

Energy meets sustainability

2015 Annual Report



**Ryerson
University**

Centre for Urban Energy
Faculty of Engineering
& Architectural Science



“It’s not how big the problem is, it's how big a part of the solution you can be. The Centre for Urban Energy houses some of the most innovative researchers and startups in the sector. They are not afraid of collaborating with industry and approaching government to deliver innovative solutions to reduce greenhouse gas emissions in our province and fight climate change.”

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



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“Over the past five years, Toronto Hydro has collaborated with the Centre for Urban Energy, taking an innovative approach to issues important to our customers and our workers. We’ve worked on feeder automation studies to improve reliability, energy storage projects to improve power quality, advanced controls to accommodate renewables, system computer models that explore contingency responses during major outages and ergonomic assessments to help reduce repetitive strain injuries for workers. Many of these issues are challenges in a dense, urban environment. We appreciate CUE’s expertise and creativity in developing solutions.”

- Dino Priore, Executive Vice President and Chief Engineering and Construction Officer, Toronto Hydro

Thank you to our supporters

Founding Sponsors



Sponsors



Collaborators



Ryerson University



Faculty of Engineering & Architectural Science

Office of the Vice-President Research & Innovation



“There are a lot of very smart, hopeful people looking at how we can improve how we use energy in urban areas.”

- Jessie Ma, IESO Distinguished Research Fellow, Centre for Urban Energy



Message from our Academic Director

I am delighted to celebrate the fifth anniversary of the Centre for Urban Energy (CUE). In September 2010, Hydro One, the Ontario Power Authority (now part of the Independent Electricity System Operator), Toronto Hydro and Ryerson University announced the creation of a place where academics, innovators and industry could come together to build a clean energy future.

Five years later, CUE remains guided by our mission to build academic, public and private partnerships to find sustainable solutions to real-world urban energy challenges. CUE has generated over \$24 million in funding and completed 27 major research projects, with another 18 currently in progress. Our endeavours have touched on nearly every aspect of the sector, from smart grid and batteries, to public policy and education, as well as kinesiology to keep our power workers safe. None of this would have been possible without the effort and dedication of our 68 current researchers, staff, students, interns and volunteers, not to mention our countless supporters and collaborators since 2010.

Each year has built upon the last, and 2015 has been no exception. In March, Energy Minister Bob Chiarelli officially opened our

\$1 million Schneider Electric Smart Grid Laboratory. A truly one-of-a-kind space, it can replicate any electricity network, allowing researchers to test the effects of countless technologies on our homes and businesses. One of the first projects completed inside the lab was our pole-top battery, built and tested in partnership with Toronto Hydro and eCAMION, which was unveiled by Environment and Climate Change Minister Glen Murray in November.

2015 was a breakthrough year for energy storage research, one of our core strengths. In partnership with Toronto Hydro and ElectroVaya, CUE's large-scale battery project will improve resiliency and reliability in Toronto's downtown core. I am also proud to announce that CUE will lead a network of 15 universities across the country to build expertise and foster innovation in energy storage technology. This network will lead the charge towards unlocking the potential of renewable generation and make Canada a world leader in clean energy. I invite you to learn more about the NSERC Energy Storage Technology Network on page 13.

This year also marked the launch of our second education program. Our Master's

Diploma in Energy and Innovation (see page 20) will help build an energy sector driven by highly skilled individuals at the managerial level. Along with our Postgraduate Certificate in Energy Management and Innovation, CUE remains committed to helping to create a workforce ready for the energy sector of the future.

Much has changed in the energy sector since we opened, but one thing remains the same. At our opening, former Ryerson president Sheldon Levy envisioned that CUE would "directly address energy and environmental issues that affect every one of us, every day." Five years on, I'm very proud to say that this principle still holds true.

Bala Venkatesh
Academic Director, Centre for Urban Energy
Professor, Electrical and Computer Engineering

Five years of progress

September 2010 >

Ryerson University announces the creation of the Centre for Urban Energy with \$7 million in support from our principal sponsors: Hydro One, the Ontario Power Authority (now part of the Independent System Electricity Operator) and Toronto Hydro.



