

Toward a carbon-free future

Future-proofing energy

At the end of the decade, seismic shifts in the way human beings live and work around the world are underway. The climate crisis, rapid urbanization and deep electrification are forcing us to rethink how we generate, store, distribute, transport, consume and pay for energy.

That's why CUE exists.

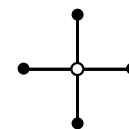
Located in the heart of Toronto, North America's fastest growing city, the Centre for Urban Energy (CUE) at Ryerson University is an academic-industry partnership focused on delivering novel, tangible, future-oriented and affordable solutions to the pressing energy problems of today – and tomorrow.



Partners bring us problems. We deliver solutions.

Our industry partners come to us for novel applications with tangible outcomes.

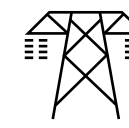
This is where we are now:



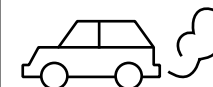
Centralized grid



Climate crisis



Aging infrastructure and rising costs

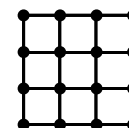


Air pollution in major urban areas

Thinking big.

We tackle the big questions about the future of energy to generate new thinking and real-world research.

This is where we are going:



Distributed energy



Thriving cities

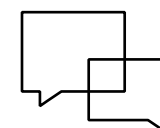


Low or zero carbon sources such as wind and solar

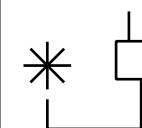


Affordable and accessible energy for all

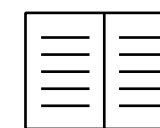
How CUE will get us there:



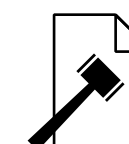
Consultation



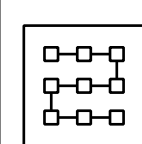
Implementation of new technologies



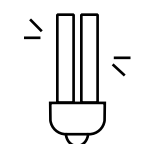
Education and professional development



Creation of new policies



Research and testing



Innovation and incubation

Partner with us

Our three pillars

CUE delivers products, services and supports in three categories

1. University-based research, testing and consulting

- Research projects and reports, often in collaboration with – or through the sponsorship of – government and industry partners.
- Testing of products or prototypes using our world-class, state-of-the-art equipment and facilities.
- Consulting projects that leverage our capacity for multidisciplinary collaborations between industry professionals and academic researchers.

2. Incubation and commercialization

CUE is home to the Clean Energy Zone, an incubator within Ryerson's Zone Learning ecosystem.

3. Professional development

Cutting-edge energy education and training through formalized curriculum and executive education seminar series.

Focus areas

conservation; demand management; electric vehicles; microgrids; electricity planning; net-zero buildings; policy and regulation; renewables; smart grids; storage; transactive energy; transmission and distribution



35

total people

21 students

7 staff

7 researchers

Leverage our capabilities

Our expertise

- World-class urban energy researchers and technologies.
- Multidisciplinary collaborations under one roof: engineering, science, environment, business, social sciences, public policy, law and infrastructure management.
- Integration of research and commercialization.
- Research and testing with direct real-world impact.
- Nonpartisan, objective, academically-driven innovation.
- Evidence-driven approach to big picture issues.

You and CUE

You:

- Have a pressing energy problem to solve.
- Need access to pioneering research and innovative development.
- Have a grid-scale prototype or project to test under real-world conditions.
- Want customized energy education for professional development.
- Would like to sponsor research, mentor a student or support awards.

CUE:

- Has world-class researchers with urban-energy expertise.
- Collaborates across disciplines and industries to develop energy solutions.
- Merges research, innovation and commercialization.
- Is non-partisan, objective and evidence-based.
- Generates and demonstrates real-world impact.

Connect with us

Have an urban energy problem or possibility worth exploring? Contact our Academic Director, Bala Venkatesh, at bala@ryerson.ca.

7,922

square feet of space

6

state-of-the-art labs

Our new home is helping us build momentum

On February 14, students, staff and faculty gathered around Canada's Minister of Finance, Bill Morneau, and Ryerson President Mohamed Lachemi to celebrate the official opening of Ryerson University's newest building, the Centre for Urban Innovation (CUI).

CUE's new space offers the latest in electrical infrastructure technology and greater opportunities to collaborate with researchers working in areas that intersect with energy, such as big data, transportation, smart cities and water. The move to CUI has also enabled CUE to host catalytic events for dialogue, networking and innovation, such as our first Clean Energy Expo in December 2019.



Acknowledgements

Founding sponsors



Sponsors and collaborators

- City of Toronto
- Mitacs
- NSERC
- Opus One Solutions
- Schneider Electric

Advisory board

Thomas Duever, Dean, Faculty of Engineering and Architectural Science, Ryerson University (Chair)

Tom Chapman, Senior Manager, Market Development and Strategy, Independent Electricity System Operator (IESO)

Steven Liss, Vice-President, Research and Innovation, Ryerson University

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

Neetika Sathe, Vice President, Green Energy & Technology (GRE&T) Centre, Alectra

Hari Subramaniam, Chief Strategic Growth and Policy Officer, Opus One Solutions

Susan Uthayakumar, Country President, Schneider Electric Canada

Bala Venkatesh, Academic Director, Centre for Urban Energy

Impact

Funding

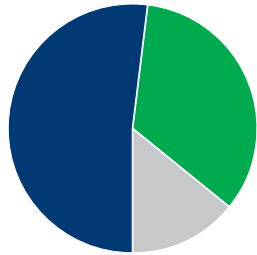
\$29.6M

total funding

\$0.8M

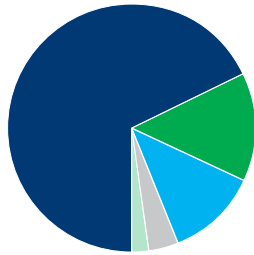
new funding in 2019

Sources of funding



- 52% Industry
- 34% Government
- 14% University

Funding distribution



- 68% Research
- 14% Operations
- 12% Research fellows
- 4% Student awards
- 2% Clean Energy Zone

Highly qualified personnel

909

alumni



98%

employed

77%

of these in energy or sustainability roles

35%

women

Outreach in 2019

23

events hosted

27

tours of our labs

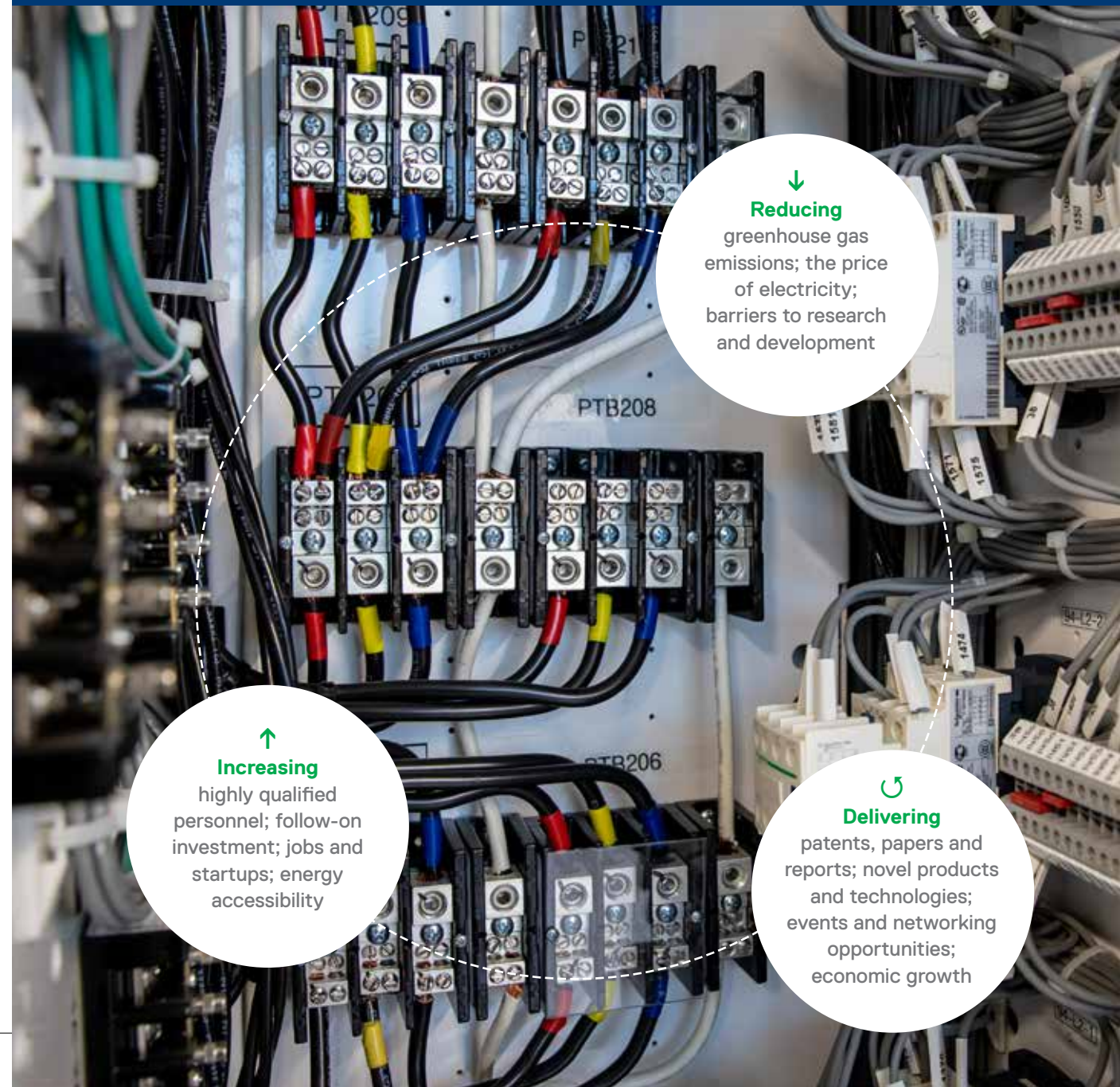
28

speaking engagements and external events

CUE's unique advantage

CUE is unique because it offers research expertise grounded in the reality of what does and doesn't work in the energy sector. We have spent years working closely with leading utilities and energy companies. Our technical and economic models of the future are informed by what is actually possible.

Our vision is to be a world-class research and innovation centre.



↓
Reducing

greenhouse gas emissions; the price of electricity; barriers to research and development



Increasing

highly qualified personnel; follow-on investment; jobs and startups; energy accessibility



Delivering

patents, papers and reports; novel products and technologies; events and networking opportunities; economic growth

Featured projects



All of our applied research projects are sponsored by an industry or government partner. Some of our key projects from the past year are highlighted below.

Opening up new economic opportunities for Ontario with the IESO

The IESO, Ontario's electricity system operator, funded research fellows to model a revolutionary market-based peer-to-peer electricity distribution system in our new Transactive Energy Distribution System Lab.

NSERC Energy Storage Technology Network completes its fourth year

Transitioning to a future of clean energy means designing new energy storage technologies, integrating them seamlessly into a more resilient grid, and understanding consumer needs and habits. CUE leads this nationwide network to position Canada as a leader in the global energy storage industry.

Funding from Mitacs expands our transactive energy project

The impact of a research project is – in part – a function of the team's size. In 2019, Mitacs provided funding, which was matched by IESO, to sponsor a new cohort of researchers that includes postdoctoral fellows and PhD students. CUE accelerates its investigations into the potential of transactive energy systems.

Toronto Hydro seeks to protect large electricity consumers and the power grid

Power quality is especially important for large industrial and health-care customers. Voltage sags or dips in supply can cause adverse impact to sensitive equipment including building systems and medical equipment. Utilizing a battery energy storage system, CUE's solution will help ensure large electricity customers have stable, reliable power, thereby making the entire grid more stable in the event of a disruption to the electricity supply.

Supporting a solar farm for the City of Toronto

Toronto Island Water Treatment Plant is considering augmenting its electric system by adding a solar generation facility. The City retained CUE to design a microgrid and an energy storage system in an effort to assess opportunities to support the solar project.

75

total projects

47 completed

28 in progress

Want to know more?

Read our digital report at ryerson.ca/cuereport2019 for extended stories about our projects and partners.

World firsts



Smart Building Analytics Lab
Opening in 2020, the \$1 million Schneider Electric Smart Building Analytics Living Lab is a new building management space testing the frontiers of energy efficiency.



Pole-top project
Our 2018 pole-mounted energy storage project, a collaboration with Toronto Hydro, eCAMION and the Ontario Ministry of Energy, Northern Development and Mines, won a major Canadian Electricity Association award for innovation and excellence.



Grid-scale battery
In 2016, we partnered with Toronto Hydro to test a homegrown utility-scale battery system in the heart of the city, the first time this kind of research had been conducted in an urban setting.



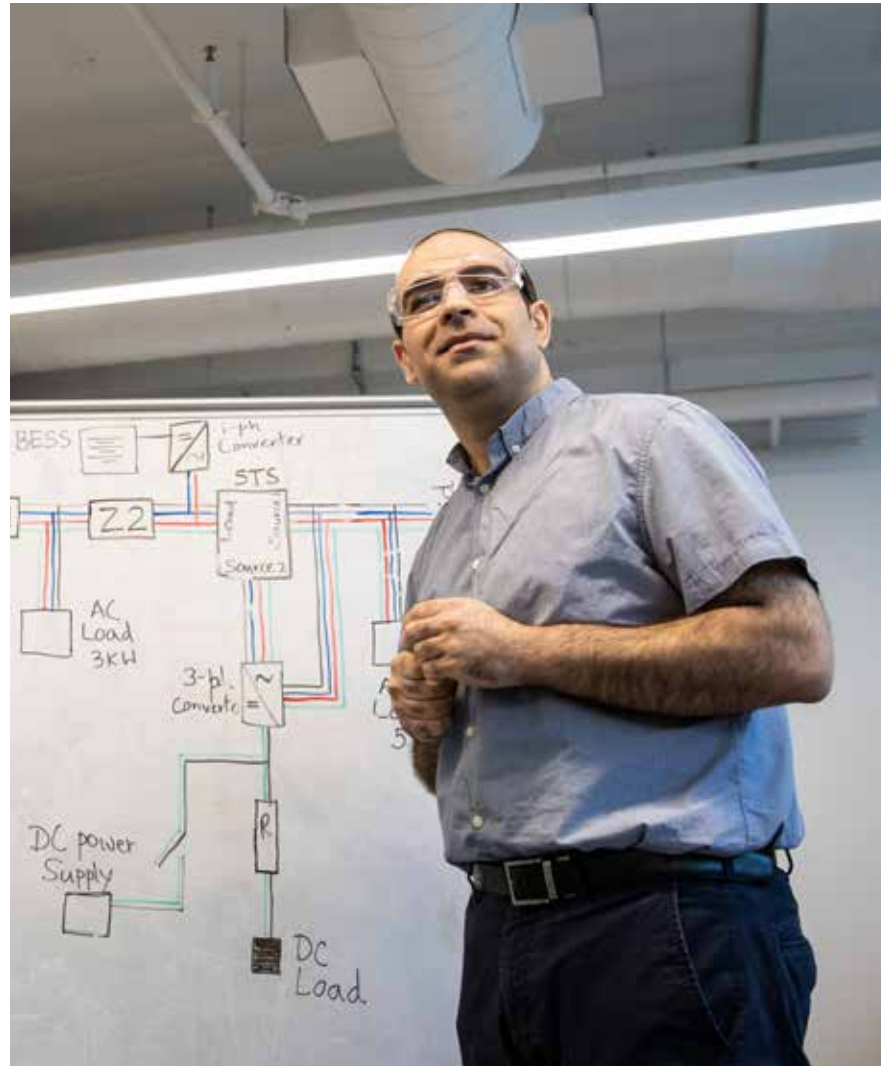
Schneider Electric Smart Grid Lab
In 2015, the Ontario Ministry of Energy, Northern Development and Mines and Schneider Electric unveiled the first lab of its kind in a university setting.



Professional development

Addressing the shortage of talent in the energy sector

Between now and 2030, the Conference Board of Canada estimates that there will be a need for more than 150,000 workers per year to carry out the renewal and modernization of Canada's electricity system. These roles will require advanced technical and analytical skill sets. CUE's professional development programs ensure a steady stream of top talent for the sector.



Our programs

Electrical Engineering 101

This seminar series introduces the fundamental concepts of Electrical Engineering to those without an engineering background looking to break into or advance their career in the energy sector.

Postgraduate Certificate in Energy Management and Conservation

In cooperation with The G. Raymond Chang School of Continuing Education at Ryerson University, this online certificate program enables adult learners to contribute effectively to energy management, conservation, sustainability, entrepreneurship and public policy.

Professional Master's Diploma in Energy and Innovation

The program addresses the pressing need for qualified personnel in the energy sector by immersing participants in the relevant knowledge and skills required to excel in leadership roles.



Industry leaders turn to CUE for professional development

When Rachel Soares needed to amplify her knowledge about innovation in the urban energy space, she turned to CUE, where she completed a Postgraduate Certificate in Energy Management and Conservation.

Soares is a Trade Commissioner for Climate Finance based in London, England. In her role, she focuses on tracking financing aimed at climate change mitigation and adaptation in developing countries, while connecting Canadian climate change solutions with financing opportunities.

Of our certificate program, Soares says, "The topical nature of the content prepared me well for my work with startups/scale-ups in the energy sector. It also added depth to the advice and guidance I was passing on, while allowing me to ask more targeted questions around policy and decision-making."

**CLEAN
ENERGY**
zone

Have an idea for an urban energy startup? The Clean Energy Zone is an industry-leading campus-based incubator located at the Centre for Urban Energy.

Since its inception, 36 startups have come through the Zone, including several \$1 million companies such as current residents Argentum Electronics, in the smart buildings space, and Elocity, which is focused on electric cars.

Learn more at ryerson.ca/cue/cez.

Learn more about our impact in the extended online version of this report at ryerson.ca/cuereport2019

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"A changing world can present challenges, but the IESO's partnership with CUE is an example of addressing change in a proactive and positive way. Together, we are exploring innovative solutions that will help Ontario's electricity system be reliable and cost-efficient in the years to come."

— PETER GREGG, PRESIDENT AND CEO, IESO

**Ryerson
University**



**Centre for
Urban Energy**