



PROGRAM

2015 Conference

RBC Convention Center Winnipeg
Winnipeg, Manitoba Canada
August 31 to September 2, 2015

"What's next for the Power Grid?"

www.cigre.ca



Hosted by



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Welcome Message from General Chair



CIGRÉ's Canadian National Committee welcomes you to the tenth annual Conference on Power Systems. The 2015 session is hosted in Winnipeg by Manitoba Hydro and is sponsored by key Canadian and international players in the electric utility industry. This year's event will focus upon the theme of "What's Next for the Power Grid?"

Over the past 10 years regulation, technology change and fiscal restraint have been huge drivers that are setting a new vision for the utility business. Many of the topics that are of serious consideration at this year's conference were not even on the "radar screen" 10 years ago.

A major item for discussion at this year's conference is Asset Management. Many components of the North American power system are reaching "end of life" and there are major challenges that need to be met in order to address this issue within the reality of fiscal limitations.

Also on the agenda is a presentation of the many evolutionary changes in HVDC systems. The growth of technology in the area of Voltage Source Converters creates new possibilities for engineering solutions to Power System problems.

Other important topics such as Smart Grid, the integration of Solar and Wind Power and the application of new modeling ideas are also key cornerstones of this year's sessions.

The purpose of this conference is to bring together the many facets of the Power System industry for a discussion of ideas and trends for the future. Amongst the conference participants are the key stakeholders representing all aspects of our industry; utilities, consultants, manufacturers and academics. This presents a tremendous learning opportunity for all and I strongly encourage your active participation.

Also, in association with this conference, we have a Technical Exhibition, which includes many of the manufacturing and technical consultant experts in our line of business. This Exhibition area provides an excellent opportunity to network with others and to pick up new ideas.

Finally, I want to welcome you to Winnipeg. Winnipeg is a city with many unique and interesting highlights including the new Canadian Human Rights Museum, the Forks Market, Assiniboine Park including the zoo and the Leo Mol Sculpture Garden, the FortWhyte Environmental Center and the French Quarter of Saint-Boniface, but to name a few. Enjoy your stay in Winnipeg!

John McNichol

HVDC Division Manager
Manitoba Hydro

Welcome Message from Technical Committee Chair



On behalf of the Technical Committee, I am pleased to welcome you to the 2015 CIGRÉ Canada Conference on Power Systems, which is the 10th edition of this prestigious event. Over 150 abstracts from 25 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. I'm quite excited to find out "What's next for the Power Grid?" from these leading experts. Among the 100 papers selected for the conference, 64 of the best papers have been assigned to provide oral presentations and 21 student papers will participate in a special *Student Poster Session*. 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. This year a special *Regular Poster Session* is also being piloted to provide additional opportunities for authors to share their ideas.

In addition, the conference program will be supplemented by a one-day workshop, a plenary session and two panel sessions. 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 the many technical committee members for the international exposure given to the Call for Papers. I am grateful for their time, effort and expertise provided during the contribution evaluation process. Also, special thanks to my local technical committee for their hard work and dedication, the session chairs for their commitment to the success of the conference program, and to the authors for their significant contributions that make the technical program highly relevant to participants.

Welcome to Winnipeg!

David Jacobson

Section Head-Interconnections & Grid Supply Transmission
System Planning Department
Transmission Planning & Design Division
Manitoba Hydro

Committees

Organizing Committee

John McNichol	General Chair
Kelly Monkman	Local Arrangements Coordinator
David Jacobson	Technical Committee Chair
Zibby Kieloch	Tutorial/Workshop Chair
Steven Desrochers	Event Manager
Mohamed Rashwan	CIGRE Canada Past Chairman
Mike Bartel	CIGRE Canada Chairman
Suzanne Lafrenière	CIGRE Canada Coordinator

Local Technical Committee

Udaya Annakkage	University of Manitoba
Andrew Isaacs	Electranix
Brent Jorowski	Manitoba Hydro
Zibby Kieloch	Manitoba Hydro
Dharshana Muthumuni	Manitoba Hydro International
Krish Narendra	ERL Phase
Rebecca Ostash	TransGrid
Vajira Pathirana	Teshmont
Rick Valiquette	Teshmont
Waldemar Ziomek	CG Power

International Technical Committee

Basile L. Agba	Hydro-Québec (IREQ)	Canada
Jean-François Allan	Hydro-Québec (IREQ)	Canada
Kankar Bhattacharya	University of Waterloo	Canada
Marc Brunet-Watson	PSC Consulting	USA
David Curtis	Hydro One	Canada
Jean-Bernard Dastous	Hydro-Québec (IREQ)	Canada
Masoud Farzaneh	Université du Québec à Chicoutimi (UQAC)	Canada
Elisa Figuero	BC Hydro	Canada
Michael Fourman	Georgia Transmission Corp.	USA
Anand Goel	Hydro One (retired)	Canada
Mike Hannon	National Grid	UK
Oswaldo Horikawa	University of Sao Paulo	Brazil
David Jacobson	Manitoba Hydro	Canada
Bogdan Kasztenny	Schweitzer Engineering Laboratories, Inc.	Canada
Zbigniew Kieloch	Manitoba Hydro	Canada
Behzad Kordi	University of Manitoba	Canada
Jody Levine	Hydro One	Canada
Ben Li	Ben Li & Associates	Canada
Serge Montambault	Hydro-Québec (IREQ)	Canada
Hadi Moradi	University of Tehran	Iran
Mukesh Nagpal	BC Hydro	Canada
Duc-Hai Nguyen	Hydro-Québec	Canada
Derek Oliver	University of Manitoba	Canada

Alberto Oscar	Tesmec S.p.A.	Italy
Steven Pai	BCHydro	Canada
Joon-Young Park	Korea Electric Power Corporation (KEPCO)	Korea
Nicolas Pouliot	Hydro-Québec (IREQ)	Canada
Ken Pratt	PSC Consulting	USA
Debashish Datta Ray	Bhabha Atomic Research Centre (BARC)	India
Ronaldo Antonio Roncolatto	Companhia Paulista de Força e Luz (CPFL)	Brazil
Glen Sale	Siemens Canada Limited	Canada
Nariman Sepehri	University of Manitoba	Canada
Joao Silva Sequeira	Instituto Superior Técnico	Portugal
Tom Sgouros	Brown University	USA
Rick Spyker	AltaLink Management Ltd	Canada
Mark Stemmler	Nexans Deutschland GmbH	Germany
Janos Toth	Enginomix Consulting Inc.	Canada
Yury Tsimberg	Kinectrics	Canada
R.K. Tyagi	Power Grid Corporation of India Ltd.	India
Pierre Van Dyke	IREQ	Canada
Xiaoyu Wang	Carleton University	Canada
Daniel C. H. Wong	AltaLink Management Ltd	Canada
Francisc Zavoda	Hydro-Québec	Canada

Social Events

Welcome Reception

Monday, August 31, 2015 | 18:00 – 21:00

RBC Convention Centre Winnipeg | Concourse (2nd 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, September 1, 2015 | 17:30 – 19:00

RBC Convention Centre Winnipeg | 2E, 2F & 2G (2nd Floor) 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, September 1, 2015 | 19:00 – 22:00

RBC Convention Centre Winnipeg | Banquet Room 5 (Ground Floor) 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

Dean Gunnarson "World's Greatest Escape Artist"

Join us for a memorable show of comedy, audience participation and edge of your seat excitement with legendary escape artist Dean Gunnarson.

