NSERC
Energy Storage
Technology Network

Leading the Charge

Conference Proceedings
Friday, June 23, 2017

#LeadingTheCharge

Ryerson University
Centre for Urban Energy

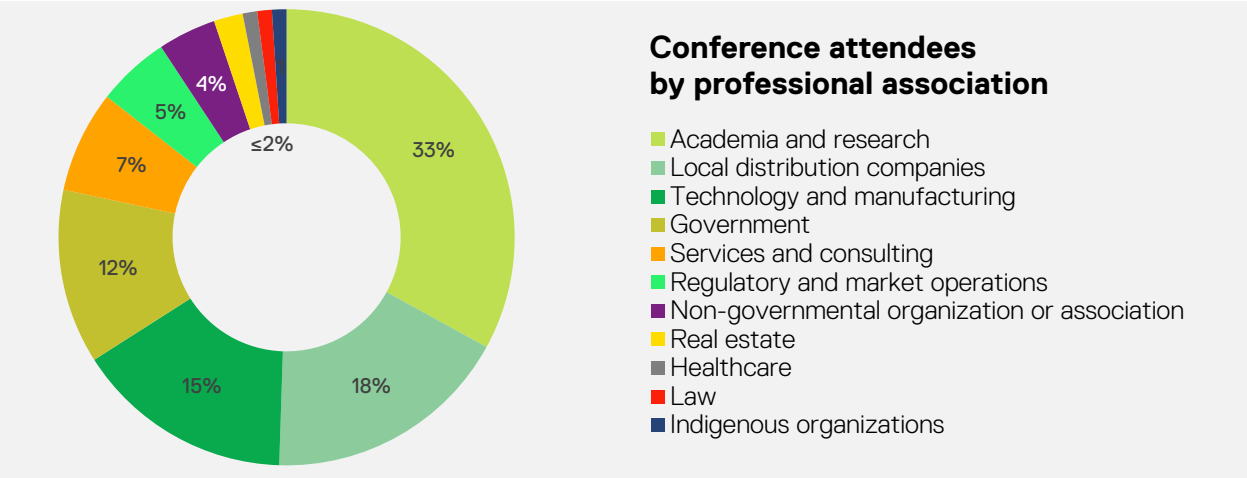
NSERC
CRSNG

The second annual NSERC Energy Storage Technology Network *Leading the Charge* Conference took place on Friday, June 23, 2017 at the Sears Atrium in Ryerson University's George Vari Engineering and Computing Centre in Toronto, Ontario. The intention of the conference was to provide a platform for stakeholders — including technology providers, local distribution companies, government and academia — to come together and share their perspectives on the challenges and opportunities of energy storage. Opening remarks were provided by Steven Liss, Vice-President of Research and Innovation at Ryerson University, and Bala Venkatesh, Academic Director of Ryerson's Centre for Urban Energy.

Acknowledgements

The Centre for Urban Energy (CUE) at Ryerson University would like to gratefully acknowledge the support from the Natural Sciences and Engineering Research Council of Canada (NSERC), without whom the event would not have been possible.

We would also like to thank all of our speakers, moderators and panelists who graciously donated their time, experience and insights. Last but not least, we extend our thanks to the around 100 conference attendees who enlivened the day with thought-provoking questions and discussion.



Disclaimer

Keynote 1: Wind and solar energy's role in the low carbon economy

Hon. Glen Murray, MPP
Ontario Minister of the Environment and Climate Change

We live in difficult times. Climate change influences our way of thinking, culture, and politics. All areas of knowledge are involved and impacted by climate change. Pursuing the problem blindly from one's own area of specialization will not help. We need more generalists specialising in many areas of knowledge. We need to take the matter seriously with an entire shift in our use of energy and technology. Involvement should include everyone, not only scientists.

Photos by Clifton Li (Ryerson University Image Arts '12).

Climate change should be considered as “going to the war”. German and Chinese governments have taken it very seriously and have embarked on a technology shift. There is productivity in carbon innovation. In Ontario talking about climate change is like a cancer patient who does not like to talk about cancer. We have to take it very seriously.

Only three jurisdictions in North America have tacked to keep their GHG emissions below 1990 levels. One of the big tasks for politicians is to create pathways for people of knowledge to design policies because the impact of climate change is very harsh. The biggest recent climate event is the one-in-900-hundred-years drought that happened in Syria. The agriculture collapse caused by drought triggered the instability. Everything is connected to everything; global effects always come back to us. The responsibility is ours.

We are building one of most intensive heat islands in the North America by not going for net-zero building. Decarbonizing inventions and carbon neutralization are some of the other big areas. These are very complex scientific areas. We can’t make decisions in politics without science. Science will help make proper decisions in the field of energy. There is much complexity and engineering behind these decisions. Scientists need stable democracies to flourish, and politicians need science to have a stable democracy.

