

Technology Innovation & Policy Forum

2016

Microgrids & Distributed Energy Is there a revolution in the making?



Thursday November 24
University of Waterloo
Federation Hall

Conference Program

8:30 am **Registration & Continental Breakfast**

9:30 am **Welcome**

Glen Wright, Chairman, Council for Clean & Reliable Energy (CCRE)

Jatin Nathwani, Executive Director, Waterloo Institute for Sustainable Energy (WISE); Member CCRE

9:45 am **Keynote Speaker**

Bruce Campbell, President and CEO, Independent Electricity System Operator

Innovation in Ontario's Electricity Sector

10:15 am **Break**

10:30 am **Panel 1: Technology and Disruptive Innovation**

Declining cost structure of distributed energy resources (solar, EVs and storage, microgrids) pose a challenge to the utility distribution network. Will prosumers proliferate? Is the state of technology mature enough for a massive exodus of customers and is there a real threat of stranded assets?

Moderator: **Jatin Nathwani**, Executive Director, WISE; Member, CCRE

Panelists: **Mark Henderson**, EVP, Asset Management and COO, PowerStream

Josipa Petrunic, Executive Director and CEO, Canadian Urban Transit Research and Innovation Consortium (CUTRIC)

Hartmut Schmeck, Professor of Applied Informatics, Karlsruhe Institute of Technology (KIT), University of Karlsruhe, Germany

David Teichroeb, Business Development, Emerging Technology, Enbridge Gas Distribution

Q&A Session: 45 minutes

12:00 pm **Lunch**

12:30 pm **Innovation Showcase, Networking & Industry-Academic Collaboration**

1:15 pm **Optional Lab Tours** (for Pre-registered Guests)

Lab 1: Fuel Cell and Green Energy Lab

Lab 2: Centre for Advanced Photovoltaic Devices

1:30 pm **Panel 2: Financing: Business Models; and, Regulatory Construct: Policy Alignment**

The traditional 'cost recovery' model for the electricity sector was designed and built for a one-way flow of energy technology. Technology is changing the texture of the system. Will distributed energy resources, high penetration of variable generation and ICT-enabled consumers undermine the existing business model of the distribution utilities?

Moderator: **David McFadden**, Counsel, Gowling WLG (Canada) LLP; Member, CCRE

Colin Andersen, Chair, Energy Council of Canada

Brian Poth, Partner, Power and Utilities, PricewaterhouseCoopers

Paul Murphy, Board Chair, Advanced Energy Centre

Vicky Sharpe, Corporate Director and founding President and CEO, Sustainable Development Technology Canada (SDTC)

Q&A Session: 45 minutes

3:00 pm **Wrap-Up and Closing Remarks**

David McFadden, Jatin Nathwani and Glen Wright

3:15-5:30pm **Reception, Innovation Showcase, Networking & Industry-Academic Collaboration**

Please join us for a Networking Reception

Optional Lab Tour 3:45 pm (for Pre-registered Guests)

Lab 2: Centre for Advanced Photovoltaic Devices

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KEYNOTE SPEAKER



Bruce Campbell

Bruce Campbell is President and Chief Executive Officer of the Independent Electricity System Operator (IESO). Under Mr. Campbell's leadership, the IESO oversees the safe and reliable operation of Ontario's bulk electrical system and market as well as long-term energy planning and procurement, and the promotion of a conservation culture in the province.

Mr. Campbell was instrumental in preparing Ontario's power system for the integration of Ontario's growing investment in renewable wind and solar generation. Under his direction, the IESO has introduced innovative technologies such as storage into the power system and is actively pursuing more competitive, cost-effective solutions to meet future power needs.

In addition, Mr. Campbell represents Ontario on several international fronts. He serves on the North American Electric Reliability Corporation's (NERC) Member Representative Committee, the Council of Independent System Operators and Regional Transmission Organizations which supports sustainable and reliable electric power delivery to millions of consumers across the continent.

A graduate of Osgoode Hall Law School and the University of Waterloo, Mr. Campbell is a member of the Law Society of Upper Canada, and also holds the Institute of Corporate Directors ICD.D (Certified Director) designation.

On January 1, 2015, Mr. Campbell assumed responsibility as President and CEO of the merged Independent Electricity System Operator, which integrated with the Ontario Power Authority.

Colin Andersen

Colin Andersen is Chair of the Energy Council of Canada, which was established in 1923 as a founding member of the World Energy Council. The Energy Council of Canada strives to shape an affordable, stable and environmentally sensitive energy sector for the benefit of all Canadians. The Energy Council covers all sectors involved in energy in Canada, and brings together senior executives from industry and government engaged in regional, national, continental and global activities.

Mr. Andersen was Chief Executive Officer of the Ontario Power Authority (OPA), responsible for ensuring a reliable, sustainable, cost-effective supply of electricity for Ontario. He led the organization in its efforts to coordinate province-wide conservation initiatives, plan the electricity system for the long term and procure clean supply resources.

Prior to joining the OPA in 2008, Mr. Andersen held a variety of senior financial and policy positions in the Ontario Public Service, including as Deputy Minister of Finance, of Revenue, of Policy, Cabinet Office and Acting Deputy Minister of Health and Long-Term Care; Secretary of Treasury Board; Chair of the Ontario Financing Authority; and Chair of the Ontario Electricity Financial Corporation.

In these and other senior management positions, Mr. Andersen provided successive governments with advice and assistance on all aspects of fiscal and financial policy and planning, expenditure management and overall stewardship of Ontario's financial resources. In addition, he has led strategic asset management initiatives, extensive intergovernmental negotiations at the federal and municipal level and large-scale infrastructure and procurement projects.

He has a Masters Degree in Economics from the University of Toronto and an Honours Bachelor of Arts from the University of Calgary.

Mark Henderson

Mark Henderson is Executive Vice President, Asset Management and Chief Operating Officer of PowerStream Inc., the second largest municipally-owned electricity distribution company in Ontario.

PowerStream serves more than 360,000 customers in eleven communities across York Region and Simcoe County and is jointly owned by the City of Vaughan, the City of Markham and the City of Barrie.

Formerly, Mark was President and CEO of Barrie Hydro Distribution Inc. Prior to joining Barrie Hydro, Mark spent more than a dozen years in the business strategy and management consulting industry.

David McFadden, Q.C.

David McFadden is a Counsel at Gowling WLG and formerly served as a member of both the firm's Board of Trustees and Executive Committee. David has extensive experience, whether it be for clients investing or operating in Canada, Canadian clients investing or operating internationally or international clients investing abroad, particularly in the energy, infrastructure, financial services and technology industries.

David acts for corporations, municipalities and utilities involved in the generation, distribution, marketing, transmission and financing of energy. He also acts for clients involved in infrastructure development, management and renewal. He has acted as counsel in a variety of infrastructure projects including toll highways and tunnels, light rail systems and health care facilities.

David serves in leadership roles in the Canadian energy industry. He is currently the chair of the board of directors of the Ontario Energy Association and a member of the board of directors of the Energy Council of Canada. He is a member of the Smart Grid Forum of the Independent Electricity System Operator and serves on the advisory board of the MaRS Advanced Energy Centre and on the Council for Clean & Reliable Energy.

David is active in the business corporation sector. He currently serves as chair of the board of directors of 407 International Inc. and is chair of the Canadian and international infrastructure advisory board of Fengage Capital Management Ltd. David is also the chair of the board of directors of Toronto Hydro-Electric System Ltd. and PCI Geomatics and the former chair of the board of directors of Collus PowerStream Inc.

Over the years, David has advised government on energy matters both in Canada and internationally. He served as co-chair of the Electricity Transition Committee of the Ontario Government (1998-2002), a member of the Electric System Working Group of the Joint Canada-US Task Force established to investigate the power blackout that hit Ontario and much of the northeastern United States (2003-2004), a member of the Ontario Government's Electricity Conservation and Supply Task Force (2003-2004), co-leader of an investigation established by the Government of Jamaica to review the reliability of the island's transmission system (2006), a member of the Ontario Government's Electricity Distribution Sector review panel (2012), and chair of the Independent Review Committee appointed by Toronto Hydro to review its response to a major ice storm event in December 2013 (2014).

He has a B.A. from the University of Toronto, an LL.B. degree from Osgoode Law School and was called to the Bar in Ontario in 1972. In 2011 he was awarded an honorary doctorate from York University.

Paul Murphy

Paul Murphy is the Chair of the Board of the Advanced Energy Centre. He has been involved with the planning and operation of the Ontario and North American electric system for over 35 years.

Prior to joining the Advisory Board of the Advanced Energy Centre, Paul was President and CEO of Ontario's Independent Electricity System Operator, responsible for directing the reliable operation of the Ontario power system and for administering the competitive electricity market.

While with the IESO, Paul was the founding Chair of the Ontario Smart Grid Forum. The Forum brings together members from the utility sector, industry associations, non-profit organizations, public agencies and universities to propose a vision for a smart grid in Ontario and examine the many components that comprise it.

Paul has a BSc in Applied Science from Queen's University and is a registered Professional Engineer in Ontario.

Dr. Jatin Nathwani

Professor Nathwani is the founding Executive Director, Waterloo Institute for Sustainable Energy (WISE) and holds the prestigious Ontario Research Chair in Public Policy for Sustainable Energy at the University of Waterloo.

WISE brings together the expertise of 110+ faculty members to develop and implement large-scale multi-disciplinary research projects in collaboration with business, industry, governments and civil society groups. The vision of the Institute is simple: clean energy, accessible and affordable for all.

His current focus is on implementing a global change initiative. He is the Co-Director, with Professor Joachim Knebel (Karlsruhe Institute of Technology, Germany), of the consortium 'Affordable Energy for Humanity (AE4H): A Global Change Initiative' that comprises 100+ leading energy access researchers and practitioners from 23 institutions and 12 countries.

Prior to his appointment at the University in 2007, Professor Nathwani worked in a leadership capacity in the Canadian energy sector over a 30 year period. He brings a unique combination of academic perspectives with extensive experience in the business sector that includes corporate planning and strategy, energy sector policy developments, power system planning, environmental and regulatory affairs and research program management.

Professor Nathwani serves on several Boards at the provincial and national

levels and has appeared frequently in the media (print, TV, radio) and has over 100 publications related to energy and risk management, including seven books.

Professor Nathwani holds a PhD in Engineering from the University of Toronto and is a registered Professional Engineer in the Province of Ontario.

Dr. Josipa Petronic

Josipa Petronic is the Executive Director & CEO of the Canadian Urban Transit Research & Innovation Consortium (CUTRIC). She is leading the formulation of several large-scale transportation technology trials through CUTRIC's consortium of private and public sector stakeholders, including the Pan-Ontario Electric Bus Demonstration and Integration Trial.

Dr. Petronic also served as the lead researcher in electric vehicle policy studies at McMaster University. She is currently completing the Ontario Electric Vehicle Technology Roadmap funded by a federal Automotive Partnership Canada (APC) grant and slated for publication in Fall 2016.

Dr. Petronic worked previously as a senior research fellow at University College London (UCL) in the United Kingdom focusing on Science and Technology Studies and the history of mathematics and engineering. She completed her PhD in the History of Mathematics at the University of Edinburgh (Scotland) as a Commonwealth Scholar, after completing a Master's of Science in Science and Technology Studies (STS), also as a Commonwealth Scholar. She previously completed a Master's of Science in Political Philosophy at the London School of Economics and Political Science (LSE) and a bachelor's degree in Political Science and Journalism at Carleton University.

Before pursuing graduate studies, Dr. Petronic worked as a journalist at the Globe and Mail, Toronto Star and Edmonton Journal. Dr. Petronic continues to lecture in Globalization Studies at McMaster University as part of the Institute for Globalization, and she lectures in interdisciplinary research methods as part of the Master of Arts in Integrated Studies program at Athabasca University.

