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2016
CIGRÉ Canada Conference
www.cigre.ca

Future Power Systems and Grid Resiliency

Vancouver, British Columbia
October 17-19, 2016

Hosted by

BC Hydro
Power smart

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GENERAL INFORMATION

PROGRAM OVERVIEW

Welcome Message from General Chair

Welcome to CIGRÉ Canada's 11th Annual Conference and welcome to our beautiful city of Vancouver, British Columbia! BC Hydro is excited to host this year's conference. I think you will find the line-up of workshops, presentations, panels and student papers to be both intellectually stimulating and relevant to the current issues and challenges we face in our industry. Our Technical Exhibition will augment these presentations and discussions, showcasing our industry's key manufacturing and technological advancements that our vendors and Original Equipment Manufacturers are proud to showcase for us.

This year's conference theme is Future Power Systems and Grid Resiliency, an appropriate topic given the increasing challenges we face to maintain or improve the resiliency of our power systems. Many of us are tasked with meeting increasing capacity demands on our systems while much of our existing infrastructure is in need of replacement. Changing environmental regulations, our relationship goals with our stakeholders and indigenous people, technological advancements, and increasing safety requirements coupled with extreme weather and seismic events, security threats, and changing regulatory regimes are just some of the things that work together to challenge us all to make our respective sections of the grid as resilient as possible.

It is important for us to gather regularly and compare notes, share ideas, and learn from each other's successes and challenges. It is also important to foster enthusiasm within our pool of up and coming technical talent as they will be called upon to be key future contributors to our exciting and complex line of business! Much young talent will attend this conference and/or present papers. Please do introduce yourselves to each other and network freely! Our conference has been designed to facilitate a sharing of the minds, so please take advantage of the many networking opportunities! This year, CIGRÉ Canada is offering Technical Tours of both Powertech Labs Inc. and Powerex Corp.

Powertech Labs Inc. is one of the largest testing and research laboratories in North America, situated in Surrey, British Columbia, Canada and Powerex Corp is the wholly owned energy marketing subsidiary of BC Hydro, situated in downtown Vancouver, British Columbia. While many of the utilities and vendors represented at this conference may have used the services of Powertech Labs Inc. or traded energy products with Powerex Corp., October 17th, 2016 is your chance to actually see the facilities and meet the people. For the first time, CIGRÉ Canada has also provided an opportunity for guests of conference attendees to partake in a Vancouver City Highlights tour and/or the Whistler Mountain and Adventure tour offered by Landsea tours.

Thank-you for attending the conference and I hope you enjoy your stay!

Kirsten Peck, P.Eng
General Manager, Generation & Transmission Engineering
BC Hydro

Welcome Message from Technical Committee Chair

On behalf of the Technical Committee, I am pleased to welcome you to the 2016 CIGRÉ Canada Conference on Power Systems, a prestigious event being organized for the eleventh time in Canada. Over 150 abstracts from xxx countries were submitted and reviewed, of which, nearly 100 were accepted to be included in the final conference program in either poster or oral presentation sessions. Based on feedback we received from the previous conference, this time, we decided to provide additional time for presenters and include Q+A session at the end of the presentation. We sincerely hope that this change will provide opportunity to engage in good discussions. Grid Resiliency and the Future of Power Systems are very relevant topics and this conference presents an opportunity to engage with some of the leading experts in the field. Among the 120 papers selected for the conference, 60 of the papers have been assigned to provide oral presentations and to accommodate the overflow we have scheduled a Poster Session which will include student presentations as well A Best Student Paper Award will be given during the conference banquet to the authors of a selected student contribution based on the quality of their abstract, paper, and poster.

In addition, the conference program will be supplemented by a one-day Tutorial workshop, a Plenary session, a Diamond Sponsor, and Technical Panel Session. For the authors, their papers presented at the conference will be published and archived in the online CIGRÉ library, *www.e-cigre.org*. I would like to express my sincere appreciation to all the International Technical Committee members of this Conference for their time, effort and expertise provided during the selection and evaluation process and providing the necessary International exposure for this event. Special thanks to my local technical committee for their hard work and dedication. I also thank all the presenters for the various Tutorials as well the Session chairs for accepting the invitations. The success of the conference also relies heavily on authors for their significant contributions making the technical program highly relevant to participants and I express my sincere thanks. I also wish to acknowledge the Entertainment committee for organizing the entertainment on banquet night.

We and all the orgnanizers hope you will have a great time at the Conference and make new professional connections.

Welcome to Vancouver

Sudhakar Cherukupalli
Principal Engineer, Team Lead
Transmission Engineering
BC Hydro

Committees

Organizing Committee

Kirsten Peck	General Chair
Val MacLanders	Local Arrangements
Dr. Sudhakar Cherukupalli	Chair Technical Committee
Dr. Mukesh Nagpal	Chair – Tutorials Workshop

CIGRÉ Canada

Mike Bartel, President
Suzanne Lafrenière, Coordinator

Conference Website http://www.cigre.ca

Steven Desrochers	Event Manager
Mohamed Rashwan	CIGRE Canada Past
Chairman Mike Bartel	CIGRE Canada Chairman
Suzanne Lafrenière	CIGRE Canada Coordinator

Local Technical Committee

Dr. Muhammad Arshad	(BC Hydro)
Galina S Antonova	(ABB)
Ed Burt	(BC Hydro)
Logan Connaughton	Powertech Labs Inc.,
Irfan Elahi	(Siemens)
Robert Gingras	(GE)
Dr. Jorge Hollman	(BC Hydro)
Keith Inman	(GE)
Kip Morison	(BC Hydro)
Terry Martinich	(BC Hydro)
Dr. Jose Marti	(University of BC)
Dr. Mukesh Nagpal	(BC Hydro)
Jim Papadoulis	(BC Hydro)
Jason Wong	(Schweitzer Engg)

International Technical Committee

Farid Abdelmalek	Alstom	France
Basile L Agba	Hydro-Québec (IREQ)	Canada
Galina Antonova	ABB	Canada
Mazana Armstrong	BC Hydro	Canada
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Abu Bapry	American Electric Power	USA
Ralph Barone	BC Hydro	Canada
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Dr. Sukumar Brahma	University of New Mexico	USA
Gustavo Brunello	General Electric	USA
David Curtis	Hydro One	Canada
Jean-Bernard Dastous	Hydro-Québec (IREQ)	Canada
Hermann Dommel	UBC	Canada
Masoud Farzaneh	Université du Québec à Chicoutimi (UQAC)	Canada
Antonio Ferraresso	BC Hydro	Canada
Manuel Ferre	Universidad Politécnica de Madrid	Spain
Elisa Figuero	BC Hydro	Canada
Dr. Norm Fisher	Schweitzer Engineering Laboratories, Inc.	USA
Michael Fourman	Georgia Transmission Corp.	USA
Chris Francis	BC Hydro	Canada
Zoran Gajic	ABB	Sweden
Anand Goel	Hydro One (retired)	Canada
Ramakrishna Gokaraju	Univ Saskatchewan	Canada
Mike Hannon	National Grid	UK
Anthony Ho	BC Hydro	Canada
Syed M Islam	Curtin University	Australia
Syed M Islam	Curtin University	Australia
David Jacobson	Manitoba Hydro	Canada
Juri Jatskevich	University of British Columbia	Canada
Foad Kasiri	BC Hydro	Canada
Jahangir Khan	BC Hydro	Canada
Zbigniew Kieloch	Manitoba Hydro	Canada
Behzad Kordi	University of Manitoba Canada	
Casper Labuschagne	Schweitzer Engineering Laboratories, Inc.	USA
Harry Lee	BC Hydro	Canada
Jody Levine	Hydro One	Canada
Ben Li	Ben Li & Associates	Canada
Ramamoorty M	KL University	India
Ska-hish Manuel	BC Hydro	Canada
Peter Mayer	BC Hydro	Canada
Kamyar Moghadam	Siemens	Canada
Serge Montambault	Hydro-Québec (IREQ)	Canada
Sai Moorty	Ercot	USA
Hadi Moradi	University of Tehran	Iran
Terrence Munro	BC Hydro	Canada
Thamir Murad	Siemens	Canada
Maria-Innes Navaro	ABB	Spain
Duc-Hai Nguyen	Hydro-Québec	Canada
Shah Nimesh	BC Hydro	Canada
David Olan	BC Hydro	Canada
Derek Oliver	University of Manitoba	Canada
Alberto Oscar	Tesmec S.p.A.	Italy
Alberto Oscar	Tesmec S.p.A.	Italy
Sergiu Padararu	ABB	Sweden
Steven Pai	BCHydro	Canada
Joon-Young Park	Korea Electric Power Corporation (KEPCO)	Korea
Nicolas Pouliot	Hydro-Québec (IREQ)	Canada
Ken Pratt	PSC Consulting	USA
Farnoosh Rahmatian	Nugrid Power	Canada
Dipendra Rai	BC Hydro	Canada
Debashish Datta Ray	Bhabha Atomic Research Centre (BARC)	India
Ronaldo Antonio Roncolatto	Companhia Paulista de Força e Luz (CPFL)	Brazil
Greg Roy	BC Hydro	Canada
Glen Sale	Siemens Canada Limited	Canada
Sanjeet Shanghera	BC Hydro	Canada
Bai-ke Shen	BC Hydro	Canada
Matthias Shubert	Siemens	Germany
Greg Smelich	Schweitzer Engineering Laboratories, Inc.	USA
Hany Soulomah	Siemens	Canada
Rick Spyker	AltaLink Management Ltd	Canada
Mark Stemmle	Nexans Deutschland GmbH	Germany
Kelly Stich	BC Hydro	Canada
Janos Toth	Enginomix Consulting Inc.	Canada
Tony Tsang	BC Hydro	Canada
Scott Tyler	BC Hydro	Canada
Marta Valescudero	Eirgrid	Ireland
Pierre Van Dyke	IREQ	Canada
Vidya Vankayala	Powertech Labs	Canada
Carlos Ventura	UBC	Canada
Rama Vinnakota	BC Hydro	Canada
Lei Wang	Powertech Labs	Canada
Marc Brunet- Watson	PSC Consulting	USA
Jerry Wen	BC Hydro	Canada
Daniel C. H. Wong	AltaLink Management Ltd	Canada
Jason Wong	Schweitzer Engineering Labs	Canada
Lei Yee	Sask Power	Canada
Francisc Zavoda	Hydro-Québec	Canada