Words by Bhanu Opathella (IESO Distinguished Research Fellow, Centre for Urban Energy at Ryerson University).

Panel 1: Pathways to research, development and innovation in the energy sector

Scott Dodd
Director of Business Development, Enbridge

Jayesh Shah
Interim Vice-President, Engineering and Operations, Oshawa Power and Utilities Corporation

Vinay Sharma
Chief Executive Officer, London Hydro and Chair, Electricity Distributors Association

📣 **Patricia Phillips**
Executive Director, Energy Storage Canada

📣 : *Moderator*

The panel considers research, development, and innovation in the energy sector at large, with focus on energy storage technologies when appropriate. The next generation of energy systems is to be developed and constructed with the key attributes of reliability, efficiency, cost-effectiveness, and clean resources. A culture of innovation is required to be combined with the way energy systems evolve and advance. The panel tries to shed some light on such issues in an attempt to pave the road towards tomorrow's electrical grid.

The big picture of the power industry tells that energy systems have undergone the largest and most dramatic change in the past 17 years. As stated by Sharma, London Hydro adopts a power-to-connect vision that identifies the future of energy focusing on distributed energy resources. The vision is appreciated by 67 different utilities inspired by the resiliency, reliability, cost-effectiveness, and positive environmental impact of distributed energy resources. On the other hand, London Hydro also embraces a project for new energy prices, affecting about 400 customers, based on different behind-the-meter technologies.

Dodd emphasized that the low carbon initiatives pursued by Enbridge concern about 2.1 million customers. In Enbridge, efforts are underway to replace natural gas by biogas, which will have great environmental impact. Also, a geothermal plant for heating will be in place as well as a net-zero program in collaboration with Alectra. Shah, nevertheless, pointed out to projects by Oshawa Power and Utilities Corporation (OPUC) considering solar PV generators combined with storage as the nucleus of microgrids. In the same context, OPUC has conceptualized Canada's largest microgrid, while fulfilling their duties towards the social aspects of energy changes in collaboration with Ryerson University.

In particular, in terms of the R&D projects in utilities, a power-to-gas project by Enbridge uses extra electricity in the grid in water electrolysis to produce hydrogen that would be used later on with fuel cells for generation purposes. A contract with the IESO marks this project as the first in North America at a utility scale. On the other hand, London Hydro owns and operates an Innovation Lab which creates programs for customers, while generating and analyzing data. Through more than 100 applications, activities of this lab help in energy management that mainly benefits commercial and industrial customers, account management, and opportunities of R&D for academia and businesses. Meanwhile, Oshawa Hydro demonstrated a microgrid project partnering UOIT, besides an automation project for Oshawa downtown.

The panelists agreed on two main factors affect R&D from a utility perspective: regulations and funding. Regulatory endeavours are ongoing at a fast pace that makes it difficult to predict what will happen in as short as two years. Funding and resources are always another challenge, for example, LDCs cannot apply to the Smart Grid Fund of the Ontario Ministry of Energy although most of the innovative ideas come from utilities. This makes utilities unable to lead the show, and become always in need to join academia or businesses. However, in a different world, the Japanese government offered funding to residential customers to install their own PV panels, inverters, storage elements, and control units.

In terms of regulations and funding policies to utilities in different jurisdictions, panelists indicated that British Columbia invokes a mechanism for long-term funding of utilities, so did the Natural Gas Innovation Fund from the Canadian Gas Association. California is another good example. London Hydro received fund from the Ministry of Energy for innovation purposes. Nevertheless, Bill-112 will give opportunity to LDCs to apply for funds directly from the regulator. It was also emphasized that collaboration between different partners such as the government, utilities, academia, industries, and regulatory bodies is indispensable to be able to build the electrical grid of tomorrow. Another major factor is to coordinate R&D activities between different utilities to share knowledge, ideas, and pitfalls; it also helps avoid duplication in the work to be conducted.

Words by Mohamed Awadallah (Research Fellow, Centre for Urban Energy at Ryerson University).

Panel 2: Challenges and opportunities in energy storage — the utility and government perspective

Sunita Chander
Director, Distribution and Agency Policy, Ontario Ministry of Energy

Michel Losier
Executive Director, Energy Efficiency and Customer Engagement, NB Power

Robert Wilhite
Managing Director, Navigant Energy

Neetika Sathe
Director, Advanced Planning, Alectra

Energy storage has the potential to deliver diverse benefits to various stakeholders. However, these diffuse benefits pose challenges to the scaling up of this technology. For energy storage to be a viable option, partnerships between utilities, governments, and others are necessary to harness the full value stacks of diffuse benefits. Experts representing the utility, public, and professional services sectors identify areas of challenge and highlight areas of hope for energy storage in this panel session.

Highlights include:

- **Revenue potential for utilities** – In a recent survey of 400 senior executives by Navigant, energy storage was ranked number two as the technology with the greatest potential as a future revenue source for utilities. (Electric vehicles were number one, but energy storage was a close second.)

- **Barriers to energy storage** – Pilot projects are essential for identifying on-the-ground barriers to energy storage. For example, permitting can be a barrier to making energy storage a reality, and regulatory processes may need to be updated as well.

- **Integration and transactive energy** – The interoperability of energy storage with other elements in the smart grid is a challenge, particularly when integrating hardware and software components from different manufacturers. Utilities are best positioned to drive innovation in this space as a platform provider, orchestrating the network by interconnecting, dispatching, and pricing distributed energy resources.

- **Promising applications** – Pilot projects and case studies so far have revealed particular situations in which energy storage would offer tangible value. Areas experiencing steady, incremental load growth are well-suited for energy storage because it is riskier to justify a large, traditional system expansion, such as a new transformer station. Rural and remote areas could also benefit from storage.

- **Customer centricity** – Ultimately, we need to understand issues from the perspective of the customers and then design solutions to meet those needs. Traditionally, past projects were utility-centric, since utilities were monopolies, and then marketed to customers. However, customers are becoming active participants in the energy ecosystem, and utilities need to adjust to this new reality. Another trap is becoming technology-centric.

Words by Jessie Ma (IESO Distinguished Research Fellow, Centre for Urban Energy at Ryerson University).

Keynote 2: Ontario's vision for clean energy

Bob Delaney
Parliamentary Assistant to the Ontario Minister of Energy

We have pumped storage in Niagara Falls. Pumped energy storage is a mature technology. Ontario is to release a third version of the Long-Term Energy Plan in the coming fall. Energy storage is one of the promising technologies identified to balance the electric system redundancy. In engineering and scientific sense, "redundancy" means prudence, planning and a margin of safety. Energy storage can provide the grid redundancy.

Ontario's Independent Electricity System Operator (IESO) secured 56 MW of storage in three separate procurements. The Smart Grid Fund is also proposing to support 12 energy storage projects. Storage projects are now coming into the mainstream of Ontario's electric system. In the electrical distribution level, studies and funding for storage are increasing. On the operational level, we need some experience to collect data and to assess the performance of energy storage. We hope it proves energy storage to be technically feasible. Replacing diesel generators in remote locations with renewables and storage technologies is one of the goals. Installing storage at residential and industrial customers and connecting them to the grid can act as a large uninterruptible source of energy. This will allow LDCs to use stored energy selectively.

From customers' perspective, storage offers flexibility in managing supply. In rural communities, storage can relieve some of the transmission costs. Ontario has a desire to expand the province's position as an industry and technology leader in the development and deployment of energy storage. The Ministry of Energy aims to collect and comprehend the body of data on energy storage and assess the level of adaptation to the technology. We should share what we have learned and what we do not know about the technology and its use.

The projections suggest that the world installed capacity of energy storage perhaps will be 16GW in middle of next decade. Ontario's future electricity capacity options will test the market viability of these new generation capacity technologies. There is a lot to learn, and the rest of the world will learn a lot from us. It is good to be the best, but it's best to be the first. Ontario will continue to be the leader and to help the world thanks to research efforts.

Words by Bhanu Opathella.

Keynote 3: Business as unusual — new language for the innovation agenda

Mark Henderson
Senior Vice-President, Energy Solutions and Services, Alectra Energy Solutions

A massive transformation is underway in the electricity business, and we need to be aware of that and to have innovation at the heart of solving that. Drivers of this transformation are: increasing energy bills; increasing emissions; congestion; explosion of technological innovation; and integration of a variety of renewables.

For example, according to a research report by Navigant, 1900 microgrids are operating, under development or proposed around the world with 20 GW of capacity. Another example, as of now, a new solar installation takes place every 2.5 minutes in the US. It is a very different world even in Ontario than ten years ago. The explosion of growth in distributed energy is the most disruptive force in power utility industry. Research suggests that the biggest impact on the grid will come from energy storage with decreased cost in storage.

The future view of Alectra is that the world will be very connected moving forward to form a smart energy system. This is the concept of a social energy network. It will be a network of things with all new technologies and distributed sources like storage and solar. It will flip the concept of generation, transmission and distribution upside down by moving the generation close to the load. The whole concept of prosumers will be extended.

Alectra is a large body of residential, commercial and industrial customers looking for solutions to help them manage energy cost, increase resiliency, improve reliability, deal with disruptions on traditional grid. It is impossible to solve these challenges on their own. We need strategic partnerships with technology partners, project regulation partners, and finance partners to bring solutions to our customers. One of the strategies is the integration and combining technologies. Alectra has done several demonstration projects to bring value to our customers. One example is the operating microgrid at the Alectra head office.

It is not possible for one organization to solve the challenges of the energy sector. Alectra believes in partnerships. The possibilities and opportunities for the future are tremendous.

Words by Bhanu Opathella.

Panel 3: Success stories and learnings — technology and LDCs

Tim Curtis
President, Niagara-on-the-Lake Hydro

Michael Melisek
General Manager, Toronto Hydro

Cole Tavener
Director of Engineering, London Hydro

Bob Singh
IESO Distinguished Fellow, Centre for Urban Energy at Ryerson University

The utility industry is going through a dramatic change with many drivers, including environmental regulations, customer choice and a multitude of new technologies. These changes along with the increasing use of distributed energy resources are putting pressure on the utilities' existing business models. As customer needs are improving, utilities are facing new challenges in justifying the value they are providing to the customers. This panel session focuses on the technology area and aims to provide answers on how utilities are making use of these technologies, by learning from both their successes and failures.

What new technologies has your utility utilized in the past few years and how is it benefiting your distribution system and the customers?

There are a number of transformer stations within Toronto that are starting to approach their maximum capacity. Toronto Hydro is looking at ways to essentially differ the heavy infrastructure spending, by approximately ten years, through the use of new technologies, such as implementation of energy storage systems along with voltage control and demand response technologies. On the customer side, utilization of pole-tope battery storage systems with scheduling intelligence for charge/discharge has been under investigation.

Some of the challenges Niagara-on-the-Lake Hydro has encountered in implementing new technologies include incompatible firmware on the new equipment and communication issues with the existing control infrastructure, and lack of sufficient reliability of the new systems.

London Hydro has been looking at new technologies for a number of applications including workforce automation technologies to reduce the burden of day work, efforts in organizing and utilizing meter data, and the use of new technologies in monitoring and controlling the grid.

What barriers did you face in implementing new technologies and how did you overcome those barriers?

New technologies provide active monitoring of the system including voltage control, which in several cases it was proven that the system monitoring data is more accurate than the input coming from the customers. Therefore, the reliability of the grid and the speed of response to system events can be improved.

In municipal areas, often times the challenge is to find a suitable location for the new equipment such as a battery storage system. One solution Toronto Hydro is considering is to maintain the property after some of the municipal substations are decommissioned such that they can locate storage and similar technologies there. Also, the pole-mounted storage system is an initiative to address this challenge.

Engagement with customers is critical in the process of adopting new technologies in the field. The other challenge utilities are facing is how to plan the new non-wire systems alongside the conventional devices such as transformers and their visibility to the control centre. Health and safety related issues and creating relevant standards are also among the important challenges and efforts are made to inform people about the new devices in the system.

What are your future plans for making use of energy storage in your system?

In Niagara-on-the-Lake, the utility is facing a surplus in generation and not load growth, and energy storage could be beneficial if employed in such a way to increase the customer load.

For London Hydro, energy storage is not likely to be a tool in the short-term since they are not facing any immediate issues on the generation or load side. However, on the customer side, they are having conversation about the application of energy storage in reducing the global adjustment costs. In the long term, to incorporate electric vehicles in a larger scale, energy storage is likely to be an important tool alongside the charging stations or residential EV chargers.

One important area that Toronto Hydro looks at energy storage to provide solutions is power quality improvement, including voltage sags that could cause interruption of service to large customers. Also, energy storage can be used with EV chargers and solar installations for improving power quality.

What R&D areas can help you better position you to strengthen your electricity delivery?

Maintaining the security of the system and proper protection practices with the new technology is one area that has a lot of potential for R&D works. We should engage in proper research that considers the needs of the customer. The R&D work should have a good probability of solving a real world problem customers are facing. The R&D work should also anticipate the problems that are likely to be faced in future as the new technologies are more widely employed in the grid, such that utilities can focus their resources for solving the upcoming issues and plan ahead of time.

Words by Omid Alizadeh (Research Fellow, Centre for Urban Energy at Ryerson University).

Appendix

I. Conference program

Visit us

147 Dalhousie Street
Toronto, ON M5B 2R2

Write to us

350 Victoria Street
Toronto, ON M5B 2K3

Contact us

416-979-5000 x2974
cueinfo@ryerson.ca

/RyersonCUE

@RyersonCUE

ryerson.ca/nestnet

Ryerson University

Centre for Urban Energy