Brian Poth

Brian is a Partner in PricewaterhouseCoopers (PwC) Toronto office, leads the Canadian Power and Utility practice and is a member of PwCs' global Power & Utility Centre of Excellence. Brian has spent more than 20 years helping electricity and gas utilities improve their performance in both consulting and operational support roles. He has a passion for the energy sector transformation that is underway and experience to share across customer, asset, work management and technology domains.

Prof. Dr. Hartmut Schmeck

Hartmut Schmeck studied at the Universities of Kiel (Germany) and Waterloo (Canada). He obtained his academic degrees (Dipl. Inform., Dr.rer.nat., Dr. habil) at Kiel. Since 1991, he has been a Full Professor of Applied Informatics at the Karlsruhe Institute of Technology - (KIT).

Dr. Schmeck is (co-)author of more than 140 publications on advanced algorithms and architectures, in particular on nature-inspired methods in optimisation, algorithms for reconfigurable architectures, and on self-organising, adaptive systems applied to energy and traffic systems. He has been program and conference chair for numerous international workshops and conferences (a.o. RAW, ARCS, IFIP BICC 2006, 2008, ATC 2009, ICAC 2011, D-A-CH Energieinformatik) and coordinator of the German priority research program SPP 1183 on "Organic Computing".

At Karlsruhe, he is one of the two Scientific Spokespersons of the KIT-Center "Information • Systems • Technologies". As a principal investigator of several cooperative projects in various funding programs he is pushing the development of intelligent systems in tomorrow's energy systems and for electric mobility, shaping the new discipline of "Energy Informatics", in particular as a director of the FZI Research Center for Information Technology.

In 2016, his achievements were honoured with the Heinrich-Hertz Prize from the EnBW Foundation.

Dr. Vicky Sharpe

Vicky is a long term champion of integrating the environment and the economy. As the first employee and founding President and CEO of SDTC, Vicky has built an internationally renowned global cleantech fund. She increased public funding from \$100M in 2001 to over \$1.4B in 2014 and mobilized private sector capital for project funding and commercialization financing of \$4.3B.

CONFERENCE PRESENTERS CONTINUED

Dr. Sharpe has successfully applied her 35 years of diverse experience in the energy, power and financial sectors with her entrepreneurial attributes, operations and leadership skills to deliver innovative solutions to Canada's primary economic sectors, increasing productivity, competitiveness and boosting exports. As VP of Ontario Hydro International Inc., she created new revenues for environmental and energy utilization practices as well as for generation and transmission businesses. Previously, she held management positions in marketing, business development and technology innovation.

Vicky is helping to shape the Canadian cleantech and investment landscape through the provision of strategic advice and leadership. She is a founding member of the Boards of; The Capital Markets Regulatory Authority, Alberta Enterprise Corporation - a fund of funds entity, Carbon Management Canada Inc. (CMC) a national network focused on a low carbon future for Canada's fossil energy sector, amongst others. Recently Vicky joined the Board of Temporal Power Ltd. (energy storage) and QUEST (Quality Urban Energy Systems for Tomorrow). Vicky has applied her governance skills (ICD.D, 2005) to boards on which she has served as well as many of SDTC's 270+ portfolio companies. She is cited by "Women on Board" and the Canadian Board Diversity Council (2015 cohort).

Vicky has served on numerous technology, industry association, investment and government committees. She represented the Canadian energy sector at the Asia-Pacific Economic Cooperation (APEC) Business Forum and has chaired both the National Advisory Board on Energy, Science and Technology, and the Board of Clean Air Canada Inc. As part of Vicky's commitment to delivering tangible commercialization results, she has joined EnerTech Capital's Advisory Board and is a member of the Advisory Panel for Mercer's Sustainable Opportunities Fund. She is an inaugural member of the Leaders

Group of Smart Prosperity that is driving a more sustainable approach to Canada's environment and the economy, has provided a report to the Ecofiscal Commission on financing options for utilization of carbon pricing revenues, delivered a strategic review and recommendations on strengthening innovation in the cleantech ecosystem for the Ontario Government and been a panel member for the Council of Canadian Academies.

For her work in advancing sustainability and clean capitalism Vicky has been awarded a number of honours. In 2016 she received the Chemical Institute of Canada Society for Chemical Industry Purvis Memorial Award (for business development for the chemicals sector). Vicky, "#Innovation Booster", was one of the 2012 Clean16 and 2015 Clean16 recipients as part of Canada's Clean50 initiative (www.clean50.com). Also, she received a Lifetime Achievement Award from Sustainable Buildings Canada, The Globe Foundation's Finance Award for Sustainability and the National Energy Conservation Association's inaugural Energy Efficiency Award.

Dr. Sharpe holds a BSc Honours in Applied Biology from Bath University, UK, and a PhD in Microbiology and Surface Chemistry, as applied to water pollution control, from Trent University, UK. In 2014 Vicky was appointed as a Senior Fellow of the International Institute for Sustainable Development and Senior Fellow at the University of Ottawa in 2016.

David Teichroeb

David has over 20 years of experience in the natural gas and power generation sectors. He is responsible for evaluating and developing new business investments involving emergent technologies. This includes distributed generation, fuel cells, energy recovery to power, hydrogen, electricity energy storage and other renewable technologies.

Before joining Enbridge in 1993, David worked in the diesel power generation

industry. He provided engineering and technical services to a varied customer base that included Canada Steam Ship Lines, the Canadian Coast Guard, and John Deere.

David graduated from Niagara College, mechanical engineering technology, and he is a graduate of the Institute of Gas Technology in Chicago, IL, as a Chartered Industrial Gas Consultant. He serves as a Board Director and Vice Chairman, for the Canadian Hydrogen and Fuel Cells Association.

Glen Wright

Glen Wright is the Chairman of the Council for Clean and Reliable Energy, a federally incorporated non-profit volunteer organization that provides a platform for open dialogue and solutions-oriented approach to the challenges of the energy sector. He is the former Chairman of Waterloo North Hydro.

Mr. Wright is currently the Chairman of LeanCor LLC and LeanCor Canada Inc., a global supply chain company that offers a unique combination of training and education, hands-on consulting and outsourced logistics services.

Mr. Wright has served as the Chair of Hydro One Inc. and Chair of the Ontario's Workplace Safety and Insurance Board, and was a Member of the Commission for Environmental Cooperation, part of the North American Free Trade Agreement, where he served as the Chair of the of the Joint Public Advisory Committee.

Glen's private sector career has focused primarily on the insurance and actuary fields. He has served on the Board of a wide range of corporations in the environmental, technology and manufacturing sectors and participated in a variety of charitable and not-for-profit Boards including the Canadian Broadcasting Corporation and Wilfrid Laurier University. Early on in his career he served as a Member of Waterloo City Council and Waterloo Regional Council, and has acted as an advisor to senior federal and provincial leaders.

Lab 1 Tour:

1:15 – 1:45 pm

Fuel Cell and Green Energy Lab

Investigating green energy topics through modeling, system analysis, experimental research and scale-up design. Among our current projects, we are developing reliable, cost-effective polymer electrolyte membrane fuel cells and clean biodiesel engines for automotive purposes. Our lab capabilities include materials characterization, process development, circuit design and fabrication, and prototyping.

Lab 2 Tour:

1:15 – 1:45 pm
3:45 – 4:15 pm

Centre for Advanced Photovoltaic Devices and Systems (CAPDS)

Promotes cutting-edge research and development that spans the spectrum of photovoltaic (PV) technology. Our 14,000-square-foot facility includes infrastructure for synthesizing semiconductor base materials; developing nanotechnologies for PV; designing and fabricating advanced PV devices and systems modules; and testing and characterizing PV materials, devices and systems.

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