Dean Gunnarson has entertained and amazed audiences around the world with his exciting and truly one of a kind stage show of incredible escapes.

Dean, who was born in Winnipeg, is an international award-winning escape artist who is always setting new records. He has successfully conquered many challenges and obstacles by taking his daring escapes to incredible limits.

Most recently Dean is the star of OLN Canada's thrilling new series "Escape or Die!" The series takes viewers into Dean's crazy, unique life as he and his team prepare for nail biting escapes that threaten his life.

www.alwaysescaping.com

Award Presentation

In recognition of the outstanding contributions by students for the 2015 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 their abstract submitted, the quality of the full paper, and the Student Poster Session.

2015 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 (Cecil Richards Suite – 2nd Floor)** 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 – Cecil Richards Suite:

Monday, August 31	15:00 – 19:00
Tuesday, September 1	07:00 – 16:00
Wednesday, September 2	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, September 1, from 17:30 to 19:00, during the cocktail reception in **Rooms 2E, 2F and 2G**. 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	MONDAY, AUGUST 31, 2015	Room
07:00-19:00	Registration	Concourse (2 nd floor)
15:00-19:00	Speaker Ready Room	Cecil Richards Suite
08:00-09:30	WORKSHOP #1: C4 – Ferroresonance	Pan Am Room (2 nd Floor)
09:30-10:00	Coffee Break	
10:00-11:30	WORKSHOP #2: B2 – Overhead Conductor Motion Phenemona and Control Methods	
11:30-13:00	Lunch (provided)	2G (2 nd floor)
13:00-14:30	WORKSHOP #3: C4 – Applications of Phasor Measurement Units	Pan Am Room (2 nd Floor)
14:30-15:00	Coffee Break	
15:00-17:00	WORKSHOP #4: C4 – Subsynchronous Resonance: Analysis, Case Studies and Equipment Development	
17:00-18:00		
18:00-21:00	Welcome Reception	Concourse (2 nd floor)
Time	TUESDAY, SEPTEMBER 1, 2015	Room
06:30-19:00	Registration	Concourse (2 nd floor)
06:30-08:00	Breakfast	2G&2H
07:00-16:00	Speaker Ready Room	Cecil Richards
08:00-09:00	Opening Plenary	Theatre
09:00-09:30	Networking Break	2G&2H
09:30-10:30	HVDC & FACTS Session 1	Track 1: Theatre
09:30-10:30	Asset Management Session 1	Track 2: Pan Am
10:30-11:00	Networking Break	2G&2H
11:00-12:00	HVDC & FACTS Session 2	Track 1: Theatre
11:00-12:00	Asset Management Session 2	Track 2: Pan Am
12:00-13:15	Lunch	2G&2H
13:15-14:15	HVDC & FACTS Session 3	Track 1: Theatre
13:15-14:15	Asset Management Session 3	Track 2: Pan Am
14:15-14:45	Networking Break	2G&2H
14:45-15:45	Renewable Energy Session 1	Track 1: Theatre
14:45-15:45	Emerging Technology Session 1	Track 2: Pan Am
15:45-16:00	Networking Break	2G&2H

Conference Schedule

Time	TUESDAY, SEPTEMBER 1, 2015	Room
16:00-17:30	CIGRÉ PANEL #1 – Lessons Learned from Recent Renewable Integration Studies	Theatre
17:30-19:00	“Poster Session & Cocktail Reception”	2E, 2F & 2G
19:00-22:30	Conference Banquet	Banquet Room 5 (ground floor)

Time	Wednesday, September 2, 2015	Room
06:30-13:00	Registration	Concourse (2nd floor)
06:30-08:00	Breakfast	2G&2H
07:00-13:00	Speaker Ready Room	Cecil Richards
08:00-09:00	CIGRÉ PANEL #2 – DIAMOND SPONSORS PLENARY	Theatre
09:00-09:30	Networking Break	2G&2H
09:30-10:30	HVDC & FACTS Session 4	Track 1: Theatre
09:30-10:30	Smart Grid Session 1	Track 2: Pan Am
10:30-11:00	Networking Break	2G&2H
11:00-12:00	Power System Modelling Session 1	Track 1: Theatre
11:00-12:00	Renewable Energy Session 2	Track 2: Pan Am
12:00-13:15	Lunch	2G&2H
13:15-14:15	Power System Modelling Session 2	Track 1: Theatre
13:15-14:15	Smart Grid Session 2	Track 2: Pan Am
14:15-14:45	Networking Break	2G&2H
14:45-15:45	Power System Modelling Session 3	Track 1: Theatre
14:45-15:45	Emerging Technology Session 2	Track 2: Pan Am
15:45-16:15	Closing Session and Prize Draws	Theatre

Exhibitor Trade Show Opening Hours (2E & 2F)
Tuesday 9:00 am-4:00 pm; 5:30-7:00 pm
Wednesday 9:00 am-3:45 pm

Cigré Workshops

Monday, August 31, 2015 | 08:00 – 17:00

RBC Convention Centre Winnipeg | Pan Am Room (2nd floor)
Lunch (11:30 to 13:00) is provided for participants in Room 2G (2nd floor)

WORKSHOP #1: Ferroresonance 08:00 to 09:30

Presenter: David Jacobson | Manitoba Hydro

The highlights from CIGRE WG C4-307 will be presented. Participants in the tutorial will learn about the differences between resonance and ferroresonance, topologies that are vulnerable, electromagnetic transient modeling considerations and mitigation options.

WORKSHOP #2: Overhead Conductor Motion Phenomena and Control Methods 10:00 to 11:30

Presenter: Pierre Van Dyke | IREQ

Understanding the motion of overhead line conductors and how to control them is critical in helping a modern utility effectively manage their assets. The tutorial will cover Aeolian vibrations, subspan oscillations and galloping, their impact, with an emphasis on conductor fatigue, and how to counteract these effects.

WORKSHOP #3: Applications of Phasor Measurement Units 13:00 to 14:30

Presenter: Athula Rajapaske | University of Manitoba, Tony Weekes | Manitoba Hydro

The synchrophasor applications discussed at the CIGRE WG C4-34 meetings will be presented. This will include successful industry implementations, well tested but not yet implemented applications, current research, and future directions.

