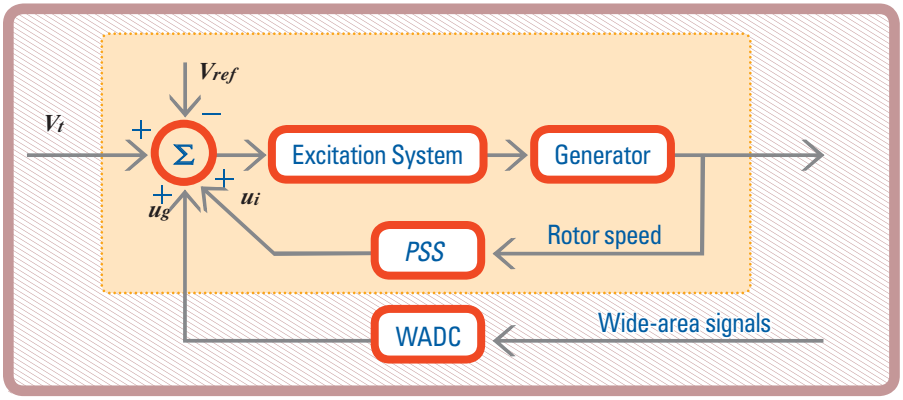

Figure 2. Control configuration with local and wide area control.

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Dr. O.P. Malik *is currently a professor emeritus in the Dept. of Electrical and Computer Engineering at the University of Calgary, where he has been since 1968, teaching and doing research. Before that, he taught at the University of Windsor for two years, and worked with English Electric Co. UK and in electric utilities in India for nine years.*

Graduating in electrical engineering in 1952 from Delhi Polytechnic, India, Dr. Malik earned the M.E.degree from the University of Roorkee, India, in 1962. He obtained the Ph.D. degree from the University of London, London, U.K., and the D.I.C. degree from the Imperial College of Science and Technology, London, in 1965 and 1966, respectively.

Dr. Malik has done extensive research in the application of adaptive control and AI techniques to the control and protection of power systems, including smart grid, and has published more than 500 papers in these areas. He is a Life Fellow of IEEE, and also a Fellow of the Canadian Academy of Engineering and the Engineering Institute of Canada.

Power Quality Data Analytics

Maike Luiken
Director, Bluewater Technology Access Centre, Lambton College

Monitoring of grid elements, collection of data and analyzing it in real-time and off-line are critical for the modern grid. The needs are many, including: grid operations, system performance optimization, predictive maintenance and system planning.

It is standard practice to collect and analyze data for electrical disturbances that would affect Power Quality (PQ), focusing on the harmful effect of the electrical disturbance to enable mitigation. But what if that data could also be used to identify concerns with the system itself?

In July 2013 Wilson Xu made a Presentation at the PES General Meeting in Vancouver reporting unexpected results of his research efforts in the study of all types of electrical disturbances that affect PQ. Dr. Xu and his team found that PQ monitors, due to their general nature are widely used and also used to meet other monitoring needs. They learned that the data has been used to solve issues beyond PQ, like feeder capacitor status monitoring and feeder fault anticipation.

Analyzing the PQ monitoring data -- particular waveform-level data --can yield information beyond the direct electrical disturbance information; the condition of the system and its equipment can also be revealed. So although electrical disturbances affecting Power Quality have negative impact on the grid performance, power engineers are beginning to be able to take advantage of these disturbances to diagnose the system condition for purposes such as fault location/detection and predictive maintenance. Disturbance analysis expertise has led to the capability to locate the disturbance source location and synchronization of measured data. This work has become accepted as a new field of research: Power Quality Data Analytics (PQDA) – the science of extracting knowledge through the examination of raw electrical disturbance data.

Applications of PQDA include:

1. Distribution Feeder Fault Anticipator. Unusual V&I waveforms are analyzed to determine if a potential fault could occur in a feeder. This capability started from a PQ disturbance monitoring project by US-EPRI; fault anticipation is claimed as a key feature of the smart grid.

2. Fault location

3. Home appliance monitoring. Each appliance is represented in a composite waveform – as monitored at the meter - as a component. The target is to profile major appliances in a home relying on unique harmonic signatures from each appliance (North American homes have about 10 to 20 appliances each). Success of this research will create even "smarter" meters. The anticipated benefits of home appliance monitoring are

   - The electricity bill is split to appliance level
   - Power cost per use of an appliance is known
   - Energy efficiency claims can be verified
   - Energy use of similar appliances can be compared
   - The replacement of appliances can be simulated
   - Malfunctioning or unusual functioning of an appliance, as in drawing more power than expected, can be flagged

4. Load parameter estimation

5. Electricity theft

A key element to the success of PQDA is the development of harmonic signatures for the various individual grid system elements.

Looking at the big picture of monitoring activities in today's grids there are four major monitoring networks in current power systems:

SCADA network: 60Hz magnitude data; For load flow, state estimation & other applications.

... continued on page 35

Delivering More Clean Electricity with Virtual Power Plants

*David Beauvais, Steven Wong, Alexandre Prieur, Wajid Muneer, Salman Nazir and, **Philippe Mabilleau
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Virtual power plants (VPPs), defined as collections of managed loads and distributed energy resources, can be used to facilitate the delivery of clean electricity on congested grids. While enabling Canada to capitalize on its vast renewable resources, VPPs bring about many benefits to consumers, generators, and transmission and distribution owners and operators. This article highlights the rationale of adopting VPPs and introduces a smart communications approach between loads and operators that is being explored at CanmetENERGY.

In Canada, smart grid technologies, such as those illustrated in Fig. 1, are being developed and integrated at all levels of the power system, from generation to the consumer. The modernization of power systems has many objectives – an important one is to transit more electricity through existing transmission & distribution (T&D) infrastructure. With a strong penetration of electric space and water heating in the country, T&D circuits must support a high peak demand that lasts only a few hours a year, contributing to annual load factors of 40% to 65%.

To value energy surpluses while mitigating the impact on the peak demand, dual-fuel heating systems and interruptible electric water heaters were deployed in a handfull of jurisdictions in Canada. Using normal appliances, relays and one-way radio systems, utilities would use the

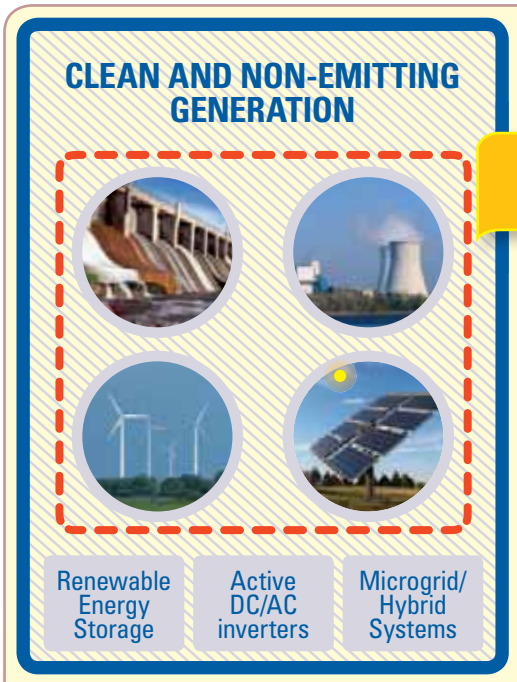
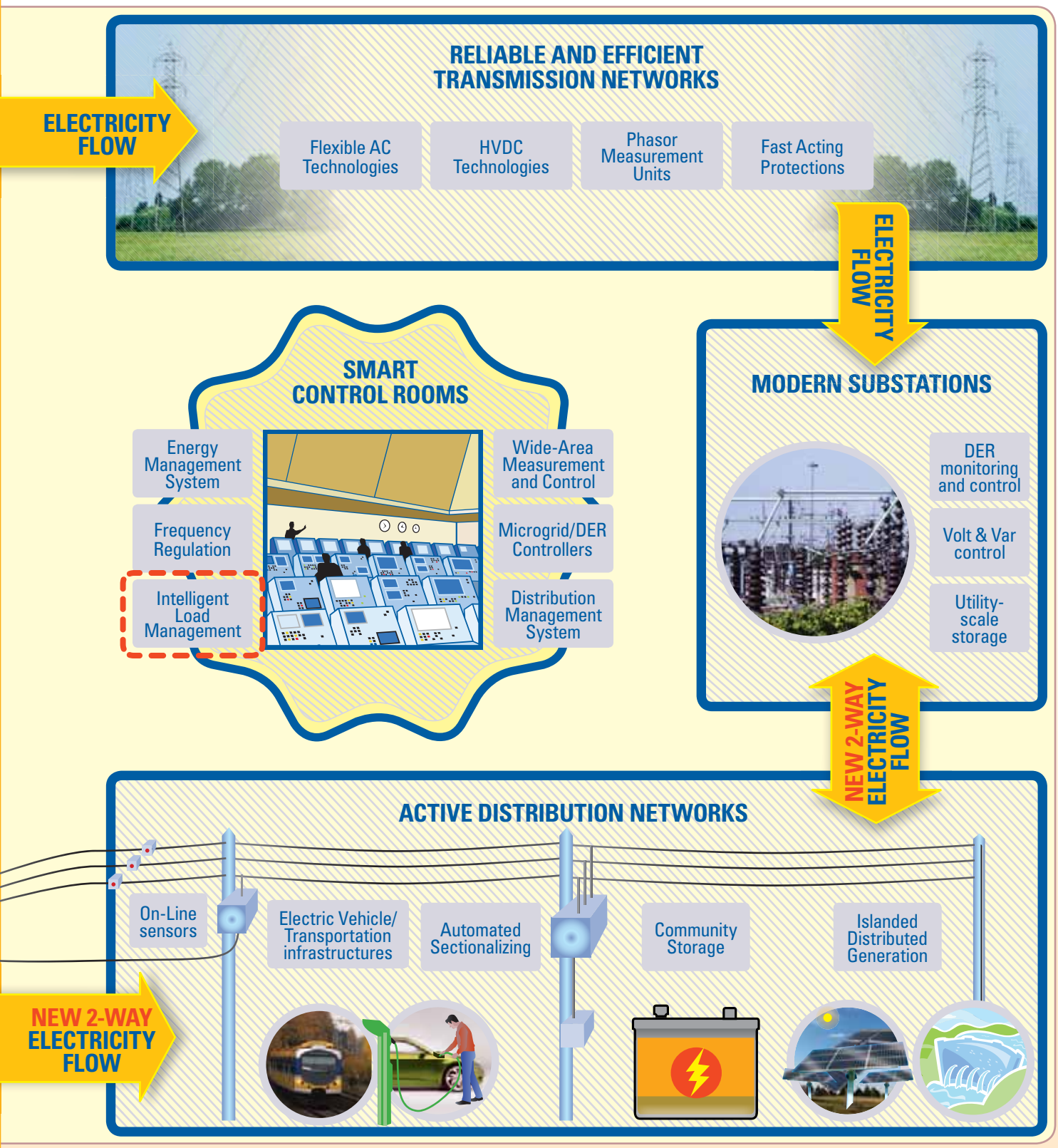


Figure 1: Map of smart grid technologies and applications on different section of the power system. In red rectangles: Clean and non-emitting generation, intelligent load management applications and smart appliances

Virtual power plants (VPPs), defined as collections of managed loads and distributed energy resources, can be used to facilitate the delivery of clean electricity on congested grids. While enabling Canada to capitalize on its vast renewable resources, VPPs bring about many benefits to consumers, generators, and transmission and distribution owners and operators.



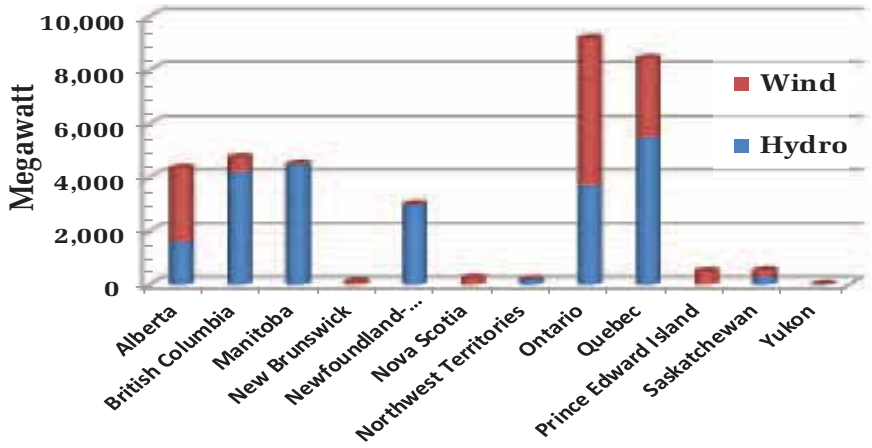


Figure 2: More than 35,800 MW of new hydro and wind generation capacity is projected or committed in Canadian provinces (CanmetENERGY)

Currently, about 75% of Canada's electricity is from clean generation sources. At the time of writing this article, 35,800 MW in hydro and wind generation is projected or committed by the provinces and territories in Canada.

system to reduce the demand during peak or emergency situations.

In a handful of jurisdictions, dual-fuel systems (electricity/wood or electricity/fuel oil) were deployed to lessen the impact of heating loads to peak demand; for control, these approaches used either local temperature sensors or one-way signals from the utility. With new Intelligent Load Management (ILM) technologies and smart appliances, utilities can not only start offering discounted electricity, but also balance renewable energy locally (Fig. 1, in red rectangles). The benefits are twofold: lower electricity prices and minimized GHG emissions.

Currently, about 75% of Canada's electricity is from clean generation sources. At the time of writing this article, 35,800 MW in hydro and wind generation is projected or committed by the provinces and territories in Canada (Fig.2). With more clean generation coming online and new smart grid technologies being deployed, there is an excellent opportunity to further decarbonize the energy sector in Canada and in the export markets.

Along with investments in large generation, programs to increase the adoption and integration of demand-side distributed energy resources (DERs), such as distributed generation, thermal and battery storage, smart thermostats and water heaters are being explored. While the integration of large centralized generation with a large number of small and geographically dispersed decentralized resources presents a dichotomy of sorts, a smarter grid can be used to facilitate their harmonious integration and draw out synergies. Together, these options can extend the boundaries of traditional utility investment, beyond network capacity, all the way to customer-side equipment.

Introduction to Demand Response

Demand Response (DR) programs and technologies aim to enable customer loads to respond to market electricity prices or stresses in the power system. Such response from the demand-side helps to mitigate costs in the power system that might otherwise be shouldered with load growth. As presented in Fig. 3, electricity from new bulk generation must be transmitted through the T&D network to the end user. Along this supply chain are infrastructure capacity limits constraining the amount of new demand that can be served during peak periods. Should peak demand increase beyond existing capacity, expensive infrastructure investments will be needed. Shifting electricity use from on-peak to off-peak times is a key strategy for deferring or avoiding capital expenditures and can help utilities to better utilize capital, remain competitive and keep costs low.

In Canada, all provinces but Ontario have winter peaking systems; residential heating plays a major role in contributing to these peaks (which typically occur in the morning and evening). Traditionally, the few DR deployments in Canada and the United States have relied upon the use of VHF radio or pager systems to communicate with thermostats or relays connected to these appliances. Participants in such DR programs often received special rates or incentives for allowing interruption of their load during system contingencies (including peak demand periods or emergencies).

With evolving Information and Communications Technology (ICT) and Intelligent Load Management (ILM), a new type of demand response is made possible. This smart grid application supports more grid services than just peak demand reduction and could lead to a more effective load management than with, e.g., a VHF system. ILM can be used by the operator (or utility) to shift, shed, or shape demand according to power system needs or market opportunities. It could be used to provide both energy and reserve to the operator.

An example of ILM capabilities was demonstrated in PowerShift Atlantic's project, where load-based spinning reserve and a new service, called "load shape management," is being tested to wind balance generation fluctuations in the Maritime Provinces. However, managing large numbers of intelligent loads requires an appropriate set of customer engagement programs and technologies. These technologies need to sense and control the demand while minimizing its effect on the end user, exploiting, e.g., heat storage or fuel-switching capabilities in real-time to optimize the network from end-to-end.

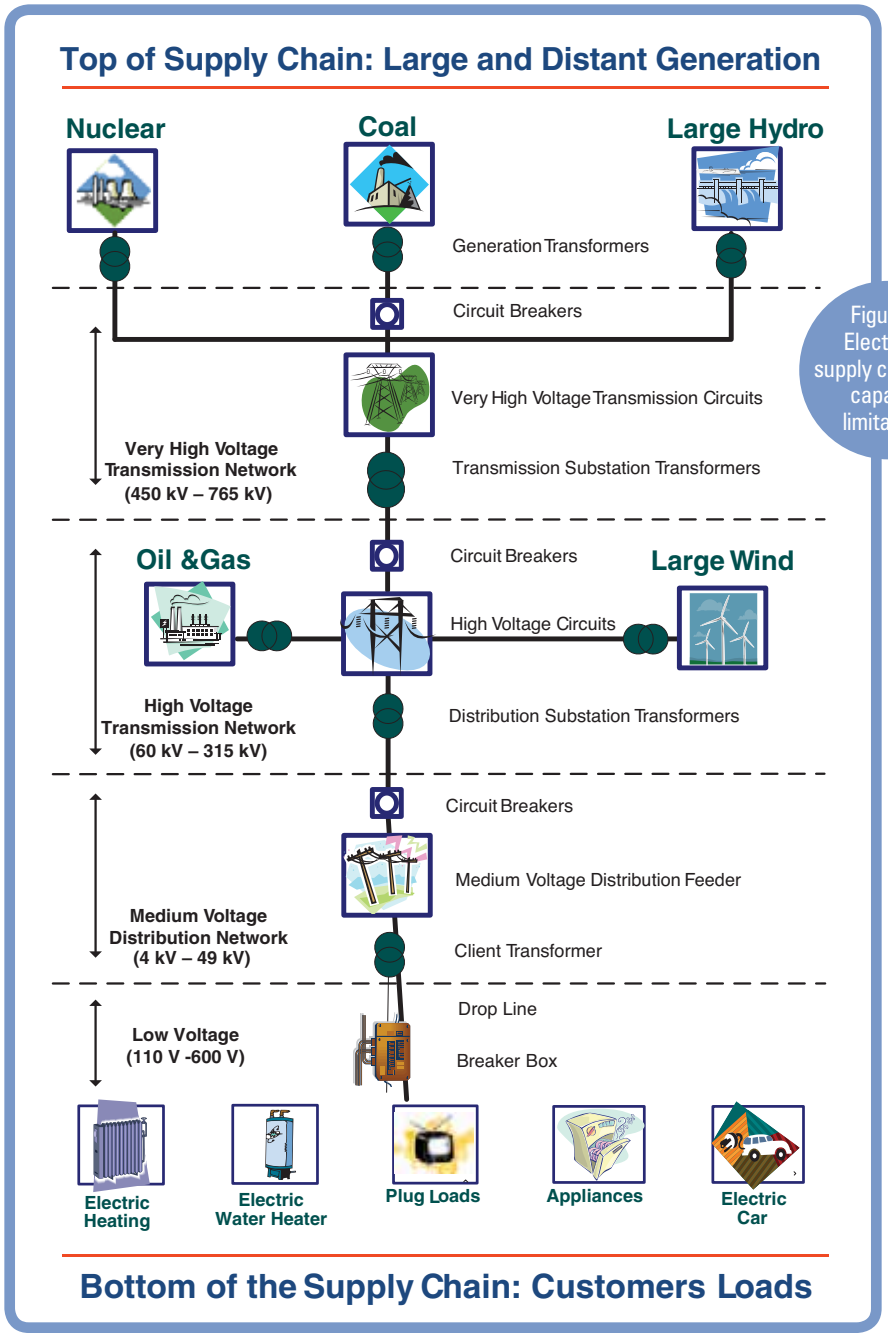


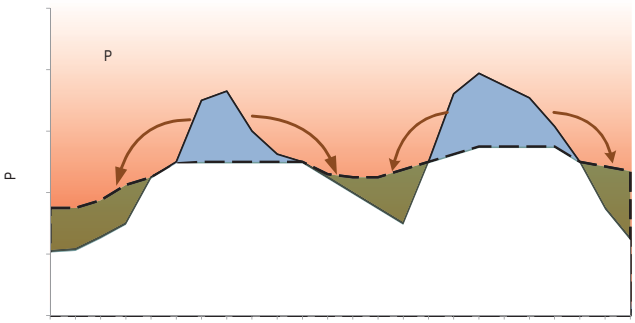
Figure 3: Electricity supply chain and capacity limitations

Off-peak heating opportunity

In Canada, only 30% of the residential space heaters and 45% of the water heaters are electric. Replacing heating oil in many regions makes economic sense for customers, but weak distribution networks may limit the capacity of utilities to tap into this market. New smart heating appliances may be used for that aim. As presented in Fig. 4, electric thermal storage units and electric water heaters, interruption devices, or dual-fuel technologies can be used to deliver more clean electricity during power system valley periods. With the right set of technologies, ILM can be made transparent to the end user by utilizing the inherent storage or substitution potential of each smart heating appliance.

Even without growing the electric heating system market, the current stock of electric space and water heaters in Canada could be easily either replaced or retrofitted to capture thermal storage potential. Currently, 6 million Canadians use electric water heaters. With a typical electric water heater having 3-5 kWh of storage (through varying temperature within the dead-band) there is 18-30 GWh, in Canada, of thermal storage capacity that is available with little required capital investment.

Additionally, central or wall-mount electric thermal storage units can be used with some of the 5.5 million electric heating systems currently in place to even further increase the storage capacity of the residential sector. Replacing or supplementing baseboard or central heating units, these units contain high-density bricks capable of reaching temperatures of 700°C that store heat for later use. In other words, they can store



With the right set of technologies, Intelligent Load Management (ILM) can be made transparent to the end user by utilizing the inherent storage or substitution potential of each smart heating appliance.

Figure 4: Load shifting on weak distribution network, using dual-fuel heating systems, smart electric water heaters and electric thermal storage devices

enough off-peak energy (up to 45 kWh in a single unit) to heat a home for peak periods of up to 16 hours. They also come in different sizes and shapes, with or without embedded communications. Alternatively, dual-fuel heating technologies can be utilized such that electricity is used during all but peak periods, when the units switch to natural gas, biofuel or wood pellets.

Virtual Power Plants

In the past, loads have usually been regarded as passive or uncontrollable elements by power system planners and operators. Managing a large volume of these small resources to draw power, at the right time, will require a new mindset and more automated intelligence in the control room. To meet these ILM requirements, the VPP concept is proposed. Still in its infancy, VPP leverages the storage or operational flexibility of DERs to provide energy and ancillary services; in essence, VPP controlled DERs act as a single generator.

Illustrated in Fig. 5, a VPP aggregates several DERs to deliver products and services to the system operator or market. By aggregating these DERs, the need for a wholesale energy market, ancillary service market, or dynamic pricing structure to drive individual DERs is alleviated. If operated by a vertically-integrated utility, a VPP would discern, for example, whether it is of a lower cost to use energy stored in a dam's reservoir or that within a population of electric water heaters. Like bulk generation, the two-way flow of information will enable DERs to be optimized and dispatched every five minutes. Applications include hedging (buying electricity when it is low cost and selling later at a high price); regulation, e.g., to smooth fluctuations in wind generation; provision of contingency reserves; reactive power compensation (voltage support); and facilitation of cold-load pickup (black-start capabilities). VPPs could also utilize, for example, the pre-heating and pre-cooling capabilities of DERs to relieve system stresses from ramping.

The functionalities of VPPs are not all that different from that of legacy energy management systems used by system operators, except that they can also manage loads. Load management requires the monitoring of resources, as well as forecasting, optimization, and dispatch capabilities. Note that while Fig. 5 depicts direct access of the VPP to DERs, a VPP platform would also be capable of managing DERs through different DER aggregators or third-party technologies.

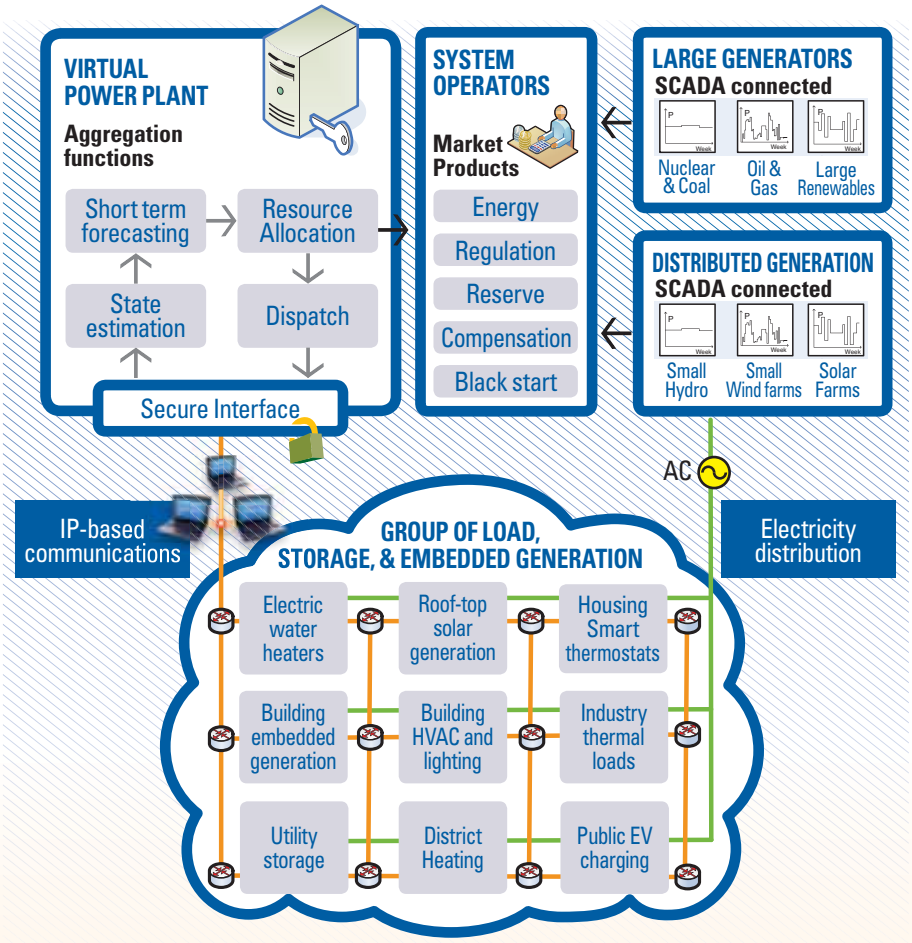


Figure 5: Overview of a virtual power plant: The distributed energy resources are aggregated and used to provide services to the system operator

A virtual power plant (VPP) aggregates several distributed energy resources (DERs) to deliver products and services to the system operator or market. By aggregating these DERs, the need for a wholesale energy market, ancillary service market, or dynamic pricing structure to drive individual DERs is alleviated.

The Information and Communication Challenge

A great challenge of the VPP concept lies in having the right information and ICT for communicating to and from smart appliances. Performance requirements, reliability, privacy and (cyber) security must all be taken into account. The acquisition of customer data

Smart grid technologies have the potential to revolutionize utility-customer relationships. They represent an opportunity for Canadian utilities and generators to sell more clean electricity, while benefitting from higher operational efficiencies. Customers can lower their energy costs while contributing to a cleaner environment.

through the internet enables greater DR potential, but at the same time poses new challenges that would not otherwise have been an issue with legacy pager systems. ICTs must be properly built to manage the fast, bi-directional flow of data and, most importantly, follow the "privacy by design" philosophy. Solutions to these challenges can be found in many different ways. Using an end-to-end mesh communication network like the Internet enables multiple paths of information and removes the possibility of a single failure on any point of the system disabling it.

On top of the physical connection, many different private and secure information technology approaches can be used to comply with information security standards. For example, to meet the "big data" and privacy requirements of vertically-integrated utilities, information exchange based on peer-to-peer (P2P) communication, instead of client-server architectures, can be used. This approach, currently being explored by CanmetENERGY, has been popularized by web applications such as Skype and is being laboratory tested for power system applications.

As presented in Fig. 6, P2P ILM solution involves intelligent electronic devices (IED) both receiving and transmitting information to their peers through a secured overlay network, without an explicit need to directly communicate with a central server. Applied to VPPs, P2P communications can be used by loads to share their status with one another to aid in their decision making to meet objectives as set out by the system operator. When receiving the information, individual entities can decide whether or not to consume electricity based on the customer's preference, the control entity's request, and the status of other peers (rather than decisions received from or negotiated directly with a central entity). With no operator in the loop of the P2P data exchanges this communication is "private by design." With the right set of operational tools for scheduling, the utility using this technology would be capable of employing energy resources from smart appliances to fill different grid service needs.

Conclusion: The intelligent load management business model

Smart grid technologies have the potential to revolutionize utility-customer relationships. They represent an opportunity for Canadian utilities and generators to sell more clean electricity while benefitting from higher operational efficiencies. For customers, there is the opportunity to lower their energy costs while contributing to a cleaner environment.

ILM and smart appliances offerings could enable electric utilities to gain and retain customers in the face of increased competition, and lead to new export opportunities. With low-priced natural gas competing with electric heating and clean/renewable energy, off-peak rates may be necessary to increase market share and remain competitive (while delivering as much energy as possible). On the plus side, off-peak rates are a natural market response to supply and demand needs. As was shown in Fig. 3 and Fig. 4, off-peak delivery of energy does not create any stresses (and costs) along the electricity supply chain that peak delivery entails. Coupled with typically higher costs for generation during peaks, peak electricity rates will have an economic tendency to be higher than off-

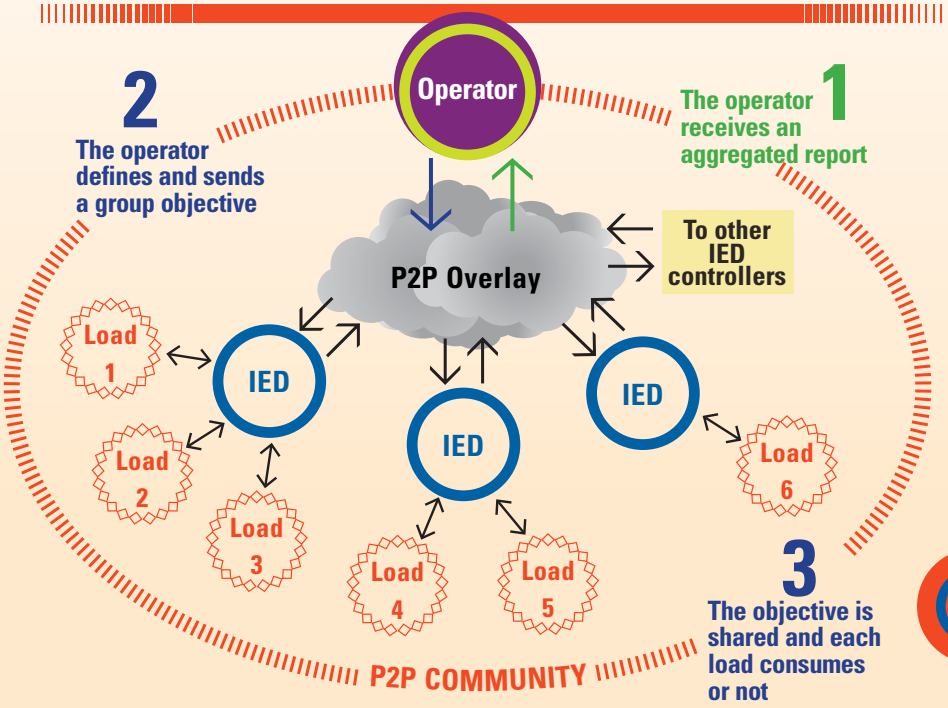


Figure 6: Peer-to-Peer (P2P) communications for power system applications with Intelligent Electronic Devices (IED)

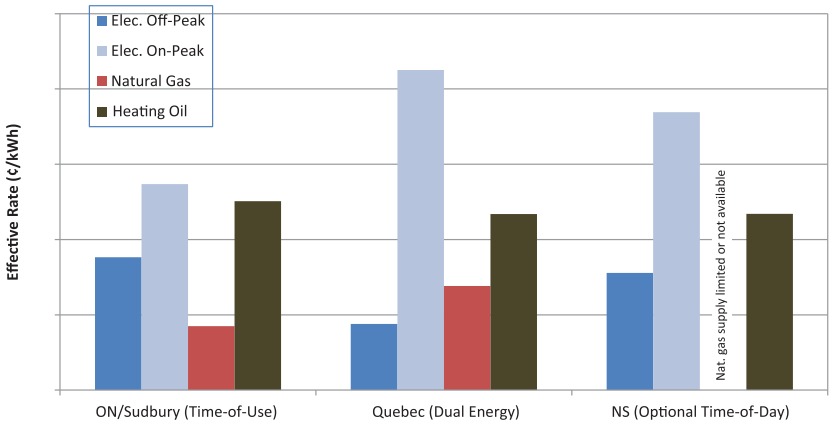


Figure 7: Off-peak prices of electric heating compare to natural gas and oil heating in Ontario, Quebec and Nova Scotia. In these jurisdictions, some utilities cover a share of the off-peak heating equipment.

Through smart grid concepts such as intelligent load management, loads will become active members in balancing the power system, banding with generation and transmission/distribution entities to contribute to a cleaner and more flourishing electricity sector in Canada.

peak rates. As presented in Fig. 7, there are already a few off-peak/dual-fuel rates offered in Canada in a mandatory (Ontario) or an opt-in fashion (Quebec, Nova Scotia). At Greater Sudbury Hydro, electric thermal storage installation cost is being covered at 75% by the utility to take advantage of off-peak electricity price in Ontario. At Hydro Sherbrooke (Quebec), 75% of the integration cost of a dual-fuel system and a cheaper tariff is offered to customers as part of their load management program. At Nova Scotia Power, an optional Time-of-Day rate is offered to customers with electric thermal storage devices.

Since using demand-side resources to balance the system also reduces the burden on the power system and reduces greenhouse gas emissions, a "green or grid-friendly tariff" valuing this benefit could be applied to further reduce off-peak prices. To engage new clients, a utility could make investments at a lower cost in customers' home appliances, rather than on their own network. Costs, and benefits of these smart appliances could be shared with customers and distributed through rate adjustments. The availability of these technologies could also lead to a new business model in the industry, where utilities would evolve from commodity providers (of kWh) to service providers (of water and space heating, for example).

Virtual power plants have the potential to herald in a new paradigm in utility and customer relationships. Through smart grid concepts such as intelligent load management, loads will become active members in balancing the power system, banding with generation and transmission/distribution entities to contribute to a cleaner and more flourishing electricity sector in Canada. ■

Further Reading on Virtual Power Plants:

1. D. Beauvais, A. Prieur, F. Bouffard, *Smart Grid to balance renewable energies – Contributing Distributed Energy Resources*, 2012 177 (RP TEC) 411 FLEXIN, 65 pages. http://www.nrcan.gc.ca/energy/publications/sciences-technology/renewable/smart-grid/6165

2. S. Wong, W. Muneer, S. Nazir, A. Prieur, *Designing, Operating, and Simulating Electric Water Heater Populations for the Smart Grid*, Report No. 2013-136 (RP-TEC), CanmetENERGY, Varennes Research Centre, Natural Resources Canada, August 2013.

3. D. Beauvais (CanmetENERGY), Michel Losier (New Brunswick Power), *A Virtual Power Plant to Balance Wind Energy – A Canadian Smart Grid Project*, Report No. 2013-057 (RP-TEC), June 2013. http://www.nrcan.gc.ca/energy/offices-labs/canmet/publications/smart-grid/14697

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Philippe Mabilleau, *PhD, is professor at l'Université de Sherbrooke since 1984. His current research focuses on networked smart devices design and pervasive computing application, especially in the context of smart home and smart grid deployment.*

Micro-Grids: Concept and Challenges in Practical Implementation

Om Malik
Professor Emeritus at University of Calgary

Strain on electrical macro-grids makes them vulnerable as evidenced by large blackouts in various parts of the world over the past few years. With an increasing awareness of the environmental effects and limitations of fossil fuels, and high capital requirements of central power plants, distributed generation (DG) at medium and low voltage levels is gaining importance. Penetration of DG sources at the distribution level causes technical problems in the network operation, e.g. excessive voltage rise, increase in the fault level, etc., because the present electric power infrastructure at the distribution level is designed for current flows predominantly in one direction. To overcome these problems the concept of micro-grid has been developed as an energy management system and is already applied in a number of communities to provide benefits to customers.

Concept

Micro-grids can help make better use of energy generated, stored and used at a local level, thereby enhancing local reliability and flexibility of the electric power system. A micro-grid may consist of multiple generating sources making use of clean renewable sources of energy, customers, energy storage units, etc. within a clearly defined electrical boundary acting as a single controllable entity and be able to operate physically islanded or interconnected with the utility grid. Local generation allows better management in case of emergencies as has been demonstrated in a number of instances recently.

A number of technologies, ranging from conventional, such as small hydro, micro gas turbines, diesel generating units, biofuel, municipal waste, to renewable generation sources such as wind turbines, photo-voltaic and fuel-cells have been applied. An illustrative example of a micro-grid is shown in Fig. 1.

Operation

A micro-grid can be operated in two modes of operation:

1 Connected to the grid. In this case it provides quality of supply, global efficiency, flexibility of use and reduced cost. In times of need it can draw energy from the grid and supply energy to the grid in times of excess energy availability.

2 Operate autonomously isolated from the grid (i) under emergency during grid faults or (ii) as energy source in remote locations where cost of providing transmission lines may be very high.

Challenges and Amelioration

Although micro-grids can be very useful in making use of renewable resources for electricity generation and providing electricity at reasonable cost even to remote communities, challenges exist. These challenges can be overcome by judicious design. Also, integration of protection and control can make a significant contribution in the operation of the micro-grid.

Electricity generation using wind and solar can be intermittent and unpredictable. They depend highly on the weather systems. Long term and even short time ahead forecast techniques for both wind (gusts) and solar (clouds) still lack the desired accuracy. As micro-grids have relatively small capacity, they are vulnerable to random

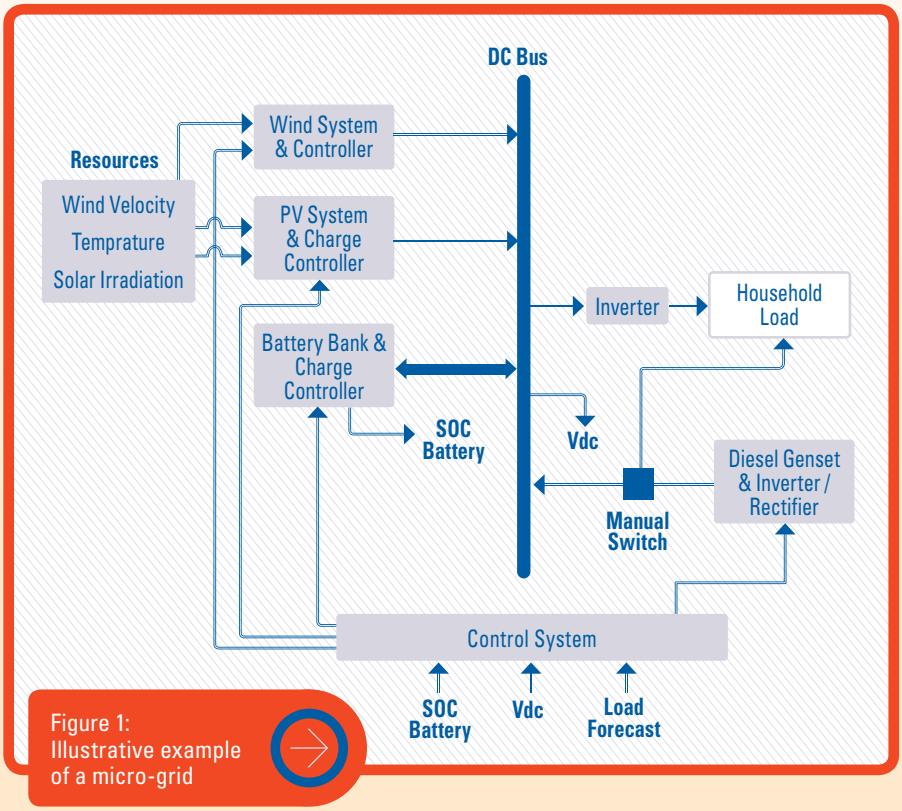


Figure 1: Illustrative example of a micro-grid

variations in generation and load. This may cause problems with operational capability and quality of supply.

- Availability of wind and solar radiation may not match the time distribution of load demand. Thus, providing electricity to meet load at all times in a regular way can be a challenge.

- Design of a hybrid system becomes complicated through uncertain renewable energy supplies.

- In isolated mode, chances of P and Q shortages that must be compensated instantly from somewhere.

- Conventional distribution systems are supplied through one source at one end. Protection schemes are relatively simple. However, presence of generation in the distribution system leads to loss of coordination of protection devices.

- Requires fast detection of islanding conditions to guarantee safety, reliability and integrity of the entire system.

Meeting these challenges requires:

- Strategic deployment of distributed energy sources in respect of location, size and technology to suit the requirement. An example is the integration of solar and wind sources in proper combination using the strengths of one to overcome the weaknesses of the other.

- Use of energy storage devices to balance load demand and generation by intermittent sources of generation.

- Proper control techniques to manage the operation of all components.

- Proper schemes for protection at the distribution level.

Role of Energy Storage

Energy storage is a critical element in the integration of DG into the micro-grid and can impact the economic feasibility of the installation. It can help maintain stability, allow optimization of generation sources, improve power quality, allow black start of the system, exploit off-peak prices and provide short term power supply to act as a buffer not only to counteract power imbalances but also for critical customers in fault situations.

Currently several types of energy storage technologies with different characteristics are available. These include: small hydro pumped storage, batteries, high speed flywheels, super-capacitors, compressed air, chemical conversion to Hydrogen for fuel cells, super heated gas. flow batteries, superconducting magnetic energy storage, etc. Which technology to employ involves a trade-off between power and energy density.

At the current state of technology, batteries are considered the best choice to provide both power and energy densities. Their efficiency varies between 60-80 %. In addition to the better known lead acid battery, several types of new batteries have been developed in recent years, Fig. 2, and are in use for industrial applications. Considerations in battery deployment are the initial and maintenance cost, energy density and response time, charge and discharge cycle life and environmental concerns.

Electric vehicles connected to the grid can also perform as energy storage units. As their numbers increase, with proper control they can play a significant role in frequency stabilization in a micro-grid in the future.

Energy storage units can be either distributed or centralized depending on the size of the micro-grid. They require power electronics interface for access to the micro-grid. For optimal operation and to derive most benefit, it requires consideration of type, configuration and the impact of energy storage system on the micro-grid.

Control Methodology

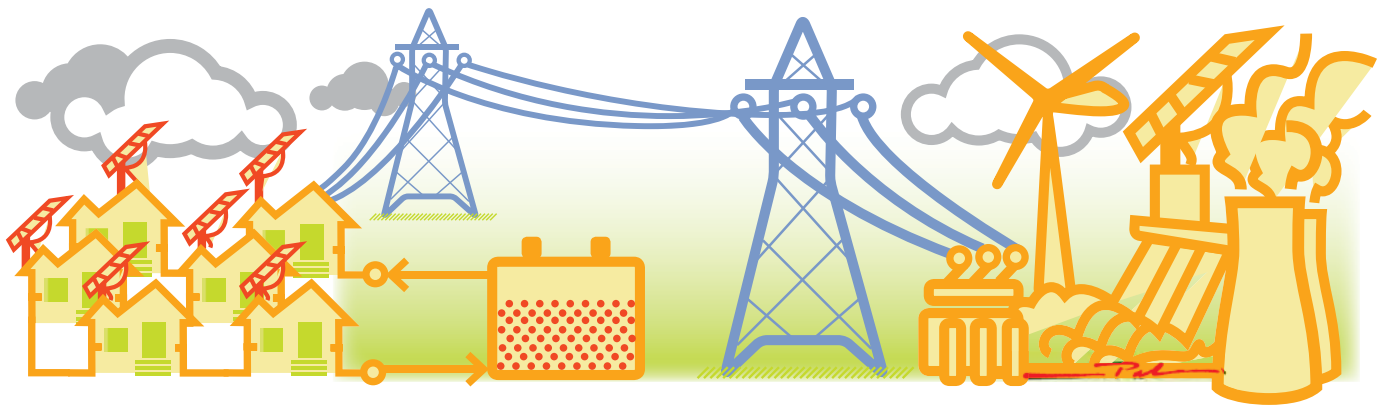
Distributed generation sources are inertia-less or have low inertia that can have a significant impact on voltage and angle stability of the system. It can be compensated by connecting energy-storage to the system, sometimes called "virtual inertia". With this control strategy, electronically interfaced DG will behave as a conventional generating system. Connecting energy storage system requires integration of power electronics interface control in the overall operation of the micro-grid.

Power and VAr injection throughout the distribution network provided by DG alters the original passive nature of the distribution network thus affecting the network voltage profile. It makes it hard to perform voltage regulation, and coordinated voltage and VAr control may be required, thus necessitating a radical revision of control strategies.

Protection

Even though most LV and MV networks are laid out as meshes, they are operated as "normally open" using automatic and manually controlled switches. Most protection schemes at the distribution level are currently designed for radial lines with unidirectional power flow. The presence of generation in the distribution system may lead to loss of coordination of commonly used simple protection devices, such as fuses, re-closers, over-current relays, automatic sectionalizing schemes. It could also result in false tripping, undesirable network islanding, prevention of automatic and asynchronous re-closing.

At a few special locations these circuits are being operated as closed meshes using special schemes such as power electronic



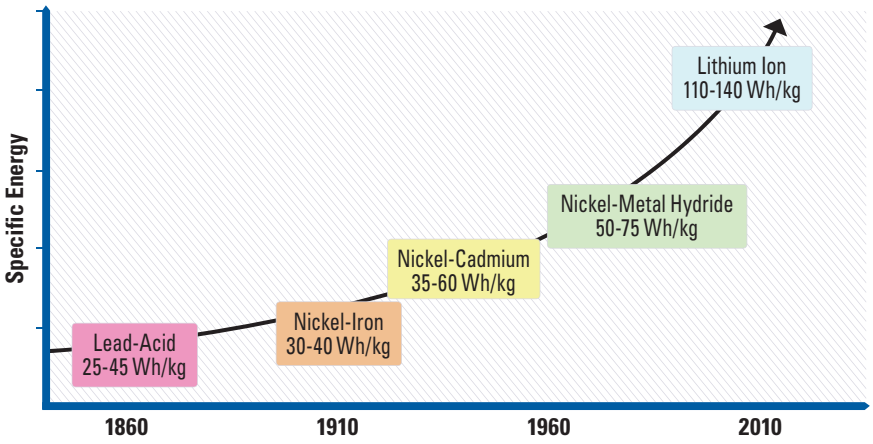


Figure 2. Characteristics of various types of batteries (source EPRI 2008)

devices to control the interface between sections of a mesh. Also, better protective equipment, such as cheaper breakers and intelligent electronic devices for relaying, is being developed that will ultimately aid in the protection of micro-grids.

Protection schemes for diagnosis and isolation of faults to protect distribution system that include DG need to be developed. It is also necessary to establish loss of mains requirements and develop methods for islanding detection.

DC Micro-Grids

One of the latest developments is the establishment of dc micro-grids. Many electric energy utilization applications now require either dc or double conversion from ac to dc to ac. These include large data centers, commercial buildings using variable speed motor drives, electric vehicle charging or anywhere power electronics based devices are used. These involve interconnecting a localized grouping of electricity sources and loads. In these cases, electricity is either predominantly generated or distributed and used in dc form at up to 1500 V dc. They can operate either connected to the traditional centralized grid or function autonomously as physical and/or economic conditions dictate.

Advantages of dc micro-grids are: reduced or complete elimination of ac-dc conversion, reduction in losses, more economical and decentralization of the grid.

However, because they are in the early stages of development, there is still a lack of suitable equipment for dc distribution coupled with lack of application knowledge at distrisbution level dc. Pathway for moving from the existing ac-centric power distribution systems to dc-based distribution systems is still unclear but evolving.

Concluding Remarks

Micro-grids can be very useful in making use of renewable resources for electricity generation. They can also provide electricity at reasonable cost to remote, isolated communities.

However, challenges exist but they can be overcome by judicious design and proper control techniques in the operation of the micro-grid. Integration of protection and control can make a significant contribution. ■

For Om Malik's biography, see page 25.

Power Quality Data Analytics

... continued from page 25

PMU network: 60Hz magnitude & phase data; killer applications have yet to be identified

PQ network: Waveform & transients data; for PQ monitoring and, in the future, for PDA/PQDA

AMI network: Interval E, P, V & I data; for billing purpose and demand monitoring

The PQ monitoring network provides a unique set of data with a significant amount of information on the performance of a network and its elements. It is the best candidate to collect and provide waveform-level data. It is just a matter of time before large-scale waveform-level data will be made available to utility companies. The goal of power disturbance analytics is knowledge extraction and to create killer applications based on such data.

To summarize, electrical power disturbances can provide information quite useful to utilities with applications beyond traditional PQ activities. At present, the PQ monitoring network is the most general platform to provide the data needed for significant knowledge extraction, and will likely emerge as a powerful platform for power system monitoring, in parallel with SCADA, WAMS and AMI.

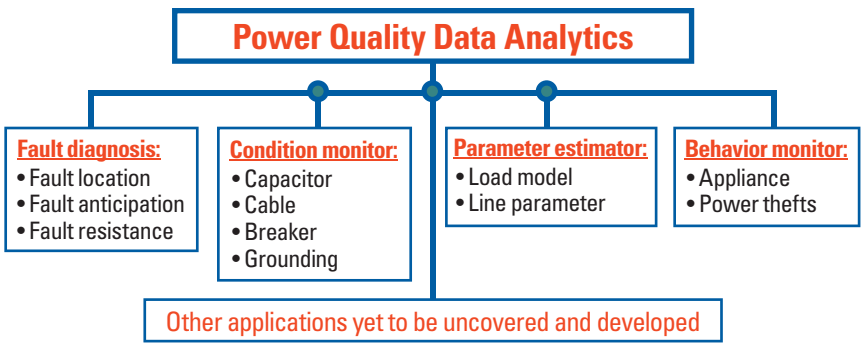


Fig. 1 Overview of Power Quality Data Analytics

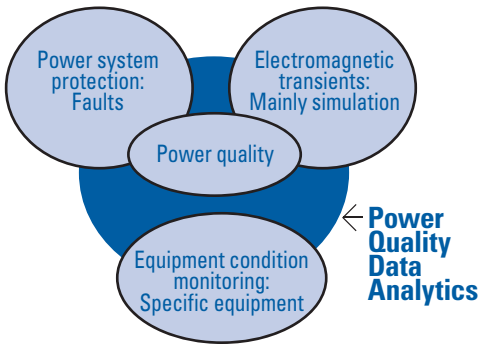


Fig. 2 Various fields contributing to Power Quality Data Analytics

For those interested in finding out more about research in this area, there are two proposed IEEE standards addressing these issues: P1836 and P1837; there is also a working group: PES PQDA WG ■

This article prepared with material from Wilsun Xu, University of Alberta.

Manitoba Hydro's plans to meet provincial electricity demands and export opportunities

Hilmi Turanli and **Ronald Mazur**[1]
Manitoba Hydro

Manitoba Hydro is experiencing an on-going growth in electricity load in the province as well as increasing export opportunities. This article describes the current power system, and identifies future hydro generation potential along with associated transmission required to deliver this generation to Manitoba load and export customers. Manitoba's hydro power resources offer a very large potential for reliable green clean energy generation for Canada: There are over 5,000 MW of clean hydro electric energy potential to develop; this requires resilient bulk transmission capacity to transfer this power to load centers in the most efficient way. Here we are discussing today's reliability, projects under way and plans for future development of electrical energy and transmission for a smart(er) , highly resilient, electricity grid.

Figure 1: Existing Generation and Major Transmission System

As reported in earlier publications [1, 2, 3], Manitoba Hydro studied the possible development of new hydroelectric generation stations in northern Manitoba. Three sites were under consideration: Gull Rapids on the Nelson River, Notigi on the Rat River and Wuskwatim on the Burntwood River. Manitoba Hydro has recently completed construction of its newest hydroelectric generation station Wuskwatim G.S. (rated 214 MW) on the Burntwood River. New outlet transmission facilities needed for the plant were completed in 2011. The plant was placed into service during the summer/fall of 2012.

Manitoba Hydro has recently studied the possible further development of new hydroelectric generating stations in northern Manitoba. Two sites were under consideration: Keeyask G.S. (formerly called Gull G.S.) and Conawapa G.S., both on the Nelson River. The necessary community consultation, engineering, economic and environmental studies were completed to enable decisions to be made on continuing development. In June 2014, Public Utilities Board (PUB) Need For Alternatives To (NFAT) Panel recommended that the Government of Manitoba authorize Manitoba Hydro to proceed with the construction of the Keeyask Project to achieve a 2019 in-service date.

Existing Generation and Major Transmission System

Manitoba Hydro is a provincial Crown Corporation providing electricity to 548,774 customers throughout Manitoba and natural gas service to 269,786 customers in various communities throughout southern Manitoba [4]. Manitoba Hydro also has formal electricity export sale agreements with a number of electric utilities and marketers in the Midwestern U.S. and the Canadian provinces of Ontario and Saskatchewan.

[1]Mr. Mazur has recently retired from Manitoba Hydro.

Figure 3: Wuskwatim G.S.

The amount of electricity generated from renewable resources amounts to 99% of the total energy generated [5] where the majority is from self-renewing waterpower. On average, about 33.1 billion kilowatt-hours of electricity are generated annually. Seventy-five percent is produced by five hydroelectric generating stations on the Nelson River; the remainder is generated at nine hydroelectric stations on the Winnipeg, Saskatchewan, and Laurie rivers; two thermal stations; and four diesel sites. The electricity is transmitted over nearly 105,000 kilometers of transmission and distribution lines.

Manitoba Hydro has 5725 MW of generation connected to its network. In addition, 116 MW of wind generation at St. Leon and 138 MW of wind generation at St. Joseph are available to Manitoba Hydro under power purchase agreements. In 2012, wind plants in Manitoba produced 875 GW.h, while in 2013 they produced 900 GW.h. Roughly 2.5% of Manitoba's annual energy generation is supplied by wind turbines.

In 2013, the corporation supplied a provincial gross total peak of 4535 MW (weather adjusted 4432 MW) [4]. The provincial peak load is growing at an average rate of about 1.5% per year (energy 1.5% per year).

The transmission system in Manitoba is interconnected to the transmission systems in the provinces of Saskatchewan and Ontario and the states of North Dakota and Minnesota by 12 tie lines. Of these, three 230 kV lines and one 500 kV line interconnect the Manitoba system to the United States, three 230 kV and two 115 kV lines interconnect to Saskatchewan, and two 230 kV lines and one 115 kV line interconnect to Ontario; see Figure 1, page opposite.

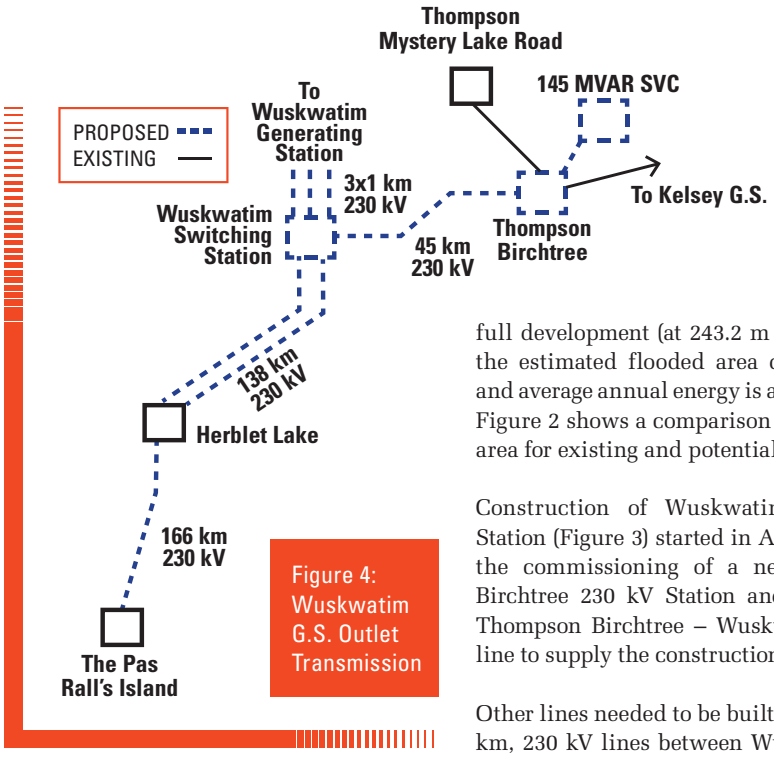


Figure 4: Wuskwatim G.S. Outlet Transmission

The tie lines to the US and Ontario are equipped with a special protection system that reduces the HVDC power (to eliminate the surplus power above tie capability) very rapidly following the loss of a tie in order to prevent cascade tripping of the remaining tie lines.

Wuskwatim Generation and Outlet Transmission Facilities

The initial concept design of Wuskwatim and Gull (now named Keeyask) started in the 1990s. The generation station design was modified to have less effect on the environment, greater public and market acceptability, but at higher cost and lower generation capacity. Flooding was designed to be less than 1-km square at Wuskwatim. When partial development (at 235 m forebay level) of Wuskwatim is compared to full development (at 243.2 m forebay level), the estimated flooded area drops by 90% and average annual energy is about 25% less. Figure 2 shows a comparison of the flooded area for existing and potential hydro plants.

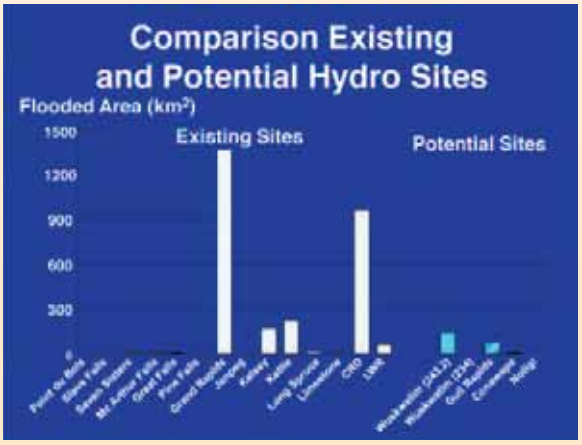


Figure 2: Comparison of flooded area [1,2]

Construction of Wuskwatim Generation Station (Figure 3) started in April 2007 with the commissioning of a new Thompson Birchtree 230 kV Station and 45 km long Thompson Birchtree – Wuskwatim 230 kV line to supply the construction power.

Other lines needed to be built were: two 138 km, 230 kV lines between Wuskwatim and Herblet Lake, and one 166 km, 230 kV line from Herblet Lake to The Pas Ralls Island (Figure 4). A Static Var Compensator, rated -50/95 MVAr continuous, and 145 MVAr for 10 seconds overload rating was installed at the Thompson Birchtree 230 kV Station to provide transient voltage control. In addition to connecting new generation to the system, the new facilities have improved the reliability of the overall transmission system.

Riel Station Reliability Project

D602F, a 500 kV line, connected the Dorsey 500 kV AC Station, north of Winnipeg, to Forbes Station near Duluth, Minnesota in the U.S. A new station, Riel, is to be built just east of Winnipeg adjacent to the right of way of the 500 kV line; see Figure 5 on following page.

The Riel Station is located on the south-east Winnipeg periphery adjacent to major 230 kV and 500 kV transmission corridors, making it an ideal location for a new supply point for Winnipeg load.

The location minimizes the need for new transmission corridors into and out of Riel and reduces the amount of new west to east transmission across Winnipeg as it provides an alternate supply point to Dorsey, which is located on the northwest periphery of Winnipeg.

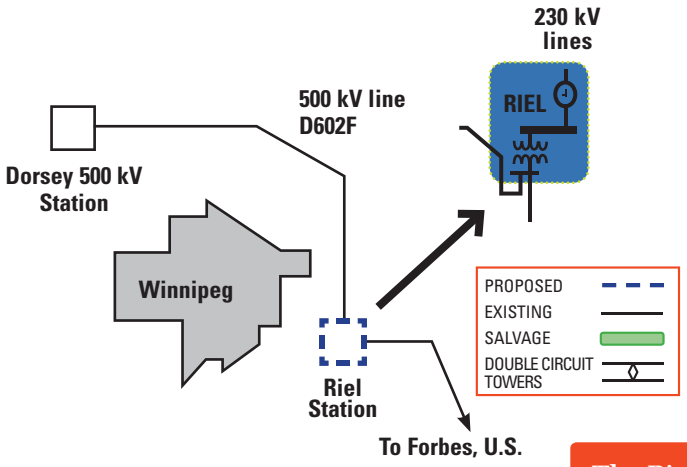


Figure 5: Riel Station Development and Dorsey – Forbes Line Sectionalization[2]

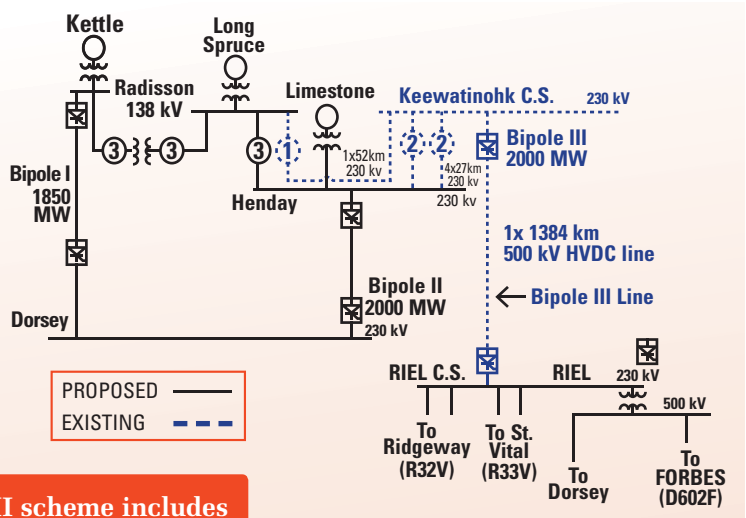


Figure 7: Bipole III Reliability Project

The Bipole III scheme includes (Figure 7):

- A ±500 kV HVDC transmission line, about 1392 km long, from Keewatinohk Converter Station to Riel Converter Station.
- A 2,000 MW converter station in the north (Keewatinohk C.S.).
- One 52 km-long 230 kV transmission line from Long Spruce to Keewatinohk.
- Four 27 km-long 230 kV transmission lines from Henday to Keewatinohk.
- A 2,000 MW converter station at Riel.
- Sectionalizing of the Ridgeway-Richer 230 kV line into the Riel Converter Station.

The project included establishing the Riel Station site, installing 230 kV and 500 kV switch yards, installing a 1,200 MVA, 230 kV to 500 kV transformer bank, sectionalizing the existing Dorsey-Forbes 500 kV line[2], sectionalizing two existing 230 kV lines (Ridgeway-St. Vital lines R32V and R33V), and installing 500 kV line reactors.

The project will improve system reliability by adding an alternate terminal point for the 500 kV transmission line to the U.S., thereby preserving Manitoba Hydro's system import capability if there is a major outage at Dorsey. The station went into service in October 2014.

Bipole III Reliability Initiative

Enhancement of the reliability and security of HVDC transmission lines and the Dorsey Converter Station has been under investigation for some time. The HVDC transmission lines, Bipoles I and II, are located on a common right-of-way corridor referred to as the Interlake corridor (green line in Figure 6), 905 kilometers in length.

Figure 6: Bipole III Transmission Route

The southern converters of Bipole I and II are both located in the Dorsey Converter Station. The Bipole I & II corridor and the Dorsey Station are vulnerable to rare, but severe weather events such as wind bursts, tornados and ice storms; that could cause extended outages and severe hardship to Manitoba Hydro customers and Manitoba. One such event occurred on September 6, 1996 when straight line winds associated with a microburst resulted in the collapse of 19 HVDC transmission towers north of the Dorsey Converter Station, resulting in the loss of the Bipole I & II lines for about 5 days.

Development of Bipole III will require a Class 3 license under The Environment Act (Manitoba). The environmental impact assessment for the project, including a program of community/public consultation and the identification of potential impacts and mitigative measures, has been documented in an Environmental Impact Statement (EIS). The project EIS was filed with Manitoba Conservation in the fall of 2011 as application for the Environment Act License. The Clean Environment Commission (CEC) began public hearings on Manitoba Hydro's Bipole III transmission project on October 1, 2012. The hearings provided participants with an opportunity to review and comment on the project and its environmental impacts. The hearings were completed in March 2013. An Environmental Act License was received in August 2013.

Bipole III transmission line will run from a new converter station named Keewatinohk in the north located near Conawapa to Riel Converter station south of Winnipeg.

Manitoba Hydro evaluated the converter technology to be used for Bipole III thoroughly [6]. A new technology, referred to as the Voltage Source Converter is available as an alternative to the existing Line Commutated Converter (LCC) technology used for Bipoles I and II, however Manitoba Hydro opted for LCC due to economical considerations

The rating of the Bipole III is planned to be operated at 2,000 MW with a 15% continuous overload. The estimated in-service date for Bipole III is the summer of 2018.

Future Nelson River Generation Development

The planning is underway for two new generating stations, the Keeyask G.S. and the Conawapa G.S., on the Nelson River (Figure 8).

[2]Sectionalizing the existing Dorsey-Forbes line means cutting the line at Riel and terminating it at Riel to form a Dorsey- Riel line and a Riel-Forbes line.

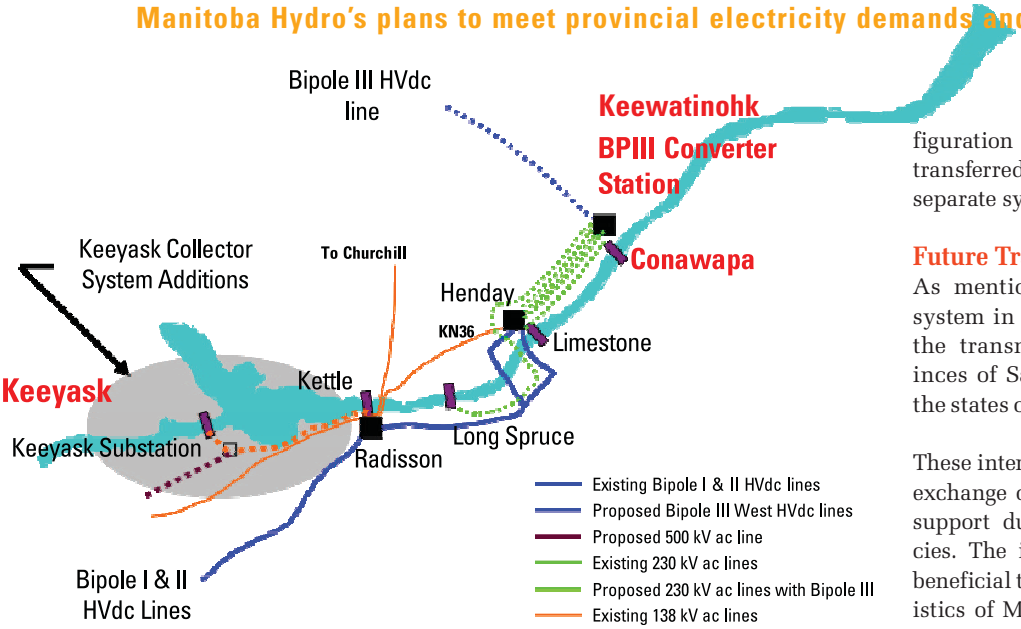


Figure 8: Northern Collector System

The Keeyask G.S. will be located about 61 kilometers upstream from the existing Kettle G.S. (1,224 MW). The Conawapa G.S. will be located about 51 kilometers downstream from the existing Limestone G.S. (1,350 MW).

Future Keeyask and Conawapa Generation and Outlet Transmission Facilities

The 695 MW (630 MW net) Keeyask Generating Station will require new outlet transmission facilities needed to connect the generating station to the Manitoba Hydro grid.

A new Keeyask Switching Station will be established to terminate seven new 138 kV lines including four unit lines (approximately 3 km each) to receive the power from Keeyask Generating Station, and three 138 kV transmission lines (approximately 35 km each) to convey the power to Manitoba Hydro's existing Radisson Converter Station [4]. The 2,000 MW Bipole III, slated to be in-service in 2018, will increase the capacity of the Bipole I, Bipole II and Bipole III HVDC system to accommodate the Keeyask generation.

A construction power station will be built and fed primarily from a 138 kV transmission line with an approximate length of 23 km tapped from existing line KN36. One of the Radisson-Keeyask lines will be constructed earlier than the other two, in order to serve as a back-up source of construction power. Station upgrades at the Radisson station will also be required. In addition to connecting new generation to the system, the new facilities will improve the reliability of the overall transmission system (Figure 9).

The in-service date for the first unit at Keeyask is anticipated to be September 2019. All of the transmission facilities will be in-service on August 2019.

Conawapa Generating Station with a rating of 1,485 MW rating (net 1,395 MW) with an in-service date of 2029/30 at the earliest and subject to further regulatory approvals will be connected into the Northern Collector System (NCS) at Keewatinohk (Figure 9). The only transmission required for Conawapa will be five short lines (7 km each) between the generating station and Keewatinohk. Also NCS will be split into two systems at Radisson to respect the stability limit and associated switching configuration and one Kettle unit will be transferred to the northern ac system (a separate system from NCS).

Future Transmission Interconnections

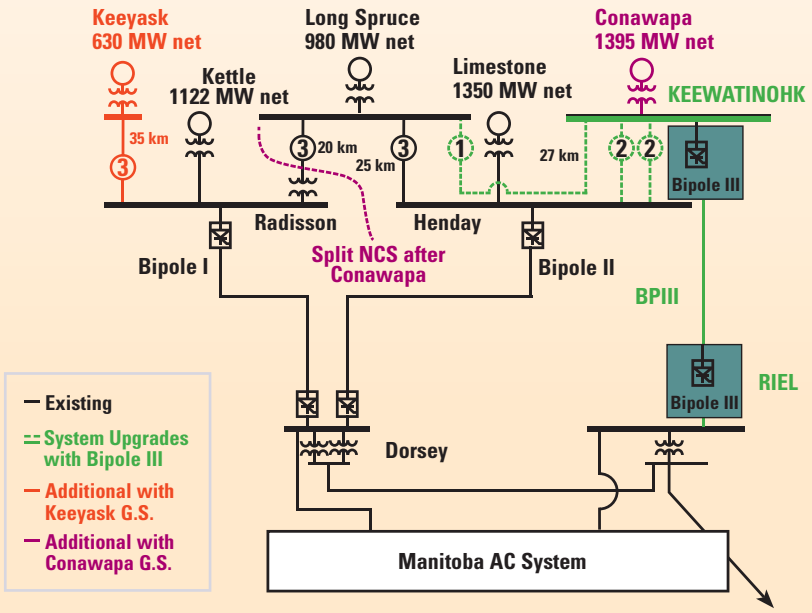
As mentioned above, the transmission system in Manitoba is interconnected to the transmission systems in the provinces of Saskatchewan and Ontario and the states of North Dakota and Minnesota.

These interconnections allow for economic exchange of electricity as well as provide support during electric system emergencies. The interconnections are especially beneficial to Manitoba due to the characteristics of Manitoba Hydro's predominantly hydraulic generation system. As well as exporting electricity surplus to Manitoba's needs, the interconnections allow Manitoba Hydro to import energy when economical or when river flows are low.

Manitoba Hydro has contracted with Minnesota Power (MP) to provide 250 MW over 15 years starting in 2020. Recently, Manitoba Hydro and Minnesota's Great River Energy have signed a memorandum of understanding to look at the province's energy utility selling up to 600 MW of electricity starting in about 2020. In February of 2014, Manitoba Hydro has inked two major power sales to Green Bay based Wisconsin Public Service (WPS) a subsidiary of Integrys Group Inc. (NYSE: TEG) in the United States. The first sale, running from 2016-2021, is for 108 MW of firm power. The second sale – based on electri-

continued >

Figure 9: Northern Collector System Development



city produced by the proposed new Conawapa Generating Station on the Nelson River – is for 308 MW of firm power for up to 10 years. The 308 MW sale is scheduled to start in 2027.

The proposed power sales agreements will require new hydroelectric development in northern Manitoba (Keeyask and Conawapa) and a new transmission line between Canada and the United States. Studies are underway to determine the necessary transmission facilities to boost the firm Canada to U.S. export capability.

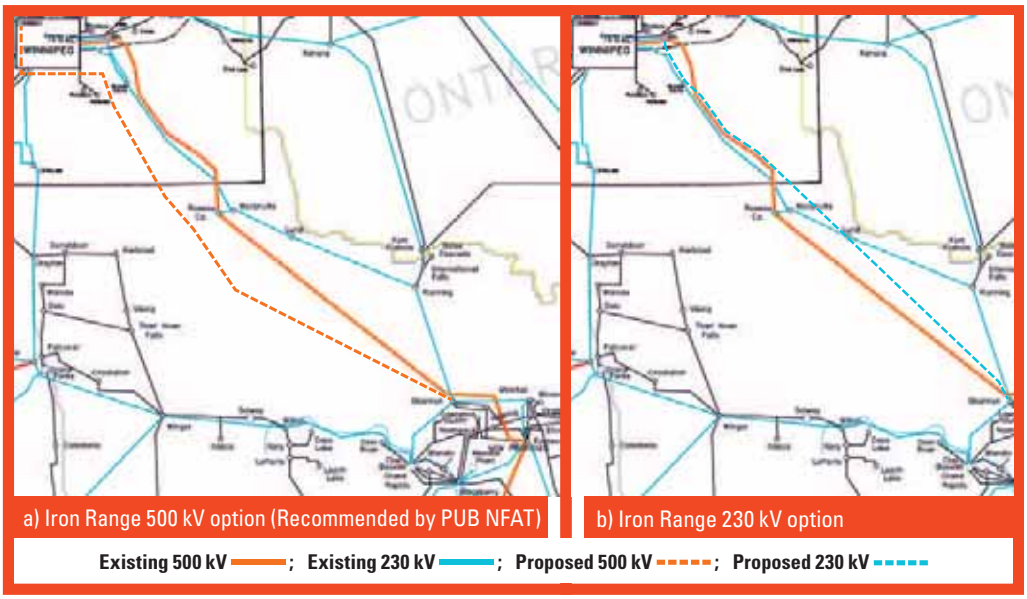


Figure 10: Options for New Transmission Line into Minnesota

There were a number of transmission line options being studied to date. These included a 500 kV line into Fargo, North Dakota area, a 500 kV line into Iron Range area in Minnesota, and a 230 kV line, also into Iron Range, Minnesota. **The Winnipeg (Dorsey)-to-Iron Range line (Option 1 below) has been found at this time as the most beneficial.**

1 Winnipeg (*Dorsey*) to Iron Range (Blackberry, Shannon, or new Iron Range Station); 500 kV line

This 750 MW project consists of a 225-kilometer-long Winnipeg-to-U.S.-border 500 kV line, and a 210-mile-long U.S.-border -to-Iron Range 500 kV line, with a planned in-service of June 2020; see Figure 10(a).

Approval for the project and this in-service date were recommended in June 2014 by Manitoba Hydro's Public Utilty Board through its Needs For and Alternatives To Review (NFAT) Panel. It is now known as the Manitoba-Minnesota Transmission Project. Further provincial and federal regulatory approvals will be required before construction starts. [3]

2 Winnipeg (*Riel*) to Iron Range (Shannon); 230 kV Line

This option (2020) identified as a minimum requirement for MP 250 MW sale consists of a 145-kilometer-long Winnipeg-to-U.S.-border line and 210-mile-long U.S.-border-to-Iron Range line; see Figure 10(b).

Conclusions

Manitoba Hydro has over 5,000 MW of clean hydroelectric energy potential to develop. The past development of its hydroelectric generating plants on the Nelson River in northern Manitoba has allowed Manitobans to enjoy some of the lowest electricity rates in North America. Manitoba Hydro is exploring the feasibility of developing new northern hydroelectric generation sites and new interconnections to meet future load growth and new contracts to ensure that these low rates can be sustained in the future. ■

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[3] This U.S. Transmission Interconnection Project has a total line length of about 560 km. It will originate at the Dorsey Converter Station, located near Rosser, northwest of Winnipeg and travel south around Winnipeg. The line will continue south crossing the Manitoba-Minnesota border, and will then connect to the Great Northern Transmission Line that will be constructed by Minnesota Power. The Great Northern Transmission Line will terminate at the Iron Range Station located northwest of Duluth, Minnesota.

Hilmi Turanli *received his B. Sc. and M. Sc. degrees (both in Electrical Engineering) from the Middle East Technical University, Ankara, Turkey in 1976 and 1980. He was granted his Ph. D. degree from the University of Manitoba in 1984, while completing a special research project for Manitoba Hydro. Later, he taught at the University of New Orleans. He also consulted for Louisiana Power and Light Company. With Manitoba Hydro since 1986, he is currently Senior Interconnections Planning Engineer in the System Planning Department. Dr. Turanli is a Senior Member of IEEE, and is registered as a Professional Engineer in Manitoba. He was designated as a Fellow of Engineering Institute of Canada and Fellow of Engineers Canada in 2001 and 2010, respectively.*

Ronald W. Mazur *received his B. Sc. and M. Sc. degrees, both in electrical engineering from the University of Manitoba, Winnipeg, MB in 1971 and 1989, respectively. Following his undergraduate graduation, he worked for Atomic Energy of Canada Limited in Pinawa, MB for a short time. In 1974, he joined Manitoba Hydro and worked on switching station design, system operations and system planning. He was the manager of System Planning Department at the time of his retirement in 2014.*

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2014 Recipients

2014 IEEE Canada A.G.L. McNaughton Gold Medal
Médaille d'or A.G.L. McNaughton de l'IEEE Canada 2014

For outstanding contributions to network virtualization and the future Internet **Pour contributions exceptionnelles à la visualisation des réseaux et à l'internet du futur**

Raouf Boutaba (FIEEE)

Raouf Boutaba (FIEEE) is professor of computer science at the University of Waterloo. He completed his Ph.D. at the University Pierre & Marie Curie in 1994. Before joining the University of Waterloo in 1999, he was the founding Lead Researcher of the Telecommunications and Distributed Systems Unit and a visiting ECE professor at the University of Toronto.

Dr. Boutaba is an internationally recognized authority and leading researcher in the management of communication networks. His pioneering work on network virtualization in the late nineties blossomed as part of the recent worldwide effort to fend off the Internet's growing ossification and the design of its future architecture. He has contributed to a major shift in how the world views network management and played a pivotal role in establishing automated network management, thereby facilitating autonomic networking. He successfully transferred technology to industry including Ericsson, Nortel and Cisco and created the first successful system for user control of lightpaths in CA*net 4 - a system also deployed by numerous institutions and research networks worldwide. He received several awards from the industry including Nortel, Cisco, Google and IBM. He published extensively, with high impact, in top-tier journals and conferences, and received several Best Paper Awards including the IEEE Fred Ellersick Prize.

Dr. Boutaba is a fellow of the IEEE and the EIC for contributions to the management of communication networks and services. He has been honored by the IEEE Communications Society with several awards, including the Harold Sobol, the Dan Stokesberry, the Joseph LoCicero, and the Salah Aidarous Awards.He also received the IFIP Silver Core.

Raouf Boutaba (FIEEE) est professeur d'informatique à l'Université de Waterloo. Il a obtenu son doctorat à l'Université Pierre et Marie Curie en 1994. Avant de rejoindre l'Université de Waterloo en 1999, il a été fondateur et chercheur principal au laboratoire de télécommunications et de systèmes distribués et professeur invité en génie électrique et informatique à l'Université de Toronto.

Dr Boutaba est reconnu à l'échelle internationale pour son expertise dans le domaine de la gestion des réseaux de communications. Son travail innovateur, à la fin des années 1990, sur la virtualisation du réseau contribue significativement à repousser les limites liées à la croissance d'internet et à la conception de son architecture future. Il a contribué à d'un changement majeur de la perception qu'on a de la gestion du réseau en jouant un rôle clé dans l'automatisation de cette dernière. Il a également collaboré à des projets industriels avec Ericson, Nortel, Cisco, Google et IBM, ce qui lui a valu plusieurs prix. Il a mis sur pied le premier système fonctionnel de control par l'usager des chemins optiques dans CA*net 4. Les travaux de Dr Boutaba font l'objet d'une vulgarisation intensive dans des revues et des conférences prestigieuses. Plusieurs prix du meilleur article, notamment le prix IEEE Fred Ellersick, lui ont d'ailleurs été décernés.

Dr Boutaba est Fellow de l'IEEE et de l'EIC. Il a été honoré à plusieurs reprises par la société des communications de l'IEEE dont il a été le récipiendaire des prix Harold Sobol, Dan Stokesberry, Joseph Locicero et Salah Aidarous. Il a également reçu le Cœur d'Argent de l'IFIP.

2014 IEEE Canada R.A. Fessenden Medal
Médaille R.A. Fessenden de l'IEEE Canada 2014

For groundbreaking contributions to electromagnetics and communications **Pour contributions révolutionnaires en électromagnétique et en communications**

Yahia Antar (LFIEEE)

Dr. Yahia Antar (LFIEEE) is the Canada Research Chair in Electromagnetic Engineering. He is a professor at the Royal Military College, vice Dean for defence and security research. He holds a cross-appointment at Queen's University. Before joining RMC, Dr. Antar worked at NRC from 1979-1987. He received the B.Sc. (Hons.) degree in 1966 from Alexandria University, Egypt, and the M.Sc. and Ph.D. degrees from the University of Manitoba, in 1971 and 1975, respectively, all in electrical engineering.

Dr. Antar has made significant innovations in Electromagnetics and introduced new concepts in Antennas for radar and communications applications. He has authored or co-authored close to 200 journal papers,many chapters in books, about 400 refereed conference papers, holds several patents, chaired several national and international conferences and given plenary talks at numerous conferences.Dr. Antar is a Life Fellow of the IEEE, a Fellow of the Engineering Institute of Canada (FEIC), and a Fellow of the Electromagnetic Academy.

In 2002, Dr. Antar was awarded the first Tier 1 Canada Research Chair at RMC. He was elected by the Council of the International Union of Radio Science (URSI) to the Board as Vice President in 2008, and to the IEEE Antennas and Propagation Society Administration Committee in 2009. In 2011, Dr. Antar was appointed Member of the Canadian Defence Science Advisory Board (DSAB). He is an IEEE Antennas and Propagation Society Distinguished Lecturer. In October 2012, he received the Queen's Diamond Jubilee Medal from the Governor General of Canada in recognition for his contribution to this country.

Dr Yahia Antar (LFIEEE) est titulaire d'une chaire de recherche au Canada en électromagnétisme. Il est professeur au Collège militaire Royal (CMR) et vice-doyen de la recherche en défense et sécurité. Il a obtenu un poste à l'Université Queen. Bien avant de rejoindre le CMR, Dr Antar a travaillé au NRC de 1979 à 1987. Il a obtenu son B.Sc (avec mention) à l'Université d'Alexandrie en Égypte, et sa maitrise puis son doctorat en génie électrique à l'Université du Manitoba en 1971 et 1975 respectivement.

Dr Antar a fait d'importantes innovations en électromagnétisme et a introduit de nouveaux concepts dans les antennes pour radar et les applications en communications. Il est l'auteur ou le co-auteur de près de 200 articles de revue, de plusieurs chapitres de livre et de près de 400 articles de conférence avec comité de lecture. Il détient plusieurs brevets et a présidé plusieurs conférences nationales et internationales à l'occasion desquelles il a très souvent donné des conférences plénières. Dr Antar est Fellow à vie de l'IEEE, Fellow de l'Institut canadien des Ingénieurs et membre de l'Académie électromagnétique.

En 2002, Dr Antar s'est vu accorder la distinction de première chaire de recherche du Canada du CMR. Il a été élu par le conseil de l'Union internationale radio-science (UIRS) à la commission en tant que vice-président, en 2008, et au comité d'administration de l'Antennas and Propagation Society de l'IEEE en 2009. En 2011, Dr Antar a été nommé membre du conseil consultatif canadien en sciences de la défense. Il est conférencier pour le compte de l'Antennas and Propagation Society de l'IEEE. En octobre 2012, le gouverneur général du Canada lui a décerné la médaille de diamant du jubilé de la Reine.

2014 IEEE Canada Power Medal
Médaille d'électricité de l'IEEE Canada 2014

For contributions to methods and applications in power system reliability **Pour contributions aux méthodes et applications en fiabilité des réseaux électriques**

Wenyuan Li (FIEEE)

Wenyuan Li (FIEEE) obtained his B.Eng. from Tsinghua University of China in 1968, and his M. Sc. and Ph.D. from Chongqing University of China in 1982 and 1987, respectively.He was a post-doctorate fellow at the University of Saskatchewan in Canada from 1989 to 1991. Dr. Li is currently a professor with Chongqing University, an adjunct professor with Simon Fraser University, and a principal engineer of BC Hydro where he has been working since 1991.

Dr. Li has made significant contributions to the methods, computing tools and actual applications in power system reliability. He has published numerous papers in international journals/conferences, authored five books, held several patents, and developed a whole set of computing programs and databases for generation, transmission, substation and distribution reliability assessments. He has directed many industrial reliability application projects and completed more than 80 technical reports. He has also offered trainings and consultations to professionals across the world through seminars, panel sessions, workshops, short courses and tutorials.

Dr. Li is a Fellow of the Canadian Academy of Engineering, Engineering Institute of Canada and IEEE. He is the chair of the IEEE PES Roy Billinton Power System Reliability Award Committee and IEEE PES PSPI Award and Recognition Subcommittee. He has been a member or chair of technical advisory committees of international conferences, and a member of several IEEE PES technical committees, working groups and taskforces. Dr. Li has received more than 10 honours, including the IEEE Canada Outstanding Engineer Award, IEEE PES Roy Billinton Power System Reliability Award, and International PMAPS Merit Award.

Wenyuan Li (FIEEE) a obtenu son baccalauréat en ingénierie à l'Université Tsinghua en Chine en 1968, sa maîtrise et son doctorat à l'Université de Chongqing en Chine en 1982 et 1987 respectivement. Il a été boursier post-doctorat à l'Université de Saskatchewan au Canada de 1989 à 1991. Dr Li est actuellement professeur à l'Université de Chongqing, professeur adjoint à l'Université Simon Fraser et ingénieur principal à Hydro BC où il travaille depuis 1991.

Dr Li a apporté d'importantes contributions aux méthodes, aux outils informatiques et aux applications actuelles dans le domaine de la fiabilité des systèmes électriques. Il a publié de nombreux articles et est l'auteur de cinq livres. Il est également détenteur de plusieurs brevets et a développé un ensemble de programmes informatiques et de bases de données pour l'évaluation de la fiabilité des réseaux en termes de production, de transmission et de distribution. Il a supervisé plusieurs projets industriels et rédigé plus de 80 rapports techniques. Il a également été formateur, conférencier et consultant partout dans le monde.

Dr Li est Fellow de l'académie canadienne du génie, de l'institut canadien du génie et de l'IEEE. Il est le président du Comité d'attribution du prix IEEE PES Roy Billinton sur la sûreté des systèmes électriques et du sous-comité de reconnaissance du prix IEEE-PES-PSPI. Il a participé ou présidé de comités techniques consultatifs de plusieurs conférences internationales et été membre de plusieurs autres comités techniques IEEE-PES et de groupes de travail. Dr Li a reçu une dizaine de distinctions parmi lesquelles le Prix d'excellence en ingénierie de l'IEEE, le prix IEEE PES Roy Billinton sur la sûreté des systèmes électriques et le prix du mérite international PMAPS.

2014 IEEE Canada C.C. Gotlieb Medal
Médaille C.C. Gotlieb de l'IEEE Canada 2014

For outstanding contributions to multimedia computing and communications **Pour contributions exceptionnelles aux calculs multimédia et aux communications**

Ling Guan (FIEEE)

Ling Guan (FIEEE) is a Professor and Canada Research Chair in Multimedia and Computer Technology at the Department of Electrical and Computer Engineering, Ryerson University, where he also directs Ryerson Multimedia Research Laboratory and Centre for Interactive Multimedia Information Mining. He received his M.A.Sc. from University of Waterloo and Ph.D. from University of British Columbia.

An internationally acclaimed scientist in computer engineering, Dr. Guan's broad range of expertise includes: human-centered computing, multimedia indexing and retrieval, visual information mining, and immersive computing and communications. He has authored/co-authored six books and more than 400 scientific papers. Under his supervision, more than 150 graduate students and researchers have completed their HQP training.

Dr. Guan serves/served on the advisory board/editorial board of numerous international journals, including six IEEE Transactions and Magazines and guest-edited a special issue for Proceedings of the IEEE. He also led the organization of several major IEEE/ACM conferences. Dr. Guan is an IEEE Fellow, a Fellow of Engineering Institute of Canada and an Elected Member of the Canadian Academy of Engineering. He is a recipient of the Kuancheng Wang Research Excellence Award from the Chinese Academy of Science (2010), the IEEE Transactions on Circuits and Systems for Video Technology Best Paper Award (2005), the inaugural Ryerson University Faculty of Engineering and Applied Science Research Excellence Award (2004), the Ontario Distinguished Researcher Award (2002), and an Invitation Fellowship from the Australian Academy of Sciences/ Japan Society for the Promotion of Sciences (1999). In 2010, Dr. Guan was named a Distinguished Lecturer of IEEE Circuits and Systems Society.

Ling Guan (FIEEE) est professeur et titulaire de la chaire de recherche du Canada en multimédia et informatique au département de génie électrique et génie informatique a l'Université de Ryerson où il a également dirigé le laboratoire de recherche multimédia Ryerson et le centre d'extraction interactif de l'information multimédia. Il a obtenu sa maîtrise en Science à l'Université de Waterloo et son doctorat à l'Université de Colombie -Britannique.

Dr Guan a une expertise internationalement reconnue en génie informatique spécifiquement : dans l'informatique centrée sur l'humain, l'indexation multimédia et l'archivage, l'extraction de l'information et l'informatique immersif. Il est l'auteur ou co-auteur de 6 livres et de plus de 400 articles scientifiques. Sous sa supervision, plus de 150 étudiants gradués et chercheurs ont achevé leur formation PHQ.

Dr Guan est/a été membre du comité consultatif/comité de rédaction de plusieurs revues internationales dont 06 Transactions et magazines de l'IEEE. Il a été le rédacteur invité d'un numéro spécial de comptes rendus de conférences de l'IEEE. Il a également supervisé l'organisation de plusieurs grandes conférences de l'IEEE /ACM. Dr Guan est Fellow de l'IEEE, Fellow de Institut canadien des ingénieurs et membre élu de l'Académie canadienne du génie. En 2010, il a été le récipiendaire du prix d'excellence en recherche Kuancheng Wang de l'Académie chinoise des sciences. En 2005, il a obtenu le prix du meilleur article de Transactions de l'IEEE sur les circuits et systèmes pour la technologie vidéo. En 2004, le prix d'excellence en recherche de la faculté d'ingénierie et de sciences appliquées de l'Université de Ryerson lui a été décerné et, en 2002, il a obtenu le prix ontarien de chercheur émérite. En 1999, une bourse d'invitation de l'Académie australienne des sciences / Société japonaise pour la promotion des sciences lui a été attribuée. Dr Guan a été nommé conférencier émérite de la société des circuits et systèmes de l'IEEE en 2010.

2014 IEEE Canada Outstanding Engineer Award
Prix d'excellence en génie de l'IEEE Canada 2014

For contributions to the practice of power system protection and planning **Pour contributions aux pratiques en protection et en planification des réseaux électriques**

William Kennedy (LSMIEEE)

W.O. (Bill) Kennedy (LSMIEEE) is President and Principal of b7kennedy & Associates Inc., a consultancy he established in 2005 to provide service to companies connecting to the electric power grid. In addition to his consulting practice, Bill presents seminars on power system basics to non-power system engineers. Previously, he was a principal engineer for Alberta Electric System Operator (AESO) and director of measurement and protection at Electricity Supply Board International (ESBI) Alberta Ltd. Graduating in Electrical Engineering from the University of New Brunswick in 1969, he has since completed graduate courses in power system engineering and management.

Bill's ground-breaking accomplishments are seen throughout most of the Canadian electricity grid, having worked in nine provinces. He pioneered a procedure enabling distance relay-testing insitu at substations, rather than costly shop-floor assessment. On the 500 kV transmission line connecting Alberta to British Columbia, he demonstrated that import could be raised to 600 MW without the requirement for load shed in Alberta.Also in that province, he developed transmission required to incorporate 3,400 MW of wind-based energy into the grid, and developed the first protection standard, based on a stakeholder consultative approach. At Saskatchewan Power Corporation, Bill led the development of a 455 km 138 kV transmission line effectively incorporating northern communities into the SaskPower grid.

Bill served as President/Director for IEEE Canada/IEEE Region 7 for 2004-2005 and as IEEE Director Division VII (Power & Energy Society) for 2006/2007. He is a Fellow of the Engineering Institute of Canada (1998) and was the University of New Brunswick's Dineen Lecturer in 2009.

W.O. (Bill) Kennedy (LSMIEEE) est le président de b7kennedy & Associates Inc., une société de conseil qu'il a fondé en 2005 pour fournir des services aux entreprises de raccordement au réseau d'alimentation électrique. En plus de ses activités de consultant, Bill tient des séminaires, adressés aux ingénieurs d'autres disciplines, sur les concepts de base des réseaux électriques. Auparavant, il a été ingénieur principal à l'office de gestion du réseau électrique de l'Alberta (AESO) et directeur du département de mesure et protection au sein de l'ESBI (Electricity Supply Board International) Alberta Ltd. Diplômé de génie électrique à l'Université du Nouveau-Brunswick, en 1969, il a également suivi des cours supérieurs en génie et en gestion des réseaux électriques.

Bill a travaillé dans neuf provinces canadiennes et ses réalisations sont visibles dans le réseau d'électricité au Canada. Il est le pionnier d'une procédure permettant le test de relai à distance directement in situ dans les stations électriques plutôt qu'en atelier. Sur la ligne de transmission de 500 kV reliant l'Alberta à la Colombie-Britannique, il a démontré que l'importation pouvait être portée à 600 MW sans qu'il n'y ait de perturbation en Alberta. Dans cette province, il a développé la transmission requise pour intégrer 3 400 MW d'énergie d'origine éolienne dans le réseau électrique et mis sur pied la première norme de protection basée sur une approche consultative des parties prenantes. À la Saskatchewan Power Corporation, Bill a supervisé la construction d'une ligne de transmission de 455 km à 138 kV qui intègre les collectivités nordiques dans le réseau SaskPower

Bill a été président et directeur de de la région 7 d'IEEE Canada entre 2004 et 2005 et de l'IEEE Division VII (Power & Energy Society) entre 2006 et 2007. Il est Fellow de l'institut canadien du génie (1998) et a été en 2009 le récipiendaire du prix Dineen de l'Université du Nouveau-Brunswick.

2013 IEEE Canada J.M. Ham Medal
Médaille J.M. Ham de l'IEEE Canada 2014

For outstanding contributions in engineering education & dedication to students **Pour contributions exceptionnelles àl'enseignement du génie électrique et dévouement aux étudiants**

Jamal Deen (FIEEE)

Mr. Jamal Deen (FIEEE) is Canada Research Chair in Information Technology, Professor of ECE and Professor of Biomedical Engineering at McMaster University. He completed his Ph.D. at Case Western Reserve University where he was both a Fulbright-LASPAU Scholar and an American Vacuum Society Scholar. His doctoral work on dynamic temperature measurements and combustion optimization in rocket and jet engines was sponsored and used by NASA, Cleveland, USA.

Dr. Deen is regarded as the world's foremost authority in modeling and noise of electronic and optoelectronic devices. He has successfully transferred powerful engineering and circuit models for high-performance semiconductor devices to several companies. His practical models and experimental innovations for reliability prediction have contributed significantly to the design and manufacture of reliable high-performance photodetectors. Dr. Deen's research record includes more than 480 peer-reviewed articles and six patents that have been used in industry. He is the author/editor of 20 books and conference proceedings, the textbook Silicon Photonics – Funda-mentals and Devices, 16 invited book chapters, and has received 12 best paper/poster awards. Over his career, he has won more than fifty awards and honors.

Dr. Deen's peers have elected him to Fellow status in nine national academies and professional organizations, including The Royal Society of Canada (RSC), The American Physical Society and The Electrochemical Society. His other awards and honors include the Callinan Award and the Electronics and Photonics Award from the Electrochemical Society; a Research Award from the Humboldt Foundation; the Eadie Medal from RSC; the McNaughton Medal and the Fessenden Medal from IEEE Canada; and three honorary doctorates from University of Waterloo, Canada and Universidad de Granada, Spain and Universitat Rovira i Virgili, Spain.

Jamal Deen (FIEEE) est le titulaire de la chaire de recherche du Canada en technologie de l'information et est professeur en génie électrique en informatique ainsi qu'en génie biomédical à l'Université McMaster. Il a obtenu son doctorat à l'Université Case Western Reserve où il a reçu la bourse Fulbright-LASPAU et la bourse de l'American Vacuum Society. Son travail doctoral sur les mesures dynamiques de température et sur l'optimisation de la combustion dans les fusées et les moteurs à réaction a été financé et utilisé par la NASA.

Dr. Deen est une autorité mondiale en matière de modélisation et de bruit dans les dispositifs électroniques et optoélectroniques. Il a transféré des modèles de circuits à haute performances à semi-conducteur à plusieurs compagnies. Ses travaux ont significativement contribué à la conception et à la fabrication de photodétecteurs fiables et très performants. Dr Deen est l'auteur de plus de 480 articles de revue et le détenteur de 6 brevets utilisés dans l'industrie. Il est l'auteur / éditeur de 20 livres et comptes rendus de conférences, du manuel Silicon Photonics – Fundamentals and Devices, de 16 chapitres de livre sur invitation et a reçu 12 prix du meilleur article / affiche. Il compte à son actif plus de 50 distinctions.

Dr. Deen est Fellow dans neuf académies nationales et organisations professionnelles, parmi lesquelles la Société royale du Canada (SRC), l'American Physical Society et l'Electrochemical Society. Il a également obtenu le prix Callinan, le prix électronique et photonique de l'Electrochemical Society, le prix de recherche de la Fondation Humboldt, la médaille Eadie de la SRC, la médaille McNaughton et la médaille Fessenden de l'IEEE Canada et trois doctorats honoraires des Universités de Waterloo au Canada, de Granada en Espagne et de l'universitat Rovira i Virgili en Espagne.

2014 IEEE Canada Robert H. Tanner Industry Leadership Award
Prix d'excellence en leadership industriel Robert H. Tanner de l'IEEE Canada 2014

For sustained leadership in product development and industrial innovation **Pour leadership soutenu au développement de produits et à l'innovation industrielle**

Gamal Refai-Ahmed (SMIEEE)

Dr. Gamal Refai-Ahmed (SMIEEE) is a Senior Technology Architect with GE Global Research Center. He is Adjunct Professor in Watson School of Engineering and Applied Science at Binghamton (State University of New York), and Department of Mechanical Engineering, University of Toronto. Prior to GE, he was an AMD Fellow. Dr. Refai-Ahmed obtained his B. Sc. and M. Sc. degrees from Alexandria University, Egypt. He obtained the M. A. SC. and Ph. D. degrees in Mechanical Engineer-ing from the University of Waterloo.

Dr. Refai has made important contributions in electronics packaging. He has significantly advanced this scientific field through his development of ground-breaking electronics cooling technologies.

His engineering practice has not only impacted the academic community, but has also greatly influenced the consumer electronics, telecommunications and energy industries. Due to his pivotal discoveries, many types of electronic systems can maintain higher performance even in the most challenging circumstances.For a wide variety of product offerings, his inventions have led to commercially viable electronic systems with improved performance, versatility and reliability. He is the author of more than 80 technical papers and 50 patents/ pending patents.

A Fellow of the Canadian Academy of Engineering, Dr. Refai is an Associate Editor of-IEEE Transactions On Components, Packaging And Manu-facturing Technology and Journal of Electronic Packaging, American Society of Mechanical Engineers (ASME); he was 2010 Best Associate Editor for this publication. An ASME Life Fellow, Refai is the recipient of the following honours from this organization: 2008 Thermal Management Award, 2010 Calvin W. Rice Lecture Award and 2013 K16- Clock Award.

Gamal Refai-Ahmed (SMIEEE) est architecte principal de technologie au GE Global Research Center. Il est professeur adjoint à l'école d'ingénierie et de sciences appliquées Watson à Binghamton (Université d'État de New York) et au département de génie mécanique de l'Université de Toronto. Avant de se joindre à GE, il a été Fellow d'AMD. Il a obtenu son B.-Sc. Et son M.-Sc. à l'Université d'Alexandrie en Égypte. Il a obtenu sa maitrise et son doctorat en génie mécanique à l'Université de Waterloo.

Dr Refaï a grandement contribué au secteur du conditionnement électronique en participant à la mise sur pied de concepts électroniques nouveaux dans les technologies de refroidissement. Sa pratique de l'ingénierie est reconnue dans la communauté universitaire et il a aussi grandement influencé les industries de l'électronique grand public, des télécommunications et de l'énergie. Ses découvertes ont rendu possible le maintien de hautes performances dans les systèmes électroniques ceci même dans les conditions les plus difficiles. Pour une grande variété de produits, ses inventions ont mené à des systèmes électroniques plus performants, fiables et commercialement viables. Il est l'auteur de plus de 80 articles techniques et il détient plus de 50 brevets dont certains sont en attente.

Le Dr Refaï est Fellow de l'Académie canadienne du génie, et est par ailleurs rédacteur en chef adjoint de l'IEEE Transactions On Components, Packaging And Manufacturing Technology, du Journal of Electronic Packaging de l'American Society of Mechanical Engineers (ASME) dont il a été le meilleur rédacteur en chef adjoint en 2010. Fellow à vie de l'ASME, le Dr Refaï a reçu les distinctions suivantes : prix de gestion thermique, en 2008, prix Calvin W. Rice en enseignement, en 2010, et le prix K16-Clock, en 2013.

2014 IEEE Canada W.S. Read Outstanding Service Award
Prix d'excellence de service W.S. Read de l'IEEE Canada 2014

For outstanding service and longstanding leadership to IEEE Canada **Pour service exceptionnel et leadership de longue date à l'IEEE Canada**

Gerard Dunphy (SMIEEE)

Gerard M. Dunphy (SMIEEE) currently holds the position of Manager, Project Execution (Non-Regulated) with Nalcor Energy. In this role, he is responsible for the execution of major expansion and refurbishment project programs, including the refurbishment program of the Churchill Falls Generating Station, one of the largest hydro-electric generating stations in the world. Previously he was Director, Information Systems and Telecommunications at Newfoundland and Labrador Hydro. He received the Bachelor of Engineering degree in 1989 and the Master of Engineering degree in 1999, both from Memorial University. In 2010 he completed a Masters of Business Administration, Executive Leadership, through Royal Roads University.

Gerard's wide-ranging service to IEEE dates to his student leadership roles at Memorial University some 30 years ago. Since then, he has held numerous positions at the Section, Region and Global levels, including: Newfoundland & Labrador Section Chair (1994); IEEE Canadian Review Associate Editor (1992-1995); Region 7 Student Activities Chair (1997-2000); Professional Activities Committee, Member, (1999-2000); Educational Activities Committee, Member (2001-2003); Nominations & Advancement Committee member (2008-2010); and, IEEE Canada Treasurer (2010-2011). He has participated in the organization of numerous conferences, including the 1997 and 2010 Canadian conference on Electrical and Computer Engineering (CCECE), the 2005 International Engineering Management Conference (IEMC) and most recently, the 2014 International Humani-tarian Technologies Conference (IHTC).

Gerard is a Registered Professional Engineer in the Province of Newfoundland and Labrador. He resides in the picturesque town of Torbay, Newfoundland, with his wife Edie and two children, Sarah and Megan.

Gerard M. Dunphy (SMIEEE) est actuellement gestionnaire, Exécution des projets (poste non réglementé) à Nalcor Energy. Il est responsable de la mise en œuvre de programmes et de projets d'expansion et de remise en état majeurs, notamment celle de la centrale des Churchill Falls, l'une des plus grandes installations hydro-électriques au monde. Auparavant, il était directeur, Systèmes d'information et télécommunications à la Newfoundland and Labrador Hydro. Il a obtenu son grade de bachelier et de maîtrise en génie électrique à l'Université Memorial, en 1989 et en 1999 respectivement. En 2010, il a terminé une maîtrise en administration des affaires, avec spécialisation en leadership pour les cadres de direction, à l'Université Royal Roads.

L'ampleur des services de Gerard à l'IEEE remonte à quelque 30 ans, alors qu'il était un leader étudiant à l'Université Memorial. Depuis, il a occupé de nombreux postes à l'échelle locale, régionale, puis nationale, comme : président de la section Terre-Neuve-et-Labrador (1994), co-rédacteur en chef de la revue canadienne de l'IEEE (1992-1995), président du comité des activités étudiantes de la région 7 (1997-2000), membre du comité des activités professionnelles (1999-2000), membre du comité des activités éducatives (2001-2003), membre du comité des nominations et de l'avancement (2008-2010) et trésorier de l'IEEE Canada (2010-2011). Il a participé à l'organisation de nombreuses conférences, notamment la Conférence canadienne sur le génie informatique et électrique de 1997 et de 2010 la Conférence internationale sur la gestion en ingénierie de 2005 et, tout dernièrement, la Conférence internationale de la technologie humanitaire de 2014.

Gerard est un ingénieur professionnel enregistré dans la province de Terre-Neuve-et-Labrador. Il vit dans la pittoresque ville de Torbay, à Terre-Neuve, avec sa femme, Edie, et leurs deux enfants, Sarah et Megan.

2014 IEEE Canada J.J. Archambault Eastern Canada Merit Award
Prix d'excellence J.J. Archambault de l'Est du Canada de l'IEEE Canada 2014

For sustained dedication and reliable volunteer work for the Montreal section **Pour dévouement soutenu et bénévolat fiable à la section de Montréal**

Anader Benyamin-Seeyer (SMIEEE)

Anader Benyamin-Seeyar (SMIEEE) is a senior telecommunications specialist at Group SMi International and affiliate associate professor at Concordia University in Montreal. His areas of expertise include the advancement of communications, mobile ad-hoc and wireless active sensor networks. He received his B.S.E.E. from Iran University of Science and Technology in 1973, his M.S.E.E. from McGill University in 1979 and his Ph.D. from Concordia University in 1985. Since then, he has worked for technology companies such as Apollo Microwave, ISR Technologies, PolarSat, ART Advanced Research Technologies, Harris Corp., Vistar Telecommuni-cations, Spar Aerospace /ComStream and Bell-Northern Research.

An IEEE member since 1977, from 2005 Dr. Benyamin-Seeyar has been involved with the IEEE Montreal Section – initially as secretary, then for two years as chair. During these years, his leadership in enhancing section services for all members earned him the IEEE MGA Leadership Award in 2008. Currently, he is chair of the Communications & Information Theory Chapter of the IEEE Montreal Section and was instrumental in helping it win the global IEEE Communi-cations Society Chapter-of-the-Year Award in 2012. He is a committee member of the IEEE Canadian Foundation and has served as chair of IEEE Canada's Teachers In-Service Program committee. He has been actively involved in contributing to the development of the IEEE 802.16a standard.

As an affiliate associate professor, Dr. Benyamin-Seeyar conducted research work supported by NSERC Canada and FCAR research grants, and is a Fellow of the Engineering Institute of Canada. He also finds time to run marathons and is fluent in multiple languages, including English, French, Spanish and Persian.

Anader Benyamin-Seeyar (SMIEEE) est spécialiste principal en télécommunications au Groupe SMi International et professeur agrégé affilié à l'Université Concordia à Montréal. Son expertise porte sur l'avancement des réseaux de communication, des réseaux mobiles ad hoc ainsi que des réseaux de capteurs sans fil. Il a obtenu son grade de bachelier en génie électrique à l'Université des sciences et de la technologie d'Iran, en 1973, puis son grade de maîtrise dans le même domaine à l'Univerité McGill, en 1979, et enfin son doctorat en philosophie à l'Université Concordia, en 1985.

Depuis, il a travaillé dans des sociétés de technologie, comme Apollo Microwave, ISR Technologies, PolarSat, ART Advanced Research Technologies, Harris Corp., Vistar Telecommunications, Spar Aerospace/ ComStream et Recherches Bell-Northern.

Il est membre de l'IEEE depuis 1977 et, à partir de 2005, il a été actif dans la section de Montréal, d'abord à titre de secrétaire, puis à titre de président pendant deux ans. Au cours de ces années, le leadership dont il a fait preuve à améliorer les services aux membres de la section lui ont valu le prix du leadership IEEE MGA en 2008. À l'heure actuelle, il préside le chapitre de la Communications Society et de l'Information Theory Society de l'IEEE à la section de Montréal. D'ailleurs, sa grande contribution a permis à la section de se voir décerner, en 2012, le prix international IEEE Communications Society Chapter-of-the-Year. M. Benyamin-Seeyar est membre du comité de la Fondation canadienne de l'IEEE et il a déjà été président du comité Teachers In-Service Program de l'IEEE Canada. Par ailleurs, il a participé activement à l'élaboration de la norme IEEE 802.16a.

À titre de professeur agrégé affilié, il mène des travaux de recherche subventionnés par le Conseil de recherches en sciences naturelles et en génie du Canada et le Fonds pour la formation de chercheurs et l'aide à la recherche. Il est également fellow de l'Institut canadien des ingénieurs. En outre, il trouve le temps de courir des marathons. Multilingue, il parle couramment l'anglais, le français, l'espagnol et le perse.

2014 IEEE Canada M.B. Broughton Central Canada Merit Award
Prix d'excellence M.B. Broughton du centre du Canada de l'IEEE Canada 2014

For exemplary service and leadership to the Young Professionals Affinity Group **Pour service exemplaire et leadership aux Young Professionals Affinity Group**

Rob Kamranpoor (MIEEE)

Rob Kamranpoor (MIEEE) has been employed with Hydro One since 2009 and is currently holding a Project Manager position. He obtained an undergraduate degree in Electrical Engineering from Ryerson University in 2004, his MBA from the University of Phoenix in 2011, and currently is completing a Masters in Law (Energy & Infrastructure) from York University (Osgoode Hall Law School).

He became a member of Professional Engineers Ontario in 2011 and a Project Management Professional in 2012. His first employment was with Electric-Spin as an electrical engineer in 2004. He moved to CN Railway in 2005 as a Signal & Communication Engineer, and went on to start his own business venture later that year in the security and surveillance industry. He continued on his employment journey as a Technical Sales Rep at Ontor Ltd. in 2006, prior to his employment at Hydro One.

Rob joined IEEE GOLD (now IEEE Young Professionals) in 2007 as the Toronto Section GOLD Group Industrial Relations Specialist and continued on to become the Group's Chair in 2012. His team has organized five-to-six events per year including: A Green Energy event featuring an industry panel; industry mixers at various venues; workshops on various skills development; and, the annual Student Transition & Elevation Program (STEP) event.

In recognition of their successes with these high-profile events, Toronto GOLD was a 2013 recipient of the GOLD Hall of Fame Award. Rob's personal efforts were recognized by Toronto Section with an Appreciation of Service Award for "Excellent Work as GOLD Vice-Chair and a Key Driver of its Fundraising/Sponsorship Efforts."

Rob Kamranpoor (MIEEE) travaille à Hydro One depuis 2009, où il occupe actuellement un poste de gestionnaire de projets. Il a reçu son grade de bachelier en génie électrique de l'Université Ryerson en 2004, celui de maîtrise en administration des affaires de l'Université de Phœnix, en 2011, et il termine actuellement une maîtrise en droit (énergie et infrastructure) à l'Université York (Osgoode Hall Law School). Il est membre de l'Ordre des ingénieurs de l'Ontario depuis 2011 et il a reçu la certification de Project Management Professional en 2012. Il a commencé sa carrière comme ingénieur électricien à Electric-Spin en 2004. En 2005, il a travaillé au CN à titre d'ingénieur à la signalisation et aux communications, avant d'ouvrir sa propre entreprise plus tard cette même année, dans l'industrie de la sécurité et de la surveillance. Il a poursuivi son cheminement de carrière comme représentant technique des ventes à Ontor Ltd. en 2006, avant de se joindre à Hydro One.

Rob s'est joint au groupe IEEE GOLD (maintenant jeunes professionnels) en 2007, à titre de spécialiste en relations industrielles de la section de Toronto. Il est devenu président du groupe en 2012. Son équipe a organisé cinq ou six événements chaque année, notamment : un événement sur l'énergie écologique réunissant un panel de l'industrie, des regroupements d'intervenants de l'industrie lors de diverses activités, des ateliers de perfectionnement des compétences et l'événement annuel Student Transition & Elevation Program (STEP).

En reconnaissance du succès de ces événements prestigieux, le groupe d'affinité des jeunes professionnels de Toronto s'est vu décerner le prix GOLD Hall of Fame pour 2013. La section de Toronto a salué l'investissement personnel de Rob en lui décernant un prix de reconnaissance pour « Excellent service à titre de vice-président GOLD et précieuse participation aux collectes de fonds et à la recherche de commandites ».

2014 IEEE Canada E.F. Glass Western Canada Merit Award
Prix d'excellence E.F. Glass de l'ouest du Canada de l'IEEE Canada 2014

For sustained contributions to the western Canada sections **Pour contribution soutenue aux sections de l'Ouest canadien.**

Tim Driscoll (FIEEE)

Tim Driscoll (FIEEE) has a B.Sc. from the University of Calgary and is the former Head Electrical Engineer for Shell Canada, where he worked for 35 years.He retired in 2010 and formed a consulting company, advising primarily to the Petrochemical industry in areas such as hazardous area classification and project planning. He is notably engaged in electrical codes and standards activities, and on various IEEE committees for conferences and the IEEE Southern Alberta Section.

Tim's support of industry-related conferences is as broad and deep as Alberta's Bow River at spring thaw. His foray began with the Industry Applications Society (IAS) Annual conference, roughly 30 years ago. In 2007 he chaired the IEEE Petroleum and Chemical Industry Technical Conference (PCIC); in 2012 he received the Russell W. Mills award for Outstanding Service to the PCIC for this and other initiatives. Sensing the need for an industry event closer to home, he worked with IEEE Canada West Area colleagues to create the IEEE Electrical Safety, Technical and Mega Projects Workshop; Tim was chair in its inaugural year (2005), and also in 2008 and 2014. He chaired the Southern Alberta IAS/PES Chapter for 2011/12, which received the outstanding IAS Large Chapter award for 2012, as well as a Power and Energy Society high-performing Chapter recognition.

Tim contributes to CSA Codes and Standards (Canadian Electrical Code, Products and OBIEC), chairing two subcommittees, and is a member of the relevant Strategic Steering Committee. He is an emeritus member of Energy Industry Electrical Engineering Associates (EIEEA) and has served on the Alberta Safety Codes Council for six years.

Tim Driscoll (FIEEE) détient un baccalauréat en sciences de l'Université de Calgary et a travaillé pendant 35 ans à titre de chef ingénieur électricien à Shell Canada. Il a pris sa retraite en 2010 et a formé une société de consultation. Il agit comme expert-conseil principalement dans l'industrie pétrochimique, notamment dans des secteurs comme la classification des produits dangereux et la planification de projets. Il est très actif dans des activités liées aux codes et aux normes en électricité, dans différents comités de l'IEEE, à l'organisation de conférences, et dans la section du Sud de l'Alberta.

Le soutien de Tim aux conférences de l'industrie est aussi prodigieux que le sont les eaux de Bow River (Alberta) au dégel printanier! Il a d'abord commencé par la conférence annuelle de l'Industry Applications Society (IAS), il y a environ 30 ans. En 2007, il a présidé la Petroleum and Chemical Industry Technical Conference (PCIC) de l'IEEE et, en 2012, il a reçu le prix Russell W. Mills pour services exceptionnels rendus à la PCIC à cet égard et pour bien d'autres initiatives. Quand il a senti la nécessité de tenir un événement sur l'industrie plus près de sa région, il a travaillé avec des collègues de l'IEEE de l'Ouest du Canada afin de mettre sur pied l'Electrical Safety, Technical and Mega Projects Workshop. Il a présidé cet atelier l'année de son inauguration, en 2005, puis en 2008 et en 2014 également. Il a présidé le chapitre de l'Industry Applications Society et de la Power and Energy Society du Sud de l'Alberta en 2011-2012, lequel chapitre a reçu le prix Outstanding IAS Large Chapter en 2012, ainsi qu'une reconnaissance de la Power and Energy Society pour un chapitre à haut rendement.

Tim apporte sa contribution aux codes et aux normes de l'Agence canadienne de normalisation (CSA), notamment le Code canadien de l'électricité et les produits connexes ainsi que le code d'électricité industriel fondé sur les objectifs (OBIEC) de la CSA, en présidant deux sous-comités et en participant à titre de membre du comité consultatif stratégique de la CSA. Il est membre émérite de l'Energy Industry Electrical Engineering Associates (EIEEA) et il a siégé au Safety Codes Council de l'Alberta pendant six ans.

IEEE Canada Members elected as 2014 IEEE Fellows

AMBRISH CHANDRA (FIEEE)—Montreal, QC
for contributions to power distribution and renewable energy systems

GUANG GONG (FIEEE)—Waterloo, ON
for contributions to sequences and cryptography applied to communications and security

HASSAN KOJORI (FIEEE)—Toronto, ON
for contributions to the design and application of predictive and diagnostic algorithms in power electronics converters

JAIN PEI (FIEEE)—Burnaby, BC
for contributions to data mining and knowledge discovery

WEN TONG (FIEEE)—Ottawa, ON
for leadership in the development of 3G and 4G wireless communication systems

ZHOU WANG (FIEEE)—Waterloo, ON
for contributions to perceptual image processing and quality assessment

WEI YU (FIEEE)—Toronto, ON
for contributions to optimization techniques for multiple-input-multiple-output communications

HONG ZHANG (FIEEE)—Edmonton, AB
for contributions to collective robotics and intelligent sensing in oil sand mining

IEEE Frank Rosenblatt Award

GEOFFREY E. HINTON—Toronto, ON
for contributions to neural networks and deep learning

Membres de l'IEEE Canada élus Fellows de l'IEEE 2014

AMBRISH CHANDRA (FIEEE)—Montreal, QC
Pour contributions à la distribution de l'énergie et aux systèmes d'énergie renouvelable

GUANG GONG (FIEEE)—Waterloo, ON
Pour contributions aux séquences et à la cryptographie appliquée aux communications et à la sécurité

HASSAN KOJORI (FIEEE)—Toronto, ON
Pour contribution à la conception et à l'application des algorithmes de prédiction et de diagnostique dans les convertisseurs en électronique de puissance

JAIN PEI (FIEEE)—Burnaby, BC
Pour contributions au forage des données et à la découverte de connaissances

WEN TONG (FIEEE)—Ottawa, ON
Pour leadership dans le développement des systèmes de communications sans fil 3G and 4G

ZHOU WANG (FIEEE)—Waterloo, ON
Pour contributions au traitement perceptif de l'image et à l'évaluation de la qualité

WEI YU (FIEEE)—Toronto, ON
Pour contributions aux techniques d'optimisation dans les communications à entrées et sorties multiples

HONG ZHANG (FIEEE)—Edmonton, AB
Pour contributions à la robotique collective et à la détection intelligente dans l'exploration des sables bitumineux

Prix Frank Rosenblatt de l'IEEE

GEOFFREY E. HINTON—Toronto, ON
Pour contributions aux réseaux de neurones et à l'apprentissage en profondeur

IEEE Canada Members elected as 2014 EIC Fellows

AMIR G. AGHDAM (SMIEEE)—Montreal, QC
For significant contributions to the development of application-oriented techniques for control of multi-agent networks

JIE CHEN (SMIEEE)—Edmonton, AB
For entrepreneurial initiatives in radio and extensive publications

JASON JIANJUN GU (SMIEEE)—Halifax, NS
For contributions to mobile and surgical robots including network control and tele-robots

ABDEL SEBAK (FIEEE)—Montreal, QC
For contributions to applied electromagnetics, antennas design and modeling

WEIMING SHEN (FIEEE)—London, ON
For outstanding contributions to agent-based collaboration technologies and applications

SHAHROKH VALAEE (SMIEEE)—Toronto, ON
For his work on distributed source localization a new research area establishing him as a leader in signal processing

Julian C. Smith Medal

LEONARD A. BATEMAN—Winnipeg, MB
For Nelson River Hydro development and the first Canadian long distance DC transmission Line

K.Y. Lo Medal

HUSSEIN T. MOUFTAH—Ottawa, ON
For seminal contributions to engineering science, computer engineering and telecommunication networks

Membres de l'IEEE Canada élus Fellows de l'ICI 2014

AMIR G. AGHDAM (SMIEEE)—Montreal, QC
Pour contribution significatives au développement d'applications de contrôle dans les réseaux multi-agents

JIE CHEN (SMIEEE)—Edmonton, AB
Pour ses initiatives entrepreneuriales en radio et ses publications

JASON JIANJUN GU (SMIEEE)—Halifax, NS
Pour contributions aux robots mobiles et chirurgicales, y compris le contrôle des réseaux et des télé-robots

ABDEL SEBAK (FIEEE)—Montreal, QC
Pour contributions à l'électromagnétisme appliqué et à la conception et la modélisation des antennes

WEIMING SHEN (FIEEE)—London, ON
Pour contributions exceptionnelles aux technologies et applications de collaboration à base d'agents

SHAHROKH VALAEE (SMIEEE)—Toronto, ON
Pour ses travaux sur la localisation de la source distribuée, un nouveau domaine de recherche, qui font de lui un leader en traitement du signal

Médaille Julian C. Smith

LEONARD A. BATEMAN—Winnipeg, MB
Pour le développement d'Hydro Nelson River et de la première ligne de transmission longue distance du courant continu au Canada

Médaille K.Y. Lo

HUSSEIN T. MOUFTAH—Ottawa, ON
Pour contributions fondamentales aux sciences de l'ingénieur, à l'ingénierie informatique et aux réseaux de télécommunications

Who Will You Nominate for 2016?

The accomplishments of our Major Award recipients speak for themselves, as summarized in their foregoing biographies. But it was words on a nomination form that launched each of their journeys to the IEEE Canada podium.

Why nominate? When we celebrate the successes of our colleagues, we can also celebrate our membership in this most special of Regions in IEEE, Region 7, also known as IEEE Canada—special because we are the only Region whose geographic boundaries totally encompass a single country, and only that country.

To find the best and the brightest, IEEE Canada depends upon nominations from across our diverse spectrum of technical interests, in both established fields and those just emerging. We also recognize those who give of their time and energy to help sustain and grow our organization. Without the countless unpaid hours, there would be no IEEE Canada to give out Awards. While experience gained in volunteering is its own reward, a public "thank-you" never hurts. If an IEEE colleague has made a difference, let us know how.

See http://www.ieee.ca/awards/nominate.htm
Nominations and endorsements must be received by **November 30, 2015**

Qui nommerez-vous en 2016?

Les réalisations de nos récipiendaires des prix majeurs parlent d'elles-mêmes, comme on peut le constater dans les résumés biographiques précédent. Mais ce sont les mots écrits sur les formulaires de mise en candidature qui les ont menés au podium de l'IEEE Canada.

Pourquoi proposer un candidat ou une candidate? Lorsque nous célébrons les succès de nos collègues, nous pouvons également célébrer notre appartenance à la plus spéciale des régions de l'IEEE, la région 7, que l'on connaît comme étant l'IEEE Canada—spéciale parce que nous sommes la seule région dont les frontières géographiques englobent totalement un pays, et seulement ce pays.

Afin de trouver les meilleurs candidat(e)s, l'IEEE Canada compte sur les candidatures provenant des différents secteurs techniques, de domaines établis ou émergents. Nous reconnaissons également ceux qui donnent temps et énergie à notre organisation. Sans ces heures innombrables de bénévolat, il n'y aurait pas d'IEEE Canada pour décerner des prix. Même si l'expérience de bénévolat constitue pour chacun sa propre récompense, un « merci » formulé en public ne fait jamais de tort. Si vous connaissez un(e) collègue de l'IEEE qui s'est démarqué(e), dites-le nous.

Consultez le site http://www.ieee.ca/prix/icanprix.htm
Les mises en candidatures et les appuis doivent être reçus d'ici le **30 novembre 2015**

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EPEC 2015

Electrical Power and Energy Conference

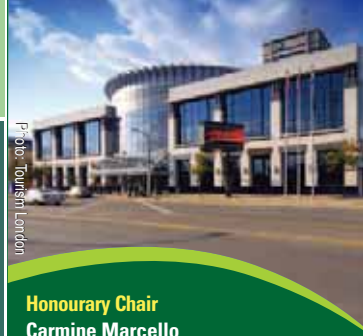
Photo: Tourism London

http://epec2015.ieee.ca

October 26-28, 2015, London, Ontario, Canada

The annual IEEE Canada Electrical Power and Energy Conference (EPEC 2015) will take place in London, Ontario, Canada from October 26 to 28, 2015. London is located in the heart of Southwestern Ontario, midway between Toronto and Detroit.

EPEC 2015 is an excellent opportunity for electric power and energy systems experts from industry, academia and government research to discuss the latest developments in the field: academic and industrial research, industrial/business trends and challenges. This may include debate on the potential impact of these developments including discussions on regulatory and policy aspects.

Topics: **The conference will be structured into 18 mini-symposia along the theme of "Smarter Resilient Power Systems."**

1. Resiliency of Electrical Power Systems
2. Smart Grids including HVDC and FACTS
3. Communications aspects of Smart Grids
4. Microgrids
5. Energy Storage
6. Energy Conservation and Efficiency
7. Nuclear Energy
8. Renewable Energy: Generation and Integration
9. Future Urban Electric Systems
10. Electrification of Transportation and its Impact
11. Integrated Energy System Planning and the Energy-Water Nexus
12. Asset Management and Condition-Based Maintenance
13. Government Support and Incentives
14. Computational Methods
15. Advanced Technology Developments
16. Power Electronics
17. Cyber Security
18. Related Topics

Call-for-Papers and Proposals for Panels, Workshops and Tutorials:
For up-to-the-minute information on key dates, please consult the website.

Exhibition: Showcase your products and services to Canadian and international audiences. Book your space now. For more details please go to:
http://epec2015.ieee.ca/exhibitors/

For more information about EPEC 2015 please contact:

Dr. Maike Luiken,
Conference Chair
Director, BTAC | Lambton College
Email: maike.luiken@ieee.org

Dr. Gerry Moschopoulos,
Technical Program Committee Chair
Associate Professor, Western University
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IEEE Canadian Foundation
Celebrates 20 Years of Support

In 1994, Revenue Canada granted the IEEE Canadian Foundation (ICF) status as a charitable organization. This all volunteer organization has helped to promote Electrical Engineering, and assisted with the funding of IEEE student activities through Grants and Scholarships. Today's organization uses the donations from IEEE members, and investment income from the previous year to fund the current year's grants and scholarships, as well as maintaining several targeted endowments for IEEE Canada and some of the Canadian IEEE Sections to provide specific prizes and grants. Thanks to the continued generosity of the Canadian IEEE membership, the ICF has been able to increase the number of scholarships and grants over the years.

The Foundation's history actually begins with the IRE Canadian Electronics Conference that was started by a number of members of the Toronto Section of the IRE (the predecessor of today's IEEE) in 1955. By 1971 the conference was incorporated as the International Electrical and Electronics Conference with a significant reserve fund at its disposal, and in 1972 a Committee on the Use of Reserve Funds was established to support IEEE Student activities.

In 1987 the conference (called Electronicom at that time) ceased to exist, when a competitive commercial show came on the scene, but the philanthropic support for IEEE student activities continued. In 1989 Bob Alden initiated the discussions to transform IEEC Inc. into the organization that exists today.

In 2002 a parallel committee in Montreal (Montreal Conferences Inc.), which had operated a similar conference, began discussions on merging their efforts with those of the Canadian Foundation. In 2004 MCI made a directed donation to the Canadian Foundation to support their Science Fair activities, and the Canadian Foundation became a national operation working in both official languages.

The Foundation's purpose is to cultivate the resources and relationships that advance the IEEE's core purpose of fostering technological innovation and excellence for the benefit of humanity. To this end the ICF provides funding in three main ways, with a condition placed on the grants and scholarships that a final report is to be submitted detailing results that were obtained (Highlights from these are featured on the Foundation web-site).

The first of which is by awarding Special Grants to new and innovative projects within Canada that seek to apply technology for the benefit of Humanity.

The ICF also provides Grants to IEEE Student Branches to establish and maintain McNaughton Learning Resource Centers at the Universities and Colleges where Student Branches exist, and since 1980 has awarded 120 grants totaling $424,147.

The IEEE Canadian Foundation Scholarships of $5000 for University students and $2500 for College students are awarded to exceptional Students who have been nominated by their IEEE Student Branch Counsellor. 204 Scholarships totaling $531,454 have been awarded since 1985. ■

The Endowed Grants and Prizes are endowed by a directed gift to the Foundation, and are generally awarded annually.

IEEE Canada Women in Engineering Prize, $1000 annually, endowed by the Judy Clift Fund

IEEEE Canada Vehicular Technology Travel Grants, 2 of up to 50% of travel costs to a Vehicular Technology Conference, endowed by the 1998 Vehicular Technology Conference

IEEE Canada Power Quality Scholarship, $1500 annually, Endowed by the IEEE Northern Canada and Southern Alberta Sections

IEEE Canadian Foundation Quebec Science Fair Prizes, Two prizes of $750 each annually, endowed by the Montreal Conferences Inc. Fund

IEEE Canada Major Awards, 11 Awards annually, 5 awards are endowed by various organizations, the remaining 6 are available for endowment (a one-time directed donation of $20,000)

A total value of **$473,247** awarded in a total of **191 grants** since 1958

2012

Project GROW - Solar Energy

In May of 2012, Emily Landry, having just graduated from UBC Okanagan Electrical Engineering, traveled to a rural area of Ghana to conduct a solar energy feasibility study, and begin the first phase of implementation. An IEEE Canadian Foundation Humanitarian grant supported this initiative. Project GROW (Ghana Rural Opportunities for Women) is a community development initiative that connects UBC Okanagan with rural villages in Ghana.

2009

All Saints High School Robotics Team

An IEEE Canadian Foundation Special Grant enables an Ottawa area High School to compete in the FIRST Robotics Competition in Toronto. While initially having no IEEE connection, this sucess and a smaller subsequent grant in 2010 generated a connection with the local IEEE Section.

2004

Winnipeg Section WIE Rosie the Robot

Rosie was constructed to showcase women in engineering and present engineering as a fun and interesting career choice for young people.

Above are the highlights of a few of the success stories that have resulted from these grants. More stories can be found on the ICF web-site at:
http://ieeecanadianfoundation.org/EN/news/success_stories_e.php for English and
http://ieeecanadianfoundation.org/FR/nouvelles/success_stories_f.php en Français

Readers are encouraged to explore the ICF in more detail by visiting the Foundations web-site at: http://ieeecanadianfoundation.org

To help the Foundation continue to expand its support to the IEEE Canadian Community, please consider making a first time donation, or contributing to our current 20 for 20 campaign 'Twenty Dollars for Twenty Years'.

Donations can be made online at:
http://ieeecanadianfoundation.org/EN/donateonline.php (English) or
http://ieeecanadianfoundation.org/FR/donateonline f.php (French)

Donations can also be made by mail using the information at:
http://ieeecanadianfoundation.org/EN/don_mail.php or
http://ieeecanadianfoundation.org/FR/don_mail_f.php

Fondation canadienne de l'IEEE
Fête 20 ans de soutien

En 1994, l'Agence du revenu du Canada accordele statut d'organisme de bienfaisanceà la Fondation canadienne de l'IEEE (FCI), un organisme bénévole qui fait la promotion du génie électrique etverse des bourses et subventions en soutien aux activités étudiantes de l'IEEE. Aujourd'hui, grâce aux dons de membres de l'IEEE et à ses revenus de placement de l'année précédente, la Fondation finance les bourses et subventions de l'année en cours, mais mobilise aussi des fonds de dotation ciblés pour IEEE Canada et certaines sections canadiennes de l'IEEE dans le but de remettre des bourses et des prix particuliers. Grâce à la générosité sans borne des membres d'IEEE au Canada, la FCI est en mesure de remettre chaque année de plus en plus de bourses et subventions.

Un total de **$473,247** ont été remis sous forme de **191 bourses** depuis 1958

L'histoire de la Fondation remonte à la Conférence en électronique canadienne (IRE), lancée en 1955 par des membres de la Section IRE Toronto (prédécesseur de l'IEEE d'aujourd'hui). En 1971, la Conférence est constituée en société sous le nom d'International Electrical and Electronics Conference (IEEC inc.) et profite d'un fonds de réserve important. En 1972 est créé un comité de gestion de ce fonds de réserve afin de soutenir les activités étudiantes d'IEEE Canada.

En 1987, la Conférence – qui porte alors le nom d'Electronicom – cesse d'exister, tandis qu un salon commercial concurrent fait son entrée en scène. Cependant, le soutien philanthropique pour les activités étudiantes de l IEEE se poursuit. En 1989, Bob Alden amorce des discussions pour rebaptiser l'IEEC inc. Fondation canadienne de l'IEEE.

En 2002, un comité parallèle à Montréal, MontrealConferences-inc. (MCI), qui tient une conférence semblable, envisaged'unir ses efforts à ceux de la Fondation canadienne. En 2004,MCI fait un don à usage déterminé à la FCI afin de soutenir les activités de sa Foire scientifique. La FCI fonctionne désormais comme une fondation nationale dans les deux langues officielles.

La Fondation vise àcultiver les ressources et les relations qui font avancer la mission de l'IEEE, soit de favoriser l'innovation et l'excellence technologiques au profit de l'humanité. À cette fin, la FCI offre du financement de trois façons (il est à noter que tout bénéficiaire d'une bourse ou d'une subvention doit soumettre un rapport final détaillant ses résultats, dont les faits saillants sont publiés sur le site Web de la Fondation).

La première, c'est par la remise de subventions spéciales aux projets nouveaux et originaux au Canada qui cherchent à utiliser la technologie au bénéfice de l'humanité.

La deuxième, c'est par la remise de subventions aux branches étudiantes de l'IEEE pour établir et maintenir le Centre des ressources éducatives IEEE McNaughton dans leurs universités et collèges. Depuis 1980, la FCI a octroyé 120 subventions, pour un total de 424 147 $.

La troisième, c'est par la remise de bourses de la Fondation canadienne de l'IEEE (5 000 $ au niveau universitaire et 2 500 $ au niveau collégial) à des étudiants exceptionnels nommés par le conseiller de leurbranche étudiante de l'IEEE. Depuis 1985, 204 bourses totalisant 531 454 $ ont été attribuées. ■

Les bourses et prix remis annuellement sont financés par des dons à usage déterminé à la Fondation.

Prix Femmes en ingénierie de l'IEEE Canada de 1 000 $ remis annuellement et dotépar le Fonds Judy Clift

Subventions de voyagede l'IEEE Canada pour les technologies véhiculaires consistant en réductions (2) pouvant représenter la moitié des frais de déplacement vers une Conférence sur les technologies véhiculaires,dotées par la 1998 VehicularTechnologyConference

Bourse d'étudesQualité de l'énergie de l'IEEE de 1 500 $ remise annuellement et dotéepar les sections Alberta-Sud et Nord du Canada de l'IEEE

Prix Foire scientifique québécoise de la Fondation canadienne de l'IEEE consistant en deux prix de 750 $ chacun remis annuellement et dotés par le Fonds MontrealConferencesinc.

Grands prix de l'IEEE Canada, 11 prix remis annuellement, dont 5 sont dotés par divers organismes et 6 sont financés chaque année par une entité différente (don unique à usage déterminé de 20 000 $)

2012
Projet GROW – Énergie solaire 2012

En mai 2012, Emily Landry, fraîchement diplômée en génie électrique de l'UBC Okanagan, a bénéficié d'une subvention humanitaire de la FCI pour effectuer une étude de faisabilité d'un projet d'énergie solaire dans une région rurale du Ghana et y lancer la première étape d'implantation. Le projet GROW (Ghana Rural Opportunities for Women) est une initiative de développement communautaire liant l'UBC Okanagan à des villages ruraux ghanéens.

2009
Équipe de robotique de l'école secondaire All Saints

Une subvention spéciale de la FCI a permis à une école secondaire d'Ottawa de participer à la PREMIÈRE Compétition de robotique à Toronto. L'équipe n'avait au départ aucun lien avec l'IEEE, mais grâce à une subvention subséquente plus petite en 2010, elle s'est liée à sa section locale.

2004
Rosie, le projet de Robot de WIE de la section de Winnipeg

Fabriquée pour faire l'étalage du talent des ingénieures, Rosie présente l'ingénierie comme un choix de carrière amusant et intéressant pour les jeunes.

Pour en savoir plus sur la FCI, visitez le site Web de la Fondation au http://ieeecanadianfoundation.org

Pour aider la Fondation à poursuivre son soutien à la communauté canadienne de l'IEEE, vous pouvez faire un premier don ou contribuer à sa campagne « Vingt dollars pendant vingt ans ».

Pour faire un don en ligne :
http://ieeecanadianfoundation.org/EN/donateonline.php (anglais)
http://ieeecanadianfoundation.org/FR/donateonline f.php (Français)

Pour faire un don par la poste, consultez le :
http://ieeecanadianfoundation.org/EN/don_mail.php (anglais)
http://ieeecanadianfoundation.org/FR/don_mail_f.php (Français)

Ci-dessus se trouvent quelques faits saillants de réussites rendues possibles grâce aux subventions. Pour d'autres histoires, consultez le site Web de la FCI :
http://ieeecanadianfoundation.org/EN/news/success_stories_e.php (anglais)
http://ieeecanadianfoundation.org/FR/nouvelles/success_stories_f.php (Français)

IEEE Canadian Foundation
Fondation canadienne de l'IEEE

FROM THE PRESIDENT—I would like to acknowledge and thank those of you who have generously given to the IEEE Canadian Foundation in 2013. Your gifts allowed us to enhance the learning experience for engineering students across Canada with our programs of McNaughton Centres and Scholarships.

Students and other recipients have also benefited through the co-funding of special projects that develop engineering or science skills at all levels. Our Special Grant recipients are required to submit project reports which are reviewed, saved and often highlighted as "Success Stories" both on our website and in this magazine. Increasingly, these projects use technology for the benefit of humanity.

Our General Fund is crucial to our ability to operate each and every year, and your undirected donations allow us to keep our base strong.

Our Endowed Funds support a wide range of awards, prizes and scholarships. Please consider a directed donation to endow an IEEE Canada award or create a new award of your choosing

Gifts may be designated to any one of the following funds of the IEEE Canadian Foundation.

- **General Fund –** supports IEEE McNaughton Learning Resource Centres across Canada, related Scholarships, and Special Grants
- **Canadian Life Members Fund –** supports activities of interest to life members, potential engineers, and engineering students
- **Technology for Humanity Fund –** supports new and innovative projects that seek to apply technology for the benefit of humanity.
- **Vancouver Section Scholarship Fund –** supports scholarships awarded by the IEEE Vancouver Section
- **The IEEE PES Canadian Scholarship Fund –** supports scholarships in undergraduate electric power programs in Canada.

I appreciate your past support and urge you to continue to do so and increase your contributions where possible. If you have not yet made a donation, I urge you to please do so—we could do so much more with your financial support. All the different ways to give and donor recognition programs are fully described on our website.

The IEEE Canadian Foundation wants to hear from you – if we can better engage and support our community, please let me know.

I close by thanking the many IEEE volunteers in Canada who contribute to the all-volunteer effort that is the IEEE Canadian Foundation. I acknowledge the invaluable assistance of Luc Matteau, John Mowbray and Amine Miled in the preparation of this document.

Yours sincerely,

David H. Whyte
President
IEEE Canadian Foundation

MOT DU PRÉSIDENT – Je tiens à remercier tous ceux qui ont fait de généreux dons à la Fondation canadienne de l'IEEE en 2013 et qui nous ont permis d'améliorer l'expérience d'étudiants en ingénierie grâce aux programmes de nos Centres des ressources éducatives IEEE McNaughton, situés dans des établissements partout au pays, et à nos bourses.

Des étudiants et d'autres bénéficiaires ont également profité du cofinancement de projets spéciaux qui visent le perfectionnement des connaissances en sciences et en ingénierie à tous les niveaux. Les bénéficiaires de nos subventions spéciales doivent soumettre des rapports de leurs projets, lesquels sont revus, archivés et souvent mis en vedette dans la section « Histoires de réussite » de notre site Web et de la présente revue. De plus en plus, ces projets utilisent la technologie pour le bien de l'humanité.

Essentiel pour alimenter notre capacité à fonctionner d'année en année, notre Fonds général est constitué de vos dons à usage non déterminé.

Nos Fonds dotés permettent d'octroyer un grand éventail de prix et de bourses. N'hésitez pas à faire un don pour financer un prix d'IEEE Canada ou créer un nouveau prix de votre choix.

Vous pouvez également contribuer à financer l'un des fonds suivants de la FCI :

- **Fonds général –** Finance les Centres des ressources éducatives IEEE McNaughton au Canada, les bourses connexes et les subventions spéciales;
- **Fonds membres à vie canadien –** Finance les activités d'intérêt pour les membres à vie, les ingénieurs en puissance et des étudiants en ingénierie;
- **Fonds de technologie pour l'humanité –** Finance les projets nouveaux et innovateurs visant l'application de la technologie au bénéfice de l'humanité;
- **Fonds de bourses d'études de la section de Vancouver –** Finance les bourses d'études décernées par la section de Vancouver de l'IEEE;
- **Fonds de bourses d'études canadiennes de l'IEEE PES –** Finance les bourses d'études décernées aux étudiants de programmes de production d'électricité au Canada.

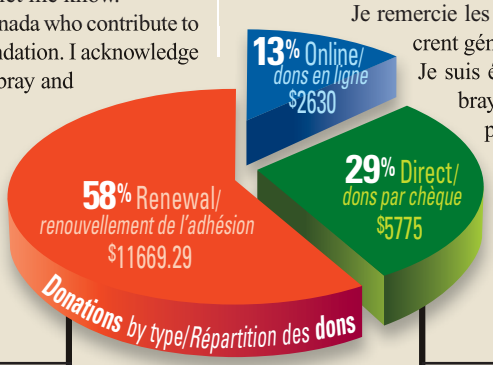
J'apprécie votre soutien et vous invite à maintenir vos contributions voire à les augmenter dans la mesure du possible. Si vous n'avez pas encore fait de don, je vous convie à le faire rapidement; nous pourrions réaliser tellement plus de choses grâce à votre appui financier. Reportez-vous à notre site pour connaître les différentes façons de procéder et en savoir plus sur notre programme de reconnaissance des donateurs.

La Fondation canadienne de l'IEEE cherche sans cesse à mieux soutenir sa communauté et accepte donc avec plaisir tous les commentaires et propositions à cet égard.

Je remercie les nombreux bénévoles de l'IEEE au Canada qui consacrent généreusement une partie de leur temps à notre Fondation. Je suis également reconnaissant à Luc Matteau, à John Mowbray et à Amine Miled de leur aide dans la rédaction du présent document.

Sincères salutations,

David H. Whyte
Le président de la Fondation canadienne de l'IEEE



The chart shows the distribution between the IEEE membership renewal process, our own Canadian online donation service (with receipts by return email), and cheques made payable to the "IEEE Canadian Foundation Inc." mailed to our treasurer.

$20,074
total received in donations from individuals in the year/*en dons reçus de particuliers en* **2013**

Ce diagramme illustre la répartition des dons des membres effectués par le processus de renouvellement de l'adhésion, par notre service de dons en ligne (avec reçus électroniques) et par des chèques à l'ordre de la « Fondation canadienne de l'IEEE inc. » postés à notre trésorier.

Every gift makes a difference. The honour roll formally recognizes all donors contributing $25 or more. The foundation extends its thanks also to those donors who are not listed.

Chaque don compte. Le Tableau d'honneur reconnaît officiellement tous les donateurs ayant versé 25 $ ou plus. La Fondation tient à remercier également tous les donateurs qui n'y figurent pas.

IEEE Canadian Foundation
Fondation Canadienne de l'IEEE

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Tableau d'honneur des donateurs 2013

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Note: There were no Platinum ($750 - $999) or Gold ($500–$749) donors in 2013; the ICF is very pleased to have its first Leader donor in the Leadership Association Tier, with a record number of donors

In Memory of / À la mémoire de
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by David Kemp

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From GOLD to Young Professionals

IEEE's GOLD (Graduates of the Last Decade) recently rebranded itself as Young Professionals. But it's more than a name change. In Canada, section chairs are providing more bang for members' bucks through innovative events. Globally, new initiatives will be launched in 2015.

By **Vawn Himmelsbach**

Young Professionals is a group of IEEE members and volunteers looking to advance their careers and build a lifelong professional network. Aside from developing technical skills, the group is also focused on helping members develop soft skills such as teambuilding and communication, as well as building a network with professionals outside of the engineering sector — and perhaps opening their eyes to career possibilities they hadn't considered before.

Young Professionals plays an important role in IEEE's overall membership. But it's such a unique group that it can sometimes gets overlooked, says Lori Hogan, project manager of OmOptics AIF at Memorial University of Newfoundland and a former Region 7 GOLD Coordinator.

"There's a lot of support for students, but once graduates get out there in the workforce that support is still needed," she says. Part of the rebranding from GOLD to Young Professionals involves expanding the timeline from 10 to 15 years from graduation. "By expanding the age range, it's a good way to keep the attention, or get the attention of people who may be dissatisfied with their original career choice," says Hogan. "We can keep them as IEEE members by presenting them with all the options available to them."

Young Professionals welcomes members up to 15 years after graduation, recognizing varied career paths.

This could involve Young Professionals groups partnering with local start-ups or other technical organizations to help members look at their careers from a different angle. "It's the same industry, but maybe a different flavour than what you were exposed to in your job, and certainly different than what you were exposed to in your undergraduate studies," says Hogan.

There's benefit to industry, too, in exposing new engineers to what they're doing and what they're about — whether or not they're hiring. "Industry should be reaching out regardless so when they do need to hire or promote their

Doing things differently in London Section

Mohamed Abu Sharkh, a cloud computing researcher at Western University, was looking to give back to the community, while at the same time practice his leadership skills.

"What better way to do it than the IEEE?" says Abu Sharkh, who took over as Chair of Young Professionals London Section in September. "A lot of my friends don't know anything about the IEEE, so there's a lot of potential to introduce a new vision and come up with new activities that interest people."

Abu Sharkh started by creating a Facebook page to generate publicity, as well as kicking off a word-of-mouth campaign. Rather than trying to do everything on his own, he recruited a skillful/capable team of four people with different engineering backgrounds. The team then reached out to students, professors and other members to get feedback on various ideas.

At its STEP (Student Transition & Elevation Partnership) event in October, the team invited five experts to talk about career elevation. "We were very careful in choosing the experts because we have a wide set of interests — some members want to work as developers, others to become research scientists or go into academia — so we wanted to get one expert from each background," he says.

They had 75 attendees, "which is great for London," says Abu Sharkh. "And I can confirm it's not the pizza." Last year, the average was about 25 attendees at events.

"The IEEE offers many distinguished lecturers and this is something members are used to," he says. "We wanted to come up with something different." So his group teamed up with Women in Engineering for a discussion on technical entrepreneurship.

"We have interesting events planned for 2015 as well, such as a new problem-solving competition for engineers." says Abu Sharkh. "We're also trying a new idea where we're helping students transition to career life by doing mock job interviews with real companies."

product or service, people will be familiar with their name," she says. "We've done that in the past — invited various companies to a networking event or activity, not necessarily to give a presentation but just to network."

Today's young professionals are more aware of what's happening globally and are more mobile than previous generations of engineers, and that's changing what they are looking for in their IEEE membership.

"The rapid growth of technology has made more people interested in working remotely or opening up shop," says Hogan. "It's no longer a 9-5 job. It's so easy to do your work anywhere, at any time, and that's a different challenge."

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Industry experts discuss risks and rewards of launching a start-up at Toronto Section event

Karl Martin Founder & CEO, Bionym | **Chris Ouslis** Co-Founder, Fresco Microchip & New Business Venture Coach | **Wendy Robertson** CEO & Founder, Assemble Incorporated | **Kamal Hassan** CEO, IncMind and Director, Founder Institute Toronto | **Devon Ryan** Co-Founder, LION Mobile

A diverse panel of entrepreneurs gave their take on the challenges and opportunities of starting a business, as part of a Toronto Young Professionals-hosted event last October. The five-hour Technical Entrepreneurship Mini Confererence (TEMC) also included two keynotes and a workshop. The panel was moderated by Mario Milicevic, 2015/2016 Global IEEE Young Professionals Chair. Topics included how to address risk, build partnerships, and "be in the right place at the right time." Some highlights follow.

Mario Milicevic Ph. D. candidate U of T, Global YP Chair, IEEE (Moderator)

Mario Milicevic: **A lot of people want to take the plunge into entrepreneurship. In your opinion or experience, what are the biggest challenges faced by many young or new entrepreneurs?**

Devon Ryan: One of the biggest challenges for me was just getting started. I started when I was pursuing my electrical-engineering degree. And that actually ended up really benefiting me because I started taking advantage of the fundamentals that I was learning in college right away, instead of waiting until post-graduation. So, getting started early, and just starting something, is a big challenge, and I

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IEEE global YP Chair to build on R7 entrepreneurship initiative

Mario Milicevic sees entrepreneurship from a global perspective. That's because this PhD candidate in electrical and computer engineering at the University of Toronto, and past Chair of Toronto Section Young Professionals, is now Young Professionals Chair for all of IEEE. And he has big plans. In November, he attended the IEEE MGA Board meeting to learn about IEEE's position on entrepreneurship-related events and initiatives.

The IEEE has several entrepreneurship initiatives scattered around its various committees and boards, such as the Boston ENET and IEEE-USA Entrepreneurship Village. Just recently, the Technical Activities Board approved the creation of an adhoc committee to run a global entrepreneurship portfolio.

"I want to provide a bridge for Young Professionals to access all of the many scattered pieces of the puzzle," says Milicevic. "I've had many lengthy discussions with other volunteers about where Young Professionals fits into the whole mix. The answer: Everywhere."

The IEEE Young Professionals Committee will work closely with the Technical Activities Board, IEEE-USA and potentially the IEEE Standards Association to develop a cohesive global entrepreneurship offering for Young Professionals members.

"The goal is to have dynamic and diverse events around the world, tapping into the existing resources of larger entities within IEEE."

Milicevic intends to spread the word about entrepreneurship among the IEEE Young Professionals community, and to explain the resources available to IEEE members in non-entrepreneurial hubs. Other goals are to provide training on how to build a successful venture, complemented by networking, funding and partnership opportunities.

"We don't wish to reinvent the wheel, so we intend to partner with external organizations such as Founder Institute — a global, reputable startup accelerator program," says Milicevic.

The Technical Entrepreneurship Mini Conference (TEMC) held last October in Toronto was run as a pilot to gauge interest; similar events could be run as one-day adjuncts to IEEE conferences and workshops in the coming year.

"The IEEE Young Professionals global entrepreneurship offering will be flexible and allow for creativity among local organizers," he says. "The goal is to have dynamic and diverse events around the world, while tapping into the existing resources of larger entities within the IEEE."

There's also more social awareness. "I've seen more people drawn to smaller start-up environments early on in their profession, where they have more involvement in the company and can shape or direct where the early products are going, and in turn shape and determine the direction of the company as a whole," she says.

Young Professionals are at a point in their life where they need a reason to justify the cost of their IEEE membership. "They're buying their first house, their first car, getting married," says

highly recommend that if you're really interested in entrepreneurship, just start something. ... Don't let that be a huge barrier. Just get the ball rolling.

Kamal Hassan: Be sure when you're getting started that you're in a place and time in your life that you're ready to commit to something, because starting a business can be very hard. Things don't always go as planned. And, if and when they don't go as planned, the people who are still around are the ones who don't give up, the ones who keep going and plug through it.

Wendy Robertson: To be an entrepreneur you have to talk to people. You have to spend a lot of time talking to your team and interacting with them daily. It's not enough to assign tasks and go off on your own direction. ... Commit to having a focus on talking to people and building those conversations that are going to convert into investment. The things that you're going to convert are people, because people buy people — they don't buy technology. So you really have to put yourself out there. And, for a lot of entrepreneurs, that's the hardest thing.

Chris Ouslis: There are two archetypes, or maybe yin and yang, which typically go on inside our heads. … The positive side can be very much elating and the negative side can be very much depressing. The thing you have to keep in mind is that this is totally natural. We do face these two aspects of our consciousness. The key thing to remember is you have to be very patient with yourself. Most of us tend to be quite patient outside, but we're not so forgiving and patient with ourselves inside. … It's going to be tough. You have to do things that you will be uncomfortable with. In fact, that's an essen-

Thoughts from the outgoing IEEE Canada YP Coordinator

Dan Hosseinzadeh, chief technology officer of PathCore Inc., is ending a successful three-year term as IEEE Canada Young Professionals Coordinator. In his role, he provided support and resources to the various chairs across Canada and acted as a liaison between the Region and the global organization.

One of his accomplishments was creation of new Young Professionals groups. There were no groups in Quebec, for example, so he started the formal process of establishing one.

Working with IEEE Canada's outgoing Member Services Group Chair, Mo El-Hawary, he set up an annual award for Best Canadian Young Professionals Group, with a $500 prize and bragging rights.

> "Once you become a volunteer with the IEEE, it's got a gravitational pull. You create friendships and depend on each other to get things done."

The 2013 winner was the Toronto affinity group, with Canadian Atlantic and London close runners-up. For 2014, the Southern Alberta group takes home the honours, with London again runnerup.

"Overall, my job was to communicate the opportunity to the chairs so they could be recognized for the work they're doing," he says. "At the same time, I was there to provide support where needed." While he says Young Professionals can provide technical information to members, it's also a valuable resource for networking with peers and advancing their careers. And there are intangible benefits that are sometimes harder to quantify.

"It's almost like a family," says Hosseinzadeh. "Once you become a volunteer and get involved with the IEEE, it's got a gravitational pull. You create friendships and depend on each other to get things done — and learn skills you can often apply to furthering your own career."

Dan Coode, business manager of cable network products at SED Systems in Saskatoon, and a previous Region 7 GOLD Coordinator. "There is no end of ways they're being asked to spend money at that point in their life."

IEEE membership is therefore a challenging value proposition, he says. But, he adds, "It's also the best time to bring them onboard because once people settle into a routine, it's hard to change it. Ten years later, they're unlikely to say, 'Hey, I'm going to join IEEE.'"

The Young Professionals demographic is perhaps the most important in the IEEE, says Coode, since they're the ones who will be creating the standards of the future and will foster a new era of engineers.

These days, people don't stay at the same job for the entirety of their career. They'll likely switch jobs, and even careers, multiple times. The ultimate goal of the IEEE is to be there throughout a person's career, no matter which organization they work for, in whatever capacity. "IEEE can be that home," says Coode. "But we need them to join up and stay as members."

tial part of your growth and your company's growth. And be patient with yourself, and forgiving, and know that you can get through this. ... It might take you until tomorrow or next month. But don't let negative thoughts detract from what your focus and your goals are.

Mario Milicevic: **So it sounds like there's a lot of risk involved. What are some of the key risk areas that entrepreneurs should be aware of, and how can we address these early on?**

Karl Martin: When you start, you will have a ton of assumptions in your head. Many of these will remain untested for some time. You will learn more as you go, but you will continue to be operating under a lot of uncertainty. And I think one of the biggest risks is simply a lack of awareness of the assumptions that you're making. You paint this picture of the future, with whatever you're making. You think it's so obvious — the world will follow what you're doing because it's so obviously the solution. But if you don't actually think through all the assumptions, you will miss important steps of validation that you need to take. … So I think it's a very clear awareness: Don't get too absorbed in your own story and the Kool-Aid that you're dishing out to other people. Think very critically, and then knock things out one by one. The magic is not going to happen on its own; you have to make it happen.

Chris Ouslis: I think one of the key aspects to risk is something I typically see in a lot of companies. When we go to select people — partners or hired staff, for example, typically we tend to hire people, maybe subconsciously, who are similar to ourselves in many aspects of character, of disposition, and, sometimes, even of skills. And that's quite dangerous. What you want to build up when you're putting together an organization is a complimentary set of individuals who are capable of addressing your weaknesses and complimenting the aspects of your skill set that are missing. What you want to do is be able to create a complete team. That's an unusual thing because it's sort of stepping out of your comfort zone into an area where you might not be so comfortable, in determining strengths and skills, and how to best determine if someone else has those.

Wendy Robertson: For entrepreneurs, I think that everybody comes to their business able to contribute a subject matter or expertise. That's why they've started the company: They feel they have a particular insight, or a particular invention, that they can apply. But most entrepreneurs don't understand cash. And cash is the most important thing you have to learn about, because everybody

IEEE has a lot to offer. "But if you look at the diversity of the IEEE membership, it's very difficult to articulate in a quick elevator pitch the value of IEEE membership — because there are probably 50 different pitches you can make depending on who you're talking to," says Coode.

His own experience has been one of ever-expanding opportunities. Since being Region 7 Young Professionals Coordinator, he has been Chair, IEEE MGA Center for Leadership Excellence, as well as a member of the IEEE MGA Strategic Direction and Environmental Assessment Committee.

"I certainly would not be where I am in my career without some of the lessons I've learned from the IEEE — like management, like communication. It's allowed me to learn and practice new skills and hone that toolbox."

But there are no shortage of opportunities for growth at the Section level, Coode says. He points out that while the IEEE provides access to technical societies and research, younger members can learn career lessons from those with more experience, a benefit they would otherwise gain the hard way.

"I see people who are overly loyal to a company — they're being overworked and there are other opportunities that might be better for them — and that same company could turn around and randomly lay people off," says Coode.

So one of the events held during his tenure with Young Professionals was a mentorship night. But rather than matching young professionals with more senior professionals, the group brought in engineers nearing retirement to talk about instructive experiences from the course of their careers.

Through events such as this, Young Professionals provides real value by addressing some of the challenges that members face — or will face — in their professional lives, such as learning how to deal with a difficult boss, start planning for retirement or invest their money.

But that value has to be ongoing. "Are young professionals going to spend that money on a rock concert or an IEEE membership? If you have 'x' amount of money you have to decide where you'll spend it, and if the value equation doesn't make sense with the IEEE, we might keep someone for a year, but we won't be able to retain them for a lifetime."

One way Young Professionals will build loyalty is by focusing on community. "A lot of people take new jobs in new cities, especially when they're starting their careers, and they're looking for some sort of community. The IEEE gives them that with a group of people who are like-minded and working in similar fields — it's a great social and professional network," says Coode.

To help accomplish this, Young Professionals is developing a mobile app so members can find local groups and events wherever they are. Young Professionals also plans to update members on the latest news and events via social networks, e-newsletters and the website, and will launch a video series to inform members of the latest happenings through one-minute clips.

In Toronto, the Young Professionals group launched innovative programming to broaden members' skill sets.

"We were tired of having the same events all the time," says Rob Kamranpoor, program manager at Hydro One and the chair of Toronto Section GOLD for 2012/2013. "We wanted to teach members something they're going to need in the real world."

looking at your business understands cash better than you do. And you have to understand that, whether you're bootstrapping or whether you've got a grant; if you have money in; if you have angel investment. The follow-on investors are going to look at how you've spent that money. And the temptation with early-stage entrepreneurs who are functioning in a granted environment is that they pay themselves, because their time has a value, and they can give it a value equivalency, and they give themselves a salary. And when the money runs out, they're surprised, because they thought that having worked diligently toward the first milestone of their company, more cash would follow on. And that isn't necessarily true. It doesn't happen for everybody in an incubator, and it doesn't happen for everybody who's earned a foundation grant from one of the innovation groups in the country. And what you have to understand is that the filter of financial responsibility, being financially literate, is actually one of your biggest defences to weathering some of the things you don't expect.

Mario Milicevic: **What are some things that entrepreneurs should think about when they're building a partnership with another company?**

Devon Ryan: To be completely frank, I think it's secondary. I did just recently partner, but that wasn't my main focus. They came to me, and it seemed like the time was right for where I was as a whole with LION Mobile. So, we went ahead and negotiated and became partners. But the key thing is sales. You want to get that first sale, and you want to be able to deliver, especially if you have investors. So I wouldn't focus too much on partnerships. That's a common thing that entrepreneurs do. People only talk about partnerships because they don't have sales. But if you have sales, sales are everything, because that's going to get you up to the next level.

Kamal Hassan: Customers are the partnership that matters. The first customer is often the toughest — so go out of your way and bend over backwards to get that first customer. Whatever your future plans are, get one customer in the door because they can leverage future ones. And make sure you serve them well. Your business succeeds when you can keep customers, so make sure that you go out of your way to give them the responsiveness they might not get from other people.

Wendy Robertson: Customers are the type of partners we're talking about. When companies say they want to partner with you, what they're really saying is: 'I'd like your customer list, please, and I'd like to sell what I'm selling to your customers.' So you have to come to that table with a good hand as well, because your value proposition is that you're going to make their relationship with their customer more valuable. And it's a very complex sale to recruit those kinds of partners. If you have a good sense of who your customer is, and a good representative sample, then you're ready to start talking about partnering.

One of his group's most popular events was a networking event — but one where they switched-up the typical format. Rather than bringing in professionals from the engineering sector, they brought in professionals from a variety of sectors to showcase other career options for those with an engineering degree, such as business or law.

"I mixed my engineering degree with a business degree, and that helped me out a lot," says Kamranpoor. "I wanted to show young professionals they have other options if they want to take another route."

When he took over as chair, he handpicked his team and set his expectations. "We set out our goals at the beginning of the year and actually went above and beyond what we wanted to do — and it hasn't stopped under my successors," says Kamranpoor. "We went from having five or 10 people coming out to events to 900 people registering for one of our events in 2013.

"If you try the same thing over and over again, you're going to get the same results over and over again," observes Kamranpoor. "With IEEE GOLD, I wanted to knock everything down and do it differently. It was risky but it paid off."

"I certainly would not be where I am in my career without some of the lessons I've learned from the IEEE — like management, like communication. It's allowed me to learn and practice new skills" — Dan Coode

His favourite event was a panel on green energy — a timely topic that he felt would catch people's attention. It did: Some 70 people showed up to the event, and it was so successful that he ran it a second time.

While these events provide networking opportunities for members, ultimately it's up to them to sell themselves, Kamranpoor says.

Social skills are critical, but that's often lacking in the engineering field, says Kamranpoor. "You don't really learn those skills in engineering, and that's something we need to really focus on and improve because in the real world if you don't have those social skills you're going to be left behind," he says.

Hence the focus during his tenure at Toronto Section Young Professionals on workshops to help participants become more adept at interacting with others. "We wanted to show them real-life perspectives," he says. "Don't just think your resume is going to get you in the door because it's not. People don't care about your 4.0 GPA if you don't have team-building skills."

Kamranpoor will have plenty of opportunity to share his enthusiasm for developing a broader skill set for Young Professionals; he is the group's 2015 Coordinator for IEEE Canada. ■

Vawn Himmelsbach *is a freelance writer who has written about business and technology for close to 20 years.*

Chris Ouslis: Partnerships may be helpful because you may want to get some of that PR exposure. Maybe the name of your partner will somehow benefit your company in some way. But, ultimately, as was mentioned, what is important are sales. The partnership might bring you some sort of tangential or indirect benefit. But what you're really looking for, typically as you're starting, are customers — and a variety of customers — because at any time any one customer may bow out. Their volumes may drop. Things may change. You need to have enough of a diversified customer base so that no one customer is providing a significant amount of your revenue. Now, having said that, typically at the beginning your first customer, or your first few customers, are the ones really who are going to provide the foundation. So you're going to have a significant amount of your revenue, or maybe 100 per cent, for a certain period of time, from one customer. You're going to need to go through that.

Mario Milicevic: **What are your thoughts on being in the right place at the right time? Is there such a thing?**

Karl Martin: Absolutely. It's like the product that we're making right now — if we had actually conceived it when we started the company, it would have been too early. So it tends to be about adaptability. There's a common saying: 'Get out of the office!' You have to see what's going on to understand where you fit in the world. It doesn't matter how perfect or ideal you think your product is: It has to be at the right place at the right time. You only know that by talking to lots of people. Your idea of the product and the market might not be at the right time, so you have to learn and iterate until you reach that. You can't brute-force your way through it.

Chris Ouslis: I guess the question could be: Is there such a thing as luck, perhaps, or that sort of an opportunity? The best response might be that luck favours the well-prepared. I can't recall who said that, but it's a great quote. That is, it's not really luck. Or, perhaps, the more effort you put into something, the luckier you become. That's another quote that I've heard. Lots of hard work, a lot of effort, knowing your area very well, getting out to see a lot of customers, and getting as much exposure and attention — you will eventually come upon an opportunity.

Wendy Robertson: If there isn't a product-market fit, being early is not a good story. Being smart enough to understand how to make your product, to deconstruct it, to make it the right thing for right now, is a much harder and more valuable skill. But the issue with being too early is like an epidemic amongst innovators, because being early means also being original and having something that's patentable. And sometimes it just comes down to finding and figuring out what the market will buy right now, and doing a little bit better than what's out there.

Devon Ryan: I like to surf, and I have yet to catch that perfect wave. It's always in my grasp, but I can never find it. And, to me, it's really rare that you can actually catch the perfect wave. In all the headlines, where you see WhatsApp or Instagram was purchased for billions of dollars — those sound like overnight successes, like they caught the perfect wave. But they're not. They started off as a minimum viable product: Somebody had an idea and they tested the market and they put the app out in the app store. And a lot of those apps, like WhatsApp and Instagram, didn't even start off with the same name, let alone the same idea. So I think the key take-away is that you've got to be dynamic. You can't be married to the idea. Be ready to change. Try not to think about chasing the perfect wave. ■

IEEE Canada IHTC 2015 International Humanitarian Technology Conference
IEEE Canada présente l'CITH 2015 Conférence internationale de la technologie humanitaire

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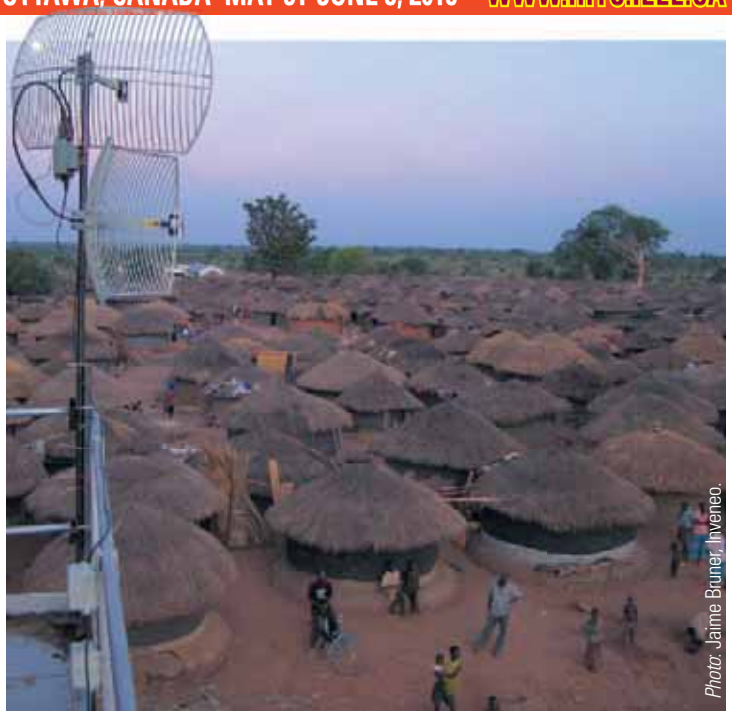

Photo: Jaime Bruner, Inveneo.

Student Design Contest

In avalanche rescue, every second counts. Fortunately new technology is making it possible to more quickly locate those in trouble. This year's student competition is to design add-on modules for a low-cost, open-source radar imaging system for snow avalanche search and rescue operations. The design is freely available from the MIT Open Course Ware Program under the popular Creative Commons licensing. Prototypes to be ready by the IHTC2015 conference time.

Photo: U.S. National Park Service

Concours de conception à l'intention des étudiants

Pour les équipes de secours sur les lieux d'une avalanche, chaque seconde compte. Heureusement, de nouvelles technologies permettent de localiser plus rapidement les personnes en détresse. Cette année, les étudiants sont invités à concevoir des modules complémentaires pour un système radar imageur open source et à faible coût pour les opérations de sauvetage sur les lieux d'avalanches. Le concept est accessible à tous dans le programme de didacticiels du MIT sous licence de Creative Commons. Les prototypes doivent être prêts pour la conférence CITH 2015.

The theme of the IHTC 2015 will be "supporting communities toward resilience" with emphasis on policies, practices, and technologies aimed at building resilient communities. The conference will focus on two key areas: humanitarian applications of technologies in disaster mitigation, relief, and recovery; and empowering communities (including aboriginal/indigenous peoples) to overcome adversity and achieve sustainable development. Objectives include understanding critical community needs and issues such as disaster management, sustainable development, capacity building, and self-sufficiency. A particular focus will be on social innovation and collaborative solution design, with an emphasis on open source technology.

La Conférence CITH 2015 se déroulera sous le thème « Renforcer la résilience des collectivités » et mettra l'accent sur les politiques, les pratiques et les technologies utilisées à cette fin. La conférence se divise en deux volets : d'une part, l'application humanitaire des technologies dans le cadre de l'atténuation des dégâts, des opérations de secours et de la reprise après catastrophe; d'autre part, les stratégies visant à donner aux collectivités (notamment autochtones) les moyens de faire face à l'adversité et de favoriser le développement durable. La conférence traitera des besoins et problèmes cruciaux des collectivités, notamment la gestion des catastrophes, le développement durable, l'amélioration des capacités et l'autonomie. L'innovation sociale et la conception de solutions collaboratives occuperont une place centrale dans le programme, qui mettra particulièrement l'accent sur la technologie open source.

WHY ATTEND?

- ★ To gain awareness of the need for technology in humanitarian and sustainable development contexts
- ★ To better understand the developmental, social and cultural contexts into which technologies may be applied and learn from the associated challenges, successes and failures in trying to integrate technology into these contexts.
- ★ To learn how to successfully develop and apply novel approaches to solve humanitarian challenges or support humanitarian initiatives;
- ★ To have an opportunity to establish relations with similar minded colleagues;
- ★ To collaborate in the creation of a mechanism for supporting peer-review of Open Source humanitarian solutions to continue beyond the conference;

POURQUOI PARTICIPER?

- ★ Pour en apprendre davantage sur les besoins technologiques dans des contextes d'aide humanitaire et de développement durable.
- ★ Pour mieux comprendre le contexte de développement et socioculturel dans lequel les technologies sont utilisées, ainsi que les défis et les exemples de réussite et d'échec de l'intégration des technologies dans ces contextes.
- ★ Pour apprendre à élaborer et à mettre en pratique des stratégies novatrices en vue de résoudre les problèmes humanitaires ou de soutenir les initiatives dans ce domaine.
- ★ Pour avoir l'occasion de nouer des relations avec des collègues qui partagent vos idées.
- ★ Pour collaborer à la création d'un mécanisme d'évaluation par les pairs des solutions humanitaires open source, qui sera maintenu après la Conférence.
- ★ Pour avoir l'occasion d'adhérer au Comité d'initiatives humanitaires (HIC) et au Groupe d'intérêt spécial sur les technologies humanitaires (SIGHT), ou de par-

- ★ To have an opportunity to get engaged in the HIC/SIGHT community, or similar programs from EPICS, TISP and WIE;
- ★ To gain the skills and knowledge to initiate or participate in any humanitarian activity (solution or initiative).
- ★ To gain the insight of experienced and influential people in the humanitarian field.

The target audience for the conference includes researchers, practitioners and students in the fields of disaster relief, sustainability, human development, education, STEM fields and management sciences as well as interested professionals and anyone wanting to contribute their talents on the humanitarian and sustainable development fields.

ticiper à des programmes similaires tels que les Projets d'ingénierie dans les services communautaires (EPICS), les Ateliers TISP (Teacher In-Service Program) et le groupe Femmes en génie (WIE).

- ★ Pour acquérir les compétences et les connaissances nécessaires pour entreprendre une activité humanitaire ou y participer (solution ou initiative).
- ★ Pour entendre le point de vue éclairé de personnes expérimentées et influentes dans le domaine humanitaire.

La conférence s'adresse aux chercheurs, aux professionnels et aux étudiants spécialisés dans les domaines de la reprise après catastrophe, du développement durable et humain, de l'éducation, des STIM et des sciences de la gestion, de même qu'aux professionnels qui s'y intéressent et à toute personne qui souhaite faire valoir ses talents dans un contexte humanitaire et de développement durable.

CONTACTS

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IHTC 2014 laid humanitarian building blocks

L'CITH 2014 contribue à l'effort humanitaire

IEEE Canada's International Humanitarian Technology Conference (IHTC) in Montreal last year provided a platform not just for presenting academic papers, but also combined technical know-how with hands-on experience and lessons learned to help drive new projects and initiatives.

"Some participants had thought this was another academic exercise," says Mohamad Sawan, Technical Program Committee Co-Chair, and Director of ReSMiQ Research Centre and Polystim Neurotech Lab at Polytechnique Montreal. "Then they realized the intent and potential."

In 2013, IEEE Canada expanded its humanitarian efforts with creation of several Special Interest Group(s) on Humanitarian Technology (SIGHT), which provide a structure for members to organize with their local section or student branch to work on humanitarian projects.

Sponsored by TELUS, IHTC 2014 was a collaboration of SIGHT teams across Canada, attracting approximately 120 attendees and technical papers from authors around the world.

"The intent was to bring together people with diverse experiences, diverse knowledge and diverse abilities to help communities at both a local and international level," says Dr. Ferial El-Hawary, Professor (former) at Dalhousie University, and Conference General Chair.

(continued on page 62)

Tenue à Montréal l'an dernier, la Conférence internationale de la technologie humanitaire d'IEEE Canada (CITH) a permis non seulement de présenter des articles universitaires, mais aussi de combiner le savoir-faire technique avec des expériences pratiques et enseignements visant à faciliter la concrétisation de nouveaux projets et initiatives.

« Certains participants pensaient qu'il s'agirait d'un autre exercice purement théorique, explique Mohamad Sawan, coprésident du comité des programmes techniques et directeur du centre de recherche ReSMiQ et du laboratoire de neurotechnologies Polystim à l'École polytechnique de Montréal. Puis, ils ont compris son intention et son potentiel. »

En 2013, IEEE Canada a intensifié ses efforts humanitaires par la création de plusieurs groupes d'intérêt spécial sur la technologie humanitaire (SIGHT – Special Interest Groups on Humanitarian Technology), qui fournissent à leurs membres une structure leur permettant de constituer une section locale ou une branche étudiante consacrée à des projets humanitaires.

(suite p. 62)

Photos on this page and the next courtesy of Jeremy Clark and Glenn McKnight

"We addressed the fundamental building blocks on what humanitarianism means, and how technology can be used for humanitarian purposes and community development," she says.

The 2015 conference will look at how to build resilient communities. "We can't just throw technology at what we engineers perceive are the problems," says Raed Abdullah, Strategic Planning Engineer with Hydro Ottawa, and 2014 Conference Vice-Chair. "When you're undertaking humanitarian work, you need to engage the community, understand what they see as their needs and priorities, and then provide solutions they can choose from."

This approach gets full endorsement from Joan Kerr, Director of the Foundation for Building Sustainable Communities, and a long-time volunteer member for IEEE Canada's Humanitarian Initiatives Committee. She says engineers can make invaluable contributions.

"I think of humanitarianism as a way of life and technology as a tool," Kerr says. "IEEE members are wonderful toolmakers, so it's important there's an integration of the two. They see things differently. But the difference is good.

"That's the power behind this whole conference — that these two groups come together to discuss how we use these creations and inventions, these tools, to better impact what's needed out into the community, especially in the developing world."■

Commanditée par TELUS, l'CITH 2014 a été le fruit de la collaboration de ces équipes SIGHT partout au pays, attirant environ 120 participants et présentant des articles spécialisés d'auteurs du monde entier.

« Nous voulions réunir des gens aux parcours, aux connaissances et aux capacités variés pour aider les collectivités à l'échelle locale et internationale, précise Ferial El-Hawary, ancienne professeure à l'Université Dalhousie et présidente générale de la Conférence. »

« Nous avons traité des bases de l'humanitarisme et de la façon dont la technologie peut servir à des fins humanitaires et de développement communautaire. »

La Conférence de 2015 se penchera sur les moyens de bâtir des collectivités résilientes. « Il ne suffit pas d'offrir des solutions technologiques aux problèmes que perçoivent les ingénieurs, explique Raed Abdullah, ingénieur en planification stratégique à Hydro Ottawa et vice-président de la Conférence de 2014. Pour mener à bien des travaux humanitaires, il faut faire intervenir la collectivité concernée, comprendre ses besoins et ses priorités puis lui fournir un éventail de solutions.»

Cette approche reçoit l'appui total de Joan Kerr, directrice de la Foundation for Building Sustainable Communities et membre bénévole de longue date du comité d'initiatives humanitaires d'IEEE Canada. Elle est persuadée que l'apport des ingénieurs peut s'avérer inestimable.

« Je vois l'humanitarisme comme un mode de vie, et la technologie, comme un outil, dit-elle. Les membres de l'IEEE sont de merveilleux outilleurs; une intégration des deux est donc essentielle. Ils voient les choses différemment. Mais la différence, c'est essentiel. »

« Voilà tout le pouvoir de cette conférence : deux groupes qui se réunissent pour trouver des façons d'utiliser les créations et inventions, ces outils, afin de mieux combler les besoins des collectivités, surtout celles des pays en développement. » ■

Vawn Himmelsbach

A Volunteer-Webmaster Needed for IEEE Canadian Foundation

The IEEE Canadian Foundation (ICF) is seeking a volunteer to maintain its bilingual website (http://ieeecanadianfoundation.org). He/she will be part of a small committee whose duties include posting ICF meeting information and other related material, and coordinating French translation with the volunteer(s) handling that task. Some proficiency in French would be helpful/of value. Experienced/knowledgeable and interested volunteers, please contact:

John Mowbray, ICF Nominations Committee, John.Mowbray@ieee.org

Webmestre bénévole recherché par la Fondation canadienne de l'IEEE

La Fondation canadienne de l'IEEE est à la recherche d'un ou d'une bénévole pour maintenir son site Web bilingue (http://ieeecanadianfoundation.org). Cette personne fera partie d'un petit comité chargé notamment d'annoncer l'information sur les réunions de la Fondation, de diffuser les documents connexes et de coordonner les travaux de traduction vers le français auprès des traducteurs bénévoles. Une connaissance du français serait utile et appréciée. Les bénévoles compétents et expérimentés qui désirent occuper cette fonction sont priés de communiquer avec:

John Mowbray, Comité des nominations de la Fondation canadienne de l'IEEE, John.Mowbray@ieee.org

La 28ème Conférence canadienne de l'IEEE en Génie électrique et génie informatique

3-6 mai, 2015 Halifax, Nouvelle Écosse Canada

Photo: HPA/Nova Scotia Tourism

Célébrant 30 Ans des frontières de l'océan

La conférence canadienne du génie électrique et génie informatique de l'IEEE pour 2015 (CCECE 2015) sera tenue à Halifax, Nouvelle Écosse Canada, du 3-6 mai, 2015, qui offre un forum pour les chercheurs et ceux qui œuvrent dans la spécialité d'échanger et explorer les sujets et opportunités dans le domaine de la recherche et développement pour le génie électrique et informatique du Canada et ailleurs.

http://www.ccece2015.org

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IEEE Women in Engineering: Profiles of Progress

Twenty years after the formalization of IEEE WIE, women are still vastly under-represented in the profession. However, creative approaches to building STEM confidence in pre-university female students show promise.

By **Vawn Himmelsbach**

While women represent the majority of young university graduates, they are still underrepresented in science, technology, engineering, mathematics and computer science (STEM) fields, according to Statistics Canada. That's something that IEEE Women in Engineering (WIE) hopes to change.

Having just passed the 20-year mark, WIE has the backing of the largest international professional organization dedicated to advancing technology. Striving for this goal means promoting women engineers and scientists, and inspiring girls to follow their academic interests towards a career in engineering.

Just a few decades ago, women who entertained the idea of this career encountered myriad obstacles from gender bias to lack of support from family and friends. And they had few role models to mentor them in a male-dominated profession.

IEEE Canada WIE Chairs

Janet Light Thompson (2015)

Year	Name	Year	Name
2014	Zahra Ahmadian	2005	Anna Zyzniewski
2013	Zahra Ahmadian	2004	Anna Zyzniewski
2012	Zahra Ahmadian	2003	Anna Zyzniewski
2011	Behnaz Ghoraani	2002	---
2010	Behnaz Ghoraani	2001	F. Albert Howard
2009	Susan Perkins	2000	F. Albert Howard
2008	Susan Perkins	1999	Monique Frize
2007	Jennifer Jessop	1998	Monique Frize
2006	Jennifer Jessop	1997	June Massoud

IEEE Women in Engineering

In IEEE, however, women were active in various societies, whether they were chairing committees or editing publications. Several even held top positions in the organization; Fellow Martha Sloan, who was IEEE's President in 1993, was the first woman to hold that position.

So in 1993, IEEE's female members decided to form their own group, which started as a Committee on Women in Engineering and evolved into the formal WIE program in 1994. The idea was to facilitate global recruitment and retention of women in technical disciplines, as well as to promote their achievements and elevate their status.

Today, there are more than 15,000 members — one-third of whom are men who joined to support women in the profession. And there are more than 450 WIE Affinity Groups around the world, offering members a chance to network at a local level.

In Canada, WIE members are dedicated to empowering, inspiring and engaging women in the field of engineering, while helping them to build a network for career advancement.

Outgoing R7 WIE Chair, **Zahra Ahmadian**, founded the Vancouver Section WIE Affinity Group in 2010 and started her term as Regional WIE Chair in 2012, where she mentored Section chairs and helped to plan region-wide activities.

One of Ahmadian's many achievements was initiating the Vancouver Section WIE Affinity Group's outreach to local schools in collaboration with IEEE Canada's Teacher In-Service Program (TISP) and through the funding provided by Westcoast Women in Engineering, Science & Technology program. In these efforts, with a goal of encouraging girls to explore a career in engineering, she organized a field trip for grade 11 and 12 science students to perform an experiment in an electronics circuit lab while touring research facilities at the University of British Columbia. She also organized a series of classroom visits aimed at introducing students to career options within engineering and presenting female engineer role models.

Surveys were conducted before and after the classroom visit to measure the students' understanding of the presented content; female engineer speakers had been requested to follow pre-defined guidelines in preparing their talks. The study conducted on 120 grade 10 students at the University Hill Secondary School in Vancouver showed that 22 percent of the students who had not considered engineering as a career option before the visit, changed their minds after the talk. Furthermore, on average, students were able to name five engineering disciplines in addition to the ones they knew

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Ladan Tahvildari

Ladan Tahvildari is an associate professor in the Department of Electrical and Computer Engineering at the University of Waterloo and has chaired the Kitchener-Waterloo Section WIE Affinity Group since 2004. She has also served as Chair of the Computer Society in Kitchener-Waterloo since 2004.

Tahvildari joined IEEE when she was a PhD student in 2000. "I learned a lot — it helped me to build my network, and I learned so many things from so many people within the domain of my research," she says.

Since then, networking has continued to play a large role in Tahvildari's career. Founder in 2004 of the Software Technologies Applied Research (STAR) Laboratory at the University of Waterloo, she has built a robust team, including visiting scholars, post doctoral fellows and graduate students. In 2006 her work in self-adaptive software was recognized by Ontario's Early Researcher Award. With broader research interests including software engineering, software evolution, and self-adaptive and self-managing systems, she has been on the program and organization committees of many international conferences, including publications chair of IEEE/ACM ICSE 2009, and program chair of IEEE ICSM 2007.

Tahvildari was instrumental in starting Go ENG Girl, which celebrated its 10th anniversary in 2014. The event provides girls in grades 7 to 10

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Laleh Behjat

Meet Laleh Behjat, an associate professor with the University of Calgary's Schulich School of Engineering and Chair of the Southern Alberta WIE Affinity Group.

One of many events she has helped spearhead is Explore IT, an event that raises awareness among young women about careers in STEM.

In May, more than 600 Grade 9 girls from the Calgary area participated in the Explore IT event— supported by three of Calgary's largest post-secondary institutions — and learned how to program their own robot and assemble a simple circuit board with electronic components. In the past 10 years, attendance at the one-day event has more than quadrupled.

Behjat has been a member of IEEE for 20 years and in August accepted the role of Chair of the Southern Alberta WIE Affinity Group. In the fall, she worked with the Young Professionals and Student Branch affinity groups to host IEEE Day, which celebrates IEEE's birthday. In the year ahead, she plans to organize several events to help promote women in engineering.

"In IEEE we have about 10 percent female representation, but females make up 50 per cent of the population," says Behjat. "We have low representation and we need WIE to bring up the profile of engineering so more women enter the field."

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Laleh Behjat discovered through her research that girls start to lose interest in math and science as early as Grade 4. "That's when they start thinking it's hard. But by giving them fun challenges, they find math and science more interesting."

As part of her research, which Behjat conducted with a graduate student, she had students create a secret agent or superhero character from Plasticine, and then gave them a set of challenges they had to overcome using science and math concepts.

"With Grade 4 students, we told them to use simple machines, levers and pulleys to find a secret message at each point in the challenge," says Behjat. "They used a lever to calculate the weight to get up high enough to retrieve the secret message. It was great — the kids were measuring and calculating and using fractions to find the right fulcrum point."

But there was more to the project than teaching science concepts. Before students tackled the challenges, they were surveyed on whether boys were better in math and science than girls. "To our dismay, 85 to 90 percent said yes," says Behjat. "This is the age when they start thinking like that."

Yet, when asked to self-identify their best subject, 36 percent of girls said math or science was their best subject, while only 33 percent of boys said so. Despite this, the girls still thought the boys were better at math and science.

After completing the project, the same question was put to the students. "We actually flipped the results — only 10 percent of girls agreed that boys were better in math and science. By being able to solve problems with math and science, it can really change their perceptions."

> Ladan Tahvildari, Continued from page 65

with an opportunity to visit a local university campus in Ontario to learn from women professionals, academics and students about the world of engineering through hands-on activities and exhibits.

Since the inception of Go ENG Girl, the overall participation of female students in engineering programs across Ontario has increased from 17.3 per cent in 2005 to 20.1 per cent in 2013. And some disciplines — such as chemical and environmental engineering — are well above the overall average.

The idea behind Go ENG Girl is to dispel stereotypes and encourage young girls to consider a career in engineering by providing real-life examples of females who are either studying engineering or excelling in their field as a professional engineer.

Part of the reason for Go ENG Girl's success is due to the fact that Tahvildari was able to bring IEEE on board in its early stages to provide support and funding. Now that Go ENG Girl is successful (it has plenty of funding, so IEEE is not a funder anymore), Tahvildari has turned her attention to ONCWIC. The Ontario Celebration of Women in Computing honours the achievements of women in technology in Ontario.

"We need to highlight WIE activities," says Tahvildari. "Doing outreach for young girls is not enough. We need to keep the momentum going after women receive their first degree."

She believes WIE should address three goals in the years ahead: pre-university outreach (to instill passion for engineering in young girls); undergrad and graduate student outreach (to prepare the next generation of leaders); and community initiatives (to build a network of individuals and partner organizations dedicated to promoting WIE).

"We need to build a community, to spread the word, to create more partnerships," she says. Go ENG Girl and ONCWIC are both Ontario-based and she'd like to see those grow and expand across Canada, from the east coast to the west.

"Increasing the number of attendees at events and conferences is the first milestone to pass. We started with 100 girls at Go ENG Girl in 2005 and in October there were more than 300 participants. And this year at ONCWIC we even had male attendees," says Tahvildari. "I don't think we'll see the changes right away, but we're making it happen."

> Laleh Behjay, Continued from page 65

There's a big role for women to play in the designing of products for the marketplace. If products are designed by men without the input of women, then that means half of the population's needs are not being addressed.

One example, says Behjat, is the cellphone. "How many times have you missed a call on vibrate because you don't have a pocket to put your cellphone in?" she says. "The cellphone was designed by men, who put it in their pocket, not in their purse. Women are using these products but they're not at the table — this is just one aspect of the whole problem. We need to have more women in the workforce making these decisions."

The biggest problem, however, is that there aren't enough females entering engineering at a university level, she says. The University of Calgary has one of the highest percentages of female engineering students in the country at 28 per cent. In other universities, that number is closer to 15 to 25 percent.

"The first thing we need to do is increase the percentage of females getting their engineering degree," says Behjat. "I'm part of an IEEE committee looking into developing a strategic plan for this."

But there's also a "leaky pipeline," she added. "A lot of women who enter into the workforce don't continue in the engineering field after 10 years or so. Women are not getting into management or high-level positions. They leave because they're not given as many opportunities or aren't given those interesting projects."

Behjat hopes WIE can offer professional development to these women, and perhaps work with other associations such as Engineers Canada and its constituent associations to encourage more women to stay in the field. So far, Southern Alberta Section has provided a professional development course, a leadership workshop for women in optimization and a workshop for women in design automation.

"I hope to build a sense of community within WIE," says Behjat. "More of our membership in WIE is coming from other countries, such as India and Asia, so this can give them a place to network and get into Canadian industry. That is one of my biggest goals — to build a sense of community, especially for women who have moved to Canada from other parts of the world."

But she'd also like to build up a network of male allies. "This is not only a women's issue — this is our issue," she says. "If we want to have more diverse engineering, we need to work together. If we have male allies, we can accomplish so much more."

> Continued from page 64

about before the talk; 85 percent of the students learned the high school requirements for engineering. For her role, Ahmadian won an Anita Borg Scholarship from Google in 2011. She was also the 2012 recipient of the Women In Engineering Prize from the IEEE Canadian Foundation.

"My involvement with IEEE WIE changed my perspective," says Ahmadian. "If you face a challenge, you know you're not the only one dealing with it. It has been very inspirational to me to meet so many amazing women in the field of engineering and to learn from their experiences."

IEEE Canada Women In Engineering Prize

sponsored by the Judy Clift Fund through the IEEE Canadian Foundation

2014	1,000	Lydia Chioukh	Montreal Section
2013	1,000	Malika Meghjani	Montreal Section
2012	1,000	Zahra Ahmadian	Vancouver Section
2011	1,000	Susan Ryan	Newfoundland & Labrador Section
2010	1,000	Rosalyn Seeton	Ottawa Section
2009	1,000	April Khademi	Toronto Section
2008	1,000	Visda Vokhshoori	Toronto Section
2007	750	Verona Wong	Vancouver Section
2006	500	Lori Hogan	Newfoundland & Labrador Section
2005	500	Jennifer Jessop	Winnipeg Section

Part of her role was to inspire other women to volunteer and to provide value to members. "You have to be passionate about what you do to keep contributing your time, and to take on the challenge of persuading others to contribute to the projects," she says.

Thanks to IEEE Canada's annual budget dedicated to WIE Committee, she has been able to allocate funds to support WIE affinity groups across Canada for special projects, workshops, and outreach events. A formal process evaluates activities for their potential to build awareness about WIE and leverage IEEE resources.

Building the future, archiving the past

by Monique Frize, FIEEE, O.C.

Much has been accomplished by the leaders and members of WIE/IEEE in the past 20 years.

I was asked to join IEEE Canada's WIE committee in January 1999, and remained on the committee for two years. This provided an opportunity for me to participate in discussions and activities of this very energetic group.

Since then there have been six WIE chairs that have each made a unique contribution to WIE and the IEEE organization as a whole.

In the coming years, my efforts will focus on co-chairing a multidisciplinary task force with Dr. Ruby Heap, a history professor at the University of Ottawa. Our team includes archivists, historians, women scientists and engineers.

Step one will be to collect an inventory of existing archives for women in science and engineering, contacting major organizations to record their involvement in such activities. We will also develop a guide on what should be collected, where and how to store materials, and how to make these available to the public. The task force will develop the oral history of selected women in science and engineering, and their materials, and create a webpage that centralizes all history collected.

Through the creation of an Archives of Women Scientists and Engineers, we will build the collective and individual memories of women scientists and engineers in various parts of the world. By researching, recovering and writing their histories, we will help to pay full tribute to their accomplishments and contributions to women's achievements. This will provide critical historical insights into the current status and role of women scientists and engineers. It will also help establish important connections between gendered practices in the past and present-day challenges and policy issues; develop a sense of pride in the depth and breadth of accomplishments of women scientists and engineers around the world; and provide girls and women with inspiring role models that could lead them to pursue careers in science and engineering.

I wish to express my congratulations to all leaders of WIE/IEEE for their efforts and imagination and hope the committee will continue its enriching activities for another 20 years and more.

My congratulations to Zahra Ahmadian for the fine work she has accomplished as the head of WIE in Canada, and I welcome Janet Light Thompson into her new role of IEEE Canada WIE Chair for 2015.

IEEE Canada's WIE affinity group Chairs set goals and celebrated in Mississauga last September

As a result, WIE membership has been increasing across the Region, often related to how active local WIE Affinity Groups are. In Quebec Section, for example, initially there was only one member; now that a WIE Affinity Group has been formed, that number has jumped to more than a dozen — and perhaps more importantly, it has managed to maintain those numbers.

A challenge she faced was organizing events for groups with a small number of members. "One of the things we worked on in Vancouver — and I encourage other small affinity groups to adopt this model — is teaming up with Young Professional and Student groups, in organizing joint social and professional development events" says Ahmadian. "This approach has allowed us to increase the number of people attending and serve a larger group of IEEE members with our programs."

While membership is increasing, "we can still do a better job in reaching out to our members," says Ahmadian.

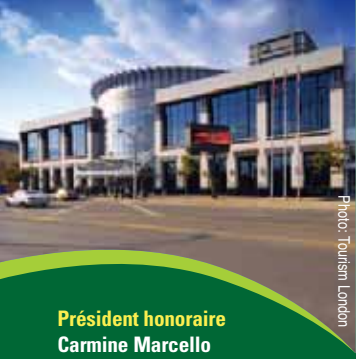
The WIE Congress held in Mississauga last September brought together WIE affinity group Chairs from across Canada for an in-person meeting to celebrate IEEE WIE's 20th anniversary. The congress program included volunteer training, panel discussion, planning and experience transfer sessions. An identified goal was to use social media to reach out to female IEEE members and further build up the WIE membership base.

Ahmadian is quick to recognize the core work of WIE — promoting the field of engineering to girls and women — takes place mostly at the local level.

"I am very grateful to our WIE Affinity group volunteers for their enthusiasm and hard work," she says.

Having completed her three-year term as WIE Chair at the end of 2014, Ahmadian leaves a strong base for incoming Chair Janet Light Thompson, Professor and Department Chair at University of New Brunswick in Saint John. And she sees an even stronger WIE in the future.

"I am confident that under Dr. Thompson's leadership the committee will continue its efforts in building up our membership and increasing member involvement." ■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Questions générales
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Systèmes intelligents résilients en puissance électrique

CEE 2015

Conférence sur l'énergie électrique

http://epec2015.ieee.ca

26-28 octobre 2015, London, Ontario, Canada

La Conférence canadienne annuelle de l'IEEE sur l'énergie et la production électrique (EPEC 2015) Lse tiendra à London, Ontario, Canada du 26 à 28 octobre, 2015. London se situe au coeur du sud-ouest de l'Ontario à mi-chemin entre Toronto et Détroit.

CEE 2015 est une excellente opportunité pour les experts en puissance électrique et systèmes énergétiques issus du secteur industriel, de la recherche gouvernementale et académique de discuter des développement récents, des nouvelles tendances industrielles et d'affaires ainsi que des défis futurs. Ceci peut inclure des discussions entourant l'impact potentiel de ces développement sur les aspects réglementaires et procéduraux.

Sujets: **La conférence EPEC 2015 invite des papiers qui seront révisés par les pairs et rattachés au thème de la conférence «Systèmes intelligents résilients en puissance électrique», incluant, mais non limité:**

1. Résilience des systèmes de puissance électrique
2. Réseaux intelligents incluant HVDC et FACTS
3. Aspects communication des réseaux intelligents
4. Microréseaux
5. Emmagasinage de l'énergie
6. Conservation de l'énergie et efficacité
7. Énergie nucléaire
8. Énergie renouvelable: production et intégration
9. Systèmes électriques urbains du futur
10. Électrification des transports et son impact
11. Planification des systèmes énergétiques intégrés et Nexus de l'énergie hydraulique
12. Gestion de l'actif et maintenance basés sur la condition
13. Support et incitatifs gouvernementaux
14. Méthodes de calcul informatique
15. Développements technologiques avancés
16. Électronique de puissance
17. Cybersécurité
18. Sujets connexes

Appel à contributions pour soumettre des articles de conférence et des propositions de session de formation:

Pour les informations les plus à jour à propos des dates importantes, veuillez vous référer au site web de la conférence.

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Dr. Maike Luiken,
Conference Chair
Director, BTAC | Lambton College
Email: maike.luiken@ieee.org

Dr. Gerry Moschopoulos,
Technical Program Committee Chair
Associate Professor, Western University
Email: gmoschop@uwo.ca

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What's New in the Literature?

by Terrance Malkinson

INNOVATION ON THE FLY is the focus of three spotlight articles in the December 2014 issue of *Harvard Business Review* [92(12). www.hbr.org]. Scott Anthony et al in "Build an Innovation Engine in 90 Days" [pp. 60-68] provide a three-month strategy to make innovation more systematic. Drawn from industry experience the authors believe that this approach will build systems that ensure that good ideas are encouraged, identified, shared, prioritized, resourced, and developed. Stefan Thomke and Jim Monzi in "The Discipline of Business Experimentation" [pp. 70-79] provide five questions important to ask when evaluating concepts for innovation development. Jeffrey Dyer in "Leading Your Team into the Unknown" [pp. 80-88] provides insights into effective leadership of innovation. The report is based on his study of companies that consistently launch novel offerings and enter new markets.

THIRTY-FIVE LEADING YOUNG INNOVATORS are profiled in *MIT Technology Review*'s 14th annual "Innovators Under 35" contest [117(5):37-62 www.technologyreview.com]. Evaluation criterion of the more than 500 nominees includes originality and the impact or potential impact of their work. Included are inventors, visionaries, humanitarians, pioneers, and entrepreneurs.

"**TURN YOUR SCIENCE INTO A BUSINESS**" is the title of an article in *Harvard Business Review* by Reddi Kotha, Phillip Kim, and Oliver Alexy [92(11):106-114 November, 2014. www.hbr.com]. The authors analyzed more than 1,000 inventions from the University of Wisconsin's Technology Transfer Office and identified seven intellectual property traps that unwary inventors fall into when developing their scientific discoveries and inventions for commercialization. They describe these traps and provide advice on how to avoid them.

ANDREA E. SMITH-HUNTER's *Women Entrepreneurs in the Global Marketplace* [Edward Elgar Publishing Limited, United Kingdom, 2013, ISBN978-1-84844-170-5] examines the status of female entrepreneurship around the world. The authors analyze the social, political, cultural, and economic factors and their contributions to entrepreneurship and innovation within their respective countries. The author analyzes in detail the experience of nine countries — Australia, Brazil, Canada, Ghana, Iceland, India, Jamaica, Sweden, and the United States. Smith-Hunter, who is a professor of management and sociology at Siena College, offers a number of recommendations for improving opportunities for women entrepreneurs globally.

THE WORLD FUTURE SOCIETY's [www.wfs.org] "Outlook 2015" provides reports that are not intended to predict the future, but rather to provoke thought and inspire action for building a better future today. Categories include: Work and the Economy; Innovation and Exploration; Environment and Resources; Health and Well-Being; and Policy, Government, and World Affairs. The reports provide links to the full article as published during 2014 by the WFS.

"**CHINA'S NEXT PHASE**" is the subject of a special report on business in China published in the Summer 2014 issue of *MIT Sloan Management Review* [55(4):27-55, www.sloanreview.mit.edu]. The report is comprised of four articles — "Accelerated Innovation: the New Challenge from China"; "What's Next for the Chinese Economy?"; "Protecting Intellectual Property in China"; and "Innovation Lessons from China.". These articles highlight China's record of economic growth, transforming itself from an impoverished and politically unstable country to the second largest economy in the world. The articles offer insights into what the future might hold for the Chinese economy and tips on how to do business there.

"**TRENDS 2015**" identifies a host of possible developments that might affect the business environment this year. Published in the December, 2014 issue of *Entrepreneur* [www.entrepreneur.com. pp. 56-74], areas examined include commerce, recreation, technology, finance, millennials, apparel, engineering, design and retail.

LOOKING INSIDE THE BRAIN is increasingly becoming a reality as described in the July/August 2014 issue of *MIT Technology Review* [117(4):20-67. www.technologyreview.com]. The series of eight articles and interviews with leading scientists explore new technologies that look inside the brain and will make it possible to change what we think, feel, and remember. As described in the articles the invention of optogenetics and other technologies provide investigators with the tools to investigate the source of emotions, memory, and consciousness for the first time. Through research, dramatic advancements in understanding brain function are emerging. We must always remember that with this comes the responsibility to use this new knowledge only for the benefit of mankind.

MCKINSEY QUARTERLY is celebrating its 50th anniversary of publication. To celebrate this milestone it is publishing a series of articles by futuristic management thinkers providing insights into the future. The first of the series, "Management Intuition for the Next 50 Years" [September 2014], focuses on how technological disruption, emerging markets, and population aging are challenging long-held assumptions underlying strategy, decision-making and management. With the goal of helping senior managers "make sense of change, anticipate what's to come, and set an agenda that enables their organizations to thrive" McKinsey and Company is a global management consulting firm and an advisor to businesses, governments, and institutions; private, public and social.

OBESITY AND DIET-RELATED CHRONIC DISEASE increases world-wide are focusing government policy on nutrition and food labeling. There is disagreement as to which labeling format is most helpful to consumers. Rachel Perez in her article "Global Nutrition Labeling: Moving Toward Standardization?" [*Nutrition Today*. 49(2):77-82 March-April, 2014. www.nutrition.org] provides a review of the global regulatory labeling framework and comments on emerging regulatory developments for packaged products and for the restaurant industry.

ENTREPRENEUR provides profiles on two generations of inspirational entrepreneurs that have re-engineered industry and our world ["A Network of Stars." Inc. October, 2014. www.inc.com] Twenty-two profiles of men and women provide insights on the thrills and challenges of running your own company. A second graphical report in the same issue provides the results of new research on "Startups: Who Succeeds and Who Fails" [pp.20-21]. Factors as discussed by Kris Frieswick and Kristin Lenz include; gender, age, race, startup capital, and intellectual property.

SCIENTIFIC AMERICAN [December, 2014 www.scientificamerican.com . pp. 40-53] provides "World Changing Ideas 2014" — editors' opinions on ten scientific advances that are considered to be drivers of progress in the years ahead.

DONNA FENN profiles 35 millennials who are transforming their original visions into business enterprises in "Generation Why Not" [*Inc.*, pp.46-56, July 2014, www.inc.com]. The web site features in-depth profiles of all of this year's winners as well as an accompanying article by the judges offering advice to young entrepreneurs. Six individuals are featured in the print issue. ■

CCTC 2015

4th Climate Change Technology Conference
4e Conférence sur les technologies du changement climatique

Hotel Omni Mont-Royal, Montreal/ Montréal

MONTRÉAL, CANADA – MAY 25 - 27 MAI, 2015 • WWW.CCTC2015.CA

Canadian and international forum to exchange ideas and present engineering solutions in the midst of a rapidly changing climate and its physical and sociological impacts

This event attracts engineering and environmental technology practitioners of all disciplines; delegates from industry, manufacturing, academia, government agencies including municipalities and regulators; consulting engineers, and special interest groups amongst economists, financial, and legal experts and other specialists working in the climate change field.

Forum national et international tenu dans l'objectif d'échanger des idées et de présenter des solutions d'ingénierie dans le contexte du changement climatique et de ses impacts physiques et sociologiques

Cet événement rassemble des spécialistes en écotechnologie et en technique du génie de toutes les disciplines. On y croise des délégués de i'industrie, des fabricants, des universitaires, des organismes gouvernementaux (municipalités et organismes de réglementation, entre autres), des ingénieurs-conseils et des groupes d'intérêt spécialisé (économistes, experts en finance et en droit, de même que d'autres spécialistes œuvrant dans le domaine du changement climatique).

Conference topic categories:

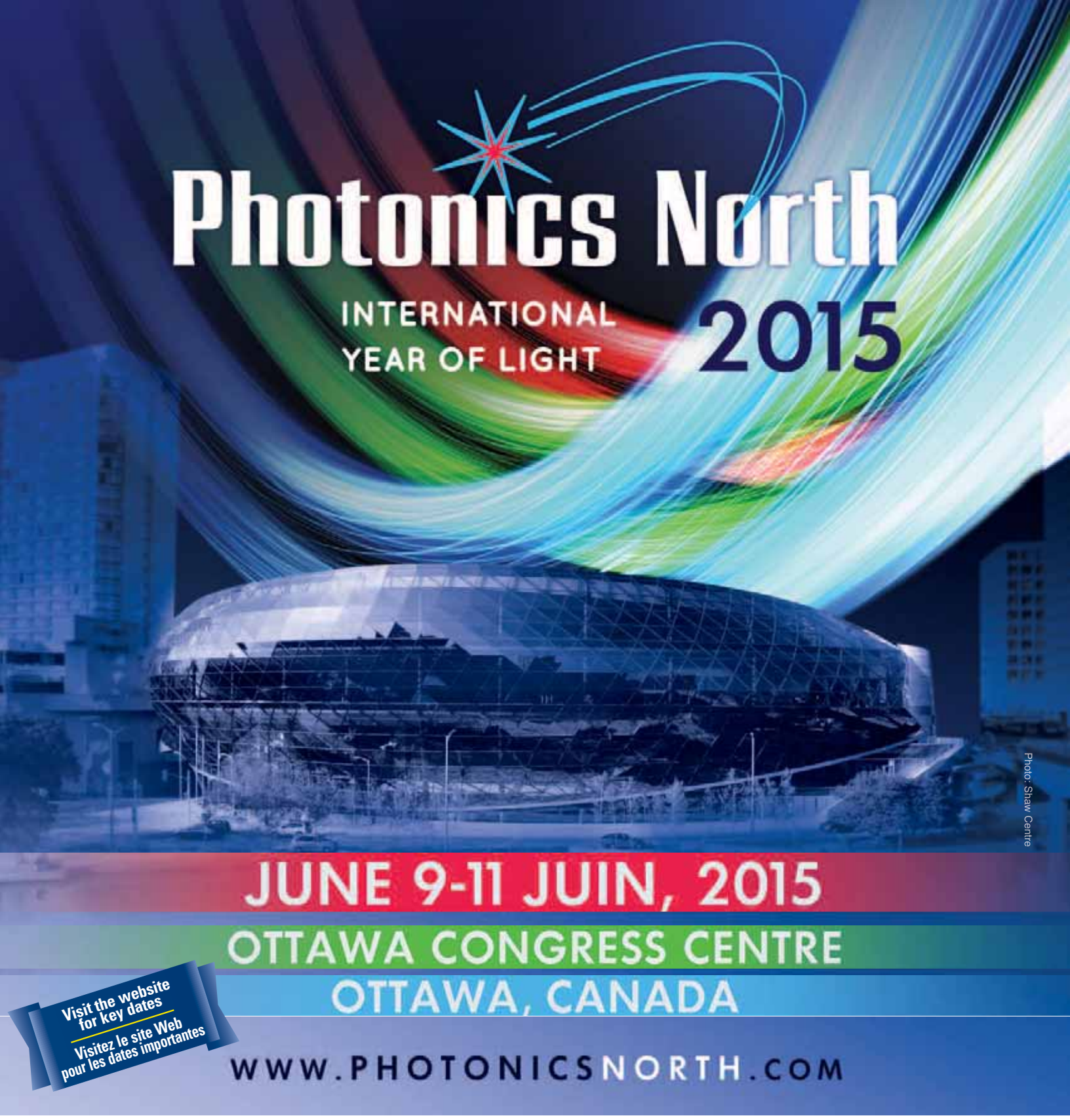
- Coastal, Ocean and Arctic Systems
- Ecological Engineering
- Energy Systems
- Infrastructure and Buildings
- Mitigation, Adaptation and Risk Management
- Modeling and Analysis
- Policies, Strategic Planning, and Education Programs
- Smart Grid and Climate Change
- Transportation Technologies and Systems
- Water Resources Engineering and Management

Les catégories de sujets proposées pour la conférence:

- Atténuation, adaptation et gestion du risqué
- Technologies et systèmes de transport
- Les systèmes d'énergétiques
- Ingénierie et gestion des ressources en eau
- Politiques, planification stratégique et programmes d'formation
- Modélisation et analyse
- Génie écologique
- Les infrastructures et les édifices
- Les systèmes côtiers, océaniques et arctiques
- Les réseaux électriques intelligents et le changement climatique

CCTC2015 is organized by The Engineering Institute of Canada and ten of its member societies
La CTCC2015 est organisée par l'Institut canadien des ingénieurs et dix de ses sociétés membres

IEEE Canada · CGS / SCG · CSSE / SCIS · CDA / ACB · CSME / SCGM · CSEM / SCGI



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