Charging Ahead

2025 Annual Report

Toronto Metropolitan University

Centre for Urban Energy
Faculty of Engineering
& Architectural Science

Welcome message

Fifteen years ago, the Centre for Urban Energy (CUE) was founded on a bold vision—that collaboration between academia and industry could accelerate Canada's shift to a net-zero energy future. In 2025, that vision continues to shine as bright as ever.

With over $1.88 million in new funding this year and more than $38.9 million secured to date, CUE proudly marks the launch of the Canada First Research Excellence Fund (CFREF) Volt-age Impact Project with Concordia University, furthering national progress in clean energy innovation. CUE's continued collaborations with Toronto Hydro, Hydro One, Tata Power and Toronto Community Housing Corporation (TCHC) have deepened CUE's role in advancing real-world applications of research, while a new project with the Independent Electricity System Operator (IESO) opens exciting pathways for future advancements.

In alignment with Cleantech as a strategic priority for the Faculty of Engineering and Architectural Science (FEAS), CUE advances FEAS's strategy by nurturing highly qualified personnel (HQP) and driving impactful innovation across the energy sector.

As Canada transitions toward a cleaner, more sustainable energy future, CUE remains committed to leading with purpose and innovation, reimagining how energy is produced, managed and shared across communities nationwide. This annual report reflects our enduring commitment to purpose-driven research, the driving force that will continue to shape Canada's clean energy landscape for generations to come.

Sri Krishnan
Dean, Faculty of Engineering and Architectural Science

Being part of CUE was one of the most rewarding aspects of my graduate studies. Collaborating with Hydro One allowed me to contribute to meaningful, industry-relevant research on an AI-based DER capacity estimation framework. CUE's supportive environment and collaborative culture played a defining role in my professional and personal development.

Amir Reza Nikzad Ghadikolaei
Postdoctoral Research Fellow, Edward S. Rogers Sr. Department of Electrical & Computer Engineering, University of Toronto

Vision

CUE aspires to be a world-class research and innovation centre dedicated to solving our most pressing urban energy challenges.

Mission

- Build academic, public and private sector partnerships
- Conduct research, development and demonstration, leading to commercialization
- Create the next generation of energy entrepreneurs
- Encourage multidisciplinary and collaborative approaches
- Provide scholarship and learning opportunities

Activities

Research, testing and consulting

- Sponsored projects and reports are executed in collaboration with government, industry and academic partners.
- Testing of products and prototypes is completed at world-class, state-of-the-art laboratories.
- Consulting projects draw on our capacity for multidisciplinary collaborations between industry professionals and academic researchers, as well as access to our unique laboratories.

Education

Professional development is offered through a formalized curriculum.

Innovation

As part of Toronto Metropolitan University's (TMU's) Zone Learning ecosystem and housed in CUE, the Clean Energy Zone (CEZ) is a startup incubator focused on fostering innovative ideas and businesses in the clean and sustainable energy sector.

Focus areas

CUE's focus areas are energy generation, transmission, distribution and use, with emphasis on:

- energy transition, deep electrification and transactive energy
- energy planning, policy and regulation
- demand management, efficiency and conservation
- renewables, smart grids, microgrids, storage, hydrogen, electric vehicles and net-zero buildings

Expertise

CUE combines the perspectives of engineering, science, environmental studies, business, social sciences, public policy, law and infrastructure management.

Advantages

- World-class urban energy researchers, technologies and facilities
- Multidisciplinary collaborations under one roof
- Integration of research and commercialization
- Research and cost-effective testing for real-world applications
- Objective, academically driven innovation
- Evidence-driven approach to big-picture issues
- Sustained commitment to supporting incubation and entrepreneurship

We're proud to continue our collaboration with CUE. Their high-quality, applied research supports Toronto Hydro's work to modernize the electricity grid and address the complex challenges of serving a growing, increasingly electrified city.

Dan Smart
Interim Chief Operating Officer,
Toronto Hydro

Addressing your needs

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

Applying our model to different stakeholders

Utilities benefit from access to cost-effective research, testing and innovation.

Governments benefit from policy and technical implementation, white papers, reports and a vision for whole energy systems.

Industries benefit from a pool of highly qualified personnel.

Students benefit from working and/or training directly with industry partners.

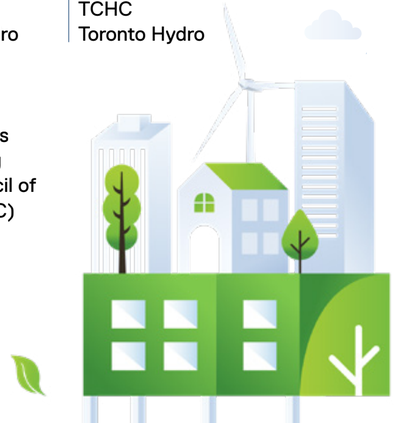
Society benefits from efficient, accessible electricity and a cleaner environment.

Acknowledgments

Founding sponsors

2025 partners and sponsors

CFREF
City of Toronto
Concordia University
Enwave
Halton Hills Hydro
Hydro One
IESO
Mitacs
Natural Sciences and Engineering Research Council of Canada (NSERC)
Peak Power
Power Advisory LLC
Simon Fraser University
Tata Power-DDL
TCHC
Toronto Hydro



2025 advisory board

Sri Krishnan
Dean and Professor, Electrical, Computer and Biomedical Engineering, Toronto Metropolitan University

Shitiz Agarwal
Vice-President, Power Systems, Sales and Operations, Schneider Electric

Steven N. Liss
Vice-President, Research and Innovation, Toronto Metropolitan University

Tom Chapman
Principal, The Brattle Group

Katherine Sparkes
Vice-President, Grid Solutions, Enwave

Thomas Timmins
Leader, Energy Practice Group, Gowling WLG

Bala Venkatesh
Academic Director, Centre for Urban Energy, Toronto Metropolitan University

Research and administrative resources

People

Administration

6 EMPLOYEES

4 UNDERGRADUATE INTERNS

Researchers

6 RESEARCH FELLOWS

1 RESEARCH ASSOCIATE

3 HONORARY FELLOWS

3 UNDERGRADUATE RESEARCH ASSISTANTS

2 RESEARCH ASSISTANTS

13 INVESTIGATORS

Achievements and impact

CUE is actively delivering innovative solutions for the energy sector, encompassing workshops and cutting-edge software offerings.

Highly qualified personnel (including visiting students)

11 UNDERGRADUATE STUDENTS

3 MASTER'S STUDENTS

13 PhD STUDENTS

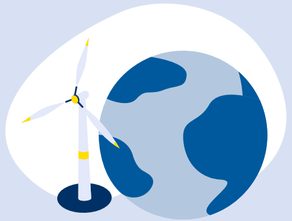
34% OF HQP ARE WOMEN

39% OF THE CUE TEAM (STAFF AND STUDENTS) ARE WOMEN

SINCE 2018, **86%** OF ALUMNI ARE EMPLOYED IN THE ENERGY SECTOR

MANY CUE ALUMNI MOVE TO
- higher education
- energy sector or related fields

Global collaborations



4	BRAZIL	1	MALAYSIA
2	ENGLAND	1	SCOTLAND
1	GERMANY	1	USA
1	INDIA	1	SINGAPORE

My time at CUE was an exceptional experience that fostered both professional and personal growth. The collaborative environment, cutting-edge projects and strong team culture turned every challenge into an opportunity to learn and excel. CUE is at the forefront of advancing Ontario's energy industry—driving innovation and developing and exporting advanced technologies, insights and technical leaders to industrial partners and organizations that power our province and beyond. I'm proud to have contributed to this mission and grateful for the connections and skills that continue to shape my career today.

Amr Mohamed
Network Management Engineer,
Hydro One

Visiting researchers

In 2025, our team included six visiting research students, with some continuing their work from 2024. Together, they contributed to key projects addressing complex energy challenges, and reinforced CUE's collaborative and innovative research culture.

Partners

10 INDUSTRY

3 GOVERNMENT

2 UNIVERSITY

Projects

93 TOTAL

81 COMPLETED

12 IN PROGRESS

Events

72 TOTAL EVENTS	**7** CUE EVENTS	**4** CUE VISITS	**53** CUE PROJECT MEETINGS	**8** CEZ EVENTS	**700+** PARTICIPANTS

Funding

$38.9M

TOTAL FUNDING FROM 2010

$1.88M

2025 FUNDING

Sources

- **46.1%** industry
- **40.3%** government
- **13.6%** university

Distribution

- **79.8%** research
- **12.6%** operations
- **3.0%** student awards
- **4.6%** CEZ

Outcomes

6
JOURNAL PUBLICATIONS

80
JOURNAL PUBLICATIONS FROM 2018

4
BOOKS / BOOK CHAPTERS FROM 2018

15
TECHNICAL REPORTS

70
TECHNICAL REPORTS FROM 2018

3
CONFERENCE PUBLICATIONS

28
CONFERENCE PUBLICATIONS FROM 2018

3
PATENTS

Featured projects

Forecasting and Modeling of Distributed Energy Resources – Hydro One, Peak Power, NSERC and Mitacs

In 2024, our research focused on developing aggregation models for synchronous generators and grid-following inverter-based distributed energy resources (DERs) in distribution feeders to enable efficient transient studies. This work demonstrated that large numbers of DERs can be represented with fewer equivalent models while retaining essential dynamic behaviour, significantly reducing computational burden in transient simulations.

Building on this foundation, the 2025 phase of the project extends aggregation techniques to grid-forming inverter-based resources (GFM-IBRs). As grid-forming units are expected to play a pivotal role in future distribution systems by establishing voltage and frequency references, their accurate representation is critical for stability and protection studies. The goal is to capture their distinct dynamic behaviour within aggregated models, enhancing simulation tools and potentially supporting utilities in planning and operating resilient distribution systems with a higher share of advanced inverter technologies.

This work is supported by Hydro One through the joint NSERC Alliance and Mitacs Accelerate program.

2025 team	3 postdoctoral fellows, 1 research associate, 5 PhD students, 1 master's student
Timeline	2022–2027

Dual Participation of Local Demand Response Resources – IESO, Toronto Hydro and Power Advisory LLC

CUE collaborated with Toronto Hydro and Power Advisory LLC, with support from the IESO Grid Innovation Fund and the Ontario Energy Board's Innovation Sandbox, to identify solutions that will enable the utility to use the same demand response resources simultaneously to meet the capacity needs of both local and provincial grids. CUE developed nine tools and a virtual platform to implement a dual participation model, ensuring seamless coordination between the IESO (bulk system) and Toronto Hydro (distribution system). The real-time software stack is engineered for redundancy and resilience, running concurrently on multiple machines, interacting directly with cloud storage, and supporting secure remote access to maintain operations during outages. The overall goals of this program are to build resilient infrastructure, promote sustainability and foster innovation.

2025 team	1 postdoctoral fellow, 1 research associate, 1 undergraduate research assistant
Timeline	2023–2026

Energy Storage Solutions for Zero Carbon 2050 Electric Distribution Systems – Toronto Hydro, Halton Hills Hydro, NSERC and Mitacs

This project focuses on identifying and addressing the economic, regulatory and technological barriers affecting the deployment of energy storage technologies by electric utilities. Through this work, CUE aims to facilitate renewable integration, reduce capital-intensive grid upgrades, and enhance the intelligence and resilience of distribution systems. CUE is exploring new models for ancillary services and new methods for evaluating and compensating storage in distribution networks. This includes ongoing work on microgrid applications and their value to customers, DER vendors and utilities.

This work is supported by Toronto Hydro through the joint NSERC Alliance and Mitacs Accelerate program.

2025 team 2 postdoctoral fellows, 5 PhD students

Timeline 2022–2027

Dynamic Reconfiguration and Feeder Power Management – Tata Power-DDL and Mitacs

Climate change is accelerating the shift toward deep electrification, which will place significant additional demand on electric power systems. Anticipating these developments, this project focuses on designing methods and strategies for dynamic reconfiguration and feeder power management to address operational challenges that utilities, such as Tata Power-DDL, are likely to face.

In this context, CUE is developing a software tool designed to optimally operate sectionalizing switches while simultaneously leveraging the flexibility of other DERs, such as demand response programs and energy storage systems, to mitigate temporary overloading and enhance grid resilience.

The significance of this work extends beyond immediate operational benefits. It contributes directly to the broader objective of building a sustainable, electrified energy future by equipping utilities with practical tools and strategies to adapt to rapidly changing load profiles and the integration of new technologies.

It is supported by funding from a Mitacs Accelerate grant, in collaboration with Tata Power-DDL. This project is in the final phase and is expected to be completed in 2026.

2025 team 1 postdoctoral fellow

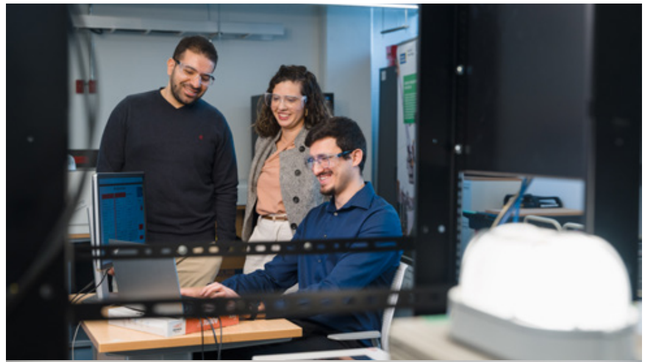
Timeline 2023–2026

Resilient Distribution System Microgrids – Concordia University and CFREF

Around the world, electricity customers in sparsely populated areas often face higher costs from lower reliability, whether from frequent, prolonged interruptions or the expense of securing diesel-powered backup generation.

This project addresses the weak business case for traditional grid reinforcement in such regions by developing utility-operated, feeder-level microgrids that deliver reliable, low-carbon electricity during outages.

To this end, a modular microgrid-in-a-box framework has been designed and validated by CUE in the Schneider Electric Smart Grid Lab using commercial off-the-shelf equipment. The project is now advancing on intelligent system management algorithms to enable seamless integration with standard utility operations, paving the way for large-scale pilots that will accelerate electrification and decarbonization in underserved communities.



2025 team	1 postdoctoral fellow, 3 PhD students, 1 research assistant, 1 master's student, 1 undergraduate research assistant
Timeline	2024–2029

Electrification of Buildings – TCHC and Mitacs

As the world moves toward achieving net-zero emissions, deep electrification has become an essential step in creating a cleaner and more sustainable energy future, and building electrification plays a key role in that journey. Electrification involves replacing carbon-emitting energy sources with cleaner alternatives. In this effort, CUE is working to develop practical strategies and tools to address the challenges that come with building electrification.

This project focuses on finding opportunities to improve metering, building more accurate energy consumption predictive models, and assessing both the technical and economic feasibility of electrifying heating systems.

2025 team	2 postdoctoral fellows
Timeline	2025–2026

Energy Transition through Hydro-Electric Energy Systems – NSERC

This project explores new methodologies for long-term power system planning in support of Ontario's goal to achieve net-zero emissions by 2050. Two complementary approaches are developed: energy balance modeling with Tools for Energy Model Optimization and Analysis (TEMOA) to evaluate electrification and transition pathways, and optimization-based formulations that incorporate economic, sustainability and reliability dimensions. The research aims to contribute planning insights and frameworks that can guide the electricity sector toward a resilient, sustainable and cost-effective net-zero future.

2025 team	1 postdoctoral fellow, 1 research assistant, 1 undergraduate research assistant
Timeline	2024–2025

2025 CUE Clean Energy Expo

The 2025 CUE Clean Energy Expo was held in May with an attendance of over 70 guests. The event opened with remarks from Roberta Iannacito-Provenzano, Provost and Vice-President, Academic at Toronto Metropolitan University, and featured a keynote from Sheikh Nahyaan, Executive Vice-President and Chief Operating Officer at Toronto Hydro, on grid modernization and electrification. Project presentations from Hydro One, Toronto Hydro and TMU highlighted new research on DER modeling and demand response. CEZ startup companies, both current and graduated, also shared their experiences, and the 2025 Toronto Hydro Student Awards were presented.

Professional Master's Diploma in Energy and Innovation

The Professional Master's Diploma in Energy and Innovation (part-time) program is designed to equip participants with the knowledge and skills required to function competently as operators, officers, administrators, managers, technicians, analysts, policy advisors and other key occupations in the fast-growing, rapidly evolving, dynamic Canadian energy sector.

CLEAN ENERGY zone

The Clean Energy Zone (CEZ) is an industry-leading, campus-based incubator located at CUE. Since its inception, 66 startups have passed through CEZ, including million-dollar companies such as Peak Power and SWTCH.

24 CURRENT STARTUPS

3 NEW STARTUPS IN 2025

1 STARTUP GRADUATED IN 2025

$7.5M IN REVENUE GENERATED BY STARTUPS IN 2025

$2.3M IN CAPITAL RAISED BY STARTUPS IN 2025

8 EVENTS IN 2025

Companies

Cence Power
BKR Energy
DisRAPTOR PAV
Niso Energy
RenMobi
Saturnu Solutions
Electric Autonomy Canada
GREEN BMG
Can Grow Here
Renergy
Proton Fuels
Airgreening (Canada) Inc.
13278247 Canada Inc
(graduated in 2025)
Innowind Energy Solutions
iClimateTech
Innovia GEO
HEBÉ
inferModel
Alphacor
Kiwi Charge
Liquid Energy
Serenity Power
Mapleview Energy
(joined in 2025)
Dawn Energy
(joined in 2025)
Doppler Energy
(joined in 2025)

Power Up Program

The Power Up Program aims to tackle energy poverty and energy entrepreneurship poverty concurrently by providing financial support to high-potential student entrepreneurs with promising clean energy–based ideas, in the form of full-time, four-month internships. This program provides student entrepreneurs with the tools necessary to build scalable enterprises and bring their clean energy ventures to life.

Featured companies

Dawn Energy

Dawn Energy is a Toronto-based home electrification company that helps homeowners understand, plan and implement energy upgrades, from heat pumps to smart home energy management. By combining real energy data with simple, user-friendly tools, Dawn Energy enables households to make confident, cost-effective decisions about electrifying their homes. Founded in March 2025, the company was a response to its founder's first-hand experience with the complexity and fragmentation of the home energy upgrade process. Dawn Energy's mission is to make home electrification accessible, transparent and financially worthwhile for every Canadian family.

2025 highlights

- Founded in March 2025 and launched its first homeowner product: a personalized electrification roadmap outlining costs, savings and actionable next steps
- Won the Impact Zero People's Choice Award, recognizing Dawn's contribution to accessible and practical home-decarbonization tools
- Formed partnerships with HVAC installers and energy professionals to support homeowners and industry stakeholders during the transition to electrification

CEZ gave Dawn both a community and a compass. The mentorship and the ability to learn from other founders have been instrumental in shaping our first year.

Tessa Peerless
Founder and CEO, Dawn Energy

Innovia GEO

Innovia GEO is accelerating clean, affordable building electrification through its revolutionary shallow-depth geothermal heating and cooling systems. Unlike traditional geothermal installations that require drilling hundreds of feet deep, Innovia GEO's technology is installed only 15 to 100 feet below ground using fast, low-cost drilling methods already common in the foundation construction and utilities sectors. By cutting geothermal installation costs in half, the company enables low- to mid-rise buildings, both new and existing, to transition to efficient, emissions-free heating and cooling.

2025 highlights

- Installed a second full-scale pilot project in partnership with a major construction company and utility
- Received a funding award from the New York State Energy Research and Development Authority (NYSERDA) to support three pilot installations
- Expanded operations into New York State and completed the first of three NYSERDA-supported pilot projects
- Selected for and completed the Venture For ClimateTech accelerator program

CEZ has been incredibly complementary to our TMU research partnership, providing a business and market acceleration ecosystem that supports the advancement of our shallow-depth geothermal technologies.

Andrew Lee
Co-Founder, Innovia GEO

Integrated ClimateTech

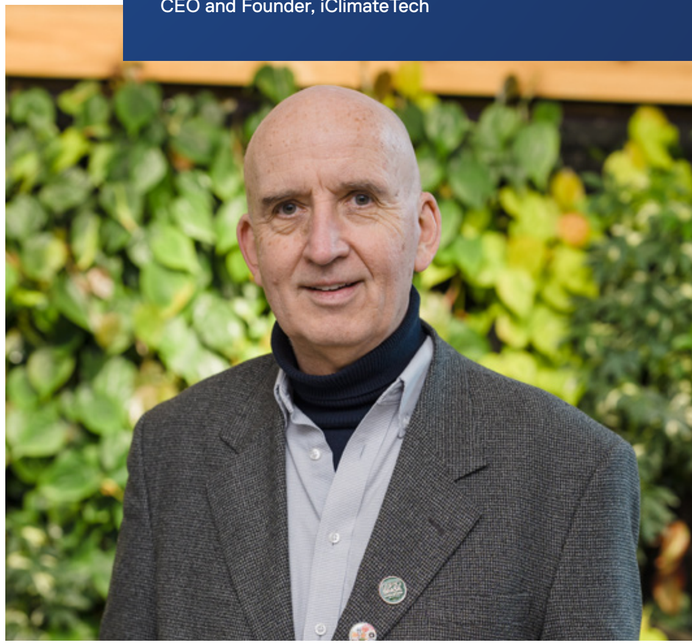
Integrated ClimateTech (iClimateTech) develops and integrates climate technologies to maximize environmental impact while ensuring long-term commercial viability. Its work spans agrivoltaics to modular package plants that produce hydrogen and ammonia. iClimateTech supports clients through consulting and joint-venture partnerships, providing project strategy, technology selection, grant support, offtake development and access to capital. Founded by Canadian engineer and serial entrepreneur Paul Stevers, the company draws on decades of experience in climate innovation, technology commercialization and social impact.

2025 highlights

- Advanced an agrivoltaics project integrating solar, sheep farming and modular hydrogen/ammonia production
- Presented at the France and Nigeria pavilions at COP30 on AI, renewable energy, climate finance and geologic hydrogen
- Led the building retrofits working group at the 2025 Ontario Climate Summit hosted by the Urban Climate Alliance, launching a partnership with ClimateFast and others towards a 2026 GTA-focused event
- Began work with two Nigerian state governments to fund expansion of a solar-powered sustainable agriculture program

CEZ has provided an important platform for iClimateTech to grow, collaborate and advance our mission of delivering scalable climate solutions.

Paul Stevers
CEO and Founder, iClimateTech



Serenity Power

Founded in 2024, Serenity Power develops efficient, clean and fuel-flexible solid oxide fuel cell systems designed for off-grid and portable power applications. The company aims to accelerate the transition to cleaner, more reliable and more affordable energy solutions for industries and communities facing hard-to-electrify challenges. CEO and co-founder Aleisha Cerny is a climate action advocate committed to advancing clean energy through innovation and activism. Her work focuses on enabling sustainable power systems that reduce emissions, lower operating costs and enhance energy resilience.

2025 highlights

- Awarded the $100K Black Entrepreneur Investment Prize at Startupfest (July 2025)
- Winner of the Best Commercial Readiness Award at the Energy Tech Nexus Pilotathon during Houston Energy + Climate Week (September 2025)
- Received the $100K Elevate Women+ Pitch Prize from The Firehood at Elevate Festival (October 2025)
- Honoured with the Catalyzing Canada Award at MaRS Climate Impact (December 2025)
- Selected for the Science Discovery Zone's Lab Catalyst Program (July–December 2025)
- Completed several accelerator and startup programs (full list available on the final page of the Serenity Power traction summary report)
- Advanced prototype development and expanded strategic partnerships in Calgary and Toronto

Have an idea for an urban energy startup?

Visit **torontomu.ca/cue/cez** today to find out how you can join the Clean Energy Zone.

Connect with us

Have an urban energy problem or possibility worth exploring?

Contact us at **cueinfo@torontomu.ca**.

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