WORKSHOP #4: Subsynchronous Resonance: Analysis, Case Studies and Equipment Development 15:00 to 17:00

Presenter: Andrew Isaacs | Electranix, Chandana Karawita | TransGrid Solutions, Dharshana Muthumuni | MHI, Krish Narendra | ERL Phase

Subsynchronous interactions have become a hot topic recently as a result of wind turbines being connected near series compensated lines. This workshop will describe the analysis methods and mitigation alternatives currently being applied in this area, as well as describe recent micro-processor based equipment developments in the protection field to help detect and protect against the phenomenon.

Keynote Speaker



TUESDAY, SEPTEMBER 1, 2015

OPENING PLENARY (08:15 – 09:00)

RELIABILITY CHALLENGES

Mark Lauby

**Senior Vice President and Chief Reliability
Officer, NERC**

Biography

Mark Lauby is the Senior Vice President and Chief Reliability Officer of the North American Electric Reliability Corporation (NERC). He has a Master of Science of Electrical Engineering and more than thirty-five years of industry experience. Mr. Lauby has been recognized for his technical achievements, including the 1992 IEEE Walter Fee Young Engineer of the Year Award, elevated in 2011 to a Fellow of IEEE, and in 2014, Mr. Lauby was awarded the IEEE Power and Energy Society's Roy Billinton Power System Reliability Award.

Presentation Summary

NERC has come a long way since it was formed in 1968 after the Northeast Blackout of 1965. Since 2007, NERC became the Electricity Reliability Organization in North America. As part of its responsibilities, NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the bulk power system through system awareness; and educates, trains, and certifies industry operating personnel.

Mark will discuss NERC's role and strategy in addressing key emerging bulk power system reliability challenges:

- Ongoing activities to identify and mitigate risks
- Changing nature of reliability
- Evolution of the grid
- Security

Cigré Panel #1 Description

Tuesday, September 1, 16:00-17:30

“Lessons learned from Recent Renewable Integration Studies”

Panel Session Chair: David Jacobson (Manitoba Hydro)

Description: Practically all of North America has been studied or is in the process of being studied in order to determine the feasibility of integrating relatively high levels of variable generation. In some cases up to 40-50% of demand energy is supplied by wind and solar generation. Canada has some unique attributes such as high penetration levels of hydro generation, extreme cold temperatures, and large distances between generation and load centers. This panel session will bring together experts to discuss some of the key lessons learned and how they might be applied to Canada as part of the Pan-Canadian Wind Integration Study.

Hydro and Wind Resource Coordination

Description: Lessons learned taken from the recent Manitoba-MISO hydro-wind synergy study and from the Nova Scotia hydro-wind coordination study will be discussed.

1. Time: 2x10 minute presentations + 5 Minutes Q/A
2. Panel Members:
 1. Kevin Gawne (Manitoba Hydro)
 2. Derek Stenclik (GE Energy Consulting)

Accounting for Icing and Cold Weather Impacts on Wind:

Description: The resource adequacy of wind is impacted by the ability of the turbines to operate in cold temperatures. An example case study from Manitoba will be described. Techniques for calculating operating losses due to icing and cold weather and how to include these real-time operating losses into the control centre will also be described.

3. Time: 2x10 minute presentations + 5 Minutes Q/A
4. Panel Members:
 1. Bagen Bagen (Manitoba Hydro) - CIGRE Paper #580, Reliability Implications of Manitoba Hydro's Development Plan
 2. Jim McCaa (3TIER/Vaisala) and Dariush Faghani (DNV GL)

Transmission Expansion and HVDC for Wind Integration:

Description: Using findings from several studies (MRITS, PJM, PCWIS and Hawaii to a smaller extent) – this session will highlight techniques for getting wind from remote areas to load centers and to increase export capacity to reduce congestion. Topics include “Transmission Overlay Analysis” with higher wind/renewable penetration for determining transmission capacity needed for market integration, and insights from the MRITS study such as the impact of high penetration levels of wind and solar on reliability, market congestion, system inertia and performance of HVDC links in Minnesota.

5. Time: 2x10 minutes presentations + 5 Minutes Q/A
6. Panel Members:
 1. Jared Alholinna (Great River Energy)
 2. Bahman Daryanian (GE Energy Consulting)

Wrap up and general questions to panel – 5-10 minutes

Cigré Panel #2 Description

Wednesday, September 2, 8:00 – 9:00

CIGRÉ DIAMOND SPONSORS PLENARY

What's Next for the Power Grid? – Challenges and Solutions for the Transmission and Distribution Industry

Panel Chair

Mike Bartel

Chairman of CIGRÉ Canada
Vice President of AltaLink,
Calgary, Alberta Canada

Panel Members

Greg Farthing

Vice President Sales & Marketing
ABB
Montreal, Quebec Canada

Alex Boyd,

President & CEO
PSC North America
Kirkland, Washington USA

Ezio Del Bello,

General Manager
Sediver
St-Laurent, Quebec Canada

Outline of Plenary Panel Discussion

The 2015 CIGRE Canada conference title is “What’s Next for the Power Grid”. At the Diamond Sponsor Plenary, each speaker will reflect on the conference theme, giving their views on the current and future challenges and changes that can be expected in the transmission and distribution (T&D) industry over the next decade by utilities and electricity customers.

Specific topics for discussion could include, but are not limited to:

- What are the current broad challenges faced by T&D utilities and customers?
- What are the recent innovative solutions provided by your company to address a few of these challenges?
- What are the future broad challenges expected to be faced by T&D utilities and customers?
- What are the areas of innovative research and development being pursued by your company to address a few of these challenges?

Regular Program Track 1 – Tuesday, September 1, 2015

Time		Tuesday, September 1, 2015		Room
06:30	18:00	Registration		Concourse (2 nd Floor)
06:30	08:00	Breakfast		2G & 2H (2 nd Floor)
07:00	16:00	Speaker Ready Room		Cecil Richards Suite (2 nd Floor)
08:00	09:00	Opening Plenary (Keynote Speaker: Mark Lauby NERC)		Presentation Theatre (2 nd floor)
09:00	09:30	Networking Break		2G & 2H
		Parallel Technical Sessions - Track 1 (Presentation Theatre (2 nd floor))		
		HVDC & FACTS Session 1 - HVDC Integration Chair: Ani Gole University of Manitoba	Presenter	
09:30	09:45	565- Towards a European Network Code for HVDC Connections and Offshore Wind Integration	Sven Rüberg TenneT TSO GmbH	Track 1: Presentation Theatre
09:45	10:00	591 - Process for Investigation and Mitigation of SSTI between HVDC Systems and Turbine Generators in a Deregulated Market	Jason Hopkinson Alberta Electric System Operator	
10:00	10:15	641 - Incorporating two HVDC links into Alberta Power system operations	Steve Heidt Alberta Electric System Operator	
10:15	10:30	712 - Considerations in specifying ac filters for the Nelson River Bipole III project	Ioni Fernando Manitoba Hydro	
10:30	11:00	Networking Break		2G & 2H
		HVDC & FACTS Session 2 - Project Implementation Chair: Rick Valiquette Teshmont	Presenter	
11:00	11:15	673 - New Zealand HVDC Pole 3 Project Testing Approach and Challenges	Richard Sherry Transpower New Zealand	Track 1: Presentation Theatre
11:15	11:30	700 - Analysis of Sub-Synchronous Frequency Interactions in Manitoba Hydro System	Chandana Karawita TransGrid Solutions	
11:30	11:45	676 - A Live Black Start Capability Test of a Voltage Source HVDC Converter	Tarjei Midtsund Statnett	
11:45	12:00	589 - Bout De L'île (BDI) Static Var Compensators An Overview of Impacts on System Performance, SVC Ratings and Special Control Features	Kamal Habashi Hydro Québec	
12:00	13:15	Lunch		2G & 2H
		HVDC & FACTS Session 3 - Technology Developments Chair: Dan Kell TransGrid Solutions	Presenter	
13:15	13:30	559 - Urban Infeed Utilising Hybrid LCC plus VSC	Carl Barker Alstom Grid	Track 1: Presentation Theatre
13:30	13:45	680 - Innovative Technologies for Stable ACDC Transmission Systems	Walter Kuehn Frankfurt University	
13:45	14:00	715 - Hybrid STATCOM Systems based on Multilevel VSC Technology – A Modern Concept for Improved Reliability in Transmission Systems	Etienne Veilleux ABB	
14:00	14:15	718 - System Impacts of an Efficient DC-DC Transformer	Maryam Salimi University of Manitoba	
14:15	14:45	Networking Break		2G & 2H
		Renewable Energy Session 1 - Large Scale Projects Chair: Andrew Isaacs Electranix	Presenter	
14:45	15:00	590 - Comparison between Canadian and European Grid Connection Requirements for Wind Generation	Patrice Godin Enercon Canada	Track 1: Presentation Theatre
15:00	15:15	609 - Cross-regional power transmission capacity analysis of the combined wind power and solar power and thermal power	Dong Zhang State Energy Research Institute	
15:15	15:30	597 - Probabilistic Planning and Risk Analysis for Renewable Power Generation Systems	Xiaodong Liang Memorial University	
15:30	15:45	678 - A New Coordinated Voltage Control Scheme for Offshore AC Grid of HVDC Connected Offshore Wind Power Plants	Jayachandra N. Sakamuri Technical University of Denmark	
15:45	16:00	Networking Break		2G & 2H
16:00	17:30	CIGRÉ PANEL #1 – Lessons Learned from Recent Renewable Integration Studies Chair: David Jacobson, Manitoba Hydro Panelists: Derek Stenclik and Bahman Daryanian, GE Energy Management Jim McCaa, 3Tier/Vaisala Dariusz Faghani, DNV GL-Energy Jared Alholina, Great River Energy Kevin Gawne and Bagen Bagen (Paper # 580), Manitoba Hydro		Presentation Theatre
17:30	19:00	Poster Sessions & Cocktail Reception		2E, 2F and 2G
19:00	22:00	Conference Banquet		Banquet Room 5 (ground floor)
Exhibitors Trade Show open from 9:00 am to 4:00 pm and 5:30 to 7:00 pm (Exhibition located in 2E & 2F (2nd floor))				

Regular Program Track 2 – Tuesday, September 1, 2015

Time		Tuesday, September 1, 2015		Room
06:30	18:00	Registration		Concourse (2 nd Floor)
06:30	08:00	Breakfast		2G & 2H (2 nd Floor)
07:00	16:00	Speaker Ready Room		Cecil Richards Suite (2 nd Floor)
08:00	09:00	Opening Plenary (Keynote Speaker: Mark Lauby NERC)		Presentation Theatre (2 nd floor)
09:00	09:30	Networking Break		2G & 2H
		Parallel Technical Sessions - Track 2 (Pan Am Room (2 nd floor))		
		Asset Management Session 1 - New Methods Chair: Brent Jorowski Manitoba Hydro	Presenter	
09:30	09:45	627 - Probabilistic Based Reliability Analysis for Transmission Systems - an Asset Management Decision	Sameh Kodsí Teshmont Consultants	Track 2: Pan Am Room
09:45	10:00	564 - Total System Reliability program for Underground	Wen Shu UtilX Corp	
10:00	10:15	639 - Long-Term Monitoring of Local Stress Changes in 67 km Installed OPGW Cable Using BOTDA	Lufan Zou Oz Optics Ltd.	
10:15	10:30	659 - On-line Monitoring of Substation Waveform Data for Improved Asset Management and Circuit Operations	Jeff Wischkaemper Texas A&M	
10:30	11:00	Networking Break		2G & 2H
		Asset Management Session 2 - Transmission Lines Chair: Zibby Kieloch Manitoba Hydro	Presenter	
11:00	11:15	574 - Assessment of toughened glass insulators removed from HVDC lines after more than 40 years of service.	Daryl Klassen Manitoba Hydro	Track 2: Pan Am Room
11:15	11:30	586 - Using condition data to make intelligent asset management decisions – electricity towers, a case study	William Higinbotham EA Technology	
11:30	11:45	592 - Real-time monitoring of crossing conductor clearance using line mounted LiDAR	Jack McCall Lindsey Manufacturing	
11:45	12:00	677 - Spacer-damper selection for twin ACSR Nelson conductors	Pierre Van Dyke Hydro-Québec Research Institute - IREQ	
12:00	13:15	Lunch		2G & 2H
		Asset Management Session 3 - Transformers Chair: Waldemar Ziomek CG Power	Presenter	
13:15	13:30	575 - Methodology and Case Study for Deciding on Optimum Station Transformer Replacement Timing	Yury Tsimberg Kinectrics	Track 2: Pan Am Room
13:30	13:45	635 - Early detection and monitoring of mechanical defects using Vibration Analysis in Power Transformers	Arturo Nunez MISTRAS Group	
13:45	14:00	692 - Cluster assessment for online DGA monitoring	James Dukam Delta-X Research	
14:00	14:15	708 - Asset Management Strategy at Manitoba Hydro: Case Example of the Refurbishment of Transformers at	Moritz Werner Reinhausen	
14:15	14:45	Networking Break		2G & 2H
		Emerging Technology Session 1 - IEC 61850 Experience Chair: Krish Narendra ERL Phase Power Technologies	Presenter	
14:45	15:00	689 - IEC 61850 Application to Automatic Fault Detection	Harmeet Cheema Siemens Energy Automation	Track 2: Pan Am Room
15:00	15:15	687 - Resolving the Challenges of Multiple Vendor 61850	Mark Roberts SUBNET Solutions	
15:15	15:30	706 - Real-Time Testing of Distributed Generator Protection Implemented with IEC 61850 GOOSE	Diego Mascarella McGill University	
15:30	15:45	660 - Performance Evaluation of IEC 61850 Process Bus (9-2) Based Distributed Bus Differential Protection Scheme	Nuwan Perera ERL Phase	
15:45	16:00	Networking Break		2G & 2H
16:00	17:30	CIGRÉ PANEL #1 – Lessons Learned from Recent Renewable Integration Studies Chair: David Jacobson, Manitoba Hydro Panelists: Derek Stenclik and Bahman Daryanian, GE Energy Management Jim McCaa, 3Tier/Vaisala Dariush Faghani, DNV GL-Energy Jared Alholina, Great River Energy Kevin Gawne and Bagen Bagen (Paper # 580), Manitoba Hydro		Presentation Theatre
17:30	19:00	Poster Sessions & Cocktail Reception		2E, 2F and 2G
19:00	22:00	Conference Banquet		Banquet Room 5 (ground floor)
Exhibitors Trade Show open from 9:00 am to 4:00 pm and 5:30 to 7:00 pm (Exhibition located in 2E & 2F (2nd floor))				

Regular Program Track 1 – Wednesday, September 2, 2015

Time		Wednesday, September 2, 2015	Room
06:30	13:00	Registration	Concourse (2 nd Floor)
06:30	08:00	Breakfast	2G & 2H (2 nd Floor)
07:00	15:00	Speaker Ready Room	Cecil Richards Suite (2 nd Floor)
08:00	09:00	CIGRÉ PANEL #2 – DIAMOND SPONSORS PLENARY (Greg Farthing ABB, Ezio Del Bello SEVES Canada, Alex Poyd Power Systems Consultants, Inc.) WHAT'S NEXT FOR THE POWER GRID? - CHALLENGES AND SOLUTIONS FOR THE TRANSMISSION AND DISTRIBUTION INDUSTRY Panel Chair: Mike Bartel AltaLink	Presentation Theatre (2 nd floor)
09:00	09:30	Networking Break	2G & 2H
Parallel Technical Sessions - Track 1 (Presentation Theatre (2 nd floor))			
		HVDC & FACTS Session 4 - Application of Real-Time Tools Chair: Ali Dehkordi RTDS	Presenter
09:30	09:45	588 - Validation of Modular Multilevel Converter Real Time Simulator in DC Pole-Pole Fault Scenario	Wei Li Opal-RT Tech
09:45	10:00	599 - Development of MMC STATCOM using RTDS	Jungsoo Park Hyosung Corporation
10:00	10:15	701 - Real-Time Simulator using digital link communication for HVDC control system	Francois Guay Hydro-Québec Research Institute - IREQ
10:15	10:30	667 - Optimization and Sensitivity Assessment of A Tri-terminal VSC-Based HVDC Power Transmission System Using Parallelism and Reduced Memory Consumption Techniques	Ali Yazdanpanah Goharrizi University of Manitoba
10:30	11:00	Networking Break	2G & 2H
		Power System Modelling Session 1 - Insulation Coordination, Controlled Switching, Switching Transients Chair: Vajira Pathirana Teshmont	Presenter
11:00	11:15	620 - A Generalized Mathematical Approach to Transient Recovery Voltage Calculations	David Peelo DF Peelo & Associates
11:15	11:30	622 - A Utility Perspective on Ferroresonance Overvoltages	Yunfei (Carl) Wang Altalink Management Ltd.
11:30	11:45	643 - Validation of Cable Modelling for HVDC Transient Analysis Simulation	Rose King Alstom Grid
11:45	12:00	585 - Shunt and Neutral Reactor Sizing Studies for AB-BC 500 kV Intertie	Yunfei (Carl) Wang Altalink Management Ltd.
12:00	13:15	Lunch	2G & 2H
		Power System Modelling Session 2 - Inrush Current and Geomagnetic Disturbances Chair: Dharshana Muthumuni Manitoba Hydro Intl.	Presenter
13:15	13:30	617 - Challenges in circuit coupled FEM Analysis of GIC in Transformers	Pradeep Ramaswamy & Dharam Vir SPX Transformer Solutions
13:30	13:45	649 - RTDS Testing of a Controlled Switching Device Used for Transformer Switching	Waruna Chandrasena Manitoba Hydro
13:45	14:00	707 - False Trips on Transformer Inrush – Avoiding the Unavoidable	Stefan Flemming Siemens Canada
14:00	14:15	630 - Energization Study of Parallel Transformers Adjacent to SVC and 500 kV Transmission Line	James Schwartz AltaLink Management Ltd.
14:15	14:45	Networking Break	2G & 2H
		Power System Modelling Session 3 - On-Line Security Chair: Udaya Annakkage University of Manitoba	Presenter
14:45	15:00	613 - Prospects of a new dynamic simulation software for real-time applications on the Hydro-Québec system	Simon Lebeau Hydro-Québec
15:00	15:15	636 - Implementation of Real Time Transfer Limit Calculation: Manitoba Hydro Experience	Gayan Wijeweera Manitoba Hydro
15:15	15:30	653 - Selection of Contingencies for Operation of the Bulk Electric System	Pedro Rebellon IESO
15:30	15:45	704 - Best Practices in Building Remedial Action Scheme Models for Steady State Analysis in Operational Studies	Christopher Kulink Bonneville Power Administration
15:45	16:15	Closing Session & Prize Draws	Presentation Theatre
Exhibitors Trade Show open from 9:00 am to 3:45 pm (Exhibition located in 2E & 2F (2nd floor))			

