CLIMATE POSITIVE ENERGY

Annual Impact Report

ISI Reporting Year
Jan 1, 2022 to Dec 31, 2022

UNIVERSITY OF TORONTO | CLIMATE POSITIVE ENERGY

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Climate Positive Energy wishes to acknowledge the land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca, and the Mississaugas of the Credit. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

EXECUTIVE SUMMARY

CLIMATE POSITIVE ENERGY

The Climate Positive Energy Initiative (CPE) is a $7-million institutional strategic initiative (ISI) at the University of Toronto. It fosters interdisciplinary clean energy research through linking science, social science, engineering, economics and policy researchers to transform our energy systems. Since its launch in January 2022, CPE has served as the tri-campus, multi-divisional, interdisciplinary network and hub for critical clean energy research and training at the University of Toronto.

CPE facilitates collaborative research, builds internal and external partnerships, promotes knowledge translation, and provides training opportunities for students, faculty and industry leaders. Our work supports existing sustainable energy and climate change initiatives across the University, including U of T's Climate Positive Campus and their plan for net negative campus by 2050. CPE activity extends the University's impact by integrating U of T's various clean energy research and training endeavours with the University's sustainable infrastructure projects (Living Lab), enabling researchers to innovate and advance science, technology, policy, and frameworks that support clean energy and more sustainable futures.

2022 was an impactful year for CPE in all measures. Our faculty membership grew by 72%, and our students membership by 60%. We supported 50 projects across 3 campuses. We have $48 million in government proposals under review. We organized 17 events and attended 21 external events. Our subscription base has grown from 100 to 939 subscribers. We sent out 51 digital newsletters with an open rate of 65% and 13% click rate, which is 3 times higher than the industry average.

EXECUTIVE SUMMARY

CONTINUED

Recognizing that equity, diversity, and inclusion (EDI) are key components to sustainability, the Climate Positive Energy Initiative examined and developed an equitable and just policy for clean energy innovations using a social justice lens.

EDI principles are considered in all activities, and implemented and evaluated by the CPE Executive Committee.

CPE is positioning the U of T strategically at the heart of the energy transition through various initiatives such as the $23M Grid Modernization Centre proposal, the built environment consortium and various events and social media coverage such as the Climate Economy Summit in partnership with Toronto Region Board of Trade.

Our strategy in year one was to build internal and external CPE brand awareness within our existing stakeholders and attracting new ones. Internally, we focused on grants, scholarships, and speaker series to fund climate research that will result in greenhouse gas reductions. Externally, we focused on outreach and business development to formulate and push our partnerships strategies through one-on-one research model and the Net Zero Alliance pre-competitive model. We continue to build on a strong first year of brand awareness through extending and maintaining strong network of relationships with various organizations and industry sectors. We were able to secure external funding from various sources and we will continue to push this further through one-on-one partnerships and grants. The Net Zero Alliance will be an essential part of our strategy and focus for year two of operation.

A MESSAGE FROM OUR ACADEMIC DIRECTOR

Professor David Sinton
Academic Director, Climate Positive Energy

On behalf of the Climate Positive Energy institutional strategic initiative, I am pleased to share our inaugural Annual Report, which highlights the important work that University of Toronto researchers are undertaking to help Canada – and the world – achieve net-zero emissions by 2050.

When you have a problem like how to respond to climate change, you've got an everybody problem: you have an all-profession, all-social sciences, all-natural sciences and all-humanities problem. This is where Climate Positive Energy comes in, as the University of Toronto's hub for interdisciplinary clean energy research. In our first year, we brought together experts from across the academic spectrum – with social, political, legal, scientific and engineering backgrounds all aligning their disciplines to solve energy challenges. From remote communities in Yukon to closer to home at the University's campuses, our researcher teams, which include both students and faculty, are engaged in all aspects of the climate-positive energy transition.

This year, we expanded our programming to support collaborative research through high-impact catalyst grants; trained a new cohort of researchers through hands-on, interactive workshops and online sessions; fostered partnerships with community, non-profit, government and industry experts to fuel solutions; and embedded important knowledge translation practices into our business development activities ensuring ongoing action.

Looking ahead to 2023, we look forward to continued engagement and action from our researchers and partners. We hope to take U of T's climate and energy research, which is broad and diverse, and put it at the forefront worldwide to enable real solutions. U of T has given us tremendous support, and we look forward to not only raising U of T's research capacities, but to growing on a global scale.

With that, I invite you to explore our first year Annual Report.

Professor David Sinton, Ph.D. P.Eng.
Academic Director, Climate Positive Energy
Canada Research Chair

MISSION AND VISION

The Climate Positive Energy Initiative at University of Toronto is developing social, scientific, technical, economic, and policy solutions to transform our energy systems.

Mission

To provide the leadership and organizational capacity to marshal U of T's tremendous transdisciplinary strength to reimagine global energy systems.

Vision

Achieving net-negative carbon emissions by 2050 while mitigating inequities in access to clean energy and the consequences of production by engaging researchers developing social, scientific, technical, economic, and policy solutions that will transform our energy systems.

PROGRAMS

In our first year, we delivered an ambitious suite of research funding, public programming, fellowships, training workshops, events and partnership development centred on four key goals.

High impact collaborative research

Through catalyst grants, collaborative spaces, and grant preparation.

Knowledge sharing and translation

Via technology validation grants, entrepreneurship training, and ongoing events.

World-class training

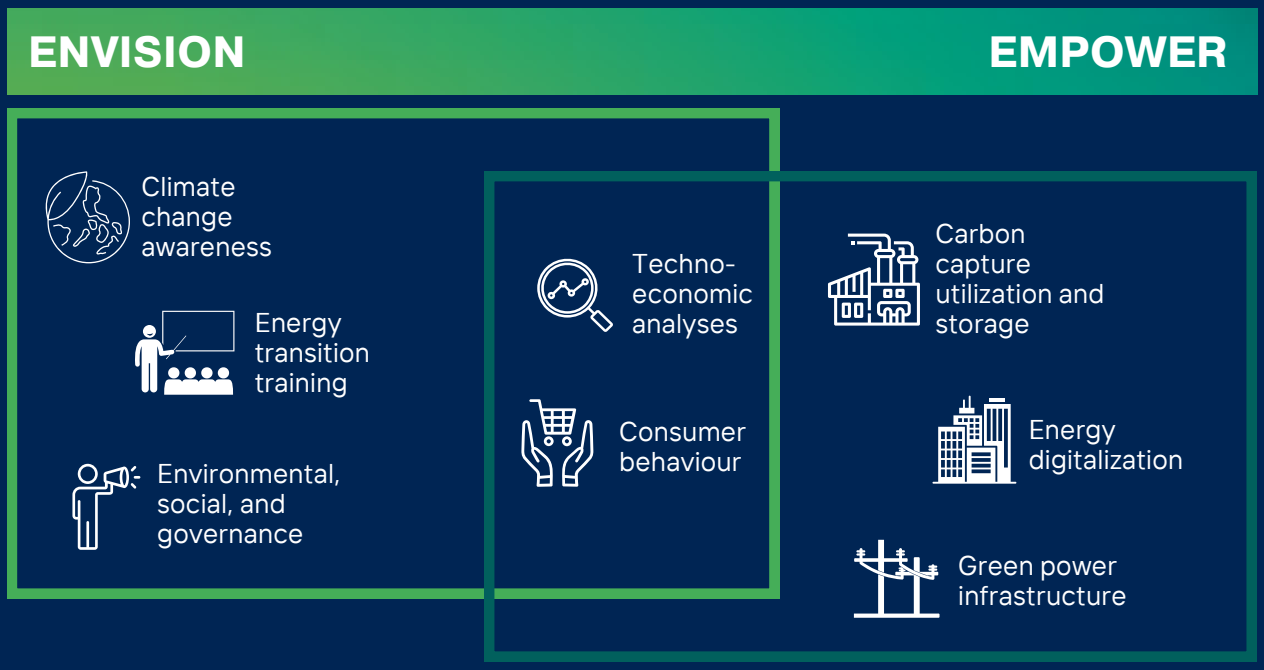
By attracting world-class students and researchers to create a network and mentorship program.

Building partnerships

Through industry and community outreach and events, including engagement with indigenous partners.

RESEARCH THEMES

Climate Positive energy research is centered on two integrated pillars representing the interplay between social and policy considerations (Envision) in the development of clean energy technologies (Empower).



Envision

Drawing upon the interdisciplinary breadth at U of T and its community partners to investigate the social, political, economic, and climate implications of sustainable energy and guide technology development for just climate change mitigation in the service of local and global communities.

Empower

Expanding renewable energy and reducing energy demands are both critical to meet our greenhouse gas (GHG) emission targets, minimize pollution, and decarbonize our energy systems. Empower blends near-term and long-term approaches, spanning carbon utilization, energy storage and efficiency, and decarbonization.

CORE TEAM

Organization and Management

Professor David Sinton

Academic Director

David is a Professor and Canada Research Chair in the Department of Mechanical & Industrial Engineering at the University of Toronto. The Sinton group is application-driven and is currently developing fluid systems to produce renewable fuels chemicals from CO2, and efficient working fluids renewable energy applications.

Shatha Qaqish-Clavering

Director, Strategy and Operations

Shatha is a strategic leader who brings over a decade of experience working in the clean technology, sustainability, and innovation eco-systems. She has experience managing large scale projects including an $85 million government grant program to drive innovative climate change related technologies to reduce greenhouse gas emissions.

Sayyeda Masood

Communications Officer

Sayyeda is a versatile communications professional and proud University of Toronto alumna. At Climate Positive Energy, Sayyeda manages the marketing, communications, and students portfolios, sharing news and updates on the website, sending weekly newsletters to our members, and organizing CPE workshops and events.

YEAR AT A GLANCE

January
- Hired Director, Strategy and Operations
- Launch of weekly newsletter

February
- Faculty kick-off meeting
- Kick-off on working with advancement division on philanthropic goals

March
- First call for proposals with Climate Positive Campus
- Students and post-doctoral fellows kick-off meeting
- Toronto Board of Trade VIP Roundtable – Academic Industry Collaborations
- Adam's Sustainability Celebration – Panel
- UTM-CPE leadership meeting
- Kick-off on work with Government Relations Office

YEAR AT A GLANCE *CONTINUED*

April

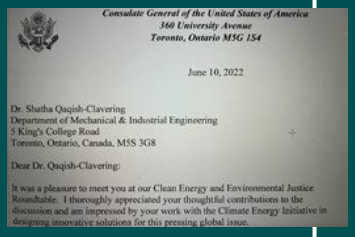
- Climate Economy Strategic Council
- Kick-off of strategy development
- Kick-off of partnerships building and outreach
- First Vice-Deans Meeting
- Speakers Series Launch - Careers at the intersection of science and business
- Rising Stars in Electrochemistry in Canada Conference
- U of T Magazine feature: *Canada's Path to Clean Energy*

May

- Appointed seven members to first Student Advisory Committee
- Held first Executive Committee meeting
- First annual cohort of grad students and post-doctoral researchers announced
- CPE outreach to Department of Sociology
- Engineering Research Day – Panel
- US Consulate Roundtable
- Research Perspective on Carbon Capture and Utilization

June

- Launched annual Visiting Fellow program
- Meeting with VPR from Singapore Metropolitan University
- Launch of undergrad summer research program
- Speakers Series: Entrepreneurship – Start your own company

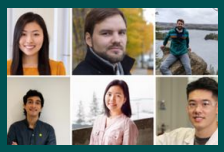

Consulate General of the United States of America
360 University Avenue
Toronto, Ontario M5G 1S4

June 10, 2022

Dr. Shatha Qaqish-Clavering
Department of Mechanical & Industrial Engineering
5 King's College Road
Toronto, Ontario, Canada, M5S 3G8

Dear Dr. Qaqish-Clavering:

It was a pleasure to meet you at our Clean Energy and Environmental Justice Roundtable. I thoroughly appreciated your thoughtful contributions to the discussion and am impressed by your work with the Climate Energy Initiative in designing innovative solutions for this pressing global issue.



YEAR AT A GLANCE *CONTINUED*

July

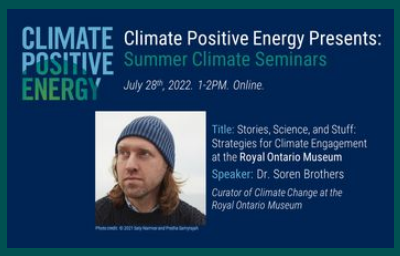
- Hired Communications Officer
- EDI Strategy approved by CPE Executive Committee
- Speakers Series - Climate Engagement at the ROM
- $700K CAAF grant application - Building More Housing and Infrastructure Within Climate Capacity
- CPE at Collision 2022
- Second Vice-Deans Meeting

August

- Inaugural Research Day
- Launched applications for Knowledge Mobilization Grant
- Launched applications for Commercialization Grant

September

- Meeting with the Associate Dean of Internationalism at Manchester University
- Hosted EDI training workshop



YEAR AT A GLANCE *CONTINUED*

October

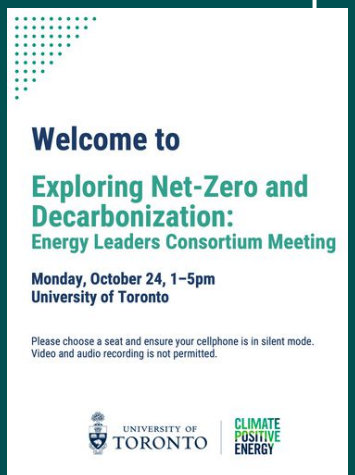
- Hosted Doorways Art Build
- Featured in season premiere of U of T *Groundbreakers*
- Supported Innovation Challenge Launch Event
- Attended Minister Wilkinson's Energy speech at Toronto Economic Club
- Governing Council Presentation
- CPE and its Research Day featured in *The Varsity*

November

- Hosted Energy Leaders Consortium
- 2nd Executive Committee meeting
- Hosted inaugural Climate Economy Summit
- Hosted Pre-Summit cocktail event at Hart House
- Climate Economy Summit featured in *U of T News*
- Launched applications for Just Energy Transition Grant
- Opened applications for Finance & Grant Administrator
- Opened applications for Partnerships & Business Development Officer

December

- Third Vice-Deans Meeting
- $23M grant application for Grid Modernization Centre
- $120K City of Toronto Youth Strategy Development



GOVERNANCE STRUCTURE

CPE is committed to building a network that brings together a wide range of perspectives and lived experiences to enrich its research endeavors.