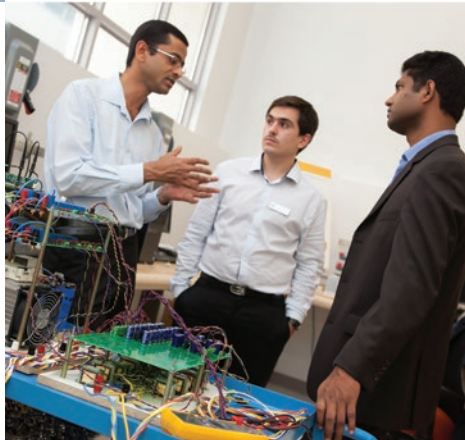
< June 2012

CUE develops the Postgraduate Certificate in Energy Management and Innovation with Ryerson's G. Raymond Chang School of Continuing Education to help address the projected shortage of workers in the electricity industry.



September 2013 >

The Ontario Ministry of Energy and Schneider Electric announce funding to build a smart grid laboratory at CUE, the first of its kind in a university setting anywhere in Canada.



May 2014 >

In the aftermath of the December 2013 ice storm, CUE holds a roundtable discussion and releases a major report on lessons from the event, including recommendations on how utilities, policymakers and communities can prepare for extreme weather events into the future.



< March 2015

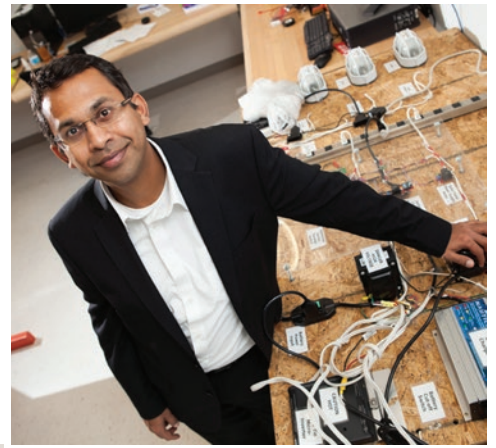
Ontario Minister of Energy Bob Chiarelli officially unveils the one-of-kind Schneider Electric Smart Grid Laboratory. The lab is opened to partners and collaborators seeking to test new products, conduct research and train personnel. PowerStream is the first utility to use the facility, creating a physical replica of three feeders from its Greenwood Transformer Station in Vaughan.





May 2011 >

CUE opens its doors at 147 Dalhousie Street for the first time. Professor Bala Venkatesh is appointed as the Centre's academic director. Sixteen industry-driven research projects led by Ryerson faculty get underway.



< July 2012

CUE establishes a partnership with Anna University in Chennai, India to develop a joint centre for research and collaboration in urban energy.



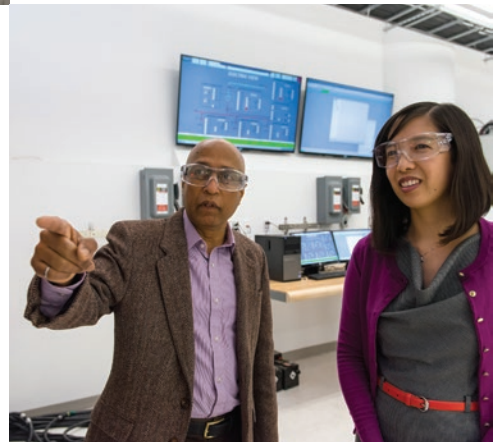
< November 2012

CUE launches the Innovation Centre for Urban Energy (iCUE), Canada's first business incubator and accelerator devoted to energy-focused startups. iCUE's goal is to help new energy companies turn their ideas into commercial products, services and technologies.



January 2015 >

The Independent Electricity System Operator (IESO) provides CUE with support through its Conservation Fund, endowing three full-time IESO Research Fellowships. Our fellows begin work on addressing the challenges facing Ontario's electricity sector. The IESO also announces its Assistantship Awards Program to support Ryerson students who have shown excellence through energy research.



< June 2015

CUE brings together energy professionals from across the province for its LDC of the Future conference. The event follows the release of a series of reports by Paul Murphy — past President and Chief Executive Officer of the IESO — on the future of the distribution sector in Ontario.



< November 2015

Ontario Minister of the Environment and Climate Change Glen Murray announces a pilot project for the world's first pole-top energy storage unit. The technology, developed by eCAMION, Toronto Hydro and CUE, promises to improve system reliability, facilitate the integration of renewable generation into urban electricity grids and help meet the energy needs of electric vehicles.

By the numbers

Priorities



Applied Research



Education



Innovation

Funding

\$24.4M

Since 2010

\$6.7M

In 2015

Current Supporters

21 Industry Sponsors

9 Industry Collaborators

Funding Breakdown

50%

Industry

14%

Academic

36%

Government

Funding Distribution

73%

Applied Research

15%

Research Fellows

3%

Research Awards

9%

Operations

Applied Research Projects

45 Total

18 In Progress

27 Completed

People

6

Staff

7

Research
Fellows

7

Postdoctoral
Fellows

30

Graduate
Students

18

Students
Interns

Education Programs

PMDip.

Professional Master's Diploma
in Energy and Innovation

Cert.

Postgraduate Certificate in
Energy Management and Innovation

Innovation

10

Current
Startups

21

Startups Incubated
Since 2012

63

Applications

40

Jobs
Created

43

Zone
Learners

Events and Outreach in 2015



76

Tours



19

Speaking
Engagements



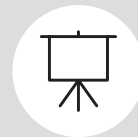
18

External
Events



11

Workshops



11

Student Info
Sessions



5

Seminars



3

Government
Announcements



2

Open Houses



1

Conference



1

Student Awards
Ceremony

Advisory Board



Chair
Mohamed Lachemi
Interim President and Vice-Chancellor
Ryerson University



Tom Chapman
Manager, Market Design and Development
Independent Electricity System Operator



Thomas Duever
Dean
Faculty of Engineering and Architectural
Science
Ryerson University



Léonce Fraser
Vice President
Services and Projects
Schneider Electric



Jenni Myllynen
Funds Manager
Conservation Fund
Independent Electricity System Operator



Dino Priore
Executive Vice-President and Chief
Engineering and Construction Officer
Toronto Hydro



Neetika Sathe
Vice President
Corporate Development
PowerStream



Hari Subramaniam
Chief Executive Officer
eCAMION



Bala Venkatesh
Academic Director
Centre for Urban Energy
Ryerson University

People



Administration

Bala Venkatesh
Academic Director

Dan McGillivray
Executive Director

Denis Arseneault
Administrative Coordinator

Karen Ho-Cespedes
Project Manager

Matthew Kerry
Marketing and Communications Manager

Lalitha Subramanian
Project Manager

Research Fellows

Mohamed Ahmed
Mohamed Awadallah
Sean Conway

Reza Ghaffari
Jessie Ma

Pascoal Rigolin
Birendra N. Singh

Postdoctoral Fellows

Omid Alizadeh
Shiv Iyer
Santhi Karthikeyan

Bhanu Opathella
Charles Tan

Venkata Yaramasu
Peng Yu

Graduate Students

Amr Adel
Abdul Afram
Jahangir Afsharian
Tamima Ahmed
Md Maniruzzaman Akan
Afarin Amirirad
Gouri Rani Barai
Altamash Ahmad Baig
Craig Brown
Apparao Dekka

Isuru Dasanayake
Ayman Elkasrawy
Aditi Garg
Nastaran Hajia
Kaveh Khorramnejad
Thomas Moore
Kamran Masteri Farahani
Corey McGrillis
Parisa Naraei
Sebastian Rivera Iunnissi

Pallavi Roy
Rohma Saeed
Thierry Spiess
Harmanjot Singh Sandhu
Shriram Shukla
Randy Tan
Matthew Tokarik
Qiang Wei
Danilo Yu
Shuo Yu

Student Interns

Maleeha Alvi
Manuel Baun
Cornel Campbell
Lucas Demarch
Come GerouDET
Rafael Gomes

Nisheeth Gunjan
Deborah Hernandez
Vanessa Lazarin
Matheus Lino
Dara Jarallah
Marina Rizk

Dana Salama
Michael Santorelli
Jonas Silva
Xi Sun
Lybuka Totina
Nabil Uddin

NSERC Energy Storage Technology Network

In 2015, CUE was honoured when the Natural Sciences and Engineering Research Council (NSERC) awarded us a grant worth close to \$5 million over five years to create a research network focused on energy storage. The NSERC Energy Storage Technology Network will be led by Dr. Bala Venkatesh, who will bring together 27 professors from 15 universities across Canada. The group will collaboratively explore many different types of energy storage, including flywheels, lithium-ion batteries and compressed air, while determining how best to integrate these technologies into electricity grids.

In addition, our researchers will consider the implications arising from the increasing adoption of energy storage. One of our research focuses includes how consumers will perceive, adopt, and interact with these technologies. This network will also team up with 17 industrial firms, who will bring their manufacturing and market expertise to the table. By partnering with the private sector, this grant enables directed progress — without duplication of efforts — towards a strong domestic Canadian energy storage industry that is also competitive in the global marketplace.

BC



Simon Fraser University

AB



University of Calgary
University of Alberta

SK



University of Saskatchewan

NL



Memorial University

QC



École Polytechnique
de Montréal

NS



Dalhousie University

NB



University of New Brunswick

ON



University of Ontario
Institute of Technology
University of Toronto
University of Waterloo
University of Windsor
University of Ottawa
York University
Ryerson University



“CUE exemplifies all of Ryerson's priorities in our 2014-19 academic plan, including enhancing the student experience, increasing research excellence, fostering innovation and expanding community engagement. CUE researchers have developed an internationally renowned culture of sustainability by inspiring innovation, creating partnerships, and translating research into commercial implementation.”

- Mohamed Lachemi, Interim President and Vice-Chancellor,
Ryerson University

Applied research projects



1 Efficiency and Conservation

- Analyzing time-of-use rates for different building scenarios ✓
- Curbing profligate energy consumption in condominiums ✓
- Energy assessment and cost-benefit analysis of selected Enbridge customers ✓
- Reducing the carbon footprint of Hydro One ✓
- IESO: integrated delivery of electricity, gas and water conservation

2 Electric Vehicles

- Assessing the impact of electric vehicles on transformer station components ✓
- Designing a plug-in hybrid charging system for the urban environment ✓

Developing a fast-charging station for plug-in hybrid cars ✓

Improving plug-in hybrid charger stations: power converter interfaces and peak shaving ✓

Monitoring wireless performance of plug-in electric vehicles

3 Generation and Transmission

Tackling transmission supply diversification challenges in central and downtown Toronto ✓

Anti-islanding detection for multiple inverters within a distribution grid

4 Net-Zero Homes

Developing a residential HVAC demand management and control system ✓

5 Policy and Planning

Meta-analysis of customer interruptions costs ✓

Reducing shoulder injuries among Toronto Hydro workers ✓

Shaping the future of Ontario's distribution companies: roundtables, reports and conference ✓

IESO: integration of urban and energy planning (*See page 18*)

6 Renewables

Assessing the impact of solar panels on transformer station components ✓

Creating a control and interface for urban clean energy microgrids ✓

Developing optimal bidding strategies for wind generation companies ✓

Designing, developing and demonstrating a microgrid (*See page 19*) ✓



Microgrid control and operation
renewable sources in Ontario ✓

Employing intelligent algorithms to
optimize Ontario wind farms ✓

Controlling short circuit currents to
increase connectivity of renewable
energy in Ontario ✓

Investigating the performance and
benefits of urban micro wind turbines

Urban solar farms

7 Smart Grid

Constructing the Schneider Electric
Smart Grid Laboratory ✓

PowerStream Greenwood Transformer
Station demonstration ✓

Secure and reliable data communications ✓

Modelling, planning and control design
of smart power grids

Reliable information processing and
communication technology

Zone energy management and
optimization systems for smart grid
applications

Developing urban electric systems

8 Storage

Establishment of the NSERC energy
storage collaborative working group ✓

Temporal Power flywheel: Energy on
time ✓

Temporal Power flywheel: Impact on
transformers ✓

System integration of large-scale energy
storage ✓

Impact of large distributed generation for
industrial facilities on a distribution grid

Asset planning with energy storage

Advanced smart energy storage
demonstration and validation in a local
distribution network

IESO: energy storage solutions

Installing and operating a large-scale
lithium-ion battery in an urban
environment (*See page 17*)

NSERC: discovery grant for exploration
and innovation in energy storage

Optimizing the economics and placement
of storage systems in an urban environment

Pole-top energy storage system

✓ = Completed



Research highlights

Operating a large-scale battery in a dense urban environment

Context: The electricity system in Ontario and other areas is moving away from a grid anchored by large power plants towards one that focuses on renewable energy, local distributed generation and conservation and demand management. Energy storage is one technology driving this change.

Problem: Instantaneously matching electricity supply with demand is becoming more difficult with these new technologies, particularly with solar and wind generation, which is weather dependent. These supply methods also introduce power quality problems into the system. Solutions to these problems are limited by the finite space available in urban environments.

Solution: This one-of-a-kind project tests and demonstrates a reasonably-sized, utility-scale and stationary electricity storage system in downtown Toronto, utilizing lithium-ion super polymer 2.0 battery technology. The unit charges during off-peak hours, when electricity prices and usage is low, and discharges during periods of peak loading.

Impact and benefits: By supplying electricity during times of high demand or bad weather, the battery can cost-effectively reduce system stress, compensate for the intermittency of renewables, and address power quality issues. The battery can easily be located and operated in an urban environment. It can even serve as a clean backup option for critical institutions – such as hospitals – that rely on diesel generators in the event of an outage. The project findings will inform ongoing discussions around the regulatory and policy framework for energy storage in Ontario.

CUE's role: Researchers integrated, tested and now operate a large-scale battery. Work continues on both exploring protection and control features and measuring its impact on an urban distribution grid. By providing access to Ryerson students and industry, CUE is also helping train energy workers on storage infrastructure.

Sponsors:

Electrovaya
OCE
Toronto Hydro

Timeline:

January 2011-December 2016

Research Team:

Bala Venkatesh
Bhanu Opathella

Key Stats:

150kW

Power capacity

600kWh

Energy capacity

23 days

Worth of electricity for a typical family of four

15 years

Potential shelf life of system



Measuring grid resiliency in an era of climate change

Context: Resiliency is the ability of an electrical grid to maintain continuity of customer supply under stress and a utility's ability to restore power to customers during an outage. Extreme weather events — such as the December 2013 ice storm — are expected to become more frequent with the onset of climate change, meaning distribution and transmission systems will need to be more resilient in order to continue delivering electricity in a reliable manner.

Problem: Both climate change and the need to remain economically competitive require that utilities and communities develop strategies to improve the resiliency of their electricity systems. To effectively measure their efforts, they require accurate, well-defined and informative metrics.

Solution: CUE proposed several indicators to measure resiliency prior to an extreme weather event, including the percentage of overhead versus underground distribution feeders in a service territory and the proportion of customers served by overhead versus underground connections. After an outage, suggested metrics include the

percentage of overhead versus underground feeders damaged; the percentage of customers interrupted and their average outage duration; the effectiveness and speed of restoration; and owing to their important public function, the percentage of critical facilities (such as hospitals) that were without power and the duration of their outage.

Impact and benefits: The indicators that were created will assist distributors and transmitters to better understand the resiliency of their networks. These statistics also present a method to compare the degree of resiliency between utilities, which, to an extent, controls for the differences in their customer density. This will facilitate comparative performance benchmarking and identify areas of improvement.

CUE's role: Researchers used a systems approach to investigate issues of resiliency and risk mitigation, which informed our proposed metrics.

Sponsors:

IESO

Timeline:

May 2015-October 2015

Research Team:

Birendra N. Singh
Pallavi Roy
Thierry Spiess
Bala Venkatesh

Key Stats:

600,000

Estimated customers across Ontario left without power following December 2013 ice storm

2,000,000

Fallen trees from the storm in Toronto alone, pulling down 500 energized wires

50

LDCs affected during the storm

Over 70%

Of power outages are weather related



Designing, developing and demonstrating a microgrid

Context: A microgrid is a network that combines all kinds of energy solutions: local generation, storage and power quality controllers along with typical poles, wires and customers. What sets a microgrid apart from a traditional electrical system is that it can work independently of a distribution system in case of an interruption. Transforming a utility’s infrastructure into a series of microgrids can increase reliability, reduce the number of customers affected by an interruption and significantly decrease the length of an outage.

Problem: A feeder is akin to an electric highway: moving a good deal of electricity for distribution to branches, which serve streets and individual customers. PowerStream — one of Ontario’s largest electricity distribution companies — wanted to determine if one of its feeders could operate as a microgrid. A secondary problem is that components of the microgrids work in different ways: some using alternate current (AC), while others use direct current (DC). These methods of transmitting electricity are incompatible and need to be converted from one into the other. The question remained: could PowerStream overcome these barriers and make it all work?

Solution: The Schneider Electric Smart Grid Laboratory physically replicated a feeder attached to PowerStream Greenwood Transformer Station and added a battery, solar power, and both AC and DC power loads. This replica allowed PowerStream to successfully test if this feeder could run as an isolated microgrid. The solution was modelled on an advanced distribution management system, a methodology that uses technology and automation to route electricity to homes and businesses.

Impact and benefits: In addition to confirming the increased reliability from a microgrid on this feeder, the Schneider Electric Smart Grid Laboratory allowed PowerStream to test the microgrid without the cost of purchasing and installing new equipment, or the risk associated with running tests on live wires connected to homes and businesses.

CUE’s role: Researchers designed, built, operated and analyzed the microgrid within the Schneider Electric Smart Grid Laboratory. They ran a number of scenarios to better understand the impact of a microgrid on major urban infrastructure.

Sponsors:
PowerStream

Timeline:
June 2015–October 2015

Research Team:
Bala Venkatesh
Bhanu Opathella

Key Stats:
27.6kV
Feeder M21 from PowerStream’s Greenwood Transformer Station

4
Different tests carried out in the Schneider Electric Smart Grid Laboratory as part of this project

3
Feeders

2
Microgrid operated modes: islanded and grid connected

Professional development

Postgraduate Certificate in Energy Management and Innovation

For every two people retiring in the energy industry today, there is only one available to replace them. Since the sector is rapidly growing, there are increasing opportunities for professionals to begin a successful career in the energy sector. This certificate program provides adult learners with an opportunity to acquire a level of knowledge and expertise that will permit them to contribute effectively to energy management, conservation, sustainability and public policy governing this regulated market. It also explores the exciting opportunities in this space through material on energy innovation, entrepreneurship and the challenges and opportunities in developing new energy technologies and businesses. The program was developed in cooperation with the G. Raymond Chang School of Continuing Education. You can take it in-class, online or in your workplace via our customized executive course.

Learn more at ryerson.ca/ce/energy

Professional Master's Diploma in Energy and Innovation

Launching in 2016, the Professional Master's Diploma in Energy and Innovation will expose participants to the knowledge and skills required to excel as corporate officers, administrators, technicians and in other leadership roles in the fast-growing and rapidly changing Canadian energy sector. In addition to providing diverse, meaningful and lucrative career experience to participants, the diploma program addresses the pressing need for individuals qualified in these areas within the public and private sectors. With the expertise gained from this program, students can also assume a variety of operational, administrative and managerial roles outside of energy companies, including becoming energy analysts, policy advisors and managers.

Learn more at ryerson.ca/graduate



Student opportunities

Internships

We recognize that young people will be those who solve the next generation of urban energy challenges, both at home and abroad. To help them kick-start their careers, CUE offers numerous opportunities for students from a variety of programs at Ryerson University to learn about the tremendous opportunities in our field. Since our inception, 50 students have worked with us as interns with many of them having gone on to careers in the energy sector. And since urban energy challenges know no borders, we've extended our reach by welcoming students from around the world through programs such as Science Without Borders.

Some of our recent interns have shared their stories about how their time at CUE transformed their careers:

Linh Nguyen studied Graphic Communications and International Economics and Finance at Ryerson University

"I knew I had a genuine interest in what is happening in green innovation, particularly with renewables. I knew I wanted to stay in this field but in a place that allowed me to be a little more creative. I fell in love with the startup community. Working at the iCUE opened up connections to the DMZ, other zones on campus and other incubators in Toronto. I credit Dan McGillivray for pushing me in this direction. Watching people take something so small and grow it into something so large scale made me want to do it for myself."

Ali Naji studied Electrical Engineering at Ryerson University; he is now an Electrical and Electronics Engineer at Siemens Canada

"Before CUE, I was never exposed to printed circuit boards. At CUE, one of the

postdoctoral fellows, Shiv Iyer, offered to teach me about them and I ended up building one by hand. It was my first time and it was hard but the experience and knowledge you gain when you build things from scratch is invaluable. I designed it, ordered the parts, and welded them. At the end I was able to say 'this is what I've done.' For my interview with Siemens, I brought printed circuit boards I had built."

Vanessa Lazarin studies Computer Engineering at Federal University of Technology in Parana, Brazil

"I worked on the iCreate Project. Our goal was to light a spark in girls from grades 7-8 to pursue a career in STEM (Science, Technology, Engineering and Mathematics). We talked about STEM and built rockets with them! It was really exciting. I also worked with an iCUE startup called Screaming Power, doing some research and providing feedback on their app. I learned how to deal with problems and become a better communicator."

Manuel Baun studies Mechatronics at the University of Applied Sciences in Osnabrück, Germany

"I worked with a team on a project on energy storage from the perspective of a transformer. Residential energy usage has peak loads which are dependent on time and consumption patterns. We worked on making this curve as smooth as possible so that there was little fluctuation over a 24-hour period. The placement gave me project management experience because in research you need to synchronize your work, talk to people, check the status of your project, and set goals."





Research Awards

The IESO's Student Assistantship Awards Program recognizes graduate and undergraduate students from a variety of programs who have shown academic excellence through an energy-related project. The IESO generously sponsored awards for six students, three times a year. Each recipient receives an award of up to \$5,000 and has the opportunity to spend a term working with an IESO Distinguished Research Fellow. These assistantships touch on a number of energy-related matters, such as integration of urban and energy planning; integrated delivery of electricity, gas and water; and energy storage. These projects serve as a great experiential learning tool as students are given the opportunity to solve real-world industry problems alongside experts in their chosen field.

Summer 2015 Recipients

Thierry Spiess	Environmental Applied Science and Management
Pallavi Roy	Environmental Applied Science and Management
Danilo Yu	Electrical and Computer Engineering
Ayman Elkasrawy	Electrical and Computer Engineering
Abdul Afram	Mechanical and Industrial Engineering
Nastaran Hajia	Electrical and Computer Engineering

Fall 2015 Recipients

Thierry Spiess	Environmental Applied Science and Management
Pallavi Roy	Environmental Applied Science and Management
Ayman Elkasrawy	Electrical and Computer Engineering
Amr Adel	Electrical and Computer Engineering
Isuru Dasanayake	Electrical and Computer Engineering
Aditi Garg	Electrical and Computer Engineering

Winter 2016 Recipients

Pallavi Roy	Environmental Applied Science and Management
Xi Sun	Architectural Science
Isuru Dasanayake	Electrical and Computer Engineering
Aditi Garg	Electrical and Computer Engineering
Ayman Elkasrawy	Electrical and Computer Engineering
Amr Adel	Electrical and Computer Engineering

A year in our life

January 19 >

Diana Ospina, co-founder of iCUE startup Grid Resources, is the recipient of a Stage 1 Norman Esch Award. The award supports student-led technology ventures by those in engineering and architectural science.



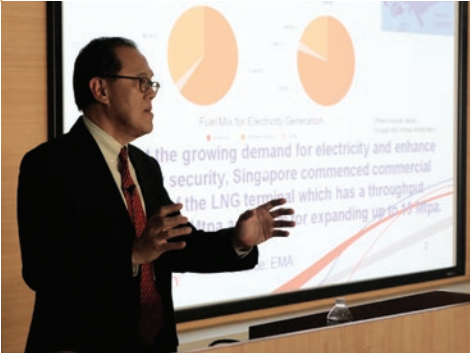
< April 9

CUE holds a debate on the future of Alberta's oil sands ventures; participants also discussed urban planning policies and new technologies that could reduce the demand for fossil fuels in Canadian cities.



July 24 >

CUE is proud to welcome Dr. H.B. Gooi of Nanyang Technological University for an enlightening talk on Singapore's technologically advanced power system.



July 29 >

CUE welcomes the MicroSkills Girls in STEM Summer Camp for a day of fun energy-related activities led by our researchers. Participants consisted of young women aged between 13 and 18 with an interest in science, technology, engineering and mathematics



< August 19

Ontario Minister of Citizenship and International Trade Michael Chan announces that Indian IT multinational Tech Mahindra and Ryerson have signed a memorandum of understanding to collaborate on microgrid research.



October 2 >

CUE is one of almost 150 locations across Ontario to participate in Green Energy Doors Open, which allows the public to experience the province's trailblazing clean energy projects in action.



November 18 >

Ontario Minister of the Environment and Climate Change, Glen Murray unveils a CUE-led pilot project demonstrating the promise of pole-top energy storage.



March 24 >

iCUE startup Plug'n Drive launches its Drive EV mobile application, developed with Ryerson Marketing and Entrepreneurship students. The app helps users see how much they can save each day by driving an electric car and addresses "range anxiety."



< April 30

Our largest awards ceremony yet honours 50 Ryerson undergraduate and graduate students. The awards are generously sponsored by Hydro One and the IESO.



< May 29

Corporate Knights Magazine names iCUE entrepreneur and EnergySavers founder M. Ryan Manchee as one of its top 30 sustainable leaders under 30.



August 15 >

The iCreate Project brings together young women from Toronto's high priority neighbourhoods for a day of experiential learning and mentorship organized by CUE.



< September 22

Brian McIntosh, Ryerson alumnus and Hydro One protection and control engineer, shares his advice with students looking for a career in energy.



< September 24

Carol Lue, founder of iCUE startup CaribShare Biogas, shares the stage with Sir Richard Branson at a Virgin Unite event in New York to celebrate the launch of the United Nations' Global Goals for Sustainable Development.



December 9 >

CUE Research Fellow Sean Conway is named chair of the Ontario Premier's Highly Skilled Workforce Strategy Expert Panel. His panel will focus on reshaping the workforce to adapt to a technology-driven, knowledge-based economy.



iCUE

Formed in November 2012, the Innovation Centre for Urban Energy (iCUE) is an incubator and accelerator focused on urban energy within Ryerson's unique experiential Zone Learning ecosystem. Instead of a co-op term where students work for someone else, the iCUE encourages entrepreneurship by providing opportunities for collaboration, support and mentorship. Our goal is to help students turn their ideas into viable commercial products, services and technologies for the energy sector, while providing environmental, social and economic value to Canadian society.

iCUE is extremely proud of the enterprises that have graduated from the iCUE. One of our recent success stories is 2nd Lot. In 2015, the City of Toronto introduced guidelines for commercial and multi-unit residential buildings to disclose their energy use, encouraging owners and builders to be more conscious of their energy footprint. Matthew Tokarik and Matt Carlsson – two Ryerson Building Science master's students – spotted an opportunity and formed their company with the help of iCUE.

2nd Lot promotes energy efficient structures by assessing small to medium-sized buildings

and providing consulting to builders looking to incorporate energy conservation methods in their projects. The startup makes three-dimensional models of structures and inputs all of the information on its systems, occupancy and building class in order to predict its energy use. Using 2nd Lot, designers can create concepts and optimize their energy use while ensuring compliance with both the City of Toronto benchmarks and the Ontario Building Code. For existing structures, 2nd Lot can predict the return-on-investment from energy retrofit projects.

In 2015, 2nd Lot received OCE SmartStart Seed Funding of \$60,000. They moved into an office at 401 Richmond Street in Toronto, and have since completed five major contracts. In 2016, the startup is looking to increase market awareness and expand their team. Cofounder Matthew Tokarik reflected on the how his experience at the Centre for Urban Energy helped his idea grow: "The iCUE offered a collaborative and innovative work environment with access to the people and resources we needed to launch our company."

Current Startups:

- Electrefy
- Grid Resources
- I-Ems
- Innovit
- Lightning Shard
- Plug'n Drive
- Screaming Power
- Smartto
- Tap The Grid
- Vavetek

Graduated Enterprises:

- 2nd Lot
- CaribShare Biogas
- DanTeb Enterprises
- Energy Savers
- En-Tire Savings
- Heliolytics
- Indee
- My Green Neighbourhood
- Power Cost Monitor
- Rigel Scientific Research
- Truly Local





Sign up for our monthly newsletter at ryerson.ca/cue to stay up to date with CUE activities in 2016.

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