Regular Program Track 2 – Wednesday, September 2, 2015

Time		Wednesday, September 2, 2015		Room
06:30	13:00	Registration		Concourse (2 nd Floor)
06:30	08:00	Breakfast		2G & 2H (2 nd Floor)
07:00	15:00	Speaker Ready Room		Cecil Richards Suite (2 nd Floor)
08:00	09:00	CIGRÉ PANEL #2 – DIAMOND SPONSORS PLENARY (Greg Farthing ABB, Ezio Del Bello SEVES Canada, Alex Poyd Power Systems Consultants, Inc.) WHAT'S NEXT FOR THE POWER GRID? - CHALLENGES AND SOLUTIONS FOR THE TRANSMISSION AND DISTRIBUTION INDUSTRY Panel Chair: Mike Bartel AltaLink		Presentation Theatre (2 nd floor)
09:00	09:30	Networking Break		2G & 2H
		Parallel Technical Sessions - Track 2 (Pan Am Room (2 nd floor))		
		Smart Grid Session 1 - Distribution System Applications Chair: Kristin Braid Manitoba Hydro	Presenter	
09:30	09:45	646 - Use of Smart Line Sensors in Distribution Planning and Operations	Corey Senkow Manitoba Hydro	Track 2: Pan Am Room
09:45	10:00	654 - Smart Switching - the changing nature of automation for the Smart Grid	Gary Ockwell Advanced Control Systems	
10:00	10:15	606 - Intelligent Electric Vehicle Charging System	Julius Roy Tech Mahindra	
10:15	10:30	669 - Smart EV Charging to Capture Curtailed Renewable Energy	Bahman Daryanian GE Energy Management	
10:30	11:00	Networking Break		2G & 2H
		Renewable Energy Session 2 - Distributed Generation Chair: Carl Ho University of Manitoba	Presenter	
11:00	11:15	638 - Application of Intelligent Islanding Relays to Hybrid Distributed Generation Resources	Qiushi Cui McGill University	Track 2: Pan Am Room
11:15	11:30	703 - An Australian Distribution Case Study on Power Quality Effects of Varying Residential Distributed Energy Resource Penetration	Timothy Browne PSC Australia	
11:30	11:45	615 - The Impact of Distributed Generation on Voltage Regulating Equipment	Mehdi Vafaei Kinectrics	
11:45	12:00	631 - Optimization of a Photovoltaic system Using Batteries for Peak Demand to Improve Rural Electrification	Umarin Sangpanich Kasetsart University	
12:00	13:15	Lunch		2G & 2H
		Smart Grid Session 2 - Transmission System Applications - PMU and dynamic line rating Chair: Brian Archer Manitoba Hydro	Presenter	
13:15	13:30	583 - Experiences of Using Wide Area Measurements for Monitoring the Electromechanical Modes in Northern Parts of Finland and Norway	Janne Seppänen Fingrid Oyj	Track 2: Pan Am Room
13:30	13:45	579 - PMU Placement for Inter-area Oscillation Monitoring	Saeed Arabi Powertech Labs	
13:45	14:00	681 - Synchrophasor Data Usage in Real Time Analysis of Grid Events in Indian Power System	P K Agarwal Power System Operation Corporation	
14:00	14:15	582 - Weather conditions based wide area Dynamic Line Rating system for 110 kV network monitoring and contingency analysis	Adam Babs Institute of Power Engineering, Research Inst.	
14:15	14:45	Networking Break		2G & 2H
		Emerging Technology Session 2 - Developments in Protection and Equipment Chair: Athula Rajapaske University of Manitoba	Presenter	
14:45	15:00	647 - Special Relay Testing Performed by Manitoba Hydro During Relay Evaluation/Commissioning	Rajita Perera Manitoba Hydro	Track 2: Pan Am Room
15:00	15:15	600 - Advances in Unidirectional Substation Cyber Security	Michael Firstenberg Waterfall Security Solutions	
15:15	15:30	696 - Fault Location in Heterogeneous HVDC Grids	Kasun Nanayakkara Teshmont Consultants	
15:30	15:45	623 - Application of the Saturated Core Based Fault Current Limiter to Improve HVDC System Performance	Chenghong Zhou Manitoba Hydro	
15:45	16:15	Closing Session & Prize Draws		Presentation Theatre
Exhibitors Trade Show open from 9:00 am to 3:45 pm (Exhibition located in 2E & 2F (2nd floor))				

Poster Session Program – Tuesday, September 1, 2015

Time	Tuesday, September 1, 2015	Room
17:30 19:00	Regular Poster Session & Cocktail Reception	
	HVdc & FACTS	
	Paper Title:	
	612 - Optimizing the availability of HVDC systems via effective Asset Management	Neil Kirby Alstom Grid
	566 - Esses STATCOM Life Assessment and Extension	Joshua Burroughs Vermont Electric Company
	680 - Innovative Technologies for Stable ACDC Transmission Systems	Walter Kuehn Frankfurt University
	701 - Real-Time Simulator using digital link communication for HVDC control system	Francois Guay Hydro-Québec Research Institute - IREQ
	683 - A Hybrid Active Filter for Operation with Harmonically Unbalanced Voltages and Currents	Leopold Herman University Ljubljana
	Asset Management	
	Paper Title:	
	584 - Operations and Maintenance Integrated Platform for Secondary Systems	Zhixue Zhang NR Electric
	651 - CXI-PT5500: The definitive solution for overhead lines wooden pole condition assessment	Umberto Bovo Cinetix
	720 - "Power to the People" Utilities Confront the Challenge of Line Upgrades by Installing Shunt Technology Via Helicopters	Carl Tamm Classic Connectors
	616 - New Methods of Monitoring Liquid Immersed Transformers and Reactors with Pressure Measurements	Joe Watson ZTZ Services
	Power System Modeling	
	Paper Title:	
	697 - GIC Analysis using PSS®E	Krishnat Patil Siemens PTI
	719 - Performance of single-phase core-type power transformers under influence of geomagnetically induced current – analysis and factory testing	Waldemar Ziomek CG Power Systems
	608 - Digital simulation training to system controllers in the AESO	Changling Luo AESO
	633 - A New Approach for Loadability Limit Estimation	Iurie Axente ABB
	Renewable Energy	
	Paper Title:	
	Smart Grid	
	Paper Title:	
	691 - Lessons Learned integrating DLR into EMS Systems	Andrew Stagg Independent Consultant
	Emerging Technology	
	Paper Title:	
	666 - Design of Booster Sheds by Laboratory Experiments for Icing Protection of EHV Post Insulators	Sayed Mahdi Ale-Emran Université du Québec à Chicoutimi
	628 - Fault Current Limiter for increasing power generation capacity in meshed networks	Yoram Valent GridON
19:00 22:30	CONFERENCE BANQUET	Banquet Room 5 (Ground Floor)

Poster Session Program – Tuesday, September 1, 2015

Time		Tuesday, September 1, 2015		Room
17:30	19:00	Student Poster Session & Cocktail Reception		
		Paper Title:	Presenter	
		572 - Risk Evaluation of Live Line Working on High Voltage Distribution Lines	Pietro Martini Manchester University	
		573 - Induction Coordination between Power Distribution Lines and Railways	Xiaoyu (Kevin) Wang Carleton University	
		576 - Development of a Hybrid Procedure Controller based on a Lead-Lag and State Feedback Power System Stabilizer using a Different Linearization Approach	Mohamed Masrob Memorial University	
		595 - Marine Tidal power in Kenya	Lucy Patricia Onundo University of Nairobi	
		596 - Structural reliability and risk assessment for the industrial electric power supply systems	Alina Luldasheva Nosov Magnitogorsk State Technical University	
		601 - Thermal Modeling And Simulation of Rectifier Transformers Under Different OFAF Conditions	Luiz Lopes Concordia University	
		605 - Smart Data management and analytics for intelligent grid	Julius Roy Tech Mahindra	
		611 - Maximum Power Extraction from Series Connected Solar Photovoltaic Modules under Partial Shading	Shruthi K J Central Power Research Institute	
		629 - Real-Time Co-Simulated Platform for Energy Conservation of Smart Distribution Network using AMI-based VVO Engine	Moein Manbachi Simon Fraser University	
		634 - Modeling and Coordination of Distribution Network Fuses Using PSCAD	Keaton Wheeler University of Saskatchewan	
		637 - Determining Optimal Smart Inverter Settings for Distributed Photovoltaic Systems	Matthew Rylander Electric Power Research Institute	2E, 2F & 2G (2 nd Floor)
		650 - A Laboratory Setup for Teaching IEC 61850 based Substation Automation	Boosabaduge Achintha Wickremasuriya University of Manitoba	
		661 - Estimation of the Insulator Pollution Level based on Frequency Characteristics of the Leakage Current	Saeed Shahabi University of Manitoba	
		662 - Partial discharge pattern recognition for thermally-degraded cellulose-oil insulation	Hamed Janani University of Manitoba	
		670 - Hybrid HVDC Transmission with LCC and Multi-Terminal Full-Bridge Modular Multilevel Converters	Udeesha Annakkage University of Toronto	
		672 - Small-Signal Stability Modelling and, Analysis of an MMC-VSC System	Arunprasanth Sakthivel University of Manitoba	
		686 - PMU Based Apparent Impedance for Transient Stability Boundary	Shengen Chen University of Maine	
		688 - Calibration of a Passive Wireless Electric Field Sensor for the Measurement of Medium/High Voltage	Mana Yazdani University of Manitoba	
		693 - A technique to ensure that the operation of system remains within the designated confines	Mateus Barreto State University of Campinas	
		695 - Load aggregation for demand response using polytopic models and the Minkowski sum	Suhail Barot University of Toronto	
		705 - A New DC Side Fault Tolerant Two-Level Converter	Arunprasanth Sakthivel University of Manitoba	
19:00	22:30	CONFERENCE BANQUET & Best Student Paper Award		Banquet Room 5 (Ground Floor)

Conference Venue

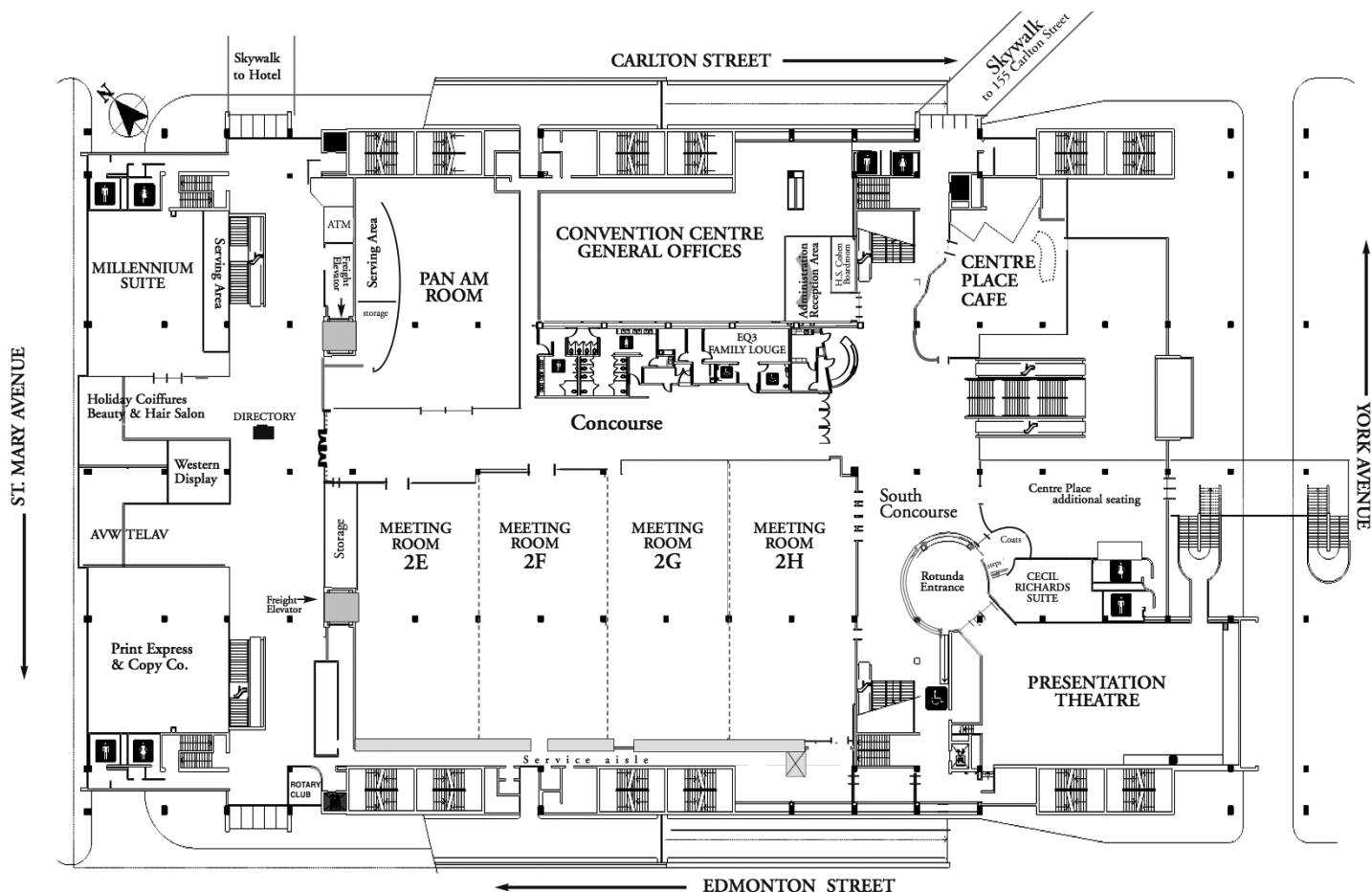
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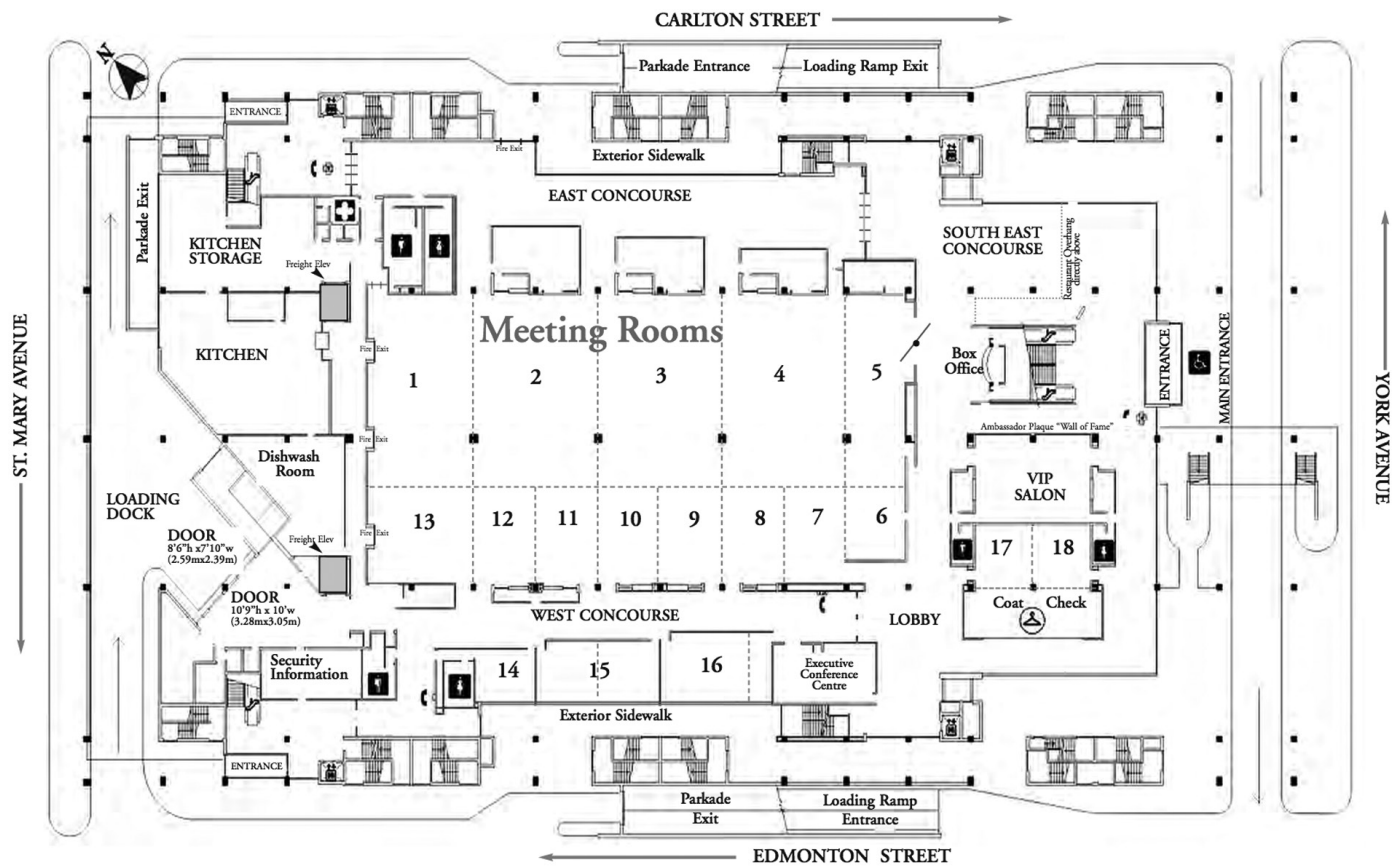
Floor Plan

SECOND FLOOR



Floor Plan

GROUND FLOOR



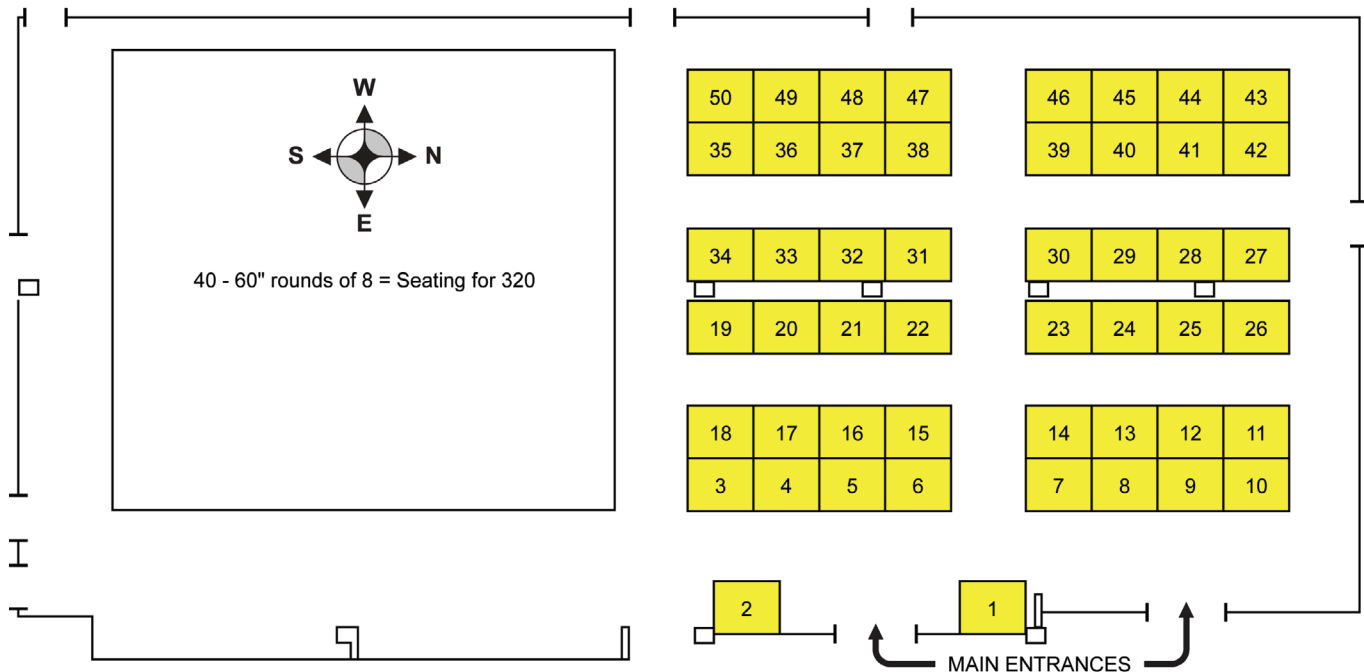
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Floor plan by...
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1: TransGrid Solutions	11: Trench Ltd	21: Delta Star	31: ERLPhase Technologies	41: Hubbell Power Systems
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3: W.I.R.E. Services	13: Power Systems Consultants, Inc	23: Kinectrics	33: Eleven Engineering Ltd.	43: Advanced Control Systems
4: Manitoba HVDC	14: IPS-ENERGY USA	24: Kinectrics	34: Siemens Canada	44: Burns & McDonnell
5: RTDS Technologies	15: Prometek	25: Oz Optics	35: ABB	45: Gentec
6: Trinity Meyer Utility Structures	16: CG Power Systems Canada	26: Fabrimet	36: ABB	46: Helix/PLP
7: Sediver	17: MHI - High Voltage Testing Services	27: ZTZ Services	37: OMICRON electronics	47: K-Line Insulators
8: Opal RT	18: Valmont Newmark	28: Classic Connectors USA	38: Aspecto Canada Inc.	48: The Colt Group
9: Sabre-FWT	19: MasTec Transmission Services Canada	29: 3M Canada	39: GE	49: MWG Apparel Corp.
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