Executive and Implementation Committees

Reflecting strong leadership with a strategic vision, CPE set up an Executive Committee responsible for supporting the initiative's activities through biannual meetings. We also launched an Implementation Committee consisting of Vice Deans and Associate Vice Principals of research, which meets three times per year to provide advice to CPE leadership team and help overcome challenges.

Executive Committee

David Sinton, Chair
Academic Director
CPE

John Robinson
Senior Advisor

Kate Neville
Academic
Associate Director
of Research

Oleksandr Voznyy
Academic Associate
Director of Research,
University of Toronto
Scarborough

Jody Grewal
Academic Associate
Director of Training
and Knowledge
Mobilization
University of Toronto
Mississauga

Laura Tozer Academic
Associate Director
of Community
Engagement and EDI,
University of Toronto
Scarborough

Shatha Qaqish-Clavering
Director, Strategy and
Operations, CPE

Implementation Committee

Arij Al Chawaf, Co-Chair
Executive Director,
Strategic Initiative
Development
Representing Associate
Vice President, and
Research and Vice Provost,
Strategic Initiatives

Heather MacLean, Co-Chair
Vice Dean Strategy, Faculty
of Applied Science &
Engineering

Vincent Tropepe
Vice Dean,
Research, Faculty
of Arts & Science

Elspeth H. Brown
Interim Associate
Vice Principal
Research,
University of
Toronto
Mississauga

Irena Frances Creed
Vice Principal Research &
Innovation, University of
Toronto Scarborough

GOVERNANCE STRUCTURE

CONTINUED

CPE reports to a Council of the Deans, which supports development of CPE strategy, advises on and approves major changes to the research program, and evaluates progress against targets and relevant benchmarks.

Council of the Deans

Timothy Chan, Co-Chair
Associate Vice-President and Vice-Provost, Strategic Initiatives

Chris Yip, Co-Chair
Dean, Faculty of Applied Science & Engineering

Melanie Woodin
Dean, Faculty of Arts & Science

Kent Moore
Vice-Principal Research, University of Toronto Mississauga

Irena Frances Creed
Vice Principal Research & Innovation. University of Toronto Scarborough

David Sinton
Academic Director CPE

OPERATIONS UPDATE

Processes and Procedures

Climate Positive Energy is setting up modern processes and strategies to meet the obligations of its internal and external stakeholders, increase efficiency, and encourage personal growth among its staff.

CPE created job descriptions, completed hiring through HR support, developed key performance indicators (KPIs) to ensure excellence in operations, and conducted onboarding for the key position of the Communications Officer, as well as conducting interviews for three new positions to be hired in early 2023 (Partnerships Officer, Finance Officer, Commercialization Officer).

For an improved process, CPE developed new budgeting templates and financial reporting processes to ensure sensitive data handling, information organization, and timely distribution of funds to grant recipients. This was supported by Elisabete Augusto, Director of Administration & Finance for the Department of Mechanical and Industrial Engineering.

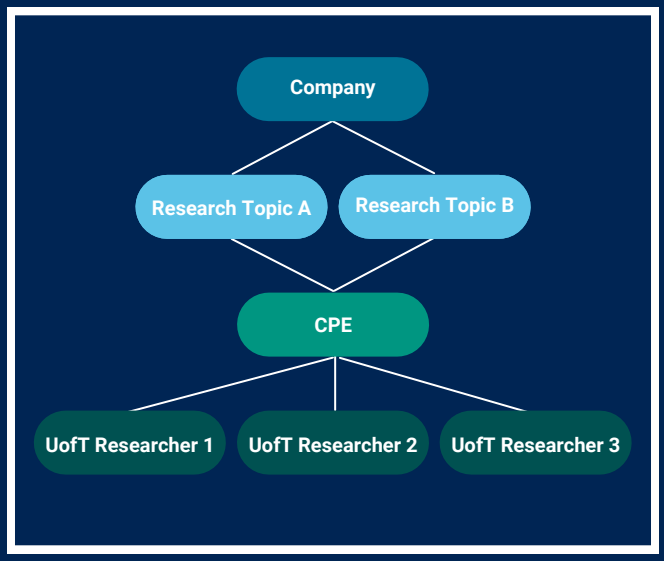
STRATEGIC PLAN

CPE is developing its **corporate and industry** engagement strategy to attract external partnerships based on two distinct models

We established ongoing active consultations with industry leaders and stakeholders from Toronto and throughout Canada who play an important role in the path to net-zero. These leaders share insights and expertise at CPE events and provide valuable programming feedback. As a result, we developed the following two business models:

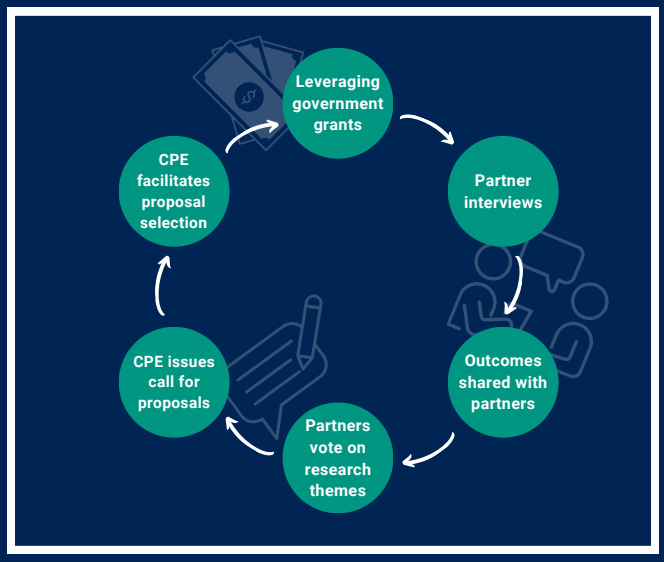
Traditional One-on-One Research Partnership

In this model, intellectual property (IP) is negotiated as part of the framework agreement. Research is directed by the company to align with their core strategic needs. CPE runs the call for proposals competitions, and the partnering company selects the winning research teams.



Net-Zero Alliance Model

This model targets future research and development issues that will support the reduction of the last 30-40% of emissions. These are 5-10 years visionary research projects and will impact various industries. Requires $200/k per year for a commitment of 3 years from each partner.



STRATEGIC PLAN

CONTINUED

In addition to partnerships, CPE is committed to attract government funding through various grants and the involvement of the government relations office at the U of T to provide government outreach and guidance.

CPE is targeting **over $48 million** of value in grant applications. Our strategy is to continue to bring research contracts and support grants that are not less than $500,000 each in value. We are also delivering on all the **4 areas** of our program (training, collaborative research, knowledge mobilization, and partnerships). It has been a strong first year for CPE with deliverables in all the various areas.

Our **communications strategy** was developed to focus on internal and external stakeholders. We launched our digital media presence through our website *cpe.utoronto.ca* and on Twitter handle *@UofT_CPE* for year 1, and LinkedIn is scheduled for year 2. We issued weekly newsletters for internal stakeholders and monthly for external audience. This will ensure continuous engagement internally while at the same time considered as relevant news and industry updates for our external network, as opposed to traditional marketing materials. This will further strengthen CPE's reputation as a thought leader in climate related research. Our subscribers base grew through website newsletter subscription, events registrants, industry outreach, and new member registration. The release of the *Groundbreakers* video and its feature at the Climate Economy Summit elevated the profile of CPE. Our strong communications strategy has resulted in an impressive **65%** weekly open rate and **13%** click rate for our weekly newsletter. This exceeds the industry average for newsletters in the education sector, which is 23.4% (open rate) and 3% (click-through rate). For government newsletters, those figures are 29% and 4%.

Our strategy is also focused on leveraging the strength and breadth of U of T's internal communications network. We partner with various marketing and communications groups across the tri-campus to communicate our events to their divisions and units, and we strategically align our key messages with the university's central messaging.

STRATEGIC PLAN

CONTINUED

CPE has developed a **stakeholders engagement strategy** for both internal and external stakeholders. Our business model described above tackles our external strategy. Internally, the CPE member network includes University of Toronto researchers across 3 campuses and various disciplines. Since our launch, we experienced continuous growth in the numbers of CPE faculty and student members, reflecting broad and diverse interest and engagement. Active outreach through one on one conversations, departmental presentations have been successful to increase CPE awareness and engagement. In addition through our various programs (events, scholarships, grants), CPE has successfully kept our members engage.

We **actively recruit** new faculty members through:

- Direct outreach and referrals
- Partnership opportunities that fall within faculty expertise
- Grants and scholarships applicants

Our **internal stakeholders** also include students and other sustainability and climate related initiatives on campus. We are working with all of these to foster some opportunities for collaboration and involvement as seen throughout the report.

To strengthen our community and commitment to increased capacity for student engagement, we created the **CPE Student Advisory Committee (below)**, consisting of seven graduate students from different programs and campuses who meet at regular intervals to provide important feedback for program development and impact.

Guillermo Lozano Onrubia, Chemistry

Tiange Yuan, Physical and Environmental Sciences, UTSC

Aaron Belman Martinez, Civil and Mineral Engineering

Mengqing Kan, Civil and Mineral Engineering

Chaeyoung (Tina) Ham, Mechanical and Industrial Engineering

Jose Martini Costa, Political Science

Hugo Cordeau, Economics

EQUITY, DIVERSITY, AND INCLUSION

Recognizing that a truly sustainable future involves meaningful connections with and participation from all members of a community, CPE developed an **Equity, Diversity, and Inclusion Strategy** to ensure that the network sustains a diverse community and intentionally cultivates a culture of inclusion. This is actioned through events and activities designed to reduce disparities in opportunities and outcomes, developing diverse future talent through equitable recruitment and outreach, and targeted funding to self-identified marginalized groups for organizing networking and social events. EDI is encouraged at all levels of CPE engagement, from surveys in every grant application, to expert-led trainings exclusively for student researchers. Furthering our commitment and impact, we began the development of a strategic plan informed by the EDI Strategy, which will be ready in 2023 and will meaningfully integrate the intersecting fields of social justice, climate, and clean energy solutions.

These activities have been planned throughout year one of operations and will continue into year two and three. For example, our **Doorways Art Build** represented artists from equity deserving groups expressing climate action through art. Our undergraduate summer awards were meant for students under-represented in the scientific research such as women and people of colour. The EDI training workshop was one of the tools we used to raise awareness about equity deserving and under-represented groups and how the CPE community could be more inclusive in the conduct and impact of research.

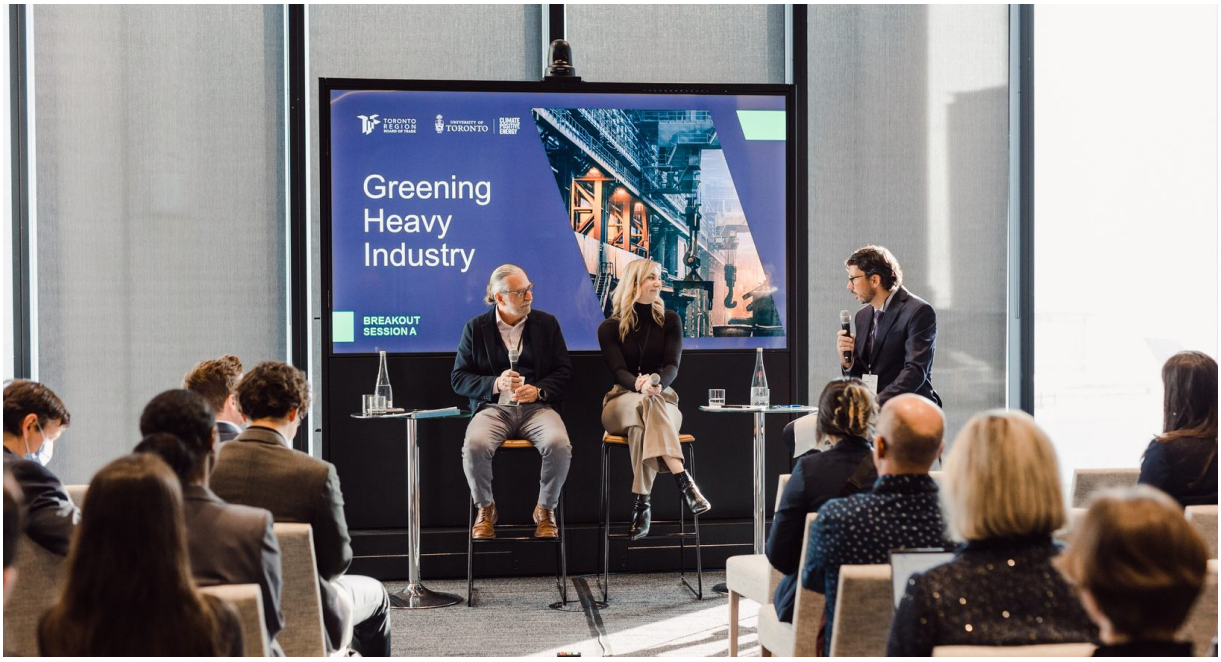
MEMBERSHIP

A Year of Growth

When CPE was launched in Jan 2022, we started with **94 faculty members**. Our membership base has been **increasing** through our active outreach and the interest in our various programs (grants and scholarships), events and industry partnerships. We continued throughout 2022 by having strong involvement with internal stakeholders and recruiting of new members. The idea is to provide an eco-system to U of T researchers to have a better understanding of their fellow researchers working on climate issues at the U of T which will foster cross departmental collaborations. **98 members** are focused on technical aspects related to climate research while **64 members** are focused on social related areas.

We saw 13 new members spike after the RBC proposal, 6 for Manulife proposal, 6 direct outreach, 3 city of Toronto proposal, the rest are through grants applications.

We have grown our faculty membership base by **72%** from 94 to **162**. These members represent **11** divisions, **38** departments and **31** climate related research areas.