Social Events

Welcome Reception

Monday, October 17, 2016 l 18:00 – 21:00

Hyatt Regency hotel Vancouver (Stanley/Cypress 34th Floor)Casual dress

Get the conference off to a great start by networking with your colleagues over cocktails and hors d'oeuvres while collecting your registration materials.

Cocktail Reception / Student Poster Session

Tuesday, October 18, 2016 l 10:00 – 19:00

Hyatt Regency hotel Vancouver (Regency Foyer/ABC) Casual dress

This event provides the ideal opportunity to network with your colleagues, exhibitors, and exchange views with students during the Student Poster Session.

Banquet

Tuesday October 18, 2016 l 19:00 – 22:00

Hyatt Regency hotel Vancouver (Regency EDF) Casual dress

The conference banquet is an evening of fine dining, entertainment, and stimulating conversation. It's a good chance to salute the work accomplished during the conference and network with participants. The Best Student Paper Award will be presented during the banquet.

Entertainment

John Gilliat

Through the strings of his guitar, John Gilliat brings to life a fresh direction and contemporary expression to new Flamenco, Rumba and Jazz in a style known as Nouveau Flamenco.The corporate world has embraced John's music, through recent performances for prestigious clients. He's also had the distinction of playing for former Prime Minister Jean Chretien and opening for Cirque Du Soleil.

Mask Dancing Presentation by - Git Hayetsk is an internationally renowned Northwest Coast First Nations

Git Hayetsk means the people of the copper shield in Sm'algyax which is spoken by the Nisga'a, Tsimshian, and Gitxsan Nations. Their dancers are bonded by their common ancestry to the Sm'algyak speaking peoples with distinctions in their family ties to the Haida, Tlingit, Haisla, and Musqueam Nations. Our home and ancestral villages are located in Southeast Alaska, Vancouver BC and along the coastline of the Terrace-Prince Rupert area including the Nass and Skeena Rivers. They will be performing during the banquet

Spousal Tours

CIGRE 2016 Conference organizers have arranged with Landsea Tours & Adventures who offer all CIGRE 2016 delegates & travelling companions special rates to their Vancouver City Highlights Tour on October 17, 2016 and our Whistler Mountains & Adventures Tour on October 18, 2016.

Technical Tour - 1

On October 17, 2016 - A technical visit and tour of Powertech Labs will be organized for 10:00 a.m. The shuttle bus to and from Hyatt Regency will bring registered visitors to the hotel at 13:00 after lunch at Powertech.

Powertech Labs Inc. is one of the largest testing and research laboratories in North America, situated in beautiful British Columbia, Canada. An 11-acre facility offers 15 different testing labs for a one- stop-shop approach to managing utility generation, transmission and distribution power systems. Powertech provides specialized testing and research services as well as product development, consulting, and investigation services to support electrical utilities, OEMs, automotive manufacturers, government and research organizations.

Technical Tour - 2

On October 17, 2016 - October 17, 2016 - A technical visit and tour of Powerex will be organized for 3:00 PM
Powerex Corp is the wholly owned energy marketing subsidiary of BC Hydro. In business since 1988, Powerex buys and sells wholesale electricity, natural gas and renewable energy products all over North America, but with a focus on Western North America. With over 200 staff, Powerex trades energy 24/7, 365 days a year. In addition to its energy marketing efforts, Powerex performs a reliability role for BC Hydro, importing energy in times of system requirements

Award Presentation

In recognition of the outstanding contributions by students for the 2016 CIGRÉ Canada Conference, a Best Student Paper Award will be presented during the conference banquet to the author(s) of a student paper, based on the quality of its abstract submitted at the first stage of the selection process, the full paper, and the Student Poster Session.

2016 CIGRÉ Canada Conference Best Student Paper Award

This award consists of a personalized certificate and a cash award in the amount of $1,000.

Sponsored by

Instructions for Presenters




Plenary, Panel and Parallel Technical Sessions

All presenters must check into the **Speaker Ready Room** (King George) at least 12 hours prior to their scheduled presentation to confirm that the latest presentation has been uploaded. A technician will be available to assist you with any compatibility or formatting issues. It is advisable to provide a USB key to upload your PowerPoint presentation file if needed. All presentations should be in PowerPoint Windows format or PDF format.

Opening Hours – Regency Foyer

Registration Sunday	17:00 – 19:00
Monday, Oct 17 2016	15:00 – 19:00
Tuesday, Oct 18 2016	07:00 – 16:00
Wednesday, Oct 19	07:00 – 13:00

Presenters are asked to arrive at their session room at least 30 minutes before the session starts. Take time to familiarize yourself with the setup. There will be technicians available on site that can assist you as needed. Please follow the instructions given by the Session Chair.

Student Poster Session

The Student Poster Session will be held on Tuesday, October 18 from 17:30 to 19:00, during the cocktail reception in Rooms Regency Foyer. Posters will be set up that day between 14:15 and 17:30. Your assigned poster board will show your paper number CIGRÉ-XXX. Push pins will be available on-site. The principal author of the paper must be present beside his or her poster throughout the session. When the session is over, authors must remove their posters. Remaining posters will be recycled. Staff will be available to help you locate your poster board and provide assistance, if needed.

Conference Schedule

Time		Room ID
17:00-19:00	Registration	Regency Foyer

Monday Oct 17 2016

Time		Room ID
07:00-19:00	Registration	Regency Foyer
15:00-19:00	Speaker Ready Room	King George
07:45 - 08:00	WORKSHOP DAY PRESENTATION AND WELCOME ADDRESS	Oxford/Prince of Wales
08:00 - 09:30	WORKSHOP #1: Electricity Markets and Regulation Presented by Sainath Moorty **Chair: Irfan Elahi**	Oxford/Prince of Wales
09:30-10:00	Coffee Break	
10:00 - 11:30	Workshop#2- Remaining Life Management of Transmission Cable Systems *Presented by Harry Orton* **Chair: Jim Papadoulis**	Oxford/Prince of Wales
11:30-13:00	Lunch (provided to registrants)	
13:00-14:30	WORKSHOP #3:Transmission Interconnection of Nonutility "Green" Generators Presented by *Dr. Mukesh Nagpal* **Chair: Terry Martinich**	Oxford/Prince of Wales
14:30-15:00	Coffee Break	
15:00-16:30	Workshop #4: Electrical Network: Seismic Reinforcement and System Recovery Presented by Dr. Jose Marti and Dr. Carlos Ventura **Chair: Dr. Jorge Hollman**	Oxford/Prince of Wales
14:00-18:00	Set up Exhibits	Regency ABC
18:00-21:00	Welcome Reception	Stanley/Cypress 34th Floor

Tuesday Oct 18 2016

Time		Room ID – Track 1
06:30-19:00	Registration	Regency ABC
06:30-08:00	Women in Engineering Breakfast	Seymore 34th Floor
06:30-08:00	Breakfast	Regency Foyer
07:00-16:00	Speaker Ready Room	King George
08:00 - 09:00	Opening Plenary Session	Regency DEF
09:30-10:30	Session -1 Reliability and Asset Management *Chair: Jim Papadoulis*	Regency EF
10:30-11:00	Coffee Break	Regency ABC
11:00-12:00	Session 2: Emerging Technologies for Power System Applications *Chair: Ed Burt*	Regency EF
12:00-13:15	LUNCH	Regency Foyer
13:15-14:15	Session 3: Digital Protection Automation and Cyber Security *Chair: Dr. Sudhakar Cherukupalli*	Regency EF
14:15-14:45	Coffee Break	Regency ABC
14:45-16:45	Session 4: Power System Modelling and Power Quality *Chair: Terry Martinich*	Regency EF
		Room ID – Track 2
09:30-10:30	Session -5 Power Systems Modelling and Power Quality *Chair: Dr. Jorge Hollman*	Regency D
10:30-11:00	Coffee Break	Regency ABC
11:00-12:00	Session 6:Interconnection of non-dispatchabel generation into grids *Chair: Irfan Elahi*	Regency D
12:00-13:15	LUNCH	Regency Foyer
13:15-14:15	Session 7: Reliability and Asset Management *Chair: Mukesh Nagpal*	Regency D
14:15-14:45	Coffee Break	Regency Foyer
14:45-16:45	Session 8: Digital Protection Automation, and Cyber Security *Chair: Dr. Muhammad Arshad*	Regency D
17:00-18:00	CIGRE Panel Session - 1 Vision of Future Power Systems Speakers: Kip Morison (BC Hydro), Kenan Ogelman (Ercot), and Narend Reddy (AMSC) *Chair: Dr. Sudhakar Cherukupalli*	Regency EF
18:00-19:00	Poster Session and Cocktail reception	Regency Foyer
19:00-22:00	Conference Banquet	Regency DEF

Wednesday Oct 19 2016

Time		Room ID
06:30-19:00	Registration	Regency Foyer
06:30-08:00	Breakfast	Regency Foyer
07:00-16:00	Speaker Ready Room	King George
08:00 - 09:00	CIGRE Panel 2 - DIAMOND SPONSOR SESSION Speakers: Marc Brunet-Watson (PSC Consulting), Steve Kunsmann (ABB), Richard Wunderlich (Siemens) *Chair: Dr. Mukesh Nagpal*	Regency EDF
09:00 - 09:30	Coffee Break	Regency ABC
09:30-10:30	Session -9 Seismic Vulnerability of Power Equipment *Chair: Dr. Muhammad Arshad*	Regency EF
10:30-11:00	Coffee Break	Regency ABC
11:00-12:00	Session 10: Power Systems Modelling, Analyses, and Power Quality *Chair: Dr. Jose Marti*	Regency EF
12:00-13:15	LUNCH	Regency Foyer
13:15-14:15	Session 11: Emerging Technologuies for Power System Applications *Chair: Ed Burt*	Regency EF
14:15-14:45	Coffee Break	Regency ABC
14:45-16:45	Session 12: Artifical Intelligence Advanced Diagnostics and Monitoring Systems *Chair: Dr. Sudhakar Cherukupalli*	Regency EF
09:30-10:30	Session -13: Digital Protection, Automation, and Cyber Security *Chair: Logan Connaughton*	Regency D
10:30-11:00	Coffee Break	Regency ABC
11:00-12:00	Session 14: Power Systems Modelling, Analyses, and Power Quality *Chair: Robert Gingras*	Regency D
12:00-13:15	LUNCH	Regency Foyer
13:15-14:15	Session 15: Interconnection of Non-disptachable Generation into grids *Chair: Jason Wong*	Regency D
14:15-14:45	Coffee Break	Regency ABC
14:45-16:45	Session 16: Artifical Intelligence Advanced Diagnostics, and Monitoring Systems *Chair: Kip Morison*	Regency D
	Closing Plenary Meeting	Regency EF

Exhibitor Trade Show Opening Hours (Regency ABC)
Tuesday 9:00 am-4:00 pm; 5:30-7:00 pm
Wednesday 9:00 am-3:45 pm

Cigré Workshops

Monday, October, 2016 | 08:00 – 17:00

Hyatt Regency Vancouver ROOM ID (Oxford/Prince of Whales)
Lunch (11:30 to 13:00) is provided for participants in Room 2G (2nd floor)

07:45 – 08:00 **WORKSHOP DAY PRESENTATION AND WELCOME ADDRESS**

Chair: Irfan Elahi

08:00 – 09:30 **WORKSHOP #1: Energy Markets: Overview and trends**

Presented by: Sainath Moorty (ERCOT, USA)

Description
The objective of this tutorial will be to provide an introduction to basic energy market principles that then leads to an overview of the energy markets, specifically, Congestion Revenue Rights (also called Financial Transmission Rights), Day-Ahead and Real-Time Markets for energy and ancillary services. Real-Time Operations at an ISO where all these market components come together and how an efficient market design is complimentary to serving the operational reliability needs of the grid will be covered.

The tutorial will conclude with a description of emerging trends/challenges (e.g. increased penetration of renewable and storage at the transmission and distribution level) and the way ISOs are addressing them along with new initiatives being considered.

Presenter of this workshop will be Mr. Sainath Moorty, Principal, Market Design & Development, Electric Reliability Council Of Texas (ERCOT)

9:30 – 10:00 **BREAK**

10:00 – 11:30 **WORKSHOP #2 – Remaining Life Management of Transmission Cable Systems**

Presenter: Harry Orton of Orton Consultants International

Title: Chair: Jim Papadoulis

Description
A methodology is presented to estimate Remaining Life of cables, based on technical, economical and strategic criteria. The methodology has two parts: the simplified approach and the detailed approach. The simplified approach separates the cables with a long life from those of which the remaining life is unknown. The detailed approach gives a more detailed answer about the category applicable on the investigated cable system:
The cable system approaches end of life
The cable system needs particular attention
The cable system does not need immediate attention.

A number of Case studies are dealt with to check the methodology with practical situations. Finally life extension programs are discussed and recommendations are given for life extension in practice.

Cigré Workshops

11:30 – 13:00 **LUNCH BREAK**

13:00 – 14:30 **WORKSHOP #3: Transmission Interconnection of Nonutility "Green" Generators**

Presenter: **Dr. Mukesh Nagpal, Principal Engineer, Team Lead, Protection Planning at BC Hydro**

Chair: Terry Martinich

Description
The high cost of generation interconnection using conventional methods of building a new transmission circuit or a switching station, impedes viability of nonutility "green" generators which are typically of much smaller size and have lower capacity factor than the traditional utility-owned generators. This tutorial will discuss creative protection solutions to substantially overcome this barrier, thereby facilitating tap-connections of small to mid-sized generation directly to the transmission system. High cost network upgrades are avoided without compromising protection reliability or grid safety. Tap-connections, though economic and commonly applied to interconnect loads, are not traditionally used for connecting generation because this creates a multi-terminal line, which degrades the line protection's ability to detect short circuits. While the academic research is on-going in this area, the presented solutions use modern off-the-shelf multifunction relays which offer a suite of relaying schemes in a single device. Depending upon system constraints, different schemes can be "mixed and matched" in conjunction with the tele-protection channels to devise the mutli-terminal line protection schemes. Examples of these schemes will be presented. Relay records from actual faults will be used to demonstrate the reliability of the schemes applied. Specific protection issues associated with interconnecting the non-conventional resources, such as windfarm or solar systems will also be discussed

14:30 – 15:00 BREAK

15:00 – 16:30 **WORKSHOP #4: Electrical Network: Seismic Reinforcement and System Recovery**

Chair: Dr. Jorgé Hollman

Part 1: System Recovery (José R. Martí)
After a large natural disaster such as an earthquake, equipment damage is widespread across multiple critical infrastructures (ICT, electrical, water, transportation, hospitals, etc.). The topic of interdependencies among critical infrastructures (CI) has received considerable attention in the last ten years and a number of approaches have been proposed to represent "domino effects". However, interdependencies among CIs are increasingly complex and include feedback loops that require a full system-of-systems solution. An effective system restoration strategy needs to take into account the interdependencies among CI, the response resources available (telecontrol capabilities, system reconfiguration capabilities, crew personnel available) and prioritize restoration in terms of which CI components are most critical for the population well-being. This tutorial will present the state-of-the-art on system-of-systems modelling with the objective of detecting system vulnerabilities to prioritize system reinforcement, and to increase system resiliency by optimizing the response and recovery strategies.

Part 2: Seismic Reinforcement (Carlos E. Ventura)
In recent years Structural Health Monitoring (SHM) of Civil Engineering Structures has attracted considerable attention. Significant advances have been made in the theory related to the "health" of structures, and the present engineering applications of SHM are very encouraging and promising. However, the large variety of approaches that have been proposed makes it difficult to compare and contrast the merits of the various methodologies. Complementary to advances in the SHM of structures are the advances in technology related to earthquake early warning (EEW). The incorporation of an EEW system as part of a monitoring project offers interesting alternatives to reduce the detrimental effects of earthquakes on industrial process and human activities. This presentation will provide a general overview of the various monitoring methodologies that are of practical applicability to Engineering Structures located in seismic regions, and will provide provoking thoughts of what the academic and research community should do to encourage owners and operators of critical infrastructure to monitor and protect their assets.

Keynote Speakers

TUESDAY, OCTOBER 18, 2016
OPENING PLENARY (08:15 – 09:00)

Historical and future perspective regarding the resiliency of BC Hydro grid

Greg Reimer
Executive Vice President
BC Hydro

Biography

Greg Reimer is Executive Vice-President of BC Hydro's Transmission & Distribution business group, and has held the EVP position since being appointed in June 2010. In his executive capacity, Greg brings a wealth of operational experience and strong leadership from over 26-years in the public sector.

In his executive role at BC Hydro, Greg is responsible for the employees that plan, design, build, operate and maintain the systems and assets needed to deliver electricity safely and reliably to BC Hydro's customers. In total, Greg is accountable for approximately 2,500 employees, $700M in annual capital investments in transmission and distribution infrastructure, and $500M in annual operating and maintenance expenditures. Greg also recently led a major strategic, multi-year transformation of BC Hydro's T&D organization that is increasing operational efficiency, improving safety performance, building a more reliable, modern electricity grid, and meeting growing customer expectations.

A Certified Public Accountant (CPA) by profession, Greg held a number of senior leadership positions in in the public sector prior to joining BC Hydro, including Deputy Minister of Provincial Revenue, Chair of the BC Oil and Gas Commission and most recently, Deputy Minister of Energy, Mines and Petroleum Resources. Greg was also a Director of the Integrated Land Management Bureau and a member of: the Deputy Ministers' Council; the Deputy Ministers' Committee on First Nations Reconciliation and Recognition; and the Deputy Ministers' Committee on Public Service.

Presentation Summary

In today's connected world, customers have high expectations of their utilities: not only from a customer service perspective, but from a technical perspective as well. As our customers' needs change, our service offering must change to prepare our electricity grid for the future. In his keynote address, Greg will offer insights into how BC Hydro is preparing for the grid of the future, from both an operational as well as a business planning perspective. Greg will speak to what he considers the four major trends in the utility industry and share how BC Hydro is working to prepare and adapt for both the challenges and opportunities that increasing customers service expectations, transformational technologies, changing business models and the future workforce present.

From engaging his employees in line rooms to leading major transformational change, Greg will share his leadership experience and insight in this plenary session.

Keynote Speakers

TUESDAY, OCTOBER 18, 2016
OPENING PLENARY (08:15 – 09:00)

Microgrids and Resilience: Benefits to Society

Dr. Mani Venkata
Affiliate Professor
Department of Electrical Engineering,
University of Washington, USA

Biography

S. S. (Mani) Venkata is an Affiliate Professor of Electrical Engineering at the University of Washington (UW), Seattle, Washington since Janaury 2008. He is also President, Venkata Consulting Solutions Inc and Director Research with GE Grid. He was with KEMA Inc. for six years during 2005-2010. He was Dean and Distinguished Professor of Wallace H. Coulter School of Engineering at Clarkson University, Potsdam, New York during 2004-2005. During 2003 he was Palmer Chair Professor of Electrical and Computer Engineering Department at Iowa State University, Ames, Iowa. From 1996 to 2002 he was Professor and Chairman of the department at ISU. Before joining ISU, he taught at the University of Washington, Seattle, West Virginia University, and the University of Massachusetts, Lowell for 25 years. He received his B.S.E.E and M.S.E.E. degrees from India, and his Ph.D. degree from the University of South Carolina, Columbia in 1971.

Dr. Venkata is a Fellow of the IEEE. He has published and/or presented over 320 publications in refereed journals and conference proceedings, and a co-author of the book Introduction to Electric Energy Systems Prentice-Hall Publications, 1987. He is a registered professional engineer in the states of Washington and West Virginia.

In 1996 he received the Outstanding Power Engineering Educator Award from the IEEE Power Engineering Society. He also received the Third Millennium Award from the IEEE in 2000.

Presentation Summary

The past decade has witnessed unprecedented growth in “microgrids” all around the world. The U. S. is the leader in this venture. Currently more than 100 active projects are occurring around the globe. The primary goal of developing microgrids is to achieve the highest level of performance in reliability, power quality, safety, security and customer satisfaction. Recently an additional focus has been to create microgrids to improve network resilience. The first part of this plenary presentation will provide an overview of this powerful concept, history, types, sizes and modes of operation. The second part of the presentation will focus on the relatively new performance measure of resilience as applied to microgrids and their profound benefits to all of us.

Cigré Panel #1 Description

Tuesday, Oct 18, 2016 17:00-18:00

Technical Panel Session - VISION OF FUTURE POWER SYSTEMS

Panel Chair: **Dr. Sudhakar Cherukupalli**

PANELISTS:
- **Kip Morison**, Chief Information Officer, BC Hydro
- **Kenan Ögelman**, Vice President of Market Operations, Settlement and Retail Operations, and Market Design and Development, (ERCOT)
- **Mike Ross** (American Superconductors)

Outline: Changes in the power systems are globally being driven by trends in technology, environmental policies, financing and business models. Declining cost of "green energy" and communication technologies are reshaping design, operation and management of the modern electric grids at a fast pace. The question remains as to how these transformations will impact overall grid reliability and benefit the end electricity consumers. It is recognized that the regulatory-utility dynamic is still a dominant component but the power system of the future will be driven by a more complex set of features. Some of these include unclear societal expectations on premium price to integrate renewables resources into the grid and on benefits of smart grid technologies such as opportunities to shorten the restoration time after distribution system outages or potential cost savings based on time of the day usage. This panel session is expected to bring together experts who will articulate these competing visions in their experience at their respective utilities.

Cigré Panel #2 Description

Wednesday Oct 18, 2016, 08:00-09:00

DIAMOND SPONSOR PANEL SESSION - WHAT IS NETWORK RESILIENCY?

Panel Chair: **Dr. Mukesh Nagpal**

Speakers:
- **Marc Brunet-Watson** (PSC Consulting),
- **Steve Kunsmann** (ABB),
- **Richard Wunderlich** (Siemens)

Outline: The cost of failure in power systems is significant and will increase as we continue to use and leverage it to function in our society. There is concern that with increased technology such as Internet of Things the Power systems become increasingly vulnerable to malicious attacks, human errors resulting from mis-configurations, and severe weather conditions as a consequence of global warming. The ability of a power system network to defend, withstand severe faults and maintain an acceptable level of service in the presence of such challenges, is becoming an important requirement as networks expand and increasingly interconnect with dispersed generation, expanded transmission and distribution networks. Network resilience cuts through classical themes of fault tolerance, network survivability and should become an integral part of future networks. This panel session will discuss the issues from a manufacturer's perspective the challenges they foresee for utilities and how they can help address the need with new products/knowledge.

Regular Program Track 1 – Tuesday, Oct 18, 2016

Time		Tuesday, Oct 18, 2016		Room
06:30	18:00	Registration		Regency Foyer
06:30	08:00	Women in Engineering Breakfast		Seymore Room 34h Floor
06:30	08:00	Breakfast		Regency Foyer
07:00	16:00	Speaker Ready Room		King George
08:00	09:00	Opening Plenary Moderator - Ms. Kirsten Peck (BC Hydro) (Keynote Speakers: Greg Reimer BC Hydro and Dr. Mani Venkata (Affiliate Professor, Dept of EE, Univ of Washington)		Regency EDF
09:00	09:30	Networking Break		Regency ABC
		Session 1 - Reliability and Asset Management Chair: Jim Papadoulis	**Presenter**	Track 1- Regency EF
09:30	09:50	724: Vulnerability of Sound Barrier Enclosure to Failure of Large Auto Transformer	Karen Callery (Hydro One Inc.)	
09:50	10:10	773: Application of Unmanned Aircraft Systems (UAS) in Transmission Line Inspection	Alex Babakov (Powertech Labs Inc.)	
10:10	10:30	745: Comparison of Different Approaches for Estimating Condition of Transmission Line Conductors	Yury Tsimberg (Kinectrics) on behalf of CEATI International	
10:30	11:00	Networking Break		Regency ABC
		Session 2 - Emerging Technologies for Power System Applications Chair: Ed Burt	**Presenter**	Track 1- Regency EF
11:00	11:20	783: A major SVC upgrade in the Canadian 735 kV transmission system	Etienne Veilleux (ABB Inc)	
11:20	11:40	766: The Application of Volt/Var Optimisation on ESKOM South Africa Distribution Feeder	Innocent Davidson (Durban University of Technology)	
11:40	12:00	814: Analyses of Transient Stability Enhancement of Power Systems using VSC Systems	Sakthivel Arunprasanth (RTDS Technologies Inc)	
12:00	13:15	Lunch		Regency Foyer
		Session 3 - Digital Protection, Automation, and Cyber Security Chair: Dr. Sudhakar Cherukupalli	**Presenter**	Track 1- Regency EF
13:15	13:35	778: Reliable and interoperable digital substation	Peter Rietmann (ABB Inc.)	
13:35	13:55	793: One box protection system for small and medium sized substation	Amin Zamani (Quanta Technology)	
13:55	14:15	790: Substation Digital Data Acquisition using Merging Units – Choice of Architecture	Farnoosh Rahmatian (NuGrid Power Corp)	
14:15	14:45	Networking Break		Regency ABC
		Session 4 - Power System Modelling, Analyses and Power Quality Chair: Terry Martinich	**Presenter**	Track 1- Regency EF
14:45	15:05	733: HVDC Grid Power Flow Controller Using Dynamic Droop Control Method	Zheng Zhao (University of British Columbia)	
15:05	15:25	771: Power system transients analysis based on rotational invariance technique	Marc-Antoine Durand (Université du Quebec à Trois Rivières)	
15:25	15:45	754: Dynamic Models for Electric Power Systems in Renewable Integration Studies	Khosro Kabiri (Powertech Labs) on behalf of CEATI International	
15:45	16:05	784: Dynamic modelling of STATCOMs and Hybrid STATCOMs for transmission applications	Etienne Veilleux (ABB Inc)	
16:05	16:25	801: Phasor Based Impedance Scan and Filter Performance Assessment versus Electromagnetic Transient Approach	Sameh Kodsi(Teshmont Consultants LP)	
16:25	16:45	815: Suppressing Wind Farm Output Power Fluctuation and Improving Power System Stability Using Battery Energy Storage System	Ashraf Ul Haque (Teshmont Consultants LP)	
17:00	18:00	CIGRÉ PANEL #1 – VISION OF FUTURE POWER SYSTEMS Chair: Dr. Sudhakar Cherukupalli Panelists: 1: Kip Morison (BC Hydro) 2. Kenan Ogelmann VP-Technology ERCOT (Energy Regulatory Commission of Texas), 3. Narend Reddy (American Superconductors) Three panelists with a 15 min Q+A Session		Regency EF
18:00	19:00	Poster Sessions & Cocktail Reception		Regency Foyer + ABC
19:00	22:00	Conference Banquet		Regency EDF
Exhibitors Trade Show open from 9:00 to 19:00 hrs (Exhibition located in Regency ABC)				

Regular Program Track 2 – Tuesday, Oct 18, 2016

Time		Tuesday, Oct 18, 2016		Room
06:30	18:00	Registration		Regency Foyer
06:30	08:00	Women in Engineering Breakfast		Seymore Room 34h Floor
06:30	08:00	Breakfast		Regency Foyer
07:00	16:00	Speaker Ready Room		King George
08:00	09:00	Opening Plenary Moderator - Ms. Kirsten Peck (BC Hydro) (Keynote Speakers: Greg Reimer BC Hydro and Dr. Mani Venkata (Affiliate Professor, Dept of EE, Univ of Washington)		Regency EDF
09:00	09:30	Networking Break		Regency ABC
		Session 5 - Power System Modelling, Analyses and Power Quality Chair: Jorge Hollman	**Presenter**	Track 2 – Regency D
09:30	09:50	805: Geomagnetically Induced Currents, their True Impact, and Methods to Protect Against	Ed Nyenhuis (ABB Inc.)	
09:50	10:10	803: Techniques for Studying the Harmonic Impacts of Wind Farm Interconnection	Bryan Lieblick (AMSC)	
10:10	10:30	765: Methods to Improve the Grid Resiliency under the Influence of GIC	Johannes Raith (Siemens AG , Austria)	
10:30	11:00	Networking Break		Regency ABC
		Session 6 - Interconnection of Non-dispatchable Generation Into Grids Chair: Irfan Elahi	**Presenter**	Track 2 – Regency D
11:00	11:20	736: An Innovative Application of PMUs for Generation Shedding	Saeed Arabi (Powertech Labs Inc.)	
11:20	11:40	804: Operational Experiences with Electricity Generation from Wind Energy Converters in Challenging Cold Climate Conditions	Patrice Godin (ENERCON Canada Inc.)	
11:40	12:00	820 Series Compensation for Distribution Networks	Etienne Veilleux (ABB)	
12:00	13:15	Lunch		Regency Foyer
		Session 7 - Reliability and Asset Management Chair: Dr. Mukesh Nagpal	**Presenter**	Track 2 – Regency D
13:15	13:35	744: Methodology and Case Study for Circuit Breaker Economic End-of-Life Assessment	Karim Abdel-Hadi (Manitoba Hydro)	
13:35	13:55	726: A Novel Built-In Insulation Condition Monitoring System Enabled by Dry Type Technologies	Robert Middleton (RHM International)	
13:55	14:15	809: Condition Monitoring - Data Driven and Knowledge Based Analyses	Tony McGrail (Doble Engineering)	
14:15	14:45	Networking Break		Regency ABC
		Session 8 - Digital Protection, Automation, and Cyber Security Chair: Dr. Muhammad Arshad	**Presenter**	Track 2 – Regency D
14:45	15:05	764: Teleprotection ensuring highest performance of the protection system using packet switched wide area networks	Ramon Bächli (ABB)	
15:05	15:25	791: Design, concept and cost of a IEC61850 Process Bus based Breaker Fail, Synchronism Check and Trip Coil Monitoring Application	Stefan Flemming (Siemens Canada)	
15:25	15:45	795: BC Hydro Synchrophasor System for Wide Area Monitoring, Protection and Control – Functional Requirements and System Architecture	Farnoosh Rahmatian (NuGrid Power Copr)	
15:45	16:05	776: Access control: from default local device access levels to centralized managed role-based access control	Peter Rietmann (ABB Inc.)	
16:05	16:25	812: Development of a Virtual Model of a Sub Harmonic Protection Relay	Nuwan Perera (Protection Design)	
16:25	16:45	774: The CMS Energy-vendor Independent SolutionImplementation for SCAD data visualisation, NERC and CIP Compliance	Amira Hamdon (SUBNET Solutions Inc)	
17:00	18:00	CIGRÉ PANEL #1 – VISION OF FUTURE POWER SYSTEMS Chair: Dr. Sudhakar Cherukupalli Panelists: 1: Kip Morison (BC Hydro) 2. Kenan Ogelmann VP-Technology ERCOT (Energy Regulatory Commission of Texas), 3. Narend Reddy (American Superconductors) Three panelists with a 15 min Q+A Session		Regency EF
18:00	19:00	Poster Sessions & Cocktail Reception		Regency Foyer + ABC
19:00	22:00	Conference Banquet		Regency DEF
Exhibitors Trade Show open from 9:00 to 19:00 hrs (Exhibition located in Regency ABC)				

Regular Program Track 1 – Wednesday, Oct 19, 2016

Time		Wednesday, Oct 19, 2016		Room
06:30	18:00	Registration		Regency Foyer
06:30	08:00	Breakfast		Regency Foyer
07:00	16:00	Speaker Ready Room		King George
08:00	09:00	CIGRÉ PANEL #2 – DIAMOND SPONSORS PLENARY What is Network Resiliency ? Panel Chair: Dr. Mukesh Nagpal 1. Marc Brunet-Watson (PSC Consulting), 2. Steve Kunsmann (ABB), 3: Richard Wunderlich (Siemens)		Regency EDF
09:00	09:30	Networking Break		Regency ABC
		Session 9 - Seismic Vulnerability Assessment of Power Equipment Chair: Dr. Muhammad Arshad	**Presenter**	Track 1 – Regency EF
09:30	09:50	808: Connecting Asset Health Indices, Asset Probability of Failure, and Risk	Tony McGrail (Doble Engineering)	
09:50	10:10	759: Seismic considerations for Electrical, Protection and Control Equipment in Generating Station	Denis Clement (BC Hydro)	
10:10	10:30	762: Seismic considerations for Electrical, Protection and Control Equipment in Generating Station	Amandeep Singh (Power Grid Corporation)	
10:30	11:00	Networking Break		Regency ABC
		Session 10 - Power System Modelling, Analyses and Power Quality Chair: Jose Marti	**Presenter**	Track 1 – Regency EF
11:00	11:20	810: Optimal Sizing of Energy Storage Capacity for a Wind Power Generator to Improve Loss of Load Probability	Bharath Kumar (KL University)	
11:20	11:40	779: Carrier Ethernet Technology in Electrical Utility Communications	Roland Cooke (Bonneville Power Adminstration)	
11:40	12:00	727: Voltage fluctuation caused be transient clouds in the distribution system with high level of PV installation	Dr. Wilsun Xu on behalf of CEATI International	
12:00	13:15	Lunch		Regency Foyer
		Session 11 - Emerging Technologies for Power System Applications Chair: Ed Burt	**Presenter**	Track 1 – Regency EF
13:15	13:35	761: HIgh Power Density 22MW Trailer Mounted Load Bank	Nicole Hampton (Synergy Engineering Ltd.)	
13:35	13:55	751: Power System Operation with Large Scale Wind Energy Integration	Amin Zamani (Quanta Technology)	
13:55	14:15	752: Underground distribution sensing and communication system	George Fofeldea (3M Corporation)	
14:15	14:45	Networking Break		Regency ABC
		Session 12 - Artificial Intelligence Advanced Diagnostics and Monitoring Systems Chair: Sudhakar Cherukupalli	**Presenter**	Track 1 – Regency EF
14:45	15:05	769: Analysis of how standards compliant bushings in Cape Spear and Mahikeng align with changing regulations	Sizwe Dhlamini (Power HV)	
15:05	15:25	746: Replacing Ageing 735 kV Insulators with Modern Equivalents – A Case Study	Ehsan Abbasi (AMEC Foster Wheeler)	
15:25	15:45	807: Transformer Reliability and Dissolved-Gas Analysis	James Dukarm (DELTA-X Research Inc.)	
15:45	16:05	819: LV Switchgear + UFES	Mauro Dandrea (ABB)	
16:05	16:25	723: New Partial Discharge Testing Method for Isolated Phase Bus and a Case Study	Luke Wang (BC Hydro)	
16:25	16:45	731: Back to back switching of underground cables and capacitor banks – concerns and mitigation measures	Iraj Rahimi Pordanjani (Alta Link)	
16:45	17:15	Closing Remarks by Kirsten Peck (Conference Chair) , Mike Bartell (President, CIGRE Canada) and Prize draws		Regency EF
Exhibitors Trade Show open from 9:00 am to 16:45 hrs (Exhibition located in Regency ABC)				

Regular Program Track 2 – Wednesday, Oct 19, 2016

Time		Wednesday, Oct 19, 2016		Room
06:30	18:00	Registration		Regency Foyer
06:30	08:00	Breakfast		Regency Foyer
07:00	16:00	Speaker Ready Room		King George
08:00	09:00	CIGRÉ PANEL #2 – DIAMOND SPONSORS PLENARY What is Network Resiliency ? Panel Chair: Dr. Mukesh Nagpal 1. Marc Brunet-Watson (PSC Consulting), 2. Steve Kunsmann (ABB), 3: Richard Wunderlich (Siemens)		Regency EDF
09:00	09:30	Networking Break		Regency ABC
		Session 13 - Digital Protection, Automation, and Cyber Security **Chair: Logan Connaughton**	**Presenter**	Track 2 – Regency D
09:30	09:50	763: Cyber Security Analyses of Islanded Microgrids Controller	Martine Chlela (McGill University)	
09:50	10:10	813: Interoperability of Protection Systems in HVDC Grids	Sahar Pirooz Azad (University of Alberta)	
10:10	10:30	792: Lessons Learned and Savings Achieved - Commissioning, Testing, Maintenance of a process bus pilot project	Stefan Flemming (Siemens Canada)	
10:30	11:00	Networking Break		Regency ABC
		Session 14 - Power System Modelling, Analyses and Power Quality **Chair: Robert Gingras**	**Presenter**	Track 2 – Regency D
11:00	11:20	789: The Way to a TransCanada Electric Transmission System	Dennis Woodford (Electranix Corporation)	
11:20	11:40	768 Performance Evaluation of Traction and Utility Network Interface: Fault Location, Protection Coordination and Management of Transient and Temporary Overvoltage	Innocent Davidson (Durban University of Technology)	
11:40	12:00	729: Impacts of High Frequency Harmonics on Power Systems	Dr. Wilsun Xu on behalf of CEATI International	
12:00	13:15	Lunch		Regency Foyer
		Session 15 - Interconnection of Non-dispatchable Generation Into Grids **Chair: Jason Wong**	**Presenter**	Track 2 – Regency D
13:15	13:35	782: Canadian Medium Voltage Network Benchmark Model for Integration of Distributed Energy Resources	Sabbir Ahmad (AMEC Foster Wheeler)	
13:35	13:55	755: Evaluation of Stand-alone PV and Battery Inverters Performance for Supplying Common Household Appliances	Amin Zamani (Quanta Technology)	
13:55	14:15	758: Investigation of Smart Inverters	Eric Valois on behalf of CEATI International	
14:15	14:45	Networking Break		Regency ABC
		Session 16 - Artificial Intelligence Advanced Diagnostics and Monitoring Systems **Chair: Kip Morison**	**Presenter**	Track 2 – Regency D
14:45	15:05	735: Damage Assessment of Existing Transmission Towers using a Modified Hybrid Fuzzy-Neural model	Karen Callery (Hydro One Inc)	
15:05	15:25	737: Transmission Line Criticality Ranking Process	Ed Shantz (Edward M Shantz Inc.,) on behalf of CEATI International	
15:25	15:45	748: Estimating Extreme Ice on Power Line by Modified Gumbel Distribution	Ming Lu (BC Hydro)	
15:45	16:05	775: Unmanned Aerial Systems Use for Transmission Line Inspection	Katherine Louman-Gardiner (BC Hydro)	
16:05	16:25	743: Methodology for Developing Transmission Line Components Failure Curves	Dr. Fan Wang and Y Tsimberg (Kinectrics) on behalf of CEATI International	
16:25	16:45	735: Condition Assessment and reliability evaluation of utility Wood Poles Using Fuzzy Logic and Monte Carlo Simulations	Karen Callery (Hydro One Inc)	
16:45	17:15	Closing Remarks by Kirsten Peck (Conference Chair) , Mike Bartell (President, CIGRE Canada) and Prize draws		Regency EF
Exhibitors Trade Show open from 9:00 am to 16:45 hrs (Exhibition located in 2E & 2F (2nd floor))				

Poster Paper, 2016

Time		Tuesday, October 18, 2016	
18:00	19:00	Regular Poster Session and Cocktail Reception	
	Paper ID	Paper Title	
	738	Assessment and Mitigation of Corrosion Risk in Transmission and Distribution Structures -	Peyman Taheri, Matergenics Engineering
	767	Multi-objective optimal placement and sizing of distributed generation units by a genetic algorithm in a chilean distribution network	Rodrigo Castro (Universidad de Concepción)
	800	Evaluation of the Operations and Control Capabilities of the BCIT Microgrid	Maninder Badial, Ali Palizban (BCIT)
	813	Interoperability of Protection Systems in HVDC Grids	Sahar Pirooz Azad (University of Alberta)
	781	Vendor-independent solution implementation for SCADA, data visualization, and NERC CIP Compliance	Ameen Hamdon (SUBNET)
19:00 to 22:00 hrs		CONFERENCE BANQUET & Best Student Paper Award	

Student Poster Session - Tuesday, October 18, 2016

		POSTER PAPERS	
	ID	Title	Student Name (University)
1	738	Assessment and Mitigation of Corrosion Risk in Transmission and Distribution Structures -	Peyman Taheri, Matergenics Engineering
2	739	A Study of Fault Location Method in Double Wye Shunt Capacitor Banks	Hessamoddin Jouybari-Moghaddam (Univ of Western Ontario)
3	740	Research on fuzzy control method for power substation inspection robot	Ying Zhang (Shandong Jianzhu University)
4	763	Cyber Security Analyses of Islanded Microgrids Controller	Martine Chlela (McGill University)
5	771	Power system transients analysis based on rotational invariance technique	Marc-Antoine Durand (Université du Quebec à Trois Rivières)
6	756	Investigation of grounding electrode impedance variation on the voltage and phase angle of 3 phase shield wire.	Alidou Koutou (Université du Québec à Trois Rivieres)
7	757	Distributed generation long-term planning in unbalanced smart distribution systems using hourly optimal operation	Hatem Sindi (University of Waterloo)
8	767	Multi-objective optimal placement and sizing of distributed generation units by a genetic algorithm in a chilean distribution network	Rodrigo Castro (Universidad de Concepción)
9	780	Offshore Wind Power Sharing and Curtailment Control Strategy for Multi-terminal VSC-HVDC Transmission Systems	Mohamed Abdelwahed (University of Waterloo)
10	785	Multi-Functional Interphase Power Controller for Power Flow Control in the Power Transmission System	Khalid Elamari (Concordia University)
11	810	Optimal Sizing of Energy Storage Capacity for a Wind Power Generator to Improve Loss of Load Probability	Bharath Kumar (KL University)

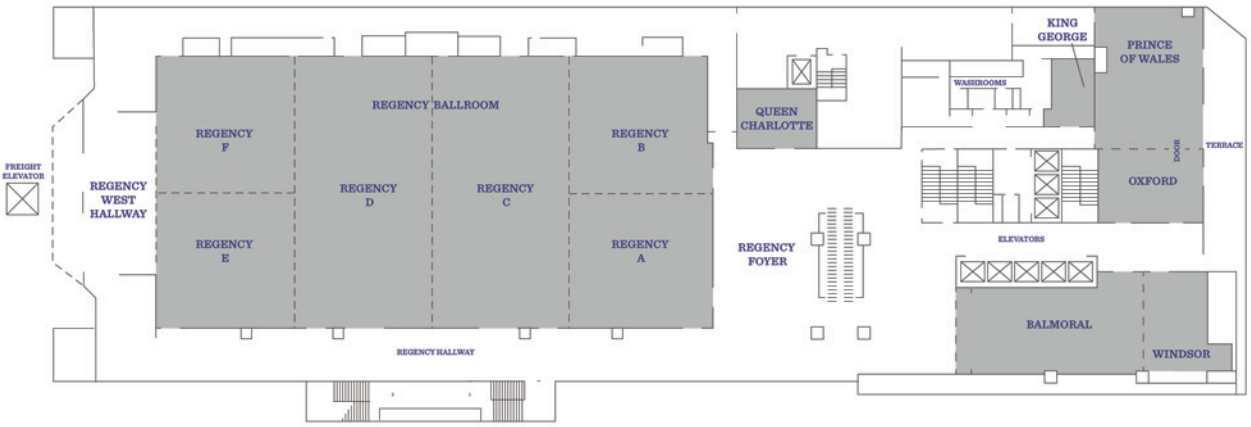
Conference Venue

CONTACT INFORMATION

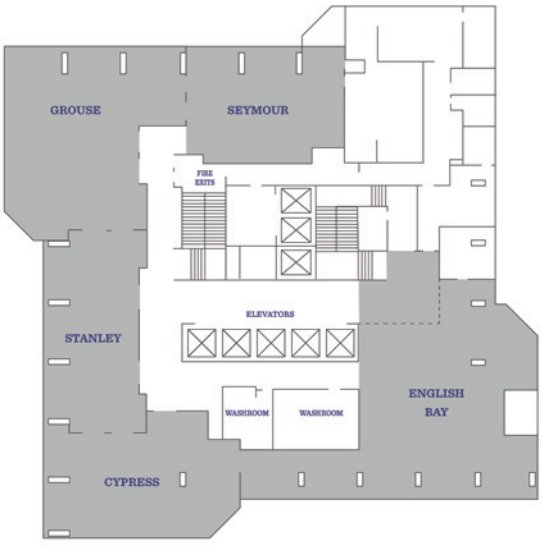
Hyatt Regency, Vancouver Center
655 Burrard St, Vancouver, BC V6C 2R7
Phone: (604) 683-1234

Floor Plan

CONVENTION LEVEL (THIRD FLOOR)



PERSPECTIVES LEVEL (34TH FLOOR)

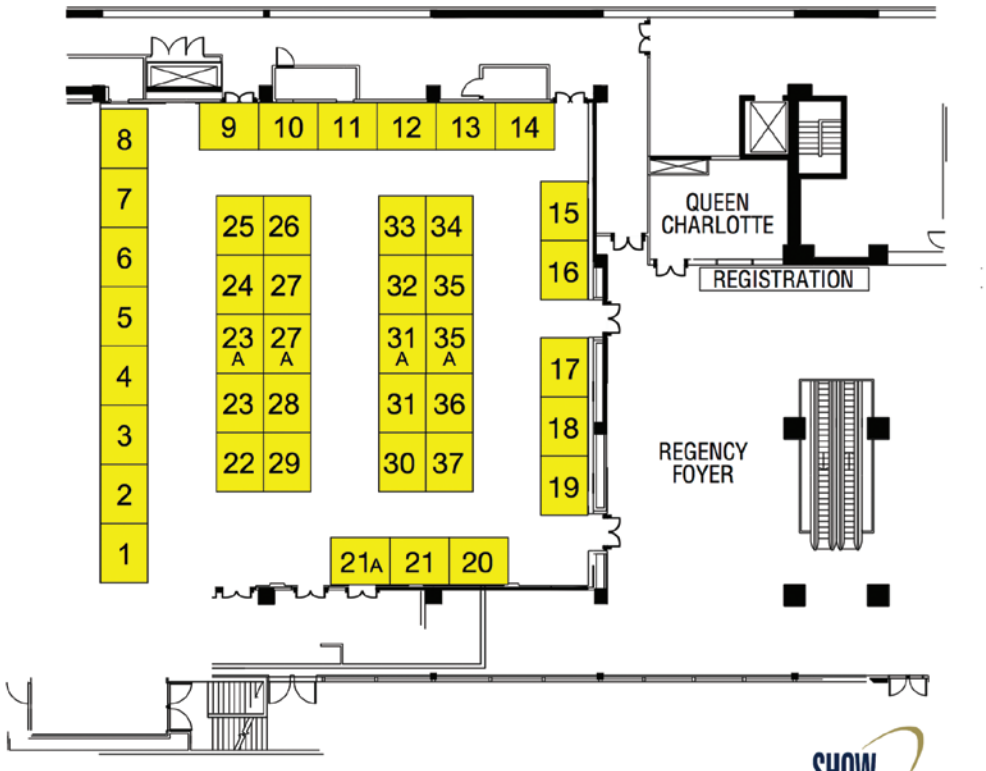


Exhibitors

CIGRÉ Canada
Hyatt Regency Vancouver | October 17-19, 2016

45 - 10' x 8' Exhibit Spaces

1: Manitoba HVDC	*15: PTI Manitoba*	*27: UBS Industries*
2: MHI - HV Test Services	*16: Oz Optics Limited*	*27A: HJT Steel Tower (North America) Co. Ltd*
3: RTDS Technologies	*17: ZTZ Services International*	*28: ABB*
4: Grid Solutions from GE Energy Connections	*18: MWG Apparel*	*29: ABB*
5: Grid Solutions from GE Energy Connections	*19: AMEC Foster Wheeler*	*30: PSC*
6: Gentec	*20: Siemens Canada*	*31: Powersys*
7: Kinectrics	*21: Siemens Canada*	*31A: Hans Steel Canada*
8: Kinectrics	*21A: AMSC*	*32: Delta Star*
9: Helix Analytix	*22: Opal-RT*	*33: Reinhausen Canada*
10: Virelec	*23: Preformed Line Products (Canada), Ltd.*	*34: BBA*
11: T&D Products Ltd.	*23A: Arteche USA*	*35: IPS-Energy USA*
12: T&D Products Ltd.	*24: OMICRON electronics*	*35A: Trench*
13: Candura Instruments	*25: LineSpect*	*36: Sediver*
14: 3M Canada	*26: SUBNET Solutions*	*37: Prometek*



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CIGRE COMPANY DESCRIPTIONS – Vancouver 2016

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Arteche Inc.
18503 Pines Blvd #313
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Arteche has 65 years of experience in the electricity sector. As an international benchmark with equipment in service in over 150 countries, it has companies in Europe, America, Asia and Oceania, as well as a service network comprised of more than 80 technical and sales offices. Arteche offers a wide range of Instrument Transformers that covers all our customers' needs including an extensive database of units that are already MC approved. The result is more than 400,000 units installed all over the world. Arteche is now selling these products directly to their customers as of 2012. Prior to that Arteche Instrument Transformers were sold in North America by Kuhlman Electric and then thru ABB.

BBA
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www.bba.ca
For over 35 years, BBA has been offering a wide range of consulting engineering and project management services, from project definition to commissioning. The firm's expertise is recognized in the fields of energy, mining and metals, and oil, gas and biofuels. BBA relies on a team of seasoned experts to transform complex problems into practical, innovative and sustainable solutions. BBA is supported by a network of offices across Canada to better serve its clients and carry out mandates at the local, national and international levels.

Burns & McDonnell
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Kansas City, MO 64114
www.burnsmcd.com
Founded in 1898, Burns & McDonnell is an employee-owned company that delivers innovative planning, permitting, design, procurement and construction solutions that provide measurable value for our clients throughout North America and the world. We safely execute complex electric and gas transmission, distribution, telecommunication and advanced technology projects and programs. Burns & McDonnell maintains a keen focus on long-term client partnerships, and we are committed to client, project and stakeholder success.

Candura Instrument
775 Pacific Road - # 26
Oakville, ON K6K 6N4
www.candura.com
CANDURA Instruments designs and manufactures high performance power quality and energy analyzer/data recorders. Our portable instruments are known in the industry for their versatility, ruggedness and ease of use. Our latest design, the iPSR™, is a rackmount 48 channel (16 analog and 32 digital) recorder that streams high resolution RMS and waveform data to two high density hotswap harddrives. Data can be accessed remotely or locally without affecting recording allowing continuous, high definition recording forever!

Delta Star
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Lynchburg, VA 24501
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Delta Star has been proudly serving the electrical manufacturing industry for over 100 years. We pride ourselves in creating power transformers and mobile substations that provide our customers with long-term service and valued investments. Performance, reliability and durability are attributes addressed in every product design and all levels of the manufacturing process. Each transformer is handmade by craftsmen who understand that quality is what makes Delta Star the choice for power companies around the world.

Grid Solutions from GE Energy Connections
PO Box 982395
El Paso, TX 79998-2395
www.gegridsolutions.com
Grid Solutions, a General Electric and Alstom joint venture, is serving customers globally with over 20,000 employees in approximately 80 countries. Grid Solutions helps enable utilities and industry to effectively manage electricity from the point of generation to the point of consumption, helping to maximize the reliability, efficiency and resiliency of the grid.

Gentec
2625 Dalton
Quebec, QC G1P 3S9
ww.gentec.ca
Since its foundation in 1959, Gentec is a leader in the design and manufacturing of solutions dedicated to the utility and industrial sector. The main product lines and services offered are innovative Special Protection Scheme and Remedial Action Scheme IED, multifunction relays, stationary battery chargers, capacitor banks, and the development of customized solutions to overcome the challenges raised by the evolving grid.

Hans Steel Canada
6 Sangster Road
Stouffville, ON L4A 7X4
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With brand new and advanced fabrication facility in Toronto, Hans Steel Canada, the North America division of Qingdao Wuxiao Group, is committed to provide fast,reliable and cost effective service and product to structural steel industry especially in Power Transmission&Distribution. Leveraged by the parent company in China with 300,000 tons annual capacity along with 25 years remarkable experience internationally, Hans Steel Canada is proud and confident to be the leading Steel Tower manufacturer in Canada and will continue to ensure each project is delivered on time with superior quality.

Helix Uniforme Ltee.
1600 46e Ave
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Helix Uniformed is an innovative Canadian manufacturer of hardware for power transmission and distribution lines, specializing in the development of motion control conductor accessories and custom-made products. Since February 2014, Helix is part of Preformed Line Products - an international designer and manufacturer of products and systems employed in the construction and maintenance of overhead and underground networks for energy, communications and broadband network companies.

HJT
www.hjtnorthamerica.com
HJT provides quality design, fabrication and delivery of steel towers and other steel structures along with after-sale services. The two offices are located in Vancouver, BC and Bellingham, WA. HJT manufacturers are located in Qingdao, China and is conveniently located near the Qingdao port for easy transportation. Our welders are CWB (Canadian Welding Bureau) certified and we follow North American standards including ASTM (American Society for Testing and Materials) and CSA (Canadian Standards Association) codes.

IPS-ENERGY USA

5 N Baldwin St., # 3, PO Box 332
Bargersville, IN 46106
www.ips-energy.com
IPS-ENERGY USA, Inc. sells and supports the IPS-ENERGY™ suite of software systems which provide for full technical asset management (asset repository, work content and data collection definition using maintenance templates, planning, scheduling, work execution/data acquisition with mobile clients and analysis) with unique to the world, robust functionality for relay setting and testing management. Data collected and stored in the IPS-ENERGY™ database as well as from other systems and sources can be extracted and used for advanced analytics. Interfaces to other systems can be easily configured using the IPS-SmartGridDI™ system. The software is licensed to run on the customer's computers or as a subscribed service in the IPS-Cloud™.

Kinectrics

800 Kipling Ave Unit 2
Toronto, ON M8Z 5G5
www.kinectrics.com
Kinectrics is an established, independent company with over 100 years of advanced technical expertise in the electricity industry. Our Transmission and Distribution group utilizes high voltage, high current and other specialized facilities and field services to perform engineering, certification and testing for manufacturers and power producers. Kinectrics offers comprehensive capabilities in Smart Grid planning and implementation, Distributed Generation and impact assessment. Kinectrics' advanced products include the LineVue™ conductor inspection tool and PowerKage™ non-electric fence.

Linespect

180-2639 Viking Way
Richmond, BC V6V 3B7
www.linespect.com
LineSpect builds self-driving drones for power line and tower inspection. Any Lineworker can safely obtain quality inspection results from multiple sensors after ground school training—no flying skills required.

Manitoba Hydro

211 Commerce Drive
Winnipeg, MB R3P 1A3
www.hvdc.ca
The Manitoba HVDC Research Centre (MHRC) is a software development and engineering company that provides products and services to the global power systems community. Our flagship product, PSCAD™/EMTDC™, is the industry standard for power system electromagnetic transient simulations. In addition, our engineering team provides consulting services for power system planning, operation and design. Our specialty includes HVDC transmission, wind and renewable technologies and insulation coordination.

MWG Apparel

1147 Notre Dame Ave
Winnipeg, MB R3E 3G1
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With more than 85 years of apparel manufacturing experience, MWG is a leading maker of professional grade PPE for the electrical production, generation and transmission industries. We work with our customers to design job specific apparel. MWG manufactures to a military spec which results in increased longevity therefore reducing costs by less frequent replacements. MWG is Canadian General Standards Board (GCGSB) certified and participates on many of the regulatory safety boards throughout Canada.

Omnicron

2001 Sheppard Ave East, Suite 104
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Customers in 147 countries rely on OMICRON's ability to provide innovative testing and diagnostic solutions for the electric power industry. Products: Test Instruments for Protective Relays, CTs, Instrument Transformers, Meters, Transducers, IEC 61850 Devices, Reclosers/Distribution Automation, PQ Analyzers; Power Factor, Moisture in Insulation, Dielectric Frequency Response, SFRA, Circuit Breakers, Advanced Transformer Diagnostics, PD.

Opal-RT Technologies

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Montreal, QC H3K 1G6
www.opal-rt.com
OPAL-RT TECHNOLOGIES is a world leading developer of open, Real-Time Digital Simulators and Hardware-in-the-Loop testing equipment for electrical, electro-mechanical and power electronics systems. OPAL-RT offers the most complete, open and high-performance power systems real-time simulation solution on the market. Not only does it cover every need for traditional power grid and power electronics simulation, it also offers an unsurpassed level of scalability to design, simulate and test complex new generation power systems.

OZ Optics' DSTS

219 Westbrook Road
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OZ Optics' DSTS (Distributed Strain and Temperature Sensor) provides high-resolution simultaneous measurements of strain and temperature along 100km of standard Singlemode fiber. DSTS detects how, where, and when strain and temperature of structures change, identifying problems before failures occur. DSTS is ideal for monitoring oil & gas pipelines, hydro power lines, bridges, tunnels, railways, dams, and security fences, detecting changes in strain/ temperature from leaks, buckling, corrosion, ground movement, lightning strikes, fire, or other influences.

Powersys

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Southfield, MI 48075
www.empt-software.com
EMTP-RV is the most technically advanced transient analysis software for simulation and analysis of electromagnetic transients in power systems. The package is a sophisticated computer program for the simulation of electromagnetic, electromechanical and control systems transients in multiphase electric power systems. EMTP-RV is used worldwide as a reference tool by the main actors of the power system industry (Hydro-Québec, EDF, RTE,). Efficiently and quickly performs simulations of very large power systems.

Preformed Line Products

1711 Bishop Street
Cambridge, ON N1T 1N5
www.preformed.on.ca
Preformed Line Products (Canada) Limited has been manufacturing in Canada since 1985. Our ISO 9001 certified manufacturing facility serves transmission & distribution power utilities, communications, tower & antenna and solar customers across Canada. Our product offering includes: Charpy rated pole line hardware, strand and open wire products, PREFORMED™ re-enterable fiber splicing closures, wildlife protection and Solar racking systems. We also provide project specific designs for pole line hardware, suspension/dead-end transmission string set assemblies and solar racking.

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1005 avenue Nordique
Quebec, QC G1C 0C7
www.prometek.net
Prometek is a steel structure manufacturer specializing in the Electric energy market (T&D). We provide high quality product like substation steel structures, transmission towers and foundations, equipment frames and any custom projects related to the electric energy market. From design to delivery we can offer you a complete package according to your high quality standards. For a worry free experience, think Prometek.

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Winnipeg, MB R3T 0L7
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PTI Manitoba Inc. and Partner Technologies Incorporated of Regina manufacture small, medium and large power transformers for the Utility and Industrial markets. We are one of the largest family owned North American Transformer manufactures and largest 100% Canadian owned. PTI manufactures transformers and offers solutions based products for Padmount, Substation and Generator Step-Up applications. Specialty products include skid mounted Portable Distribution Substations (PODS), Deadfront Padmount Transformers up to 138kV, Auto Transformers, Regulating Transformers, Grounding Transformers, Mobile Substations and HVDC Transformers.

Reinhausen Canada
3755 Place Java, Suite 180
Brossard, QC J4Y 0E4
www.reinhausen.com
Reinhausen Canada Inc. is a wholly owned subsidiary of the German group Maschinenfabrik Reinhausen GmbH (MR), world leader in Tap-changer (LTC) technology, and is the only registered and certified Premium Service Provider for MR LTC's in Canada. Since its creation in addition to traditional maintenance service Reinhausen Canada has expended its activities to offer asset management solutions for transformers including LTC retrofit for MR and non MR LTC and full Transformer services.

RTDS Technologies Inc.
100-150 Innovation Drive
Winnipeg, MB R3T 2E1
www.rtds.com
RTDS Technologies is the exclusive supplier of the RTDS® Simulator. We are the world leader in real time power system simulation with over 340 customers in 40 countries. Utilities, manufacturers, research institutes and universities worldwide rely on the RTDS Simulator for power system studies and closed loop testing of protection and control equipment. The RTDS Simulator has also been used in the development and testing of DG systems, MMC based HVDC schemes and wide area protection using PMU.

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SNC-Lavalin
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SUBNET
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www.ztzservices.com
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