



Evolution of the Power System to Accelerate Electrification

# 2023 CIGRE Canada Conference & Exhibition

Westin Bayshore Vancouver, BC • September 25-28, 2023

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## Welcome Message From the General Chair

On behalf of the members of the CIGRE Canada committee and BC Hydro, I invite you to join us in Vancouver for the 18th Annual CIGRE Canada Conference, September 25 to September 28, 2023.

I would like to acknowledge that this conference is taking place on the unceded traditional territory of the Musqueam, Squamish, and Tsleil-Waututh First Nations.

Over the four days of this conference, business leaders, utilities, manufacturers, engineers, and academics will collaborate and discuss the latest trends and developments within the evolving electricity sector.

This year's theme, "Evolution of the Power System to Accelerate Electrification" recognizes that there will be new demands on the power system as we transition to clean energy. We are experiencing increased demands for renewable energy from wind, solar and hydro, at both large and small scale, central and decentralized. Along with increased use of energy storage systems like batteries for grid support and energy supply, these technologies come with their own characteristics and demands on the power system.

The power system is also needing upgrades and modernization as much of it was designed and installed around the middle of the last century. This combination of increased demand and the need for renewal of the power system presents a generational opportunity to evolve the power system towards increased reliability, automation, security, and efficiency. It also challenges us to do this in a way that is affordable, respectful of First Nations and stakeholders, and sustainable both in terms of impacts on the environment and in terms of resilience as we experience the impacts of a changing climate.

The CIGRE Canada Conference provides an excellent forum to meet, share our knowledge and ideas, and discuss how we can evolve the power system to meet these opportunities and challenges. Looking forward to welcoming you to Vancouver in September.

Yours truly,

Chris O'Riley  
BC Hydro President and CEO



Chris O'Riley

## Committees

### General Chair

**Chris O'Riley**  
President & CEO, BC Hydro

### Organizing Committee

Chair: **Murray Kroeker**  
BC Hydro

**Muhammad Arshad**  
BC Hydro

**Phil Zinck**, Emera

**Michael Kobzar**  
Siemens Energy

**Angela Driver**  
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**Greg Farthing**  
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**Susana Van Der Veen**  
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**Steven Desrochers**  
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**David Flandin**  
Pro4Events

### Women in Energy (WiE) Representative:

**Robyn Koropatnick**  
Stantec

### Next Generation Network (NGN) Representatives:

**Kurtis Martin-Sturmey**  
BBA

**Aine NurAizza Nuruddin**  
Hatch Ltd.

### Technical Co-Chairs

**Dr. Sudhakar Cherukupalli**  
BC Hydro

**Dr. Ming Lu**  
BC Hydro

### Technical Committee

**Alberto Oscar**, Tesmec

**Amy Li**, BC Hydro

**Andrew Wagner**, BC Hydro

**Antonio Ferraresso**, BC Hydro

**Aslam Khan**, Hydro One

**Bob Stewart**, BC Hydro

**Brent Maksymiw**, Sask Power

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**Claude Rajotte**, Hydro Quebec

**David Jacobson**, Manitoba Hydro

**David Olan**, BC Hydro

**Dipayan Chakrabarti**, BC Hydro

**Dr. Bogdan Kasztenny**, Schweitzer Engg Labs

**Dr. Dipendra Rai**, BC Hydro

**Dr. Farnoosh Rahmatian**, Nugrid Power

**Dr. Jahangir Khan**, BC Hydro

**Dr. Jorge Hollman**, Powertech labs

**Dr. Jose Marti**, University of British Columbia

**Dr. Kankar Bhattacharya**, University of Waterloo

**Dr. Ming Lu**, BC Hydro

**Dr. Muhammad Arshad**, BC Hydro

**Dr. Mukesh Nagpal**, Burns & Mcdonnell

### CIGRE Canada Executive Committee

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**Dominique Mercier**, Member, Canada

**Donna Jablonsky**, Member, Canada

**Greg E. Farthing**, Co-Vice Chair, Canada

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**Dr. Sudhakar Cherukupalli**, BC Hydro

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**Francisc Zavoda**, IREQ

**Janak Acharya**, ATCO

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**Karl Mai**, BC Hydro

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**Tom Sgouros**

**Wenli Hong**, BC Hydro

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**Ramy Azar**, Member, Canada

**Stéphane Talbot**, Member, Canada

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**Suzanne Lafrenière**, Coordinator, Canada

**Udaya Annakkage**, Member, Canada

**NEW!**

## Access the Latest Updates on the App

For the most up-to-date information regarding the technical program, list of speakers, speaker biographies, list of exhibitors, floor plan, list of sponsors, and more, download the CIGRE 2023 program via Cvent Events app.

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## How to Download the App

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- Open the app and search for the event name **"CIGRE 2023 Canada"**
- Tap the  icon to download the event
- Once downloaded, tap on the arrow  to view the program

... or scan the QR Code:



## Schedule-at-a-Glance

<b>TECHNICAL EXHIBITION OPENING HOURS</b> ♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)	<b>Monday, Sept. 25</b> 18:00 - 20:00	<b>Tuesday, Sept. 26</b> 09:00 - 20:00	<b>Wednesday, Sept. 27</b> 09:00 - 17:00
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### Monday, September 25, 2023

08:00 - 17:00 — Registration ♦ FOYER

	<b>WORKSHOP SESSION 1</b>	<b>WORKSHOP SESSION 2</b>	<b>TECHNICAL VISITS (UPON REGISTRATION)</b> Buses will leave and return from the main entrance of the Westin Vancouver Hotel and come back to the same place.
09:00 – 10:30	<b>Workshop 1</b> ♦ SEYMOUR <b>Introduction to Blockchain and Application to the Power Utility Industry</b> Anant Venkateswaran, Hitachi Energy	<b>Workshop 5</b> ♦ MACKENZIE <b>Current Interruption in Atmospheric Air</b> Dr. Dave Peelo, Specialist Engineer, BC Hydro	<b>Innergex Run-Of-River Hydro Power Facility</b> Innergex is hosting a guided tour of The Ashlu Creek run-of-river hydroelectric power generating plant. The facility is located approximately 35 kilometres northwest of Squamish, British Columbia, on Ashlu Creek, a tributary of the Squamish River. Experience how we generate environmentally friendly electricity from hydropower along with history and facts related to this 49.9 MW facility.
10:30 - 11:00 — Coffee break for Workshops attendees only ♦ RIVER FOYER			
11:00 – 12:30	<b>Workshop 2</b> ♦ SEYMOUR <b>Protection Challenges and Potential Solutions on Lines Supplied by Inverter-Based Resources</b> Dr Mukesh Nagpal, Senior Associate Technical Consultant, Burns & McDonnell	<b>Workshop 6</b> ♦ MACKENZIE <b>Recent Trends and Challenges in Implementing Point-On-Wave Switching (Controlled Switching) For Special Applications Including Combined Loads, High Compensated Lines and Low Current Reactors</b> Dr. Urmil Parikh, Principal Engineer, Hitachi Energy	
12:30 - 14:00 — Lunch for Workshops attendees only ♦ SALON D			
14:00 – 15:30	<b>Workshop 3</b> ♦ SEYMOUR <b>Engineering Considerations When Lifting Towers Using the AMPJACK® Lift System</b> Nathan Stahl, Vice-President Engineering, Ampjack Industries Ltd.	<b>Workshop 7</b> ♦ MACKENZIE <b>Hydro Turbine Governors</b> Ravi P Mutukutti, Principal Engineer, BC Hydro	<b>Powertech Labs</b> Location: Vancouver Departure: 09:00 Return: 15:00
15:30 - 16:00 — Coffee break for Workshops attendees only ♦ RIVER FOYER			
16:00 – 17:30	<b>Workshop 4</b> ♦ SEYMOUR <b>Distributed Fiber Optic Sensing Systems and Its Applications in Power System Environment</b> Dr. Sudhakar Cherukupalli, Principal Engineer, BC Hydro	<b>Workshop 8</b> ♦ MACKENZIE <b>Power Systems Hybrid Simulations</b> Dr. Ning Lin, Senior Engineer with the Power System Studies and Dr. Xi Lin, Director of Engineering Services, Powertech Labs Inc	
18:00 - 20:00 — Welcome Reception ♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)			

Workshops are open to registered attendees upon specific registration.

Program updated on September 10, 2023. Titles and speakers are subject to change at any time. **Latest updates available on the CIGRE 2023 APP.**

Time		Tuesday, September 26, 2023			
06:30	19:00	Registration <span style="float: right;">♦ FOYER</span>			
06:45	08:00	Breakfast <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
07:00	16:00	Speakers ready at the registration desk <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
09:00	20:00	Exhibition <span style="float: right;">♦ SALON ABC + BAYSHORE GRAND FOYER</span>			
08:00	08:30	<b>08:10 — First Nations Territory Welcome</b> Phil Zinck, Chairman of CIGRE Canada		<b>08:20 — Word of Welcome</b> <span style="float: right;">♦ PLENARY SALON DEF</span>	
08:30	09:00	<b>Keynote: BC Hydro’s Plan for a Clean Future Powered by Water</b> Chris O’Riley, President & CEO, BC Hydro <span style="float: right;">♦ PLENARY SALON DEF</span>			
09:00	10:00	<b>Business Panel: What Has to Change From the Business Perspective to Meet Electrification Targets in BC/Canada/Global?</b> <span style="float: right;">♦ PLENARY SALON DEF</span> Nathan Bingham, Chief Digital Officer, POWER Engineers; Osmond J. Tsang, Regional VP, Utility Sales, Western Canada, HITACHI; Ahsan Upal, Regional Manager, Business Development, Burns & McDonnell; Moderator: Melissa Holland, VP Project Delivery, BC Hydro			
10:00	10:30	Networking Break <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
10:30	12:00	<b>SESSION 1</b> <span style="float: right;">♦ PLENARY SALON DEF</span>	<b>SESSION 2</b> <span style="float: right;">♦ SEYMOUR</span>	<b>SESSION 3</b> <span style="float: right;">♦ MACKENZIE</span>	<b>SESSION 1</b> <span style="float: right;">♦ CYPRESS 2</span>
		<b>5 Oral Presentations</b> <b>SCA2</b> Power Transformers & Reactors CIGRE 548 - 560 - 564 - 673 - 713	<b>5 Oral Presentations</b> <b>SC C2</b> Power System Operation & Control CIGRE 622 - 650 - 726 - 580 - 599	<b>5 Oral Presentations</b> <b>SCA3</b> Transmission & Distribution Equipment CIGRE 633 - 663 - 672 - 550 - 576	<b>6 Poster Presentations</b> <b>SC B2</b> Overhead Lines CIGRE 569 - 615 - 649 <b>SC B3</b> Substations & Electrical Installations CIGRE 559 - 709 <b>SC C3</b> Power System Environmental Performance CIGRE 732
12:00	13:15	<b>Women in Energy Luncheon: Accelerating the Energy Transition</b> <span style="float: right;">♦ PLENARY SALON DEF</span> Colleen Giroux-Schmidt, VP Corporate Relations, Innergex; Joanna Osawe, Senior BD Manager, Burns & McDonnell, and President & CEO, WiRE; Kirsten Peck, Senior VP, Safety & Chief Compliance Officer, BC Hydro; Moderator: Robyn Koropatnick, Global Sector Lead HVDC, Stantec			
13:15	14:30	<b>SESSION 4</b> <span style="float: right;">♦ PLENARY SALON DEF</span>	<b>SESSION 5</b> <span style="float: right;">♦ SEYMOUR</span>	<b>SESSION 6</b> <span style="float: right;">♦ MACKENZIE</span>	<b>SESSION 2</b> <span style="float: right;">♦ CYPRESS 2</span>
		<b>4 Oral Presentations</b> <b>SCB5</b> Protection & Automation CIGRE 675 - 686 - 703 - 706	<b>4 Oral Presentations</b> <b>SC B2</b> Overhead Lines CIGRE 549 - 585 - 635 - 718	<b>4 Oral Presentations</b> <b>SCC4</b> Power System Technical Performance CIGRE 571 - 637 - 646 - 660	<b>4 Poster Presentations</b> <b>SC C2</b> Power System Operation & Control CIGRE 605 - 623 - 662 - 734
14:30	15:00	Networking Break <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
15:00	16:15	<b>SESSION 7</b> <span style="float: right;">♦ PLENARY SALON DEF</span>	<b>SESSION 8</b> <span style="float: right;">♦ SEYMOUR</span>	<b>SESSION 9</b> <span style="float: right;">♦ MACKENZIE</span>	<b>SESSION 3</b> <span style="float: right;">♦ CYPRESS 2</span>
		<b>4 Oral Presentations</b> <b>SCB5</b> Protection & Automation CIGRE 591 - 659 - 674 - 692	<b>4 Oral Presentations</b> <b>SC B2</b> Overhead Lines CIGRE 572 - 584 - 643 - 712	<b>4 Oral Presentations</b> <b>SCA3</b> Transmission & Distribution Equipment CIGRE 630 - 695 - 566 - 678	<b>3 Poster Presentations</b> <b>SCA2</b> Power Transformers & Reactors CIGRE 642 - 687 - 731
16:15	16:45	Networking Break <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
16:45	17:45	<b>SESSION 10</b> <span style="float: right;">♦ PLENARY SALON DEF</span>	<b>SESSION 11</b> <span style="float: right;">♦ SEYMOUR</span>	<b>SESSION 12</b> <span style="float: right;">♦ MACKENZIE</span>	<b>SESSION 4</b> <span style="float: right;">♦ CYPRESS 2</span>
		<b>3 Oral Presentations</b> <b>SCB3</b> Substations & Electrical Installations CIGRE 587 - 600 - 711	<b>3 Oral Presentations</b> <b>SC B4</b> DC Systems & Power Electronics CIGRE 616 - 645 - 694	<b>3 Oral Presentations</b> <b>SCA2</b> Power Transformers & Reactors CIGRE 558 - 638 - 671	<b>4 Poster Presentations</b> <b>SC B5</b> Protection & Automation CIGRE 577 - 583 - 607 - 691
17:45	19:00	<b>Cocktail Reception</b> <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
19:00	22:00	<b>Conference Banquet and Presentation of the Finalists</b> <span style="float: right;">♦ PLENARY SALON DEF</span> Best Student Paper Award - Next Generation Network Best Paper Award - Best Paper Overall Award			

Conferences are open to registered conference attendees only

Program updated on September 10, 2023. Titles and speakers are subject to change at any time. **Latest updates available on the CIGRE 2023 APP.**

Time		Wednesday, September 27, 2023			
06:30	13:00	Registration <span style="float: right;">♦ FOYER</span>			
06:45	08:00	Breakfast <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
07:00	13:00	Speakers ready at the registration desk <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
09:00	17:00	Exhibition <span style="float: right;">♦ SALON ABC + BAYSHORE GRAND FOYER</span>			
08:00	08:30	<b>Keynote: Perspective on the Opportunities and Challenges With Accelerating Electrification and the Evolution of the Power System</b> <span style="float: right;">♦ PLENARY SALON DEF</span> Francis Bradley, President & CEO, Electricity Canada			
08:30	09:30	<b>CEO Panel: What Would Have to Be True to Accelerate Electrification?</b> <span style="float: right;">♦ PLENARY SALON DEF</span> Chris O'Riley, President & CEO, BC Hydro; Jay Grewal, President & CEO, Manitoba Hydro; Francis Bradley, President & CEO, Electricity Canada; Pierre Poulain, President & CEO, Powertech Labs Inc.; Moderator: Diana Stephenson, Senior VP Customer and Corporate Affairs, BC Hydro			
09:30	09:45	Networking Break <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
09:45	10:45	<b>SESSION 13</b> ♦ PLENARY SALON DEF <b>3 Oral Presentations</b> SC D2 Information Systems & Telecommunication CIGRE 677 - 684 - 685	<b>SESSION 14</b> ♦ SEYMOUR <b>3 Oral Presentations</b> SC A1 Rotating Electrical Machines CIGRE 579 - 619 SC D2 Information Systems & Telecommunication CIGRE 693	<b>SESSION 15</b> ♦ MACKENZIE <b>4 Oral Presentations</b> SC C4 Power System Technical Performance CIGRE 653 - 733 - 683 - 689	<b>SESSION 5</b> ♦ CYPRESS 2 <b>4 Poster Presentations</b> SC A3 Transmission & Distribution Equipment CIGRE 555 - 565 - 593 SC B4 DC Systems & Power Electronics CIGRE 629
		Networking Break <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
11:15	12:15	<b>SESSION 16</b> ♦ PLENARY SALON DEF <b>3 Oral Presentations</b> SC D2 Information Systems & Telecommunication CIGRE 612 - 626 - 724	<b>SESSION 17</b> ♦ SEYMOUR <b>4 Oral Presentations</b> SC A1 Rotating Electrical Machines CIGRE 553 SC B1 Insulated Cables CIGRE 658 - 679 SC B3 Substations & Electrical Installations CIGRE 608	<b>SESSION 18</b> ♦ MACKENZIE <b>3 Oral Presentations</b> SC B2 Overhead Lines CIGRE 681 SC B4 DC Systems & Power Electronics CIGRE 700 SC D1 Materials & Emerging Test Techniques CIGRE 632	<b>SESSION 6</b> ♦ CYPRESS 2 <b>3 Poster Presentations</b> SC C4 Power System Technical Performance CIGRE 552 - 567 - 568
		<b>12:15 13:45 NGN Panel Luncheon: How the Next Generation is Preparing to Tackle Future Challenges</b> <span style="float: right;">♦ PLENARY SALON DEF</span> Russell Samasuwo, Director, Client Services - Engineered Intelligence Inc.; Mark Mitchell, Global Lead, Distributed Energy Solutions & Microgrids, Hatch Ltd.; Roshani Kaluthantrige, Power Systems Specialist, Simulation & Studies, TransGrid Solutions; Kurtis Martin-Sturme, Manager, Asset Management & Performance, BBA; Moderator: Aine NurAizza Nuruddin, Electrical EIT, Hatch Ltd.			
13:45	15:30	<b>SESSION 19</b> ♦ PLENARY SALON DEF <b>6 Oral Presentations</b> SC B5 Protection & Automation CIGRE 682 - 714 - 586 - 598 - 699 - 701	<b>SESSION 20</b> ♦ SEYMOUR <b>6 Oral Presentations</b> SC A2 Power Transformers & Reactors CIGRE 561 - 563 - 597 - 613 - 627 - 654	<b>SESSION 21</b> ♦ MACKENZIE <b>6 Oral Presentations</b> SC C2 Power System Operation & Control CIGRE 562 - 582 - 625 - 676 - 698 - 704	<b>SESSION 7</b> ♦ CYPRESS 2 <b>5 Poster Presentations</b> SC C1 Power System Development & Economics CIGRE 640 SC C5 Electricity Markets & Regulation CIGRE 596 SC D2 Information Systems & Telecommunication CIGRE 601 - 621 - 651
		Networking Break <span style="float: right;">♦ EXHIBITION (SALON ABC + BAYSHORE GRAND FOYER)</span>			
16:00	17:00	<b>SESSION 22</b> ♦ PLENARY SALON DEF <b>3 Oral Presentations</b> SC B5 Protection & Automation CIGRE 697 SC C6 Active Distribution Systems & Distributed Energy Resources CIGRE 631 - 647	<b>SESSION 23</b> ♦ SEYMOUR <b>3 Oral Presentations</b> SC C1 Power System Development & Economics CIGRE 570 - 705 SC C2 Power System Operation & Control CIGRE 624	<b>SESSION 24</b> ♦ MACKENZIE <b>3 Oral Presentations</b> SC C5 Electricity Markets & Regulation CIGRE 606 - 688 SC D2 Information Systems & Telecommunication CIGRE 636	<b>SESSION 8</b> ♦ CYPRESS 2 <b>4 Poster Presentations</b> SC A1 Rotating Electrical Machines CIGRE 602 - 644 SC C6 Active Distribution Systems & Distributed Energy Resources CIGRE 554 - 611
		<b>17:00 17:30 Award Presentation of the Best Papers (NGN - Students - Overall Award), Prize Draw and Closing Session</b> <span style="float: right;">♦ PLENARY SALON DEF</span> Phil Zinck, Chairman CIGRE Canada			

Conferences are open to registered conference attendees only

Program updated on September 10, 2023. Titles and speakers are subject to change at any time. **Latest updates available on the CIGRE 2023 APP.**

All times are in the PST - Pacific Standard Time (Vancouver - Canada)

Time		Thursday, September 28, 2023		
08:00	12:00	<b>TUTORIAL 1 *— SIEMENS ENERGY</b> <span style="color: red;">📍 SEYMOUR</span> <b>Decarbonizing District Heating Through Electrification in Downtown Vancouver: Creative Energy and Siemens Energy's Work in GHG Mitigation Using Environmentally Friendly Technologies</b> <b>Speakers:</b> Deryl Varkey, Ben Ellison, Eduardo Gomez Hennig, Felipe Migliato	<b>TUTORIAL 2 *— HITACHI ENERGY</b> <span style="color: red;">📍 MACKENZIE</span> <b>Transformer Service – Transformer Life Extension Options and Benefits</b> <b>Transformer Refurbishment and Repair Alternatives to Extend Transformer Life</b> <b>Speaker:</b> Ed teNyenhuis (Transformer Service) Technical and Operations Manager, also Chair of the IEEE Transformer Technical Committee  <b>ADMS to Improve Reliability and Resiliency</b> <b>Speaker:</b> Colton Pierce (Senior Scada / ADMS Consultant)  <b>HVDC - Enabling the Grids of the Future. Technology Update and Global Perspectives for HVDC</b> <b>Speakers:</b> Mauro Monge (Global Product Manager HVDC Grid Applications) and Etienne Veilleux, ing. (HVDC Business Development)	<b>TUTORIAL 3 *— SIEMENS CANADA</b> <span style="color: red;">📍 SALON 3</span> <b>SIPROTEC Digital Twin - Cloud Based Testing of Numerical Protection Relays</b> <b>Interactive session discussing the Siemens SIPROTEC Digital Twin solution.</b> <b>Speakers:</b> Paul Lourenco, Senior Business Developer, Siemens Canada Limited Moein Manbachi, Project Leader, Centre for Applied Research & Innovation, BCIT  Attendees will use the application to test various scenarios (relating to protection, control and automation) on a virtual copy of a protection relay located in the cloud. No additional infrastructure or hardware requirements.  <b>NOTE:</b> Attendees must bring a laptop with Google Chrome installed in order to access a demo version of the application (Internet access will be provided via Wi-Fi).

\* **For Tutorial Attendees only:** Breakfast from 07:00 to 08:00 / Coffee break from 10:00 to 10:30  
**Location:** In front of room SALON 1

Tutorials are open to registered conference attendees only

## Workshops

### Workshop 1

📅 MONDAY, SEPTEMBER 25, 2023

🕒 09:00 – 10:30

📍 SEYMOUR

### Introduction to Blockchain and Application to the Power Utility Industry

PRESENTED BY: **Anant Venkateswaran**, Hitachi Energy

The power and utility industry value chain is undergoing a major transformation. Driven by regulatory, policy, business, technology and the consumer, change is being driven in all aspects of the value chain. This transition is marked by increasing penetration of renewables and DER's across the value chain and electrification across transportation and other industries. As the democratization continues to evolve, customers of today will become prosumers of tomorrow.

Blockchain has grabbed the attention of the heavily regulated power industry as it braces for an energy revolution in which both utilities and consumers will produce and sell electricity.

Blockchain can offer a reliable, low-cost way for financial and operational transactions to be recorded and validated across a distributed network with no central point of authority. While no change is immediate or quick, the industry is seriously evaluating the pros and cons of this technology and where it can bring most value.

This tutorial will provide an introduction to Blockchain and review the applications across the value chain, with special focus around current applications across the value chain. It will also show how the goals of an Active Network, Active Consumer/ Prosumer, Active Market and other benefits can be accrued.

A 360 review will be done with case studies and examples from across the world and the value of each application will be demonstrated. This tutorial will also look into the future of blockchain and its associated concepts.

**Target audience for this tutorial is as follows:**

1. Business Leaders and Utility/ Market Operators personnel - including executives
2. IT/ Ops Managers
3. Architects, Data Analysts, Scientists, BI Developer/ DW Professionals, QA and other SME's.
4. Regulatory Personnel
5. Generation, Transmission Distribution and Customer Services Personnel
6. Vendors
7. Consultants, Engineering companies etc.
8. Academia

## Workshop 2

📅 MONDAY, SEPTEMBER 25, 2023

🕒 11:00 – 12:30

📍 SEYMOUR

### Protection Challenges and Potential Solutions on Lines Supplied by Inverter-Based Resources

PRESENTED BY: **Dr Mukesh Nagpal**, Senior Associate Technical Consultant, Burns & McDonnell

The short circuit response of a conventional synchronous resource machine is determined by the laws of physics and machine parameters. Two physically similar machines exhibit similar output characteristics. Inverter-Based Resources (IBRs) are also subject to physical constraints, but their actual output characteristics are defined by the programming of the control system. Consequently, two identically built IBRs can exhibit vastly different system responses due to differences in their programming parameters. The controlled

short circuit current characteristic of IBRs depends on specific, and often proprietary, control systems designed to protect the interfacing power electronics and comply with utility grid code requirements. Consequently, the reliability of a traditional line protection system, designed for conventional synchronous resources, may be compromised when operating solely on the current contribution from IBRs without considering the controlled nature of their short circuit current.

This tutorial presentation illustrates the reliability risks posed to traditional line protection schemes through real-life examples of short circuit currents on lines supplied by sources with converter or inverter interfaces. Specifically, it focuses on schemes that employ negative sequence quantities for the detection of unbalanced faults. Examples will be drawn from the protection schemes adopted by BC Hydro for lines interconnecting IBRs.

## Workshop 3

📅 MONDAY, SEPTEMBER 25, 2023

🕒 14:00 – 15:30

📍 SEYMOUR

### Engineering Considerations When Lifting Towers Using the AMPJACK® Lift System

PRESENTED BY: **Nathan Stahl**, P.Eng, Vice-President Engineering, Ampjack Industries Ltd.

The AMPJACK® tower lifting system has been developed as a “tool in the toolbox” that can be used on its own or in conjunction with other transmission line upgrade solutions to increase transmission line capacity. This is accomplished using state of the art engineering and construction methods to address challenges encountered when increasing tower heights for line upgrading. This workshop will provide an overview of the engineering considerations used when lifting transmission towers using the AMPJACK® Lift System. The workshop will have a technical focus on the execution details, operational and safety

considerations, lift system components, process and interactions, and explore the design workflow from feasibility through to detailed design. Ampjack Industries Ltd. is a North American based company, providing innovative upgrade solutions for the electrical transmission industry. We have developed the AMPJACK® tower lifting system to mitigate transmission line clearance issues economically with environmentally friendly solutions that enhance safety while bringing utilities back into compliance or adding additional line capacity. The benefit of using the AMPJACK® upgrade solution is that towers can be raised while the transmission lines remain energized. This provides significant system reliability improvements and will save utilities lost revenue over using traditional methods of raising transmission line towers with large cranes. With the ability to safely lift the towers while the lines are energized, utilities save costly outages, outage planning, contingency planning and scheduling while maintaining system reliability.

## Workshop 4

📅 MONDAY, SEPTEMBER 25, 2023

🕒 16:00 – 17:30

📍 SEYMOUR

### Distributed Fiber Optic Sensing Systems and Its Applications in Power System Environment

PRESENTED BY: **Dr Sudhakar Cherukupalli**, Principal Engineer, BC Hydro

This talk will begin with an overview of Distributed Fiber Optic Sensing; the science, benefits, challenges. It will then examine how

the technology may be harnessed in the context of power system applications. The talk will also present a few case studies as to how and where it is being applied in the industry today. Its adoption and application of these technologies and been extremely valuable in Underground Land and Submarine Cable systems and these will be included in this Tutorial. It will conclude with an overview the future applications of this technology.

## Workshop 5

📅 MONDAY, SEPTEMBER 25, 2023

🕒 09:00 – 10:30

📍 MACKENZIE

### Current Interruption in Atmospheric Air

PRESENTED BY: **Dr Dave Peelo**, Specialist Engineer (Retired), BC Hydro

The tutorial is based on his own work and later research in the Netherlands It will explain the behavior of free burning arcs in air and what it takes for the arc to extinguish. The Presentation will comprise mostly of video material to use non-commercially to promote safe switching practices. There will be no handout.

**Workshop 6**

📅 MONDAY, SEPTEMBER 25, 2023

🕒 11:00 – 12:30

📍 MACKENZIE

## Recent Trends and Challenges in Implementing Point-On-Wave Switching (Controlled Switching) For Special Applications Including Combined Loads, High Compensated Lines and Low Current Reactors

PRESENTED BY: **Dr. Urmil Parikh**, Dr. Engg & Tech, Principal Engineer - Power Systems & Global Program Manager - Controlled Switching, Power Products High Voltage Technology Center, Hitachi Energy, Sweden

Controlled switching (CS), also known as Point on wave (POW) switching has been successfully applied since decades for mitigation of over-voltages, related to dielectric stresses as well as inrush currents, related to thermal stresses during switching of various power equipment including reactor & capacitor banks, transformers, long cables & transmission lines. It also reduces the wear & tear of circuit breaker (CB) components as well as aging or damage to the insulation of power equipment. In this way it improves life cycle duration of both CB and the power equipment, and thereby, reduces total cost of ownership. Moreover, recent changes in network topology and dynamically changing system configurations, the application of controlled switching is not just limited to above mentioned purely inductive or capacitive loads with fixed ratings. It is now extended to the variable & combined loads such as shunt compensated long HV cables, long HV transmission lines with changing compensation levels, transformers with permanently connected capacitive loads and variable shunt reactors with very low current ratings. Selection of improper switching strategies for such loads may lead to phenomenon like delayed current zeros, various

types of resonance (series, parallel or ferro-resonance) conditions, which may create risk of faster aging or even catastrophic failure of the power equipment or the CB. In recent times, it has also been observed that the usage of very low current reactors (in range of 30-40 Amps) or variable shunt reactors with lowest tap setting having extremely low currents is rapidly increasing. The interruption of such low inductive currents imposes very high switching over-voltage stresses on internal components of the CB as well as on insulation of the reactor. De-energization of the impedance grounded shunt reactors used on transmission lines is even more challenging, since the first pole to interrupt the current will see further magnification in over-voltage stresses. In such cases, the implementation of controlled switching needs special attention, which otherwise, can lead CB failing to interrupt the current, or in extreme cases, can result into damage of the CB and/or insulation of the reactor. In this tutorial, various technical aspects and associated challenges of implementing POW for abovementioned special cases will be discussed. The results together with learnings from field implementation of CS for few such cases will also be included in this tutorial.

**Workshop 7**

📅 MONDAY, SEPTEMBER 25, 2023

🕒 14:00 – 15:30

📍 MACKENZIE

## Hydro Turbine Governors

PRESENTED BY: **Ravi P Mutukutti**, Principal Engineer, BC Hydro

Hydro turbine Governors evolution starting from early mechanical governors to today's digital governors will be discussed. The basic operation principles of hydraulic amplification and speed sensing techniques will be demonstrated. Islanded operation and bulk electricity system (interconnected grid) droop operation, Automatic Generation Control (AGC) concepts will be presented.

**Workshop 8**

📅 MONDAY, SEPTEMBER 25, 2023

🕒 16:00 – 17:30

📍 MACKENZIE

## Power Systems Hybrid Simulations

PRESENTED BY: **Dr. Ning Lin**, Senior Engineer with the Power System Studies  
**Dr. Xi Lin**, Director of Engineering Services, Powertech Labs Inc

Conventionally, two types of digital simulations have been essential. The first type (Transient Stability (TS) analysis) is mainly for large power system models. Electromagnetic Transient (EMT) analysis is the second type that focuses on the detailed behaviors of individual components in a power system. Combining both methods in a single simulation has been considered by researchers for decades and it becomes more desirable as power systems undergo significant changes with more and more renewables and HVDC systems have been connected to the power grids.

In this tutorial, real-time and non-real-time EMT/TS hybrid simulation techniques will be introduced, practical applications and issues will be discussed, and real-world case studies will be used to demonstrate the practical value of this power system simulation technology.

# Technical Sessions

## Tuesday, September 26, 2023

	SESSION 1 <span style="color: red;">♦</span> PLENARY SALON DEF	SESSION 2 <span style="color: red;">♦</span> SEYMOUR	SESSION 3 <span style="color: red;">♦</span> MACKENZIE	SESSION 1 - POSTERS <span style="color: red;">♦</span> CYPRESS 2
10:30 – 12:00	<b>CIGRE-548 A2</b> Low-Frequency Heating for Drying Transformer Insulation James Cross, Kinectrics Inc	<b>CIGRE-622 C2</b> Prefeasibility Study for Integrating 2000 MW of Hydro Generation in Remote Northern Ontario Chi Tang, McMaster University	<b>CIGRE-633 A3</b> UHF PD Monitoring Data Enables Condition-Based Maintenance of the GIS Bharat Nandula, Qualitrol DMS	<b>CIGRE-559 B3</b> Using Smart, Contactless Sensors to Optimize Asset Maintenance Richard Harada, Systems With Intelligence
	<b>CIGRE-560 A2</b> Power Transformer Cooling Upgrades for Rating Increase Ed TeNyenhuis, Hitachi Energy	<b>CIGRE-650 C2</b> Towards Fully Autonomous Control Center for 100% Renewable Energy Dominated Grid Operation: State-of-the-Art and Future Potential Innovations Yusuf KAYA, Siemens Energy Global GmbH Co. KG	<b>CIGRE-663 A3</b> Feasibility of Point-On-Wave Switching as Replacement of Pre-insertion Resistors for Switching Overvoltage Mitigation on Long Transmission Lines Urmil Parikh, HITACHI Energy Sweden AB	<b>CIGRE-569 B2</b> Transmission Line Positive Sequence Parameter Estimation Using Synchronized Measurements at Both Ends Roul Martin, PSC North America
	<b>CIGRE-564 A2</b> Coping with Big Data Challenge for Fleet Management of POWERGRID Transformer & Reactor Assets Amandeep Singh, POWERGRID	<b>CIGRE-726 C2</b> Optimizing Under-Frequency Load Shedding in Active Islanded Power Networks Using Reinforcement Learning: A Q-Learning Approach Gayashan Porawagamage, University of Manitoba	<b>CIGRE-672 A3</b> Innovative Solutions for Liquid and Dry Type High Voltage Transformer Bushings to Cope Loading Pattern Changes and Increased Reliability and Resiliency Expectations Kurt Kaineder, Siemens Energy	<b>CIGRE-615 B2</b> On The Degradation Assessment of ACSR Condors Aged on Their Operational Conditions and Environment Using Electrical and Thermal Analysis Yatshamba Daniel Kubelwa, Département de Génie Civil, Université de Sherbrooke
	<b>CIGRE-673 A2</b> Supervised-Learning Partial Discharge Localization in Transformer Winding Based on Axial Multiconductor Transmission Line Model Hamed Moraditavasani, University of Manitoba	<b>CIGRE-580 C2</b> An Adaptive SOC-based Droop Control Method for Battery Energy Storage Systems Participating in Primary Frequency Regulation in Low-Inertia Power Grids Harindya Attanayaka, University of Manitoba	<b>CIGRE-550 A3</b> An Isolating Disconnect Switch Arcing Incident Investigation and Mitigation Luke Wang, BC Hydro	<b>CIGRE-649 B2</b> Mitigating the Imposition of RIV and Corona Noise and Light Pollution in the wake of Infrastructure Development for Electrification Alex Lucas, POWER Engineers
<b>CIGRE-713 A2</b> Energization Below -20°C and the Risk of Dielectric Failure on Different Insulating Liquids Roberto Da Silva, Cargill Bioindustrial	<b>CIGRE-599 C2</b> Comparative Analysis of the Distribution Lines Falling Conductor Protection Methods Daniel Ransom, GE Vernova	<b>CIGRE-576 A3</b> Practical Application of On-line Partial Discharge Monitoring for the Improvement of Long-Term Power Network Reliability Ken Vander Eyken, Phoenix Monitoring Technologies	<b>CIGRE-709 B3</b> Impact of Intelligent Asset Monitoring on the Edge - Transformers Anant Venkateswaran, CIGRE Member	
13:15 – 14:30	<b>SESSION 4</b> <span style="color: red;">♦</span> PLENARY SALON DEF	<b>SESSION 5</b> <span style="color: red;">♦</span> SEYMOUR	<b>SESSION 6</b> <span style="color: red;">♦</span> MACKENZIE	<b>SESSION 2 - POSTERS</b> <span style="color: red;">♦</span> CYPRESS 2
	<b>CIGRE-675 B5</b> Smart Sensing of Current and Voltage in Medium-Voltage Power Distribution Systems Mirza Danish Baig, ABB Inc.	<b>CIGRE-549 B2</b> A Methodology for Quantifying the Number of Lightning-Initiated Simultaneous Outages of Parallel Transmission Lines Hamed Ahmadi, BC Hydro	<b>CIGRE-571 C4</b> A New Tool for Obtaining Dynamic Equivalent Models for Large Power Systems Thilini Hathiyaldeniye, Manitoba Hydro	<b>CIGRE-605 C2</b> Electrical Load Forecasting Using an Artificial Neural Network Chi Tang, McMaster University
	<b>CIGRE-686 B5</b> Optimization of Distance Protection Performance Used in Wind Farms' Collection Networks Mike Kockott, Hitachi Energy, USA	<b>CIGRE-585 B2</b> Recommended Practice for Implementing Ambient Adjusted Ratings on Overhead Transmission Lines Ming Lu, BC Hydro	<b>CIGRE-637 C4</b> Development and Comparison of Generic Models for Variable-Frequency Drive Systems in PSCAD/EMTDC and PSS/E Farhad Yahyaie, Siemens Canada Limited	<b>CIGRE-623 C2</b> Voltage Dip Mitigation by STATCOM Chi Tang, McMaster University
	<b>CIGRE-703 B5</b> Protection and Automation (Pac) System Design of a 500kV Switchyard With "An Unconventional Layout" Dan Song, Burns & McDonnell Canada Limited	<b>CIGRE-635 B2</b> Numerical Modeling Predicts Overhead Line Electric Fields for Accelerated Electrification Stephen Bell, K-Line Insulators Limited	<b>CIGRE-646 C4</b> Value and Gain of Grid-Forming Inverters for RoCoF and Frequency Regulation in Island Grids Matin Rahmatian, Quanta Technology	<b>CIGRE-662 C2</b> Effect of Fault Level on 765 kV EHV line charging from RES complex: A Case study from Western Regional Grid of India Minnakuri Venkateswara Rao, Grid Controller of India Limited (Grid-India)
<b>CIGRE-706 B5</b> Active Arc-Flash Mitigation for Medium and Low Voltage Switchgear using the UFES (Ultra-Fast Earthing Switch) System Mirza Danish Baig, ABB Inc.	<b>CIGRE-718 B2</b> Dynamic Thermal Ratings of Overhead Transmission Lines - A line sensor-less approach based on statistical AI/ML modelling John Penaranda, Hydro One	<b>CIGRE-660 C4</b> Decoupling the Variability Using Multi-Step Moving Average Filters Ming Hu, AESO	<b>CIGRE-734 C2</b> Actions Taken for Mitigation of Forced Oscillations: A Case study from Western Regional Grid of India Srinivas Chitturi, Grid Controller of India Limited (Grid-India)	

### CIGRE'S STUDY COMMITTEES AND DOMAINS OF WORK

#### Group A – Equipment

- A1** Rotating Electrical Machines
- A2** Power Transformers & Reactors
- A3** Transmission & Distribution Equipment

#### Group B – Technologies

- B1** Insulated Cables
- B2** Overhead Lines
- B3** Substations & Electrical Installations
- B4** DC Systems & Power Electronics
- B5** Protection & Automation

#### Group C – Systems

- C1** Power System Development & Economics
- C2** Power System Operation & Control
- C3** Power System Environmental Performance
- C4** Power System Technical Performance
- C5** Electricity Markets & Regulation
- C6** Active Distribution Systems & Distributed Energy Resources

#### Group D – New Materials and IT

- D1** Materials & Emerging Test Techniques
- D2** Information System & Telecommunication

All times are in the PST - Pacific Standard Time (Vancouver - Canada)

15:00 – 16:15	<b>SESSION 7</b> <span style="color: red;">♦</span> <b>PLENARY SALON DEF</b> <b>CIGRE-591 B5</b> Line Protective Relays Suitable for Systems With a High Penetration of Unconventional Sources – Operating Principles and Field Experience Bogdan Kasztenny, Schweitzer Engineering Laboratories, Inc. <b>CIGRE-659 B5</b> Method for Reducing Interruptions in Power Distribution Networks using Remote-Controlled Automatic Reclosers Mariana Resener, Simon Fraser University <b>CIGRE-674 B5</b> Best Practices for Voltage and Frequency Protection Coordination of Inverter Based Resources (IBRs) Rahim Jafari, Electric Power Engineers (EPE) <b>CIGRE-692 B5</b> Application of Standard 87T Differential Protection on Phase Shifting Transformers Mike Kockott, Hitachi Energy, USA	<b>SESSION 8</b> <span style="color: red;">♦</span> <b>SEYMOUR</b> <b>CIGRE-572 B2</b> Case Study of Northwest Territories Power Corporation's L150 115kV Transmission Line Making Informed Decisions for Overhead Transmission Line Hardening and Operations Ryan Troeller, Ampjack Industries Ltd. <b>CIGRE-584 B2</b> Mitigating Forced Outages on a 287kV Transmission Line due to Snow Storms Ming Lu, BC Hydro <b>CIGRE-643 B2</b> Electrostatic Field Reduction Underneath Transmission Lines by Active and Passive Shielding Jorge Hollman, Powertech <b>CIGRE-712 B2</b> XML Transmission Line Modeling and Python Impedance Calculation James Schwartz, AltaLink Management Ltd.	<b>SESSION 9</b> <span style="color: red;">♦</span> <b>MACKENZIE</b> <b>CIGRE-630 A3</b> EMI Interaction of HV AC Transmission Lines with Railway Infrastructure Jay Taylor, AtkinsRéalis <b>CIGRE-695 A3</b> Inductive Power Harnessing for Powering High Voltage Line Monitoring Devices Jahangir Khan, Specialist Engineer <b>CIGRE-566 A3</b> Asset Performance Management: Transformer Monitoring Khaled Chaabani, Suncor Energy <b>CIGRE-678 A3</b> Medium Voltage Gas Insulated Switchgear M. Sharif Ahmed, Electrical Engineer, Sr. Member IEEE	<b>SESSION 3 - POSTERS</b> <span style="color: red;">♦</span> <b>CYPRESS 2</b> <b>CIGRE-642 A2</b> Design and Operation of Renewable Energy Collector Transformers Waldemar Ziomek, PTI Transformers LP <b>CIGRE-687 A2</b> Impacts on T&D Products by Climate Change and Visa Verse Martin A. Stoessl, Siemens Energy <b>CIGRE-731 A2</b> On the Actuation Learning and Condition Assessment of Power Transformers Cooling Systems Therence Hounghadi, High Voltage Software Systems/ Ecole Polytech
	<b>SESSION 10</b> <span style="color: red;">♦</span> <b>PLENARY SALON DEF</b> <b>CIGRE-587 B3</b> New Dry Type Insulated Products for Your IEC 61850 Digital Substation Robert Middleton, RHM International <b>CIGRE-600 B3</b> Virtualization Technology Applications in Advanced Digital Substations Moein Manbachi, British Columbia Institute of Technology <b>CIGRE-711 B3</b> Improving Substation Grounding Performance in Cold Climate Region Using New Method Based on Electrically Conductive Concrete Encased Electrode (ECON-EE) Christophe Volat, University of Quebec at Chicoutimi	<b>SESSION 11</b> <span style="color: red;">♦</span> <b>SEYMOUR</b> <b>CIGRE-616 B4</b> Hardware in the Loop Simulation of DC-DC Converters for HVDC Applications Juan Paez Alvarez, Electrical Modelling and Simulation Specialist <b>CIGRE-645 B4</b> An Online Probing Frequency Injection Method for Grid-Forming IBRs Inertia Measurement Ting Lin, University of Manitoba <b>CIGRE-694 B4</b> Parallel Operation of AC and HVDC Systems Connected to Offshore Energy Islands Roshani Kaluthantrige, TransGrid Solutions	<b>SESSION 12</b> <span style="color: red;">♦</span> <b>MACKENZIE</b> <b>CIGRE-558 A2</b> Investigation of a Dry type Transformer Arcing Incident Amy Li, BC Hydro <b>CIGRE-638 A2</b> Effect of the Faults in a Wind Farm Utilizing SCIG Turbines on the Voltage Stability and Its Mitigation Abolfazl Babaei, University of Manitoba <b>CIGRE-671 A2</b> Understanding Development of Failure Mechanisms in Transformer Bushings Through Continuous Online Monitoring Nathan Jacob, Camlin Energy	<b>SESSION 4 - POSTERS</b> <span style="color: red;">♦</span> <b>CYPRESS 2</b> <b>CIGRE-577 B5</b> Automating Commissioning Tests, Firmware Updates and Inventory Checks Using a Device Management System Adriano Pires, GE Grid Solutions <b>CIGRE-583 B5</b> Application of Cyber Security Frameworks for Power System Cyber Threat Modeling and Training using Digital Twins Kelly Stich, SUBNET Solutions Inc <b>CIGRE-607 B5</b> DER Penetration Level Impact on the Distribution System Protection Ehsan Dehghanpour, CanmetENERGY, Natural Resources Canada <b>CIGRE-691 B5</b> Experiences in the Commissioning of IEC61850 Digital Busbar Protection Systems Ivan Otarola, Soluciones Teleinformáticas y Control S.A.
	<b>SESSION 13</b> <span style="color: red;">♦</span> <b>PLENARY SALON DEF</b> <b>CIGRE-677 D2</b> Communication Bandwidth Considerations for Digital Substation Applications Jake Groat, Hitachi Energy <b>CIGRE-684 D2</b> Security by Design: Building Security into Your Projects John Biasi, Burns & McDonnell <b>CIGRE-685 D2</b> Securing the Supply Chain Krista Koors, Burns & McDonnell	<b>SESSION 14</b> <span style="color: red;">♦</span> <b>SEYMOUR</b> <b>CIGRE-579 A1</b> Site C Clean Energy Project - A Unique Approach to Turbine-Generator Design Optimization Dustin Dowler, BC Hydro <b>CIGRE-619 A1</b> Decisions and Strategies for Hydro Generators Refurbishment and Replacement Wenli (William) Hong, BC Hydro <b>CIGRE-693 D2</b> "Cybersecurity Challenges in the Electric Vehicle Market" Nalindrani Malimage, Burns and McDonnell	<b>SESSION 15</b> <span style="color: red;">♦</span> <b>MACKENZIE</b> <b>CIGRE-653 C4</b> Evaluating Reliability in Expansion Planning of Primary Distribution Networks Gustavo Aschidamini <b>CIGRE-733 C4</b> Increasing Climate Change Impacts on Power System Demands High System Resilience and Trained Manpower Suresh Vishwakarma, Senior Engineer <b>CIGRE-683 C4</b> Utilization of Hybrid PV Systems for Inertia and Frequency Support Raveen Gunarath Adikari Mudiyansele, TransGrid Solutions <b>CIGRE-689 C4</b> Fast and Real-Time EMT Simulations for Hardware-In-The-Loop Controller Performance Testing and for On-Line Transient Stability Analysis of Large-Scale Low-Inertia Power Systems Shijia Li, OPAL-RT Technologies Inc.	<b>SESSION 5 - POSTERS</b> <span style="color: red;">♦</span> <b>CYPRESS 2</b> <b>CIGRE-555 A3</b> Dielectric Investigations of Nitrogen and its Mixtures with CO <sub>2</sub> and N <sub>2</sub> O to Replace SF <sub>6</sub> as Insulating Medium in an Outdoor Circuit-Breaker up to 38kV Mactar THIAM, University of Quebec at Trois-Rivières <b>CIGRE-565 A3</b> Application of Dry-Type High Voltage Condenser Bushings for the AC and DC Grids of the Future Alexander Doutrelepon, HSP Hochspannungsgeräte GmbH <b>CIGRE-593 A3</b> Use of Fault Indicators to Reduce the Duration of Power Outages and Real-Time Monitoring of the Distribution Network Guilherme Martinez Figueiredo Ferraz, HVEX <b>CIGRE-629 B4</b> A Review of the Latest NERC Compliance Standard Under Development Applicable for FACTS and HVDC Systems Zhibo Wang, Mitsubishi Electric Power Products, Inc

## Wednesday, September 27, 2023

09:45 – 10:45	<b>SESSION 13</b> <span style="color: red;">♦</span> <b>PLENARY SALON DEF</b> <b>CIGRE-677 D2</b> Communication Bandwidth Considerations for Digital Substation Applications Jake Groat, Hitachi Energy <b>CIGRE-684 D2</b> Security by Design: Building Security into Your Projects John Biasi, Burns & McDonnell <b>CIGRE-685 D2</b> Securing the Supply Chain Krista Koors, Burns & McDonnell	<b>SESSION 14</b> <span style="color: red;">♦</span> <b>SEYMOUR</b> <b>CIGRE-579 A1</b> Site C Clean Energy Project - A Unique Approach to Turbine-Generator Design Optimization Dustin Dowler, BC Hydro <b>CIGRE-619 A1</b> Decisions and Strategies for Hydro Generators Refurbishment and Replacement Wenli (William) Hong, BC Hydro <b>CIGRE-693 D2</b> "Cybersecurity Challenges in the Electric Vehicle Market" Nalindrani Malimage, Burns and McDonnell	<b>SESSION 15</b> <span style="color: red;">♦</span> <b>MACKENZIE</b> <b>CIGRE-653 C4</b> Evaluating Reliability in Expansion Planning of Primary Distribution Networks Gustavo Aschidamini <b>CIGRE-733 C4</b> Increasing Climate Change Impacts on Power System Demands High System Resilience and Trained Manpower Suresh Vishwakarma, Senior Engineer <b>CIGRE-683 C4</b> Utilization of Hybrid PV Systems for Inertia and Frequency Support Raveen Gunarath Adikari Mudiyansele, TransGrid Solutions <b>CIGRE-689 C4</b> Fast and Real-Time EMT Simulations for Hardware-In-The-Loop Controller Performance Testing and for On-Line Transient Stability Analysis of Large-Scale Low-Inertia Power Systems Shijia Li, OPAL-RT Technologies Inc.	<b>SESSION 5 - POSTERS</b> <span style="color: red;">♦</span> <b>CYPRESS 2</b> <b>CIGRE-555 A3</b> Dielectric Investigations of Nitrogen and its Mixtures with CO <sub>2</sub> and N <sub>2</sub> O to Replace SF <sub>6</sub> as Insulating Medium in an Outdoor Circuit-Breaker up to 38kV Mactar THIAM, University of Quebec at Trois-Rivières <b>CIGRE-565 A3</b> Application of Dry-Type High Voltage Condenser Bushings for the AC and DC Grids of the Future Alexander Doutrelepon, HSP Hochspannungsgeräte GmbH <b>CIGRE-593 A3</b> Use of Fault Indicators to Reduce the Duration of Power Outages and Real-Time Monitoring of the Distribution Network Guilherme Martinez Figueiredo Ferraz, HVEX <b>CIGRE-629 B4</b> A Review of the Latest NERC Compliance Standard Under Development Applicable for FACTS and HVDC Systems Zhibo Wang, Mitsubishi Electric Power Products, Inc
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	SESSION 16 <span style="color: red;">◆</span> PLENARY SALON DEF	SESSION 17 <span style="color: red;">◆</span> SEYMOUR	SESSION 18 <span style="color: red;">◆</span> MACKENZIE	SESSION 6 - POSTERS <span style="color: red;">◆</span> CYPRESS 2
11:15 – 12:15	<p><b>CIGRE-612 D2</b> Utility Perspectives on IT/OT Convergence Kelly Stich, SUBNET Solutions Inc</p> <p><b>CIGRE-626 D2</b> Efficient Power System Operations using a Neuromorphic Computing Approach: A Case Study on IEEE 14-Bus System with Spiking Neural Networks Manish Kumar, Punjab Engineering College, Chandigarh</p> <p><b>CIGRE-724 D2</b> Test Methods for Evaluating the Compression Recovery and Oil Compatibility of Elastomer-Based Gasket Materials Abimbola Akingba, Manitoba Hydro</p>	<p><b>CIGRE-553 A1</b> Extreme Cold Weather Temperature Definition for BC Hydro Bulk Electric System Generating Stations in accordance with NERC EOP-012-1 Standard Christian Bonilla, BC Hydro</p> <p><b>CIGRE-608 B3</b> Experience of Online DGA Device Installation Jack (Jun) Wang, ATCO Electric</p> <p><b>CIGRE-658 B1</b> Reliability of Offline PD Testing of Insulated Medium Voltage Cables: Analyzing PRPD Patterns at Different Frequencies Shahryar Farhang, P.Eng.</p> <p><b>CIGRE-679 B1</b> EHV Oil Filled Cables: Perspicacity After Decades of Operational Experience Prakash Chand Sharma, NHPC LTD</p>	<p><b>CIGRE-632 D1</b> LineOhm and LineCore: Non-Destructive Technologies for Field Monitoring of the Condition of Splice Joints and Overhead Conductors Étienne Martel, Nucleom</p> <p><b>CIGRE-700 B4</b> Design of Solar Powered Bi-Directional DC Fast Charging and Ultra Fast Charging Station Sony Susan Varghese, CANMET, NRCAN</p> <p><b>CIGRE-681 B2</b> Improving ENMAX System Safety with new MV Arc-resistance Switchgear and Retrofitting Switchgear Pallavi Sehgal-Sidhu</p>	<p><b>CIGRE-552 C4</b> Modelling and Benchmarking of Hybrid System in PSS/E and PSCAD Divya Jain, Hatch</p> <p><b>CIGRE-567 C4</b> Utilizing HOMER Pro® for Optimizing Microgrid Design in a Typical Remote/Isolated Community in Canada's North Minoo Shariat-Zadeh, Simon Fraser University</p> <p><b>CIGRE-568 C4</b> Accurate Calculation of VAR demand for appropriate assessment of Power System Vulnerability due to GIC – Case Study Ed teNyenhuis, Hitachi Energy</p>
13:45 – 15:30	<p><b>SESSION 19 <span style="color: red;">◆</span> PLENARY SALON DEF</b></p> <p><b>CIGRE-682 B5</b> Line Protection Operate Time: Speed vs. CB Wear, Power System Stability and Security Mike Kockott, Hitachi Energy, USA</p> <p><b>CIGRE-714 B5</b> DER Integration: Transformer Overload Protection Using Wireless Communications Galina Antonova, Hitachi Energy</p> <p><b>CIGRE-586 B5</b> Critical Infrastructure Protection with Modern Protection Relays Daniel Ransom, GE Vernova</p> <p><b>CIGRE-598 B5</b> Modern Capacitor Bank Protection Methods Daniel Ransom, GE Vernova</p> <p><b>CIGRE-699 B5</b> Protection Data Analysis in Phasor Domain Environment Daniyal Qureshi, Hydro One Networks Inc.</p> <p><b>CIGRE-701 B5</b> Lessons Learned: Implementation of the IEC 61850 Process Bus Technology in ATCO Electric Substation – A Pilot Project Henry Zeng, ATCO</p>	<p><b>SESSION 20 <span style="color: red;">◆</span> SEYMOUR</b></p> <p><b>CIGRE-561 A2</b> Switching Transient Overvoltage Issues for GIS and Associated Equipment Design Luke Wang, BC Hydro</p> <p><b>CIGRE-563 A2</b> Mitigation of High Transient Recovery Voltage for the 230 kV Shunt Reactor Protective Tripping Bruce Chen, BC Hydro</p> <p><b>CIGRE-597 A2</b> Optimizing Power Transformer Maintenance with 1Hz testing and Individual Temperature Correction Cade Patton, Megger</p> <p><b>CIGRE-613 A2</b> Power Transformer Digitization - A Custom Approach Guibin Zhang, ATCO</p> <p><b>CIGRE-627 A2</b> GMD Induced Part-Cycle Core Saturation Detection and It's Thermal Impact to Temperature of Power Transformers Winding Hot-Spot and Structural Parts Hakim Dulac, Advanced Power Technologies</p> <p><b>CIGRE-654 A2</b> Enhancing Transformer Oil Dissolved Gas Analysis Methods by Utilizing Artificial Neural Networks with Ensemble Classification Kale Ewasiku, University of Manitoba</p>	<p><b>SESSION 21 <span style="color: red;">◆</span> MACKENZIE</b></p> <p><b>CIGRE-562 C2</b> Grid Forming Inverter (GFM) Capabilities and Challenges for Black Start Procedure of an Islanded Network Sam Maleki, Electric Power Engineers</p> <p><b>CIGRE-582 C2</b> Quantifying Alarm Performance for Power Networks by Adapting and Extending Indicators Antony Hilliard, Hitachi Energy Research</p> <p><b>CIGRE-625 C2</b> Self Synchronizing Grid Connected Converter Using First Order Sliding Mode Control Tuhin Das, University of Manitoba</p> <p><b>CIGRE-676 C2</b> Preliminary Results on the Transient Stability Assessment of a Grid-connected Inverter Using a Decision Tree Terulun Terulun, University of Manitoba</p> <p><b>CIGRE-698 C2</b> Centralizing Power System Model Information to Improve Automation Capabilities, Operational Readiness, and Efficiency Gary Webster, Quanta Technology</p> <p><b>CIGRE-704 C2</b> Application of Virtual Synchronous Machine Approach to Control a Solar PV to Improve System Stability Randupama Gunasekara, University of Manitoba</p>	<p><b>SESSION 7 - POSTERS <span style="color: red;">◆</span> CYPRESS 2</b></p> <p><b>CIGRE-596 C5</b> Integrating Green Hydrogen Systems in Day-Ahead Electricity Market Auctions Anshul Goyal, University of Waterloo</p> <p><b>CIGRE-601 D2</b> Are you ready for FERC 881? Jerry Day, IPS-ENERGY USA, Inc</p> <p><b>CIGRE-621 D2</b> Cyber Interdependency Assessment of Communication Networks for Power Systems Dr. Sajal Sarkar, Power Grid Corporation of India Ltd</p> <p><b>CIGRE-640 C1</b> Considerations for Developing Clean Electricity Projects for Indigenous Communities Jeanie Chin, ATCO</p> <p><b>CIGRE-651 D2</b> Online Monitoring of Substation Equipment Russell Samasuwo, Engineered Intelligence Inc.</p>
16:00 – 17:00	<p><b>SESSION 22 <span style="color: red;">◆</span> PLENARY SALON DEF</b></p> <p><b>CIGRE-631 C6</b> The future of DER Management begins with Visibility George Bjelovuk, Siemens Industry, Inc.</p> <p><b>CIGRE-647 C6</b> Study on the Mechanism of Synchronization Loss of Type IV Wind Turbine Generator and Its Simulation Method Wei Li, Powertech Labs Inc.</p> <p><b>CIGRE-697 B5</b> 15 Years, Continuing Journey Securing, and Managing Edge Devices Ameen Hamdon, SUBNET Solutions Inc</p>	<p><b>SESSION 23 <span style="color: red;">◆</span> SEYMOUR</b></p> <p><b>CIGRE-570 C1</b> ENMAX's Electric Vehicles, Solar PV, and Building Electrification Forecast and Load Analysis Mayssam Amiri, ENMAX Power</p> <p><b>CIGRE-624 C2</b> Developing an Optimal Hybrid Power Plant Controller for a 100MW Solar and BESS Power Plant Kasun Samarasekera, Electric Power Engineers</p> <p><b>CIGRE-705 C1</b> Transition to Net Zero =&gt; Smart Grid: The Digital Platform that Enables an Economical Transition (Business Impact) Syed Shah Nawaz Ahmed, Siemens Canada</p>	<p><b>SESSION 24 <span style="color: red;">◆</span> MACKENZIE</b></p> <p><b>CIGRE-606 C5</b> Offshore wind transmission planning in Canada – Lessons Learned from US Mohsen Zadeh, Jacobs Engineering Group</p> <p><b>CIGRE-636 D2</b> The Compelling Case for an Open Clean Technology-Focused Engineering Knowledge Graph Joel Krupa, University of British Columbia</p> <p><b>CIGRE-688 C5</b> Taming Uncertainties from Renewable Resources: Industry Experience on Data-Driven Models for Flexibility Markets Julio Massignan, Siemens</p>	<p><b>SESSION 8 - POSTERS <span style="color: red;">◆</span> CYPRESS 2</b></p> <p><b>CIGRE-554 C6</b> Optimizing PV-Battery Grid-Connected Power Systems with Peak Shaving Control: A Techno-Economic Feasibility Analysis for Metro Vancouver, BC Payam Tavakoli, BCIT</p> <p><b>CIGRE-602 A1</b> Advanced Corona Partial Discharge Detection and Localization for High Voltage Rotating Machines: Abstract Eran Frisch, OFIL Systems</p> <p><b>CIGRE-611 C6</b> Fast Electric Vehicle Charging Stations Configured as Microgrids Geza Joos, McGill University</p> <p><b>CIGRE-644 A1</b> Current &amp; Emerging Techniques in Motor Failure Detection Atef Boukadi, Technical Application Specialist</p>

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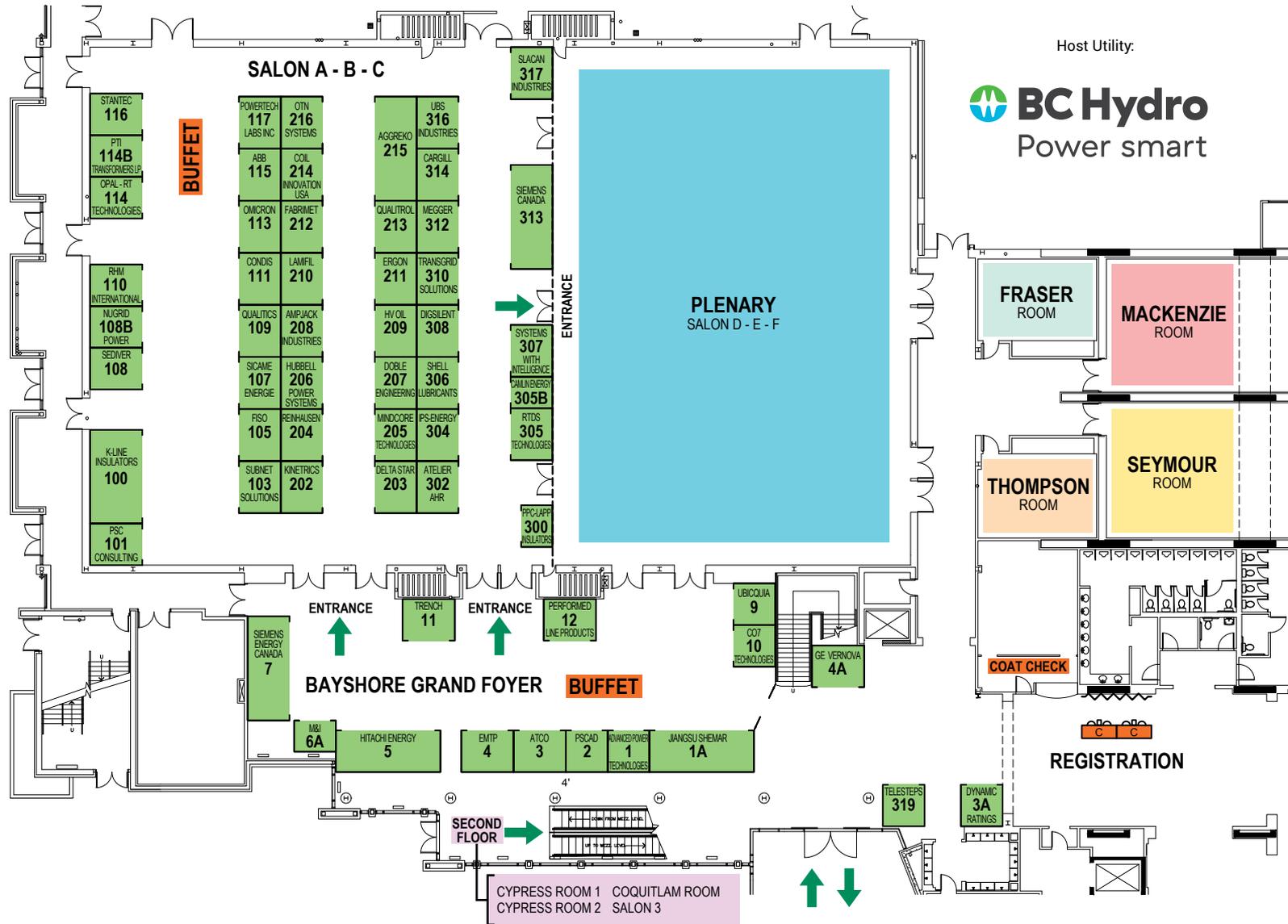


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**TUESDAY, SEPTEMBER 26, 2023** ⌚ 08:30 – 09:00 📍 **PLENARY SALON DEF**

## KEYNOTE BC Hydro’s Plan for a Clean Future Powered by Water

PRESENTED BY: **Chris O’Riley**, President and CEO, BC Hydro

Through its CleanBC plan, the Government of B.C. has set ambitious targets to lower climate-changing emissions by 40% by 2030 and achieve net-zero carbon pollution by 2050. An important part of reaching these goals will be to make it easier for people and businesses to switch from using fossil fuels to clean energy. This includes 100% of light-duty vehicles being zero-emission by 2035 and all new buildings to be zero-carbon by 2030. We’re fortunate in B.C. that 98% of the power BC Hydro generates already comes from clean or renewable resources, mostly powered by water. And this will play a significant role in the province’s energy transition. BC Hydro has a plan to meet the increased demand for electricity that ensures we meet our technical, reliability and regulatory requirements, while keeping rates affordable for our customers.



Chris O’Riley

**TUESDAY, SEPTEMBER 26, 2023** ⌚ 09:00 – 10:00 📍 **PLENARY SALON DEF**

## BUSINESS PANEL

### What Has to Change From the Business Perspective to Meet Electrification Targets in BC/Canada/Global?

PRESENTED BY: **Nathan Bingham**, Chief Digital Officer, POWER Engineers  
**Osmond J. Tsang**, Regional VP, Utility Sales, Western Canada, HITACHI  
**Ahsan Upal**, Regional Manager, Business Development, Burns & McDonnell  
MODERATOR: **Melissa Holland**, VP Project Delivery, BC Hydro

The push to decarbonize the energy we use has resulted in aggressive targets to increase the use of electricity for residential, commercial and industry uses. This increase in demand has both opportunities and challenges for electricity related businesses which already face a constrained supply chain from design expertise to raw materials to manufacturing capacity. The business panel discussion will focus on what needs to change for businesses and in the relationship between businesses and customers to meet local, national and international electrification targets.



Nathan Bingham



Osmond J. Tsang



Ahsan Upal



Melissa Holland

TUESDAY, SEPTEMBER 26, 2023 12:00 – 13:15 PLENARY SALON DEF

## WOMEN IN ENERGY LUNCHEON Accelerating the Energy Transition

PRESENTED BY: **Colleen Giroux-Schmidt**, VP Corporate Relations, Innergex  
**Joanna Osawe**, Senior BD Manager, Burns & McDonnell, and President & CEO, WiRE  
**Kirsten Peck**, Senior VP, Safety & Chief Compliance Officer, BC Hydro  
MODERATOR: **Robyn Koropatnick**, Global Sector Lead HVDC, Stantec

The energy transition is a shift in how we produce and consume energy. During the past few years, we have also seen a significant transition in the way we live, work, and create community. In this panel, we will discuss factors that are accelerating the energy transition.



Robyn Koropatnick



Colleen Giroux-Schmidt



Joanna Osawe



Kirsten Peck



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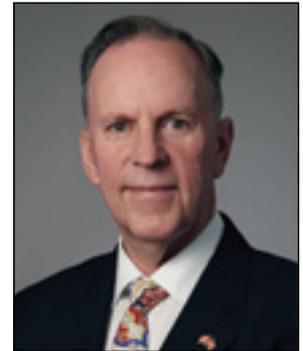


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📅 WEDNESDAY, SEPTEMBER 27, 2023 ⌚ 08:00 – 08:30 📍 PLENARY SALON DEF

## KEYNOTE Perspective on the Opportunities and Challenges With Accelerating Electrification and the Evolution of the Power System

PRESENTED BY: **Francis Bradley**, President & CEO, Electricity Canada



Francis Bradley

At the start of the big shift: Canada’s electrification journey is only beginning. With almost \$1 of every \$8 of anticipated new spending going to clean electricity projects, this year’s Federal Budget is not only a down-payment on a low-carbon future, it also seeks to make clean electricity more affordable. Even so, we will need an equally significant expenditure of political capital if we are to achieve the level of collaboration required to see significant progress in meeting our Greenhouse Gas reduction goal. Canada also needs regulation that is flexible: the government’s draft Clean Energy Regulations has begun that conversation, though considerable work is still needed for it to be effective across the country. And there are practical concerns, ranging from how we get regulators whose rule book was (literally) published in the 1960s to accept the realities of net zero, to what Canada needs to do build massive infrastructure projects faster. Join Electricity Canada CEO Francis Bradley as he surveys the opportunities, and challenges, for the electricity sector in the coming years.

📅 WEDNESDAY, SEPTEMBER 27, 2023 ⌚ 08:30 – 09:30 📍 PLENARY SALON DEF

## CEO PANEL What Would Have to Be True to Accelerate Electrification?

PRESENTED BY: **Chris O’Riley**, President & CEO, BC Hydro; **Jay Grewal**, President & CEO, Manitoba Hydro; **Francis Bradley**, President & CEO, Electricity Canada; **Pierre Poulain**, President & CEO of Powertech Labs Inc.

MODERATOR: **Diana Stephenson**, Senior VP Customer & Corporate Affairs, BC Hydro

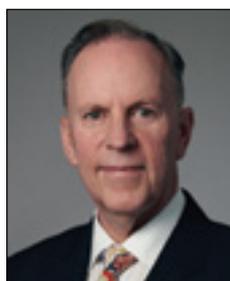
Canada has a plan to achieve net-zero carbon emissions by 2050 as a means to minimize climate-change related risks. The push to decarbonize our energy supply has triggered an increase in demand for clean electricity from all sectors of the economy and is expected to be unlike anything we have seen since the last big electrification boom of the 1950s. Combined with aging and at-capacity electrical infrastructure, this represents both a challenge and an opportunity for utilities. The members of the CEO panel will discuss what needs to be true to meet the accelerating demand for electricity.



Chris O’Riley



Jay Grewal



Francis Bradley



Pierre Poulain



Diana Stephenson

📅 WEDNESDAY, SEPTEMBER 27, 2023 ⌚ 12:15 – 13:45 📍 PLENARY SALON DEF

## NGN Panel Luncheon

### How the Next Generation is Preparing to Tackle Future Challenges

PRESENTED BY:

**Russell Samasuwo**, Director, Client Services - Engineered Intelligence Inc.

**Mark Mitchell**, Global Lead, Distributed Energy Solutions & Microgrids, Hatch Ltd.

**Roshani Kaluthanthrige**, Power Systems Specialist, Simulation & Studies, TransGrid Solutions

**Kurtis Martin-Sturmey**, Manager, Asset Management & Performance, BBA

MODERATOR: **Aine NurAizza Nuruddin**, Electrical EIT, Hatch Ltd.

CIGRE Canada's Next Generation Network (NGN) aims to support the next generation of Canadian Power System Professionals by providing opportunities for technical growth, networking and leadership skills for Students and Young Members. Our panel session would be the perfect opportunity to explore industry trends, learn from success stories of experienced professionals and gather the tools required to address future challenges!



Russell Samasuwo



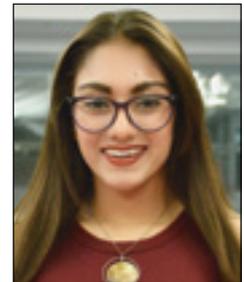
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SEPTEMBER 25  
**MONDAY**

### Welcome Reception 📍 CASUAL (OPEN TO ALL)

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### Lunch (OPEN TO ALL)

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**TUESDAY**

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🕒 17:45–19:00

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### Banquet 📍 BUSINESS CASUAL (UPON REGISTRATION)

The conference banquet is an evening of fine dining and stimulating conversation, providing an opportunity to salute the work accomplished during the conference. Network with participants and enjoy the entertainment.

The finalists for the Best Student Paper Award, Best NGN Paper Award, and Best Paper Overall Award will be presented during the banquet.

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🕒 19:00–22:00

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🕒 06:45–08:00

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### Networking Breaks (OPEN TO ALL)

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🕒 09:30–09:45 10:45–11:15 15:30–16:00

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### Lunch (OPEN TO ALL)

🕒 12:15–13:45

📍 SALON ABC + BAYSHORE GRAND FOYER



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### CIGRE Canada NGN Networking Reception Outside the Hotel 📍 CASUAL (UPON REGISTRATION)

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### Award Presentation, Prize Draw & Closing Remarks 📍 CASUAL (UPON REGISTRATION)

In recognition of the outstanding contributions for the 2023 CIGRE Canada Conference, 3 awards will be presented:

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🕒 17:00–17:30

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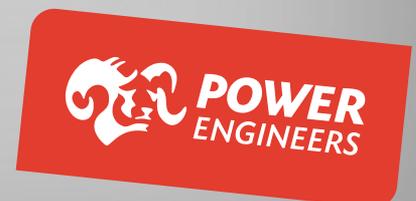
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