MEMBERSHIP

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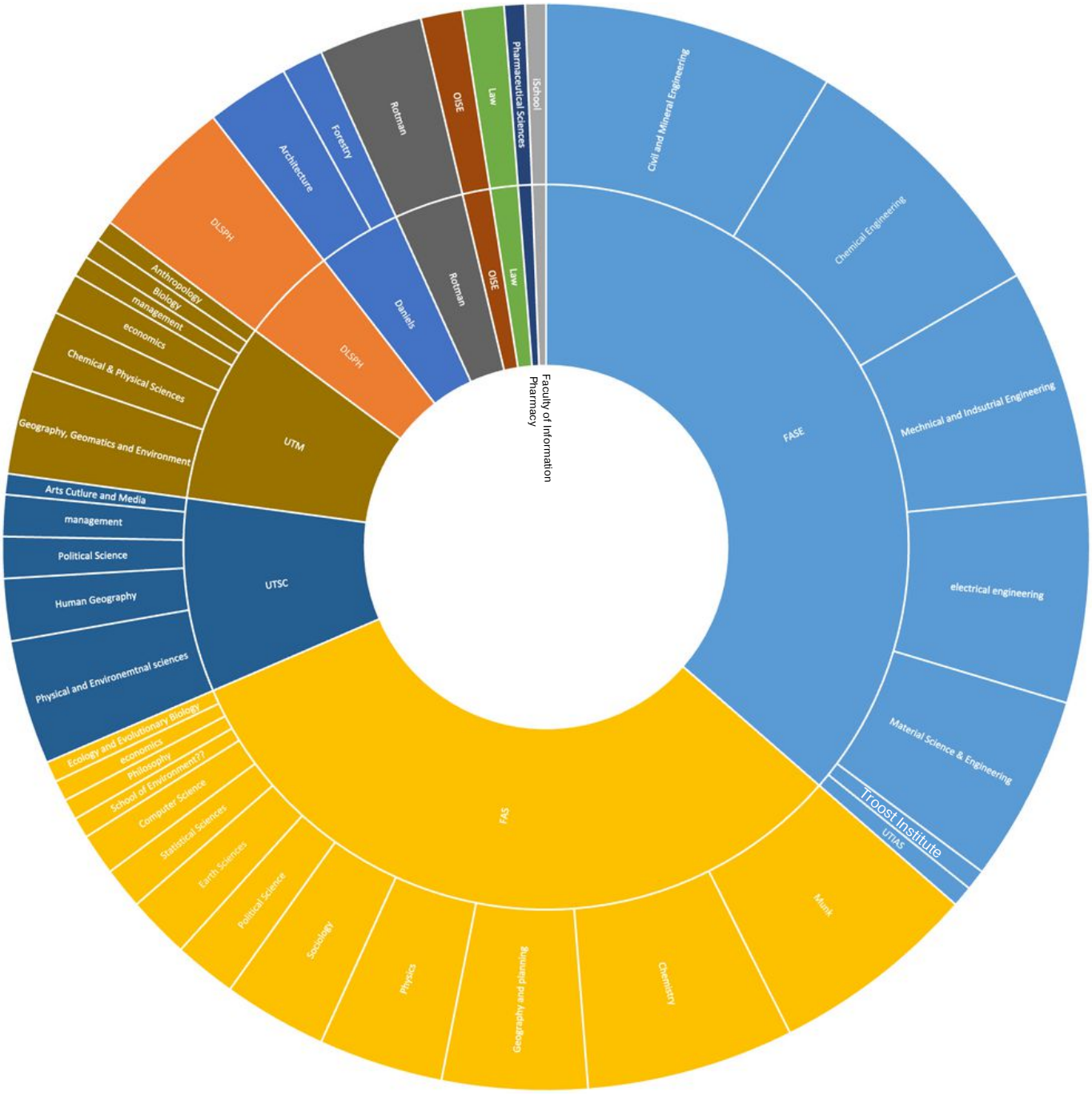
Member Units and Divisions

Total members: 162



MEMBERSHIP

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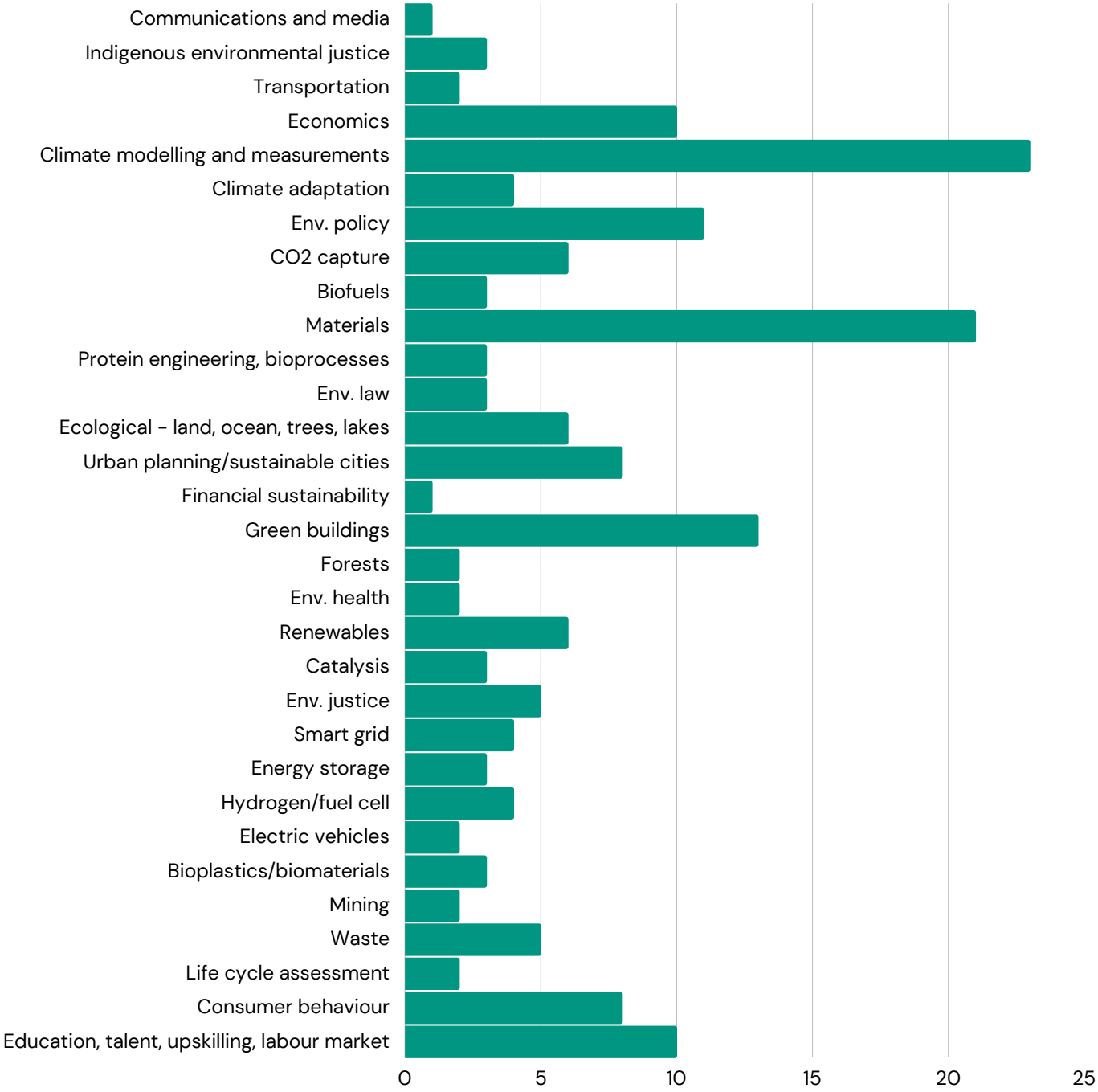
CPE Faculty Member Research Areas



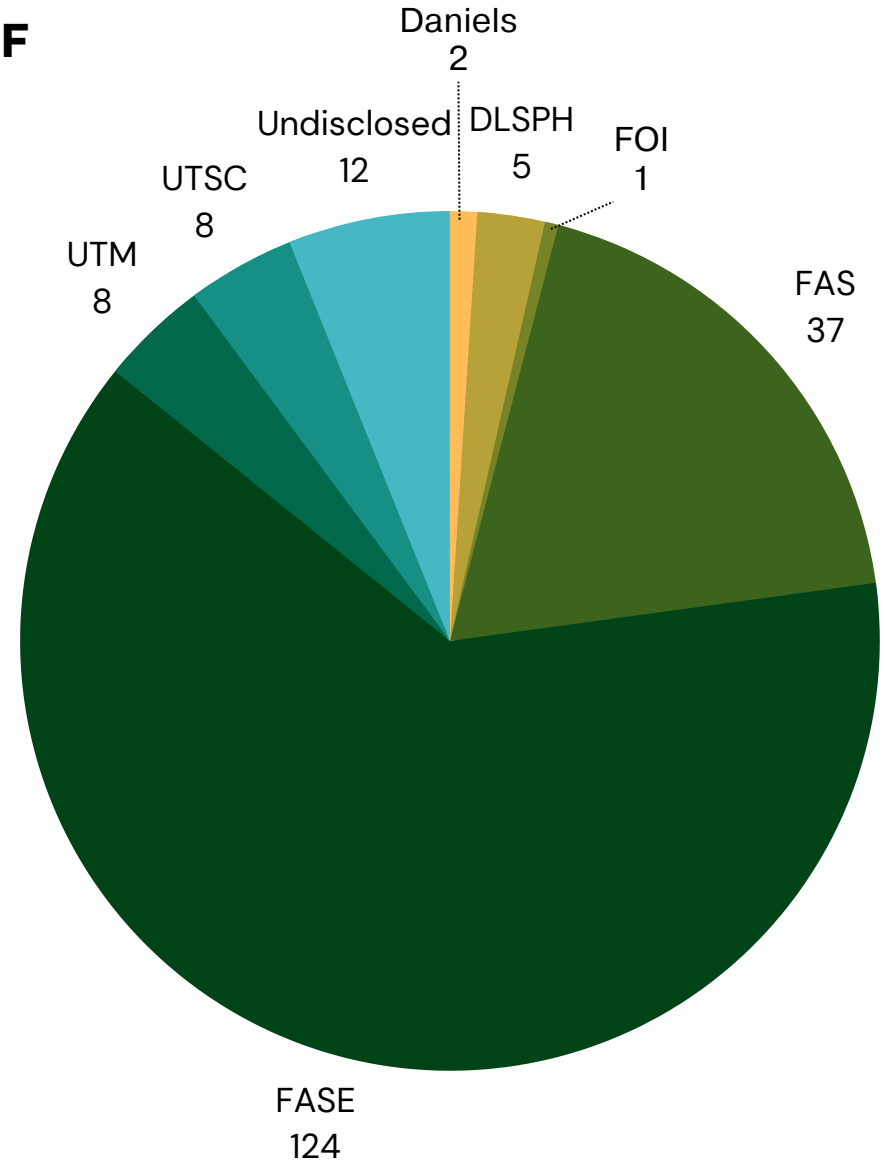
MEMBERSHIP

CONTINUED

Our **students and PDF network** has grown from 124 to **197 members** in 2022, an increase of **60%** in membership due to CPE continuous engagement and programming. **197** student and PDF members (PDF, graduate and undergraduate) represent **7** different divisions reflecting on the width and breadth of CPE outreach. Grad students represent the majority of the network **124** members or **63%** while PDF makes **41** (**27%**) and undergrad students represent the remaining **29** (**15%**). This is due to the nature of research oriented focus at CPE.

Student and PDF Members

Total members: 197

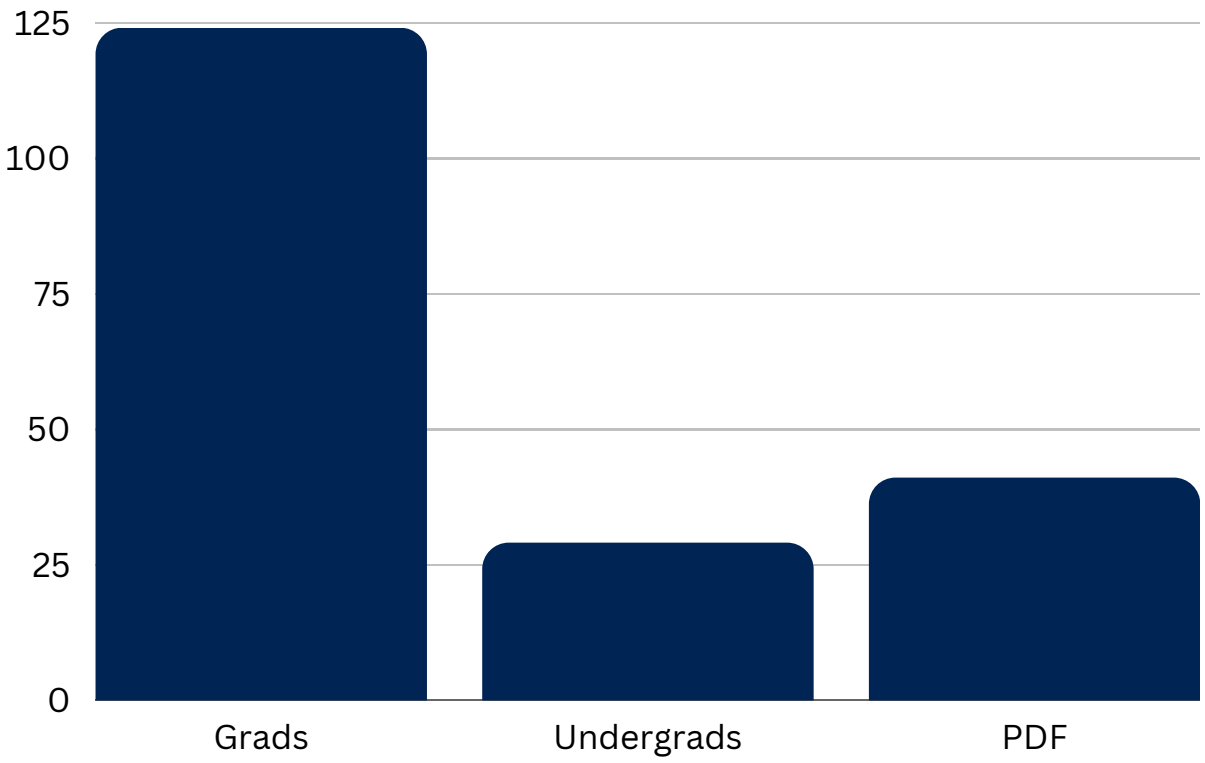


MEMBERSHIP

CONTINUED

Student and PDF Member Program Distribution

Total members: 197



BUDGET

CPE Projects and Operations

In 2022, the total CPE budget was **$2,773,790.** CPE received funding from 6 different sources including FASE, FAS, UTSC, UTM, ISI, and additional partnerships. Our operating costs were mostly covered by the original funding. Additional partnerships of **$325,000** were received from CPC and the City of Toronto to be spent on research projects. Of this, **$225,000** went towards the CPE/CPC joint call for proposals, and **$100,000** towards the City of Toronto Youth Engagement Strategy for Climate Action.

In terms of expenses, our major spend was providing research funding to PIs and scholarships to students. Approximately **70%** of our spending went towards research and training programs. Our operational spending in terms of staff salaries and business development and outreach represent **17%** of our total budget. Our **$297,450** in commitments is currently awaiting delivery of funding from City of Toronto before CPE can release matching funds. The remaining budget was allocated to grants and scholarships that are being released on an installment basis. As a result, for 2022, CPE will be carrying forward **$70,339**.

Budget Expenses

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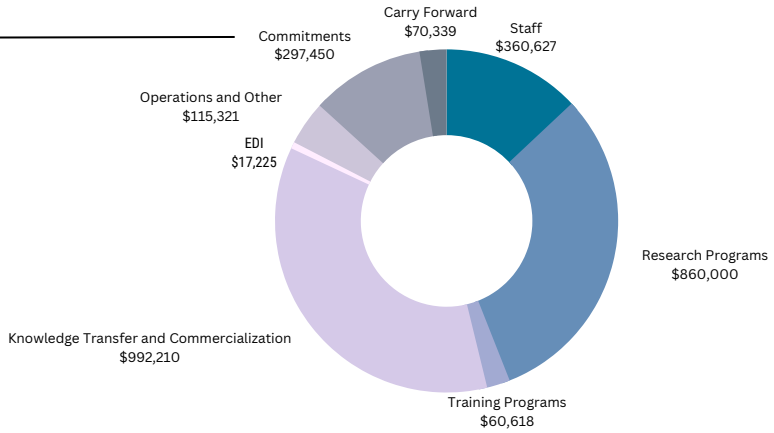
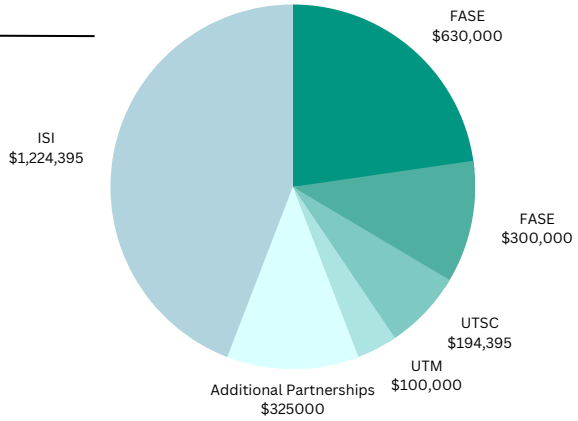


Sources of Funding

ISI Reporting Year 2022



BUDGET

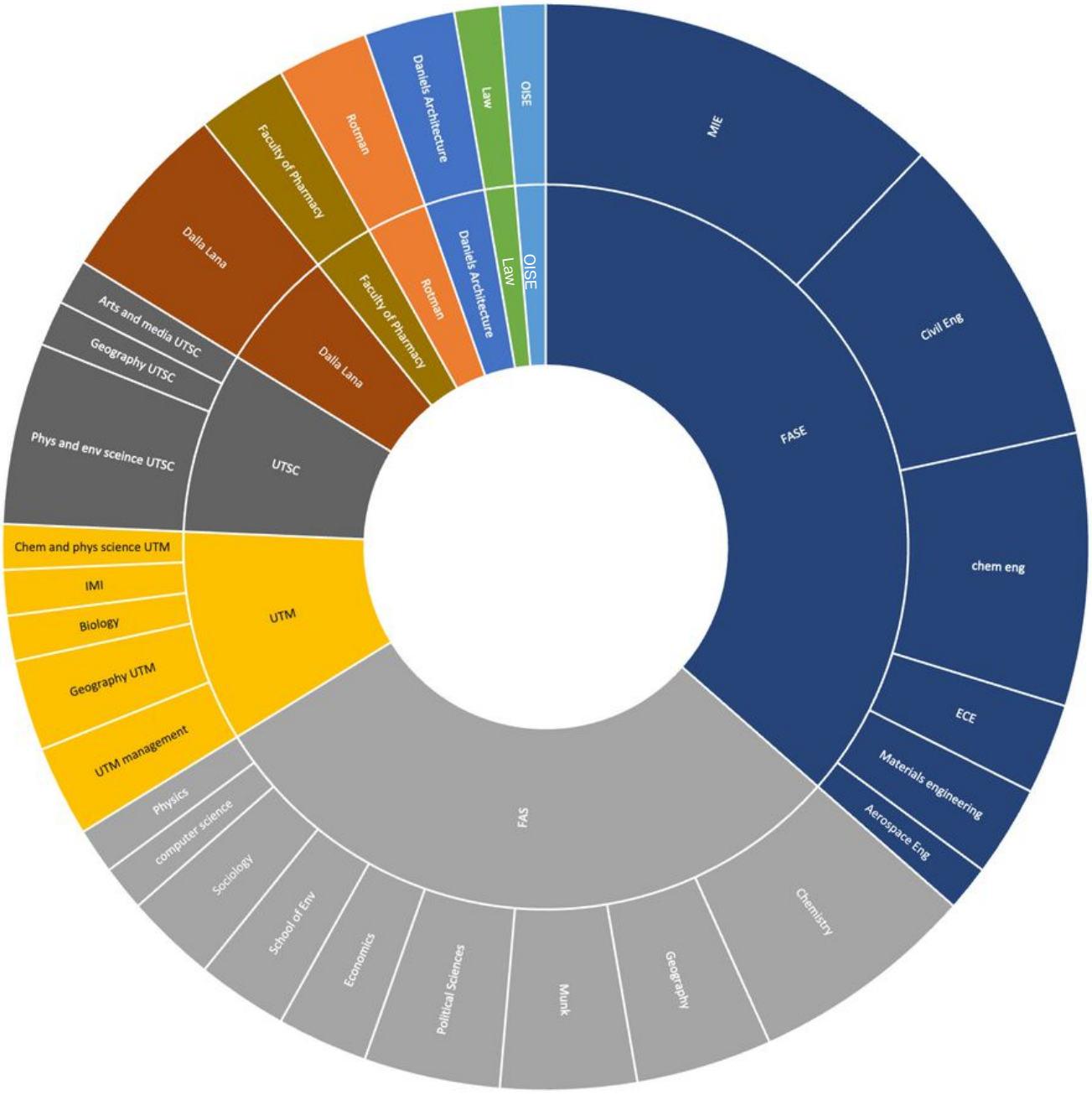
CONTINUED

Call-for-Proposal Awardee Unit and Divisions (PIs)

Total successful projects: 50*

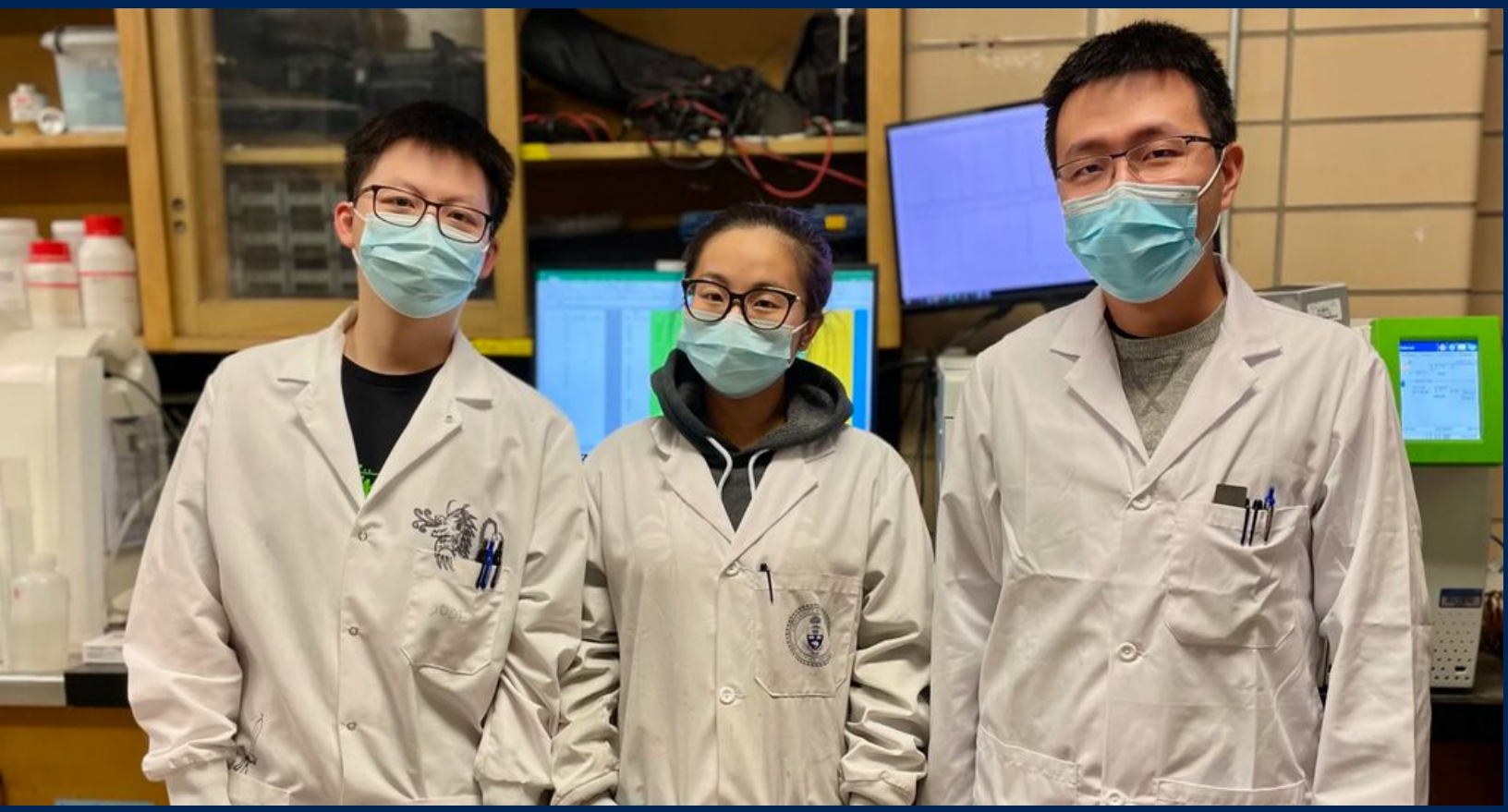
* Includes City of Toronto youth project

Below is the allocation of the $1.9M* in total funds distributed through grants and scholarships reflected through the number of PIs per department.



INTERNAL IMPACT Through Research

CPE has issued **4** calls for proposals (valuing at a total of **$1.1M**) encompassing catalyst, commercialization, knowledge mobilization, and just energy transition themes. The **19** successful projects represent **72** multidisciplinary investigators from **24** departments across **3** campuses.



INTERNAL IMPACT Through Research

CPC-CPE Jointly Funded Projects

The Climate Positive Energy research initiative and U of T's Climate Positive Campus are supporting research that assists the University in reaching its net-negative 2050 campus goals, funding 4 projects with a total of $450,000 in grants for 2 years. The projects represent 16 interdisciplinary PIs across the tri-campus. Achieving the campus climate positive 2050 goal requires a major transformation of the campus and a new model of sustainable growth. These projects represent an opportunity to innovate and advance science, technology, policy, and frameworks that can be proven and piloted at U of T as a living lab. The four CPC-CPE funded projects focused on the themes renewable energy, energy efficiency, health, well-being and behaviour, and emissions accounting.

Solar panel coating for increased power output of PV installations at U of T

Theme: Renewable Energy
Team: Cynthia Goh (Chemistry) and Sanjeev Chandra (Mechanical and Industrial Engineering)
Summary: Designing a nano-composite based solar panel coating that can be applied on-site to minimize light reflection and repel dust, snow and other deposits, improving the power output by approximately 5%.

Active, fluidic windows for energy savings, load management and enhanced daylighting on U of T campus

Theme: Energy Efficiency
Team: Ben Hatton (Materials Engineering) and Alstan Jakubiec (Architecture)
Summary: Designing active, fluidic windows modelled after systems found in nature to allow for dynamic control of transmission, absorption and scattering of light. This can save75% on heating energy, 20% on electric lighting energy, and 43% on total operational energy compared to the best available electrochromic technology.

INTERNAL IMPACT Through Research

CONTINUED

Decarbonizing the UofT community: How can we enable more sustainable and equitable personal choices across the three campuses?

Theme: Health, well-being and behaviour
Team: Eric Miller, Marianne Hatzopoulou, Daniel Posen, Khandker Nurul Habib, Heather MacLean, Sham Gamage, Junshi Xu (Civil Engineering), Matt Adams (UTM Geography), Karen Chapple (UTSG Geography), Steven Farber (UTSC Geography)
Summary: Analyzing the factors that influence travel behaviour to and from campus to provide understanding into how transportation infrastructure is meeting the needs of the community. and where inequities exist.

Grid-Interactive Smart Campus Buildings

Theme: Renewable Energy
Team: Seungjae Lee (Civil and Mineral Engineering) and Chi-Guhn Lee (Mechanical and Industrial Engineering)
Summary: This project aims to develop a novel and scalable building energy modelling and optimal control framework by using modern AI techniques to optimize campus building HVAC operations and transform campus buildings into grid-interactive smart buildings.

INTERNAL IMPACT Through Research

CONTINUED

Commercialization and Knowledge Mobilization

CPE awarded $400,000 in funding for 8 projects. These projects represent 18 interdisciplinary PIs in 8 departments across the tri-campus network, and an opportunity to innovate and advance science, technology, policy, and frameworks to achieve a just and equitable energy transition and a decarbonized economy. We announced 8 projects under the Empower (green chemistry, renewable energy, hydrogen, and fertilizers) and Envision (buildings and infrastructure, a just transition, and sustainable transit) themes.

Smart De-icing Coatings Enabling Efficient, Year-Round Wind Turbine Energy Production

Theme: Renewable Energy
Team: Kevin Golovin (Mechanical and Industrial Engineering)
Summary: A smart, next-generation de-icing technology that combines ice sensors, heaters, and a novel de-icing coating that can keep turbine blades ice-free using less than 1% of the power that current solutions use.

Developing a Carbon Capturing Combustor-reactor Powered by Hydrogen Generated in-situ from Thermally Coupled Pyrolysis of Natural Gas

Theme: Hydrogen
Team: Swetaprovo Chaudhuri (Aerospace Science and Engineering)
Summary: Developing a new hydrogen pyrolysis based system with a dual combustor-pyrolytic reactor, based on a new concept combustor fuelled by the existing natural gas network, with very little or no additional energy input.

Fertilizer and Plastics Precursor, Greenhouse Gas-Free, using Air and Sunlight

Theme: Carbon Neutral Fertilizer
Team: Ulrich Fekl (Chemical and Physical Sciences, UTM)
Summary: Designing an effective, greenhouse gas-neutral process for ammonia production that requires only a small energy input, which can conveniently come from sunlight.

INTERNAL IMPACT Through Research

CONTINUED

Building More with Less: Pathways to build the infrastructure of the future within allowable embodied GHG budgets

Theme: Buildings and Infrastructure
Team: Shoshanna Saxe, Daniel Posen, Heather MacLean, Evan Bentz, Daman Panesar (Civil and Mineral Engineering), Elias Khalil (Mechanical and Industrial Engineering), Chris Essert (Law)
Summary: Ensuring that the construction associated with much-needed new buildings and infrastructure consumes resources within the carrying capacity of the planet.

How to Decarbonize Automobile Transit: Lessons from Norway

Theme: Sustainable Transit
Team: Robert McMillan (Economics)
Summary: Examining how the raft of policies that Norway implemented can provide unique insight into the levers that could be used in Canada, to understand what factors affect individual decisions to purchase electric cars, and measure the benefits to the environment of doing so.

Manufacturing Unnatural and D-Amino Acids using Green and Recyclable Chemistry

Theme: Green Chemistry
Team: Jik Chin (Chemistry)
Summary: Developing a general and modular method for the synthesis of unnatural and D-amino acids which, when compared to existing methods, allows the generation of a greater diversity of unnatural amino acids at a low cost using recyclable chemicals that minimize pharmaceutical pollution.

Just Mitigation?: Applying a climate justice approach to the implementation of mitigation policies in growing cities in Southeast Asia

Theme: Just Transition of Climate Action
Team: Amrita Daniere, Joanna Kocsis (Geography and Planning), Try Thuon (Royal University of Phnom Penh, Cambodia)
Summary: Comparing two different models of GHG emissions reduction, as implemented by municipal governments in Southeast Asian secondary cities, to better understand how they impact marginalized communities.

Grounding Models: Co-creating agent-based models to understand TransformTO goals

Theme: Just Transition: Urban Living
Team: John Robinson (Munk School of Global Affairs and Public Policy), Heather Dorries, Majd Al-Shihabi (Geography and Planning)
Summary: Addressing the TransformTO Modelling Advisory Group 2017 final report of low carbon goals and strategies through participatory modelling, where stakeholders from across affected communities work together to understand and evaluate the impact of the policies by designing and running experiments in “virtual worlds” using a simulation technique.

INTERNAL IMPACT Through Research

CONTINUED

Just Energy Transition

The transition to a Net-Zero future involves not only reducing our energy demands and lowering GHG emissions, but also ensuring that the adoption of these new solutions continues to serve local and global communities. Supporting research that assists the University, Canada, and the world in reaching our Net-Zero 2050 emissions goals, Climate Positive Energy announced the funding of 6 new projects with a total of $300,000 in grants over 2 years. The projects represent 18 interdisciplinary PIs in 6 departments across the tri-campus network.

Development of a climate resilience and environmental sustainability toolkit for pharmacists

Theme: New Skills for the Decarbonized Economy
Team: Zubin Austin (Pharmaceutical Sciences, Leslie Dan Faculty of Pharmacy), Annalise Mathers (Leslie Dan Faculty of Pharmacy), Jamie Kellar (Dalla Lana School of Public Health)
Summary: Bringing together a guiding coalition of educators, regulatory bodies, patient groups and others to develop a pan-Canadian toolkit of best practices with respect to climate mitigation and adaptation in pharmacy.

Exploring gaps and requirements to support more just engagement with energy modelling for building retrofits

Theme: Climate Modelling
Team: Robert Soden (Computer Science and School of the Environment), Samar Sabie (Computer Science), Steve Easterbrook (Computer Science and School of the Environment)
Summary: Investigating how a modelling-based approach to energy transitions can support more equitable participation and just decision making for building retrofits.

Performance matters: Augmenting analyses of residential solar PV deployment and distribution with system performance data

Theme: Policy recommendation
Team: Fedor A. Dokshin (Sociology)
Summary: Providing actionable policy recommendations for governments to ensure that residential solar PV contributes to a rapid and just energy transition.

INTERNAL IMPACT Through Research

CONTINUED

Application of the University of Toronto Climate Downscaling Workflow to the Just Energy Transition

Theme: Climate Modelling
Team: Paul Kushner (Physics), Oya Mercan (Civil and Mineral Engineering), Daniel Posen (Civil and Mineral Engineering), Marianne Touchie (Civil and Mineral Engineering), Karen Smith (Physical & Environmental Sciences), Sam Markolf (University of California, Merced)
Summary: Developing tools to accelerate research and applications using downscaling, which maps available climate information with engineering requirements, while accounting for sampling, biases, and uncertainty.

Assessing opportunities in carbon capture and conversion to fuel technologies for empowering Indigenous-led clean energy projects and Northern utilities

Theme: Climate, Energy and Indigenous Peoples
Team: David Sinton (Mechanical and Industrial Engineering), Michael Ross (Yukon University), Kate Neville (Political Science and School of the Environment)
Summary: Uniting deep CO2-to-fuels technological expertise, engagement with Northern Indigenous community-led projects and their leaders, and expertise in environmental politics, resource governance, water, and energy to explore the potential for carbon conversion technologies to support low-carbon energy transitions in the Canadian North

Accounting for the Extractivist Footprint of EVs: A Comparative Analysis of Local and Transnational ESG Standards Governing Lithium Production

Theme: Corporate Governance and Environmental, Social, and Governance (ESG)
Team: Teresa Kramarz (School of the Environment)
Summary: Investigating how the emergent ecosystem of ESG standards and regulations is being constituted by addressing transnational standards and domestic legislation related to electric vehicle sales, social and environmental requirements, and affected local and Indigenous communities.

INTERNAL IMPACT Through Training

CPE has issued 4 calls for scholarships $600,000 for graduate and undergraduate student researchers, visiting fellows, and post-doctoral fellows, supporting 30 scholarships and awards from 20 departments across 3 campuses.

INTERNAL IMPACT Through Training

CONTINUED

Post-Doctoral Fellowships

Climate Positive Energy invited applications for the Rising Stars in Sustainable Energy Postdoctoral Fellowship, supporting 6 successful projects to undertake multi-disciplinary sustainable energy research. These fellowships attracted distinguished early career researchers to the University of Toronto. Postdoctoral fellows were supported with a minimum of $50,000 for one year, and served as part of a growing network of Climate Positive Energy members with access to dedicated programming and career and professional development activities.

Da Huo,
Civil Engineering
Modelling electric and hydrogen fuel cell pathways for Canadian light-duty vehicles to meet climate targets

Alexandre Tugirumabano,
Mechanical & Industrial Engineering
Enhancing Mass Transport in Polymer Electrolyte Membrane Electrolyzer for Effective Hydrogen production

Jinjin Chen,
Chemical Engineering
Sustainable carbon-negative biomining-coupled biofuel production using genetic engineered Acidithiobacillus ferridurans

Yishi Zhou,
Mechanical & Industrial Engineering
Photothermal ice nucleation inhibiting coating for improved clean energy equity

Harrison Mills,
Chemistry
Sustainable carbon-negative biomining-coupled biofuel production using genetic engineered Acidithiobacillus ferridurans

Pengfei Ou,
Electrical & Computer Engineering
AI Driven Catalyst Research

INTERNAL IMPACT Through Training

CONTINUED

Graduate Scholarships

We funded our first annual cohort of graduate student researchers, tackling research related to Just Transitions, Carbon and Measuring, Modelling and Markets. Graduate scholars were supported with a minimum of $15,000 each, and served as members of a growing network of Climate Positive Energy graduate students and post-doctoral fellows with dedicated programming and career and professional development activities.

Sabrina Madsen,
PhD Student in Atmospheric Physics
Quantifying Toronto's Vegetative and Anthropogenic CO2 Fluxes

Aldrick Arceo,
PhD Candidate in Civil Engineering
Embodied Carbon Intensity Reduction of Single-Family Dwellings in the City of Toronto

Charlie Bain,
PhD Student in Political Science
The political economy of convertible firms: Electric utilities and automakers in climate politics

Garrett Morgan,
PhD Candidate in Urban Planning
Equitable climate action in the world's 'most sustainable cities'

Valeria Morozova,
PhD Student in Chemistry (UTSC)
Machine learning-enabled discovery of redox agents for electrochemical capture and concentration of CO2

Nina-Francesa Farac,
PhD Candidate in Chemical Engineering & Applied Chemistry
Harnessing More Solar Energy : The Sustainable Design of Hybrid Organic Materials for Next-Generation Organic Solar Cells

INTERNAL IMPACT Through Training

CONTINUED

Hugo Cordeau,
Economics
Canadians and the Carbon Tax: A Story of Inequality

Shahzeb Mirza,
Mechanical and Industrial Engineering
Cooling Electric Vehicle Power Electronics using Metallic Phase Change Materials

Mehran Dadsetan,
Mechanical and Industrial Engineering
Low-GHG Hydrogen Production by Microwave-Driven Methane Pyrolysis

Rick Fu,
Chemistry
Guanidinesas a Motif For Carbon Capture and Activation

Laura Jones,
Biology (UTM)
Resilient Forests in a Changing Climate: Understanding Long-Term Responses of Trees to Weather Extremes

Guangming Cai,
Chemical Engineering
Catalytic Insight into Direct Synthesis of Renewable Liquid Fuel

Mircea Ghergina.
Sociology
Capturing Carbon: Innovation, Values, and the Emergence of a Clean Technology, 1996-2021

INTERNAL IMPACT Through Training

CONTINUED

Undergraduate Summer Researcher Awards

We supported ten undergraduate summer researchers working on clean energy and climate related projects. Undergraduate researchers who are underrepresented in research or in their field were awarded $5,000 to support work focused on achieving a just and equitable net-zero future.

Amelie Desroches,
Geography, Geomatics and Environment, UTM
Understanding the Social Benefits of Urban Trees

Amalie Wilkinson,
International Relations and Peace, Conflict and Justice Studies
The dynamics of lithium mining for a clean energy transition in Québec, Canada

Katherine Liang,
Engineering Science
48V-to-1V Converter for Improved Efficiency in Automotive Applications

Mishaal Kandapath,
Atmospheric Physics, UTSC
Validating Satellite Measurements of Urban Emissions

Michal Korteweg Davis,
Engineering Science
A Fine-Grained Dataset of Material Usage in Buildings to Increase Material Efficiency

Matthew Edghill,
Biochemistry
Artificially Evolving Bacteria to Consume Recyclable Feedstocks

Karen Chen,
Engineering Science
The Holiday Effect: A Natural Experiment to Understand Anthropogenic Emission Sources and Reduction

Badr Abbas,
Chemical Engineering
Transport of Medium Chain Fatty Acids through Rubbery Polymer Films

Tobin Zheng,
Materials Science and Engineering
Converting Tea Waste to Electrodes for Energy Storage

Tomi Bamigbade,
Architectural Studies
School of the Environment Photovoice Research

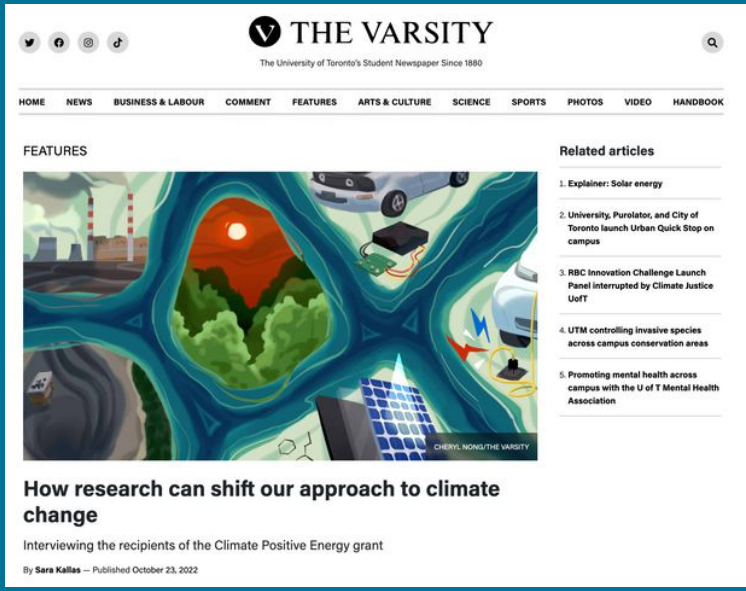
INTERNAL IMPACT

Through Training

CONTINUED

News feature: *The Varsity*

Climate Positive Energy student researchers and graduate scholars were featured in an article in student-run publication, *The Varsity*, published October 2022. The article highlights the value of a multi-disciplinary approach to climate change research, and the extended network of researchers and experts available to CPE student members.


THE VARSITY

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CHERYL NONG/THE VARSITY

How research can shift our approach to climate change

Interviewing the recipients of the Climate Positive Energy grant

By Sara Kallas — Published October 23, 2022

> *Though [Amalie] Wilkinson has only recently started working for CPE, she has already seen a noticeable difference between its working environment and the environment of initiatives she was formerly involved with. In her past experiences, Wilkinson found that researchers would only interact with professionals in their fields; while working with CPE, she has already spoken with lithium stakeholders, university researchers, and biologists who specialized in hydrogeology.*

INTERNAL IMPACT Through Training

CONTINUED

Visiting Fellowship

CPE awarded Ian Hamilton, a renowned and accomplished researcher in the field of energy, environment and Health, a visiting fellowship of $40,000. Ian led the development of the UK's health impact assessment model for evaluating all UK building energy efficiency policy and its impact on indoor environmental conditions and population health, and used in the National Institute of Health and Care Excellence guidance on excess winter death in the UK. Ian was previously Executive Director of the Lancet Countdown on Health and Climate Change, and is now the Mitigation Chair for the Countdown. Ian is the co-investigator on the UKRI Centre for Research into Energy Demand Solutions, the NERC APEx London Air Pollution and ANTICIPATE project, and Newton funded Capability and Energy Poverty project in Mexico. He has worked with the IEA to develop the Global and Regional Roadmaps for Buildings and Construction for Africa, Asia and Latin America, and the Global Alliance for Buildings and Construction's Buildings Global Status Reports since 2018.

Ian Hamilton,
CPE Visiting Fellow
Tracking the impacts of climate mitigation and energy transition actions on health in Toronto among vulnerable communities

As part of this fellowship, Ian will work with colleagues across U of T to identify and develop the conceptual framework to describe the health impacts of climate change and climate actions across the Greater Toronto Area. The outcome will identify a set of potential indicators that can be used to identify risks and opportunities for health, especially among communities who are climate and health vulnerable, in order to better be able to develop a broad coalition of stakeholders to support climate positive actions that can enable greater resilience and inclusive societies within a thriving ecosystem.

INTERNAL IMPACT Through Training

CONTINUED

We understand the impact of non-curricular training on our network of students. This is why we organized a Speaker Series and additional events to provide trainees with the opportunity to hear about various perspectives as they relate to climate, networking with other peers, and preparing for their future careers. These events include:

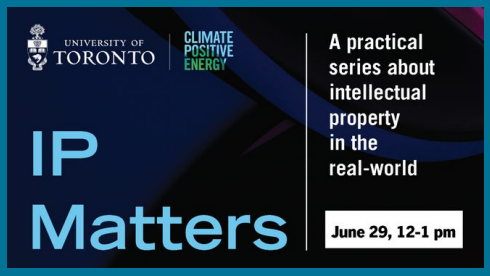
April 27, 2022: Climate Careers at the Intersection of Business and Science: Speakers include Zoltan Tompa (Managing Director at BDC Cleantech Practice, Fiona Oliver – Glasford, President at ClearBlue Markets, Charles Sole, Director Commercial at Leyton). The guests shared their career paths with the students and indicated that a technical training does not necessarily lead to a technical career. There is so much more the students could do with their technical training such as investment analysis where an understanding of the technology and its value is one of the key elements to make a sound investment decision. Fiona discussed carbon markets, credits and taxation system and how they can have careers in this field. In addition, from business perspective, Charles explained how technical training can be important in the business development world.

May 26, 2022: Research Perspectives: Carbon Capture, Utilization, and Storage. Originating from the multi-disciplinarity of CPE, we selected students across various disciplines to speak about technical, economic and social challenges to carbon capture. The session helped CPE students to breakdown the complexity of their research to present it to their peers and external audience. It also provided a platform for these students to gain confidence and share their research.

INTERNAL IMPACT Through Training

CONTINUED

June 29, 2022: CPExIPO Cleantech Commercialization Stories provided relevant real world experience of clean technologies that originated in the labs of the U of T and moved ahead to be incorporated as successful businesses. The session provided great insights and tips for students of how to spot a good idea they are researching, when to think about filing a patent and how to go about financing it. The session was moderated by Jennifer Fraser, Director of Innovation at the Innovation and Partnerships Office at the university. Challenges and roadblocks were shared but the bottom line is determination. Speakers were founders of the U of T start-ups CERT, Aurora Hydrogen and Reeddi.



July 28, 2022: Stories, Science, and Stuff: Strategies for Climate Engagement at the Royal Ontario Museum. Soren Brothers the First Curator of Climate Change at the Royal Ontario Museum provided an inspiring talk about climate awareness and how to handle various opinions and various perspectives. It provided the students and the audience with a wealth of insights to think about when we talk to each other about climate a change, a topic that is highly polarized.

August 17, 2022: CPE Research Day, an opportunity to encourage students to present their research in front of large group of audience who is not mainly scientifically oriented. This helped student researchers to overcome presentation anxiety, and to break down complex ideas to be understood by a general audience and to network with their peer colleagues and various faculty and industry partners who were present.

In addition to these, there are further events throughout this report that were targeted to and especially designed for students, where they benefited the most.

INTERNAL IMPACT

On Equity, Diversity, and Inclusion (EDI)

CPE is keen on supporting EDI throughout our strategy, and has developed an **EDI strategy** to promote its mandate within our research communities. We have EDI questions in every application. We also made it mandatory for applicants to fill out our EDI survey. We have also designed a summer undergrad program to increase enrollment from underrepresented groups in their fields which include women, indigenous, persons with disability, LGBTQ community members. We hosted an EDI workshop for students to encourage them about including EDI principals in every aspect of their research work and how that could look like, as illustrated by a panel of EDI experts (pictured to the right).

CPE Faculty Grants

CPE launched 4 calls for proposals, and in the last 3 calls, made it mandatory to fill out the EDI survey. One of the takeaways from our EDI report is that there is no indigenous representation in our applicants, with majority being male applicants. Majority of applicants were white in some grants, whereas in others, the majority were people of colour. We did not see a difference on this percentage depending on the theme as it relates to our applicants (technical versus humanities). Future programs should seek to improve on the representation of Indigenous people, people of colour, people with disabilities, and sexually diverse individuals.

INTERNAL IMPACT

On Equity, Diversity, and Inclusion (EDI)

CPE Student and Post-Doc Scholarships and Awards

For our Graduate and PDF scholarships, some of the measures were different from what we have seen in our faculty awards. We do not yet have Indigenous representation among our student applicants. However, through the CPE-funded collaborative project with Yukon University, we attracted an Indigenous engineering graduate school applicant, and are hoping that she will join the team in 2023. The majority of student applicants were from a racialized group. There is more diversity in sexual orientation for this segment. Future programs will seek to improve on the representation of Indigenous and Black people, and people with disabilities. To address this gap, we launched an EDI workshop and we issued a competition for students that are underrepresented in their fields to ensure CPE's outreach and support to the various demographic communities at the U of T.

INTERNAL IMPACT

CONTINUED

On Equity, Diversity, and Inclusion (EDI)

Grant Applicant Gender Distribution

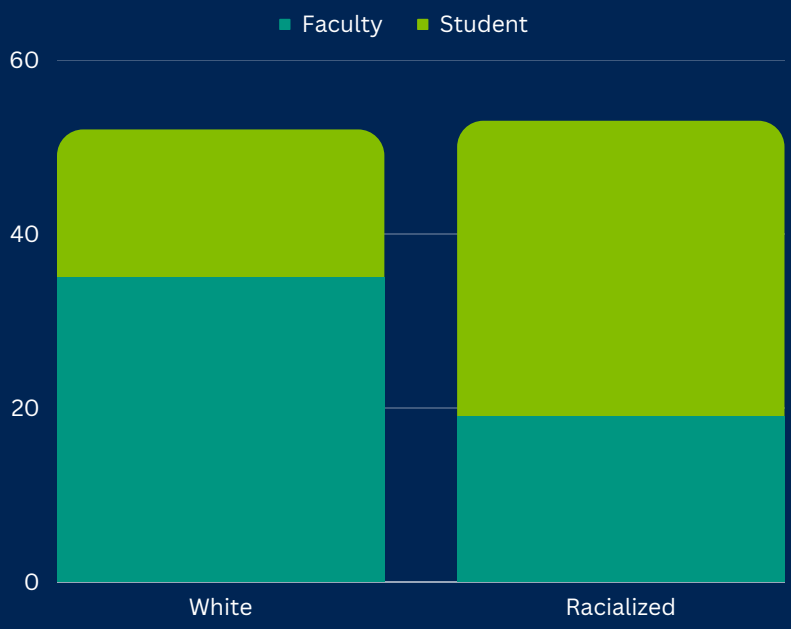
For Faculty

Grant Applicant Gender Distribution

For Students

Grant Applicant Race Distribution

For Faculty and Students



INTERNAL IMPACT Through Partnerships

Our 162 members who span across 11 divisions and 38 departments and our funding programs that supported 30 departments are just an indication of the reach and engagement that CPE accomplished internally with various stakeholders at the U of T. Our newsletter reaches 939 total subscribers, 717 of which are internal subscribers. Our newsletters have an impressive average open rate of 65.2% (Industry average metrics for newsletters in the education sector are 23.4% open rate and 3% click-through rate, or CTR. For government, those figures are 29% and 4%. CPE is very proud of all the support we have received by our internal champions, funders, and stakeholders.

CPE partnered with U of T's **Climate Positive Campus** an initiative part of the office of **Facilities and Services** to support research that assists the University in reaching its net-negative 2050 campus goals. The current estimate of direct (Scope 1+2) emissions is 114 kT CO2/yr. Achieving the climate positives 2050 goal requires a major transformation of the campus and a new model of sustainable growth. Facilities and Services are already implementing programs to reduce the carbon footprint associated with university operations, including responsible growth, cleaner and more efficient heating and cooling, low-carbon buildings, and Canada's largest geo-exchange system. These current initiatives are expected to reduce emissions (scope 1+2) to ~ 85 kT CO2/yr by 2024. This $225,000 in funding from Climate Positive Campus was matched by CPE funding to supports research projects that have the potential to be piloted at UofT within 5 years and mitigate or quantify a substantial portion of current emissions – and an opportunity to innovate and advance science, technology, policy, and frameworks that can be proven and piloted at U of T as a living lab.

INTERNAL IMPACT

Through Partnerships

CONTINUED

Originating from CPE's belief that commercialization is key to the impactful research, **CPE partnered with U of T Entrepreneurship** for the launch event of the RBC Innovation Challenge, an annual, university-wide competition open to all students, that invites multi-disciplinary teams to think big and focus on technology projects with the potential for global impact.

We provided awards for the winning teams and provided mentorship support and connection for student groups through our wide network in the cleantech space. We also partnered with Innovation and Partnerships Office and the U of T Entrepreneurship to host a well-attended online event oriented to provide researchers with insights and lessons learned on commercializing their research and brining it from the lab to the market. The event featured U of T entrepreneurs in the cleantech space to share their stories and anecdotes with the audience.

> *CPE has been incredibly supportive of the University of Toronto Entrepreneurship (UTE) community and the rapidly increasing number of climate and cleantech startups being created across the tri-campus. As a delivery partner for the Tech for a Greener Future – RBC Innovation Challenge they supported 25 student teams working on projects to help us reach Net zero, through mentorship, speakers and prizes. Representatives from CPE, including Professor Sinton have spoken and inspired at a number of UTE events over the past year.*

Jon French, Director, University of Toronto Entrepreneurship

INTERNAL IMPACT

Through Partnerships

CONTINUED

CPE strengthened our partnership with **U of T's Mobility Network**, a network of mobility researchers from across University of Toronto. CPE provided a $100,000 grant and marketing support for the Network's flagship event. We also continuously included some of the network members in our partnership proposals and made multiple introductions and referrals for the network to various organizations.

> *CPE played a crucial role in enabling our research and partnerships in the area of transport decarbonization, by supporting our work on behaviour and mobility choices and their role in climate mitigation.*

Marianne Hatzopoulou, Professor, Civil and Mineral Engineering, Canada Research Chair in Transport Decarbonization and Air Quality

INTERNAL IMPACT Through Partnerships

CONTINUED

Supporting innovative ways to meet the urgent and growing Canadian and global need for infrastructure, CPE assisted with the establishment of the **Centre for the Sustainable Built Environment**, which will study how improved structural design, smarter planning and better materials can reduce the environmental footprint of construction. CPE support was through $50,000 grant and introductions to potential partners.

CPE is supporting my research to find pathways to meeting of functional and social needs to construction more while limiting the climate change impacts of constriction resource use. CPE has been very supportive in the creation of my new Centre, the Centre for the Sustainable Built Environment and in attracting both private sector and government funding. The seed funding provided by CPE to the centre has allowed us to move faster and make progress on calculating Canada's GHG construction budget, assessing the need for infrastructure and housing, and developing the world's largest database of construction resource use and embodied GHG in buildings.

Shoshanna Saxe, Prof of Civil and Mineral Engineering and Founder of Centre for Sustainable Built Environment

INTERNAL IMPACT

Through Partnerships

CONTINUED

We were pleased to also support **U of T's School of Cities**, the **School of Environment** and the **Centre of Landscape Research** through funding their various researchers and promoting their events through our website and newsletter. Specifically with the School of Cities' 2022 focus on sustainability and climate, we managed to support many of their researchers through CPE grants and including them in CPE partners proposals.

CPE has been enthusiastically and generously searching for industry partnerships, grants, and other opportunities to boost and support design research on urban climate resilience and adaptation. The Centre for Landscape Research is grateful for the tireless efforts of the CPE team that is working to advance interdisciplinary research and collaboration.

Fadi Masoud, Assistant Professor of Landscape Architecture and Urbanism at the School of Cities and the Daniels Faculty, and Director of the Centre for Landscape Research

INTERNAL IMPACT

Through Partnerships

CONTINUED

We worked closely with **The President's Advisory Committee on the Environment, Climate Change and Sustainability** (CECCS). CPE Academic Director David Sinton is a speaker at their annual Adam's Sustainability Conference. We contributed to their 2022 annual report. We promoted their events on our website and newsletter, and are in constant discussions to contribute to some high level strategies related to research and training discussed within the committee.

CPE is strongly aligned with the activities of the Committee on Environment, Climate Change and Sustainability (CECCS) in two key ways: (i) The size and complexity of our campus buildings and systems provides an opportunity to use the campus as a living lab. Through our partnership, we are able to advance research and technologies that accelerate our progress towards our operational sustainability goals, (ii) As a deeply interdisciplinary Institutional Strategic Initiative, CPE brings over 100 faculty from across the university to work on energy and climate issues. This is consistent with the research mission of CECCS. We look forward to continuing collaboration and joint activities.

Ron Saporta and John Robinson, Co-Chairs of the Committee on Environment, Climate Change and Sustainability (CECCS)

INTERNAL IMPACT Through Partnerships

CONTINUED

We have maintained a strong relationship with **University of Toronto Scarborough** (UTSC) where we supported various initiatives such as the Environmental and Related Technologies Hub (EaRTH District)'s application to the Sectoral Workforce Solutions Program (SWSP) leverage existing strengths to boost the talent pipeline for clean economy sectors that have been identified as priorities for local and national post-pandemic growth. We also supported the application for CERC in Sustainability Transitions with Dr. Patricia Romero-Lankao as the selected candidate to centre justice in net-zero urban energy transitions, Ontario Vehicle Innovation Network (OVIN) – Regional Future Workforce Program. Our support was through extending our own letters of support and securing additional 6 letters of support for both cash and in kind contributions for these initiatives from external partners. We also made numerous valuable industry connections to team members. We highlighted UTSC researchers in our partner proposals. We secured $120,000 in external funding from the City of Toronto and provided additional $100,000 in matching funds to develop a youth led climate strategy with Laura Tozer from the department of Physical and Environmental Sciences at UTSC as the principal investigator. In addition, we supported various UTSC researchers through our calls for proposals.

> *CPE has been a fantastic node for connecting the research interests of community and municipal partners to my research group at U of T Scarborough. With their vital support, we've established a new partnership with the City of Toronto for community-engaged climate research.*

Laura Tozer, Assistant Professor, Department of Physical and Environmental Sciences, University of Toronto Scarborough

INTERNAL IMPACT Through Partnerships

CONTINUED

We also have an ongoing relationship with **University of Toronto Mississauga** (UTM) office of Business Development and the office of Facilities Management and Planning where we provided them with updates regarding a proposal submitted to the City of Mississauga. We also suggested climate and sustainability to be one of the pillars of engagement between UTM and the City of Mississauga since the city indicated some initial interest in exploring this. We made some introductions to relevant partners. We also have a strong relationship with the communications team that promoted CPE events and mainly scholarships and calls for proposals. We highlighted UTM researchers in our partner proposals. We also supported numerous UTM researchers through our calls for proposals.

The Climate Positive Energy is a great interdisciplinary initiative of the university. The initiative is dedicated to collaborative research and training in high-risk research areas focused on climate change and sustainability. The initiative is acting as a catalyst to create the culture of collaboration across disciplines. Within a very short period, it has made enormous impact in transforming interdisciplinary research at the university, specifically related to climate change and sustainability.

Shashi Kant, Director of Master of Science in Sustainability Management (MScSM) Program and Professor of Forest Resource Economics and Management, University of Toronto Mississauga

INTERNAL IMPACT Through Partnerships

CONTINUED

We have established a strong relationship with various faculty members at the **Faculty of Arts and Science** (FAS) to deliver on the multi-disciplinary vision of CPE and the urgency of cross-divisional collaboration to address the climate challenge. We were successful in our outreach at the department level and at the personal level with professors from various disciplines such as Munk School of Public Policy and Global Affairs, Sociology, Economics. CPE was able to include researchers from 11 different departments at FAS as part of our roster.

We presented the work of these researchers in our partner proposals. We have also provided funding to various researchers through our various programs. We made numerous introductions for FAS researchers to potential industry partners. We engaged with them through our events. We hosted various faculty members as speakers. For example, we invited Professor Joseph Heath from Philosophy to provide keynote address and Professor Fedor Dokshin from Sociology to speak during our Climate Economy Summit pre-event. We also hosted Professor Soren Brothers from Ecology and Evolutionary Biology in one of our speaker series.

I have found a valued partner and resource in CPE. The timely CPE grant I received enabled me to jumpstart a research project that uses a unique dataset to identify the causes and distributional patterns of underperforming residential PV systems. I have been especially impressed at CPE's efforts at interdisciplinary engagement. Both I and my graduate student have made valuable connections to researchers outside our field through CPE events.

Fedor Dokshin, Assistant Professor, Department of Sociology

INTERNAL IMPACT Through Partnerships

CONTINUED

The **Faculty of Applied Science and Engineering** (FASE) is a strong supporter of CPE and in recognition, CPE provided support to various faculty members under our programs and calls for proposals. We provided external grants support to 3 major projects as further discussed in the grants section below. We also invited Prof. David Sinton (MIE), Prof. Ali Hooshyar (ECE) and Prof. Shoshanna Saxe (Civ Min) as speakers in our Climate Economy Summit and Eric Miller (Civ Min) to speak at our pre-summit to highlight the work that U of T is doing in the climate agenda. We have strong relationships with all of the 6 departments at FASE. As mentioned above, CPE has supported various FASE initiatives through grants funding, communications profiling and external outreach.

The Climate Positive Energy Initiative has been a great resource for our student Shahzeb Mirza, not only through financial aid but also through the various University-industry networking opportunities, seminars, and summits. It was also enriching for Shahzeb to present at the first annual Climate Positive Energy Research Days event and attend the EDI workshop for CPE scholars, both of which were engaging and inspiring.

Cristina Amon, Professor, Department of Mechanical and Industrial Engineering

INTERNAL IMPACT

CONTINUED

Through Partnerships

Throughout 2022, we worked extensively with the **Central Advancement Office** at the **Vice President Research and Innovation Office** who coordinated with other divisional advancement teams to pitch CPE and secure potential philanthropic funding. We supported advancement efforts in preparing 3 CPE pitches that went to potential donors. We also collaborated with advancement on various potential donor calls and first meetings. We also work continuously with the advancement office at FASE who brings opportunities forward once they are available.

> *Supporting efforts to create a sustainable future—on our campuses, across Canada and around the world—is a priority of the Defy Gravity campaign. With the support of U of T Advancement, CPE is identifying exciting new philanthropic opportunities for individuals, corporations and foundations interested in investing in climate positive research.*

Gillian Morrison, Assistant Vice President, University Development

CPE also worked closely with the **Government Relations Office** (GRO) on various opportunities related to cleantech and climate funding and how to position the U of T as a leader in specific areas. GRO provided instrumental support for CPE Grid Modernization Proposal. We worked together on drafting briefing notes and meetings with ministers' staffers.

EXTERNAL IMPACT Through Partnerships

We had strong outreach activities throughout the year. Over 200 unique organizations were approached and met with. Proposals were sent to potential partners (municipalities, industry, financial institutions, government, associations). Of those, we would like to highlight some notable external partnerships:

The City's TransformTO Net Zero Strategy, which outlines a pathway to achieve net zero emissions in Toronto by 2040, was adopted by Toronto City Council on December 15, 2021. As part of the research and development of TransformTO, it was identified that the creation and implementation of a youth-specific engagement strategy is critical to the adoption of the city-wide actions to reduce greenhouse gas emissions. CPE received $120,000 from City of Toronto to help develop a city-wide youth engagement strategy to enable youth-led leadership in climate action. This was matched by additional $100,000 from CPE to make the total project value $220,000. The project engaged 8 principal investigators from 7 departments, reflecting the multi-disciplinary work that CPE stands behind.

For our inaugural Research Day showcase event, we engaged with Toronto-based law firm **Ridout and Maybee LLC**, who generously served as Awards Sponsor for the event to provide a total of $6,000 in intellectual property (IP) services to two CPE student researchers. This originates from CPE's belief in commercialization of research to reach its potential and to benefit the society and help solve the climate issue. These IP services will support CPE led research in evaluating the intellectual property position and draw a roadmap for patent filing. This takes place in consultation with Innovation and Partnerships Office (IPO) at the University of Toronto.

EXTERNAL IMPACT Through Partnerships

CONTINUED

Reflecting a strategic interest in supporting Toronto's business community while tapping into CPE's industry network, we partnered with **Toronto Region Board of Trade** for our flagship business conference, the Climate Economy Summit. The sold-out event convened more than 300 industry leaders, decision-makers, and experts to discuss practical recommendations for embracing innovation and growing our region's economy while reducing emissions. The outcome of the event was, as anticipated, a myriad of relationships and introductions made for potential corporate/academic collaborations with CPE.

The **Climate Economy Strategic Council** is an initiative led by **Toronto Region Board of Trade** and **MaRS Discovery District** with a goal to support the small and medium size enterprises in the region to pilot and scale their innovative climate solutions. This will help in the economic growth in the region while at the same time tackles the climate challenge. U of T is represented by President Meric Gertler is part of the council, in which U of T volunteered to be a demonstration site for new technologies. CPE and Climate Positive Campus spearheaded the implementation strategy of the council at the U of T to support campus decarbonization efforts and help grow made in Canada cleantech solutions.

> *The Toronto Region Board of Trade and U of T Climate Positive Energy have struck up a wonderful collaborative partnership over the past year. Together, we hosted the inaugural Climate Economy Summit that brought together multi-sector and government leaders to advance solutions to our most pressing challenges. And through the Board's Climate Economy Strategic Council, we are working together to provide opportunities for local innovators to thrive and for other institutions to learn from U of T's transformational climate leadership*
>
> Roselle Martino, Senior Vice President, Public Policy & Economic Blueprint Institute, Toronto Region Board of Trade

EXTERNAL IMPACT

Through Partnerships

CONTINUED

Another strategic collaboration was our partnership with **Partners in Project Green**, a network of 80+ companies making the GTA a greener place to do business. Initiated by Toronto Pearson and Toronto and Region Conservation Authority (TRCA), Partners in Project Green (PPG) is a not-for-profit community of leaders advancing environmental action and economic prosperity across the GTA. Comprised of businesses, government, institutions and utilities, PPG works to collectively advance social and environmental sustainability through knowledge sharing, technology and infrastructure implementation, and network building. The joint strategic interest in supporting businesses led to 2 workshops, one online and the second was in person at U of T hosted by CPE and welcomed more than 40 energy professionals across different sectors.

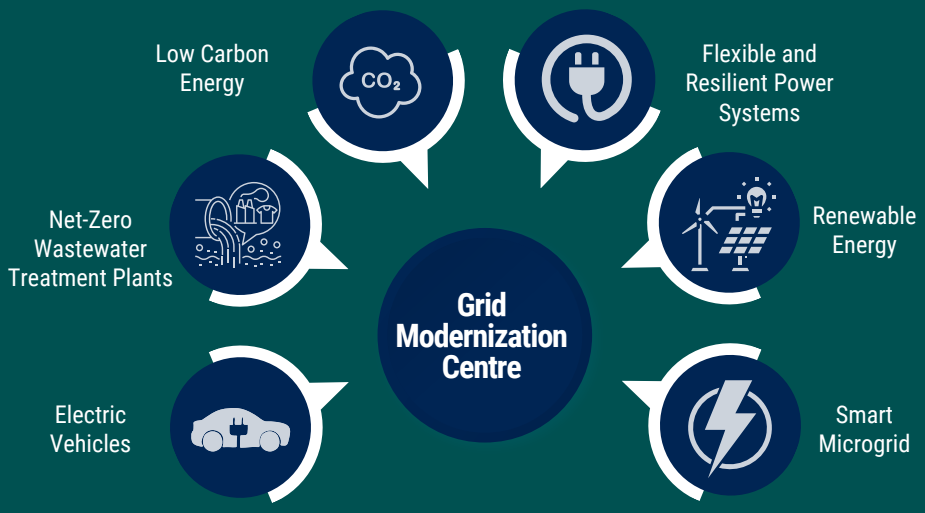
Helping to transform climate anxiety into positive action, CPE partnered with **Canadian Climate Challenge** and the **School for Climate** to host an art activism event on campus. Six Toronto-based youth artists create life-sized artwork that sparked meaningful engagement and discussions from passers-by. Reflecting on climate change through the arts was just one of the ways that CPE took a multidisciplinary approach in engaging students and youth to take climate action.

As a result of our strong outreach strategy, CPE was recognized as one of the integral assets for climate innovation in Ontario and was invited to the **Clean Energy and Environmental Justice Roundtable** hosted by the **Consul General of the United States in Toronto**. CPE was also listed in the **City of Toronto Green Industries Directory**. We were also highlighted in a presentation by the **Ontario Ministry of Economic Development, Job Creation and Trade** organized by the **French Consulate in Toronto**, about cleantech innovation hubs in Ontario. Internally at the University we have received recognition through 3 stories: ***U of T Magazine*** on our CanStore Energy project, ***The Varsity*** for CPE Research Day, and ***U of T News*** for our Climate Economy Summit.

EXTERNAL IMPACT Through Grants Support

$23M FedDev / NRCAN Application

CPE has developed a $10M application under the Regional Innovation Eco-system program administered by the Federal Development Agency of Southern Ontario (FedDev) and a $5M application for Natural Resources Canada (NRCAN) to support the launch and initial operation of a Grid Modernization and Simulation Testing Centre. The project is led by Professor Ali Hooshyar and participation of Professors Reza Iravani, Cristina Amon and Deepa Kundur. Supported by partners such as Siemens Canada and Hydro One, and backed by about 50 letters and $11M in partner support. The first of its kind in Canada, this industry-facing test centre will help accelerate the integration of renewable energy sources and EV charging infrastructure into the grid through technology testing and real time simulation of various grid models. Net Zero and energy transition will require new connections to the grid and improved sustainability. This grid modernization testing facility will bring unique testing capabilities for the Canadian electrical energy industry to help in the evolution to a more decarbonized, decentralized, and digitalized power system. This facility will support a grid system that offers resiliency, efficiency, sustainability, security, adequacy and quality of service. Significant industry interest exists due to the impact of technologies such as energy storage, EV chargers, renewables and power management systems on the grid, as well as the impact of disruptions such as severe weather events. In addition, reflecting the needs of the evolving smart grid, the test centre will also support AI and security work. This centre will play a crucial role in the Pan-Canadian Grid and cross province connectivity. Micro-grid connections to renewable energy in rural areas specifically in Northern communities is another important aspect that the centre will service through its modelling capabilities. This application is under review.



EXTERNAL IMPACT

CONTINUED

Through Grants Support

$24M NFRF Application

CPE has supported in the development of CanStore Energy: Seasonal storage of renewable energy for New Frontiers in Research Fund - Transformation 2022. The grant was led by Professor David Sinton and included an impressive roster of 22 collaborators from U of T, UBC, University of Calgary, Yukon University, Dalhousie, Waterloo, Winnipeg, McMaster and Toronto Metropolitan University, Carleton University, and Canada has vast renewable energy capacity yet remains deeply reliant on fossil fuels. The key barrier to the expansion of renewable sources is a lack of seasonal storage: our renewable energy supply is 6- months out of sync with demand. Storing the excess summer-generated renewable energy for use in winter is a grand challenge, which can only be addressed with grid-scale conversion of renewable electricity into storable fuels. The urgency of global stressors and local needs preclude the conventional approach of technology-first followed by piecemeal adoption, assessment of implications in hindsight, and decades of iteration. Application is under review. The image below showcases the breadth of our partnerships.

EXTERNAL IMPACT

CONTINUED

Through Grants Support

$700K CAAF Application

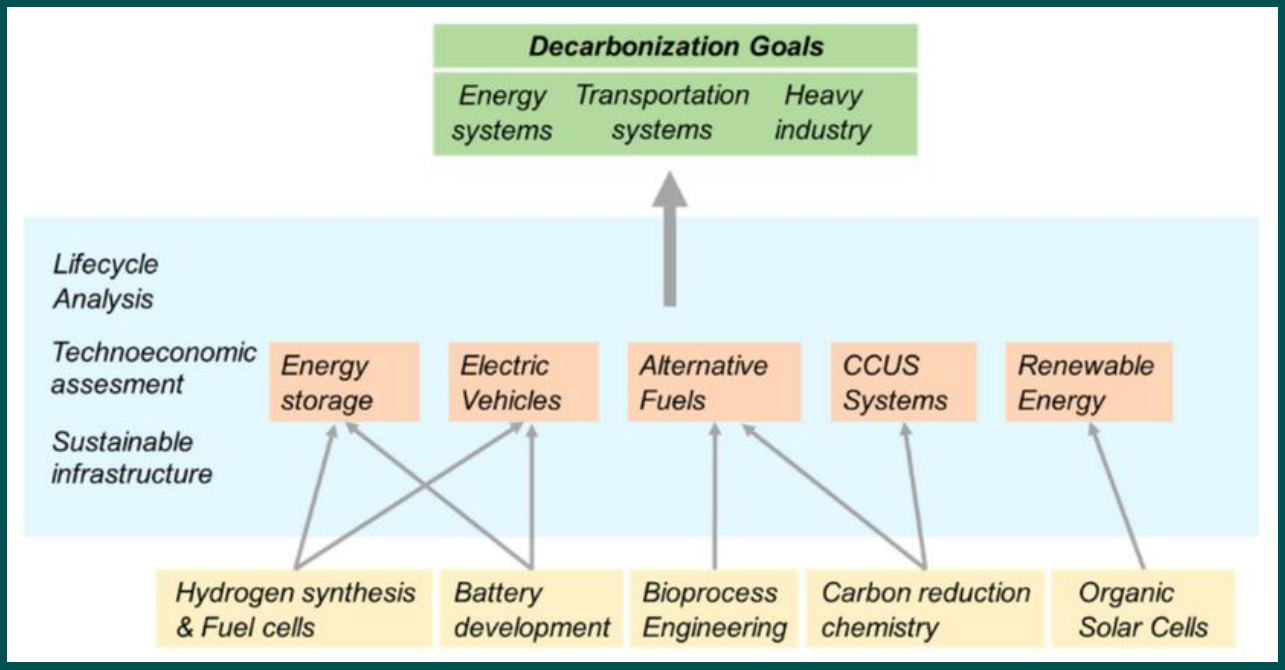
CPE played a key role in the development of the Climate Action and Awareness Fund (CAAF) proposal entitled “Building more housing and infrastructure within climate capacity” and headed by Prof. Shoshanna Saxe. Canada is dealing with a pressing challenge arising from the tension between the country’s need to build more housing and infrastructure, and its need to reduce its greenhouse gas (GHG) emissions. Canada is falling short on both, yet both of these goals must be met to achieve a net-zero future that is equitable and desirable for all. However, without dramatic changes in material stewardship, resource use related to housing construction alone will make meeting our net zero emission targets by 2050 almost impossible. Often overlooked when compared to building-related energy consumption, construction material use accounts for ~20% of total annual greenhouse gas emissions, and is growing both in its share of greenhouse gas emissions and in total. However, with decreasing operational GHG emissions due to more efficient building operation and AI management systems, and the use of renewable energy, embodied emissions from construction material use represent a larger portion of life cycle emissions (up to 90% of life cycle building GHG emissions). Climate Positive Energy researchers are on a mission to ‘re-think’ current practices, using new analyses and insights to inform the building and infrastructure sector and its stakeholders on new reduced GHG emission approaches. The project output will be a series of pathways—recommendations on policy, design, and construction that can be readily adopted by key building and infrastructure sector stakeholders which include technical and scenario modelling analyses. Application is under review.

EXTERNAL IMPACT Through Grants Support

CONTINUED

$1.65M CREATE Letter of Intent

CPE has supported the development of a CREATE LOI led by Amy Bazylak and 10 engineering Co-PIs. Training to DECARBONISE: Developing ElectroChemical Approaches for a Renewables- Based Economy in Sustainable Energy. A multidisciplinary approach is required to address climate Change, which is a defining challenge of the 21st century. DECARBONISE will prepare trainees for the Canadian workforce and empower multidisciplinary highly qualified personnel (HQP) to transform the hardest-to-decarbonize sectors such as energy, transportation, steel, cement, and manufacturing. We will train HQP to have the expertise to reduce, mitigate or eliminate carbon emissions in the development and deployment of hydrogen fuel cells, carbon capture and utilization, electric vehicles, and sustainable energy infrastructure — objectives that are directly aligned with Canada's research priorities in achieving bolder climate action and growing a more resilient economy. Our training program leverages three new and unique UofT facilities: the Electrolyzer Lab for hydrogen and CO2 conversion, the Electric Vehicles Lab (Energy Transition), and the Renewable Integration Lab (Sustainability Lab). The LOI has not moved forward.



ADDITIONAL IMPACT

Through Environmental Responsibility

Sustainable Practices at CPE Events

CPE is pleased to work collaboratively with our colleagues at the Sustainability Office to ensure that all of our on-campus events align with our environmental commitments. We are continuously optimizing our on-campus operations to minimize all environmental impacts. For example, we are pleased to have our events catered exclusively by U of T Food Services, who have pledged to convert another 20 per cent of their menus to plant-based options as part of the university's broader sustainability goals. We also avoid distributing bottled water at our events. In doing so, we reduced about 500 water and refreshment bottles during our EDI Workshop, Research Day, and Climate Economy Summit. This resulted in an avoidance of 41KgCO2, which is equivalent to the emissions from a trip from Toronto to Ottawa. This would also result in preserving a minimum of 750L of water used in the making of these bottles. We take public transportation as much as possible to reduce our carbon footprint.

ADDITIONAL IMPACT

Through Knowledge Sharing and Promoting Climate Action

Research Day

On August 17, 2022, Climate Positive Energy hosted its inaugural Research Day project showcase and student awards event. We were pleased to welcome more than 120 students, faculty, staff, and experts from partner organizations to Myhal Auditorium and online for an exciting day of presentations. Graham Takata, Director of Climate Change for BMO, opened the afternoon with a keynote on how BMO Global Asset Management is engaging companies on the road to net-zero. The keynote was followed by multidisciplinary presentations from our 20 student researchers from 16 different departments, who received graduate scholarships and summer research awards from Climate Positive Energy. These presentations were observed by a panel of judges who awarded prizes to researchers who demonstrated exceptional capabilities to advance CPE themes. Congratulations to our winning researchers: Katherine Liang, Karen Chen, Amalie Wilkinson, Nina Farac, Laura Jones, and Charlie Bain.

I was impressed to see student researchers from across different schools and faculties united to tackle this giant, multidisciplinary challenge — and to have our audience connect with this diverse network of individuals who have dedicated their research to de-carbonization.

Professor David Sinton

ADDITIONAL IMPACT

CONTINUED

Through Knowledge Sharing and Promoting Climate Action

EDI Workshop

On September 28, 2022, Climate Positive Energy hosted EDI In Action, the group's first hands-on workshop dedicated to equipping University of Toronto students with important ideas and skills themed around equity, diversity, and inclusion in research. The half-day workshop opened with a keynote by Julius Lindsay, Director of Sustainable Communities at David Suzuki Foundation, and accomplished U of T alumni). Julius offered important insights on designing sustainable communities, and equity entering the climate conversation. "How can we be equitable in the transition to a Low-Carbon Resilient Future? How can we be equitable in engaging others in the transition?"

Julius also shared that when conducting research, simply going to people alone isn't enough. "You need to hear from them, too. And then, you need to do what the people want you do. And, don't do it alone."

Focusing efforts when it comes to EDI and climate work was one of the topics that carried through in an engaging panel discussion following the keynote. CPE member and UTSC professor Laura Tozer moderated the discussion between panelists Phil De Luna, Sustainability Expert at McKinsey & Company, and Emmay Mah, Executive Director of the Toronto Environmental Alliance. The panelists discussed ideas around how climate action and research can benefit historically marginalized and structurally disadvantaged communities, as well as what researchers must do different in their practices and support structures moving forward to improve EDI outcomes.

Nicole Kaniki, U of T's Director of EDI in Research and Innovation, expanded on earlier discussions centred on understanding the history and impact of EDI in research. Nicole shared important insights on assumptions and implications of EDI in research: "There are many ways you can frame a research question, and it is the very framing of the research question that can cause harm or perpetuate racial stereotypes or biases." Nicole also shared key steps and on embedding EDI best practices into research data and data analysis, as well as EDI issues in climate research.

ADDITIONAL IMPACT

CONTINUED

Through Knowledge Sharing and Promoting Climate Action

Pre-Summit Cocktail Reception

On November 23, 2022, Climate Positive Energy held a private reception and networking event for 100 of VIPs registered to attend our flagship business conference. Timothy Chan, Associate Vice-President and Vice-Provost of Strategic Initiatives at the University of Toronto, delivered opening remarks, and Joseph Heath, Professor in the Department of Philosophy at the University of Toronto, offered insights on Climate Pessimism. Exclusive research updates shared by CPE members (Eric Miller, Civil Engineering; Ali Hooshyar, Electrical & Computer Engineering; and Fedor Dokshin, Sociology) on projects related to the grid integration of renewables, consumer behaviour, and electric vehicle policy analysis. Attendees mixed and mingled at U of T's historic Hart House venue, enjoying a curated assortment of appetizers and drinks to fuel important conversations.

ADDITIONAL IMPACT

CONTINUED

Through Knowledge Sharing and Promoting Climate Action

Climate Economy Summit

On November 24, 2022, Climate Positive Energy held its inaugural business conference, the Climate Economy Summit. Along with our co-hosts Toronto Region Board of Trade, we were delighted to welcome more than 300 guests and thought leaders from across Ontario to hear from 45 expert speakers – including Ontario Minister of Energy Todd Smith, U of T President Meric Gertler, and Toronto Region Board of Trade President and CEO Jan De Silva. The Climate Positive Energy initiative at University of Toronto is developing solutions to transform our energy systems, and to help Canada become a global clean-energy model in achieving net-zero by 2050. Key to this is building partnerships and facilitating collaborative research with local and global companies, across all industries.

Toronto has what it takes to be a global leader in the climate economy," said Toronto Region Board of Trade's Jan Da Silva during remarks. "And industry must be at the table – a table set up to advance projects that will close the clean tech adoption gap."

"U of T and its partners are collaborating to move the needle quickly," added President Gertler. He emphasized the call for collaboration during his remarks, noting that partnerships between the public and private sectors are crucial in helping the Toronto region capitalize on its strong cluster of clean energy companies.

Climate Positive Energy Academic Lead David Sinton, along with members Shoshanna Saxe and Ali Hooshyar, also emphasized the importance of collaboration in accelerating activity towards net-zero during breakout sessions and remarks. Professor Sinton moderated a discussion between Tony Valeri of ArcelorMittal Dofasco and Katherine Arblaster of Uranium Energy Corp, who discussed the "greening" of heavy industries like steel, cement, and chemical manufacturing, which face unique challenges on their pathway to decarbonization. Valeri emphasized the importance of the next generation in tackling the climate challenge – for example, highly skilled individuals such as CPE researchers, who are dedicating their careers to stepping in with great solutions to the climate change problem.

We look forward to future events and discussions advancing clean energy research at the University, and across Canada.

ADDITIONAL IMPACT

CONTINUED

Through Knowledge Sharing and Promoting Climate Action

Doorways Art Build

On September 16, Climate Positive Energy was pleased to welcome six Toronto-based youth artists to University of Toronto's St. George campus to create life-sized artwork as part of the Doorways Art Build, hosted in partnership with Canadian Climate Challenge. Taking over Willcocks Common, the artists used a variety of mediums to create large-scale, double-sided artwork: one side reflecting our current climate trajectory, and the other reflecting the vision for a sustainable future supported by science-based solutions. Reflecting on climate change through the arts is just one of the ways that CPE is taking a multidisciplinary approach in engaging students and youth to take climate action.

Energy Leaders Consortium

On October 24, Climate Positive Energy hosted a network of energy industry professionals to join us on campus as part of a monthly session for the Energy Leaders Consortium (ELC), a flagship program by Partners in project Green. Nearly 40 leaders from across the ELC member joined experts from University of Toronto to hear about the university's newest research projects and infrastructure updates to support a climate positive campus by 2050. The Energy Leaders Consortium brings together a dynamic network of energy professionals to share best practices and support collective action on energy projects. Members benefit from a collaborative environment where they can learn about new technologies, share innovative approaches, troubleshoot project challenges, and identify strategies to enhance their energy efficiency. CPE invited various U of T leaders in sustainability to participate and introduce their work to the network members. These presentations sparked exciting discussions from the group on mutual challenges and strategic solutions – as well as opportunities for collective action.

CPE BY THE NUMBERS

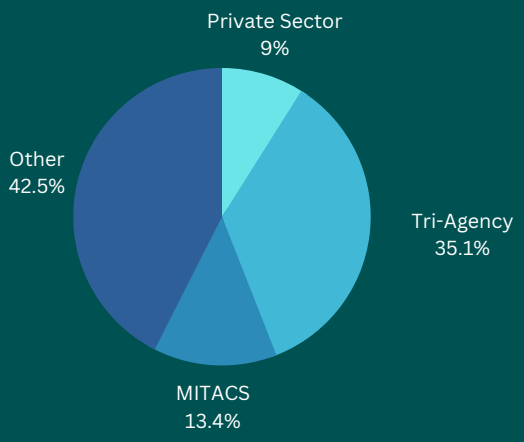
Additional Grant Awards*

134
Grants received by CPE members

$24.9M
in total support

4
Major sources of funding

**External to CPE*



Audience Engagement

51
Digital newsletters sent

100
Number of e-mail subscribers in January 2022

939
Number of e-mail subscribers in December 2022

17
Events organized

162
Faculty members

21
External events with CPE representation

197
Student members

WITH GRATITUDE

Acknowledgements

The Climate Positive Energy team would like to express its sincere gratitude to the individuals and organizations that have contributed to our operations and successes. This support and dedication has been invaluable in helping us to achieve progress towards Net-Zero. We would like to extend special thanks to the following U of T internal champions and supporters for their contributions to this report and our year-round activities:

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- Leah Cohen
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- Alex Irving
- Nicole Kaniki
- Beth Weintrop
- Adria Miller
- Rashmi Gupta
- Padraic Foley
- Patrycja Thompson
- Jason Riordon
- Marit Mitchell
- Adriano Vissa
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- Illan Kramer
- Ali Candib
- Ainka Jess
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- Kristy Faccer
- Jennifer Fraser
- Tina Coccia
- Helen Lasthiotakis
- Kara Kim
- Samuel Woo
- Tyler Irving
- Lisa Ru
- Glaucia Lima
- Suzanne Jaeger

APPENDIX

Graduate Student Scholarships

Student	PI Department	Supervisor	Project Title
Charles Bain	Political Science	Jessica Green	The political economy of convertible firms: Electric utilities and automakers in climate politics
Mircea Ghergina	Sociology	Fedor Dokshin	Captured: Green Innovation, Social Values, and the Quest to Solve Climate Change, 1996-2021
Hugo Cordeau	Economics	Adonis Yatchew	Canadians and the Carbon Tax: A Story of Inequality
Aldrick Arceo	Civil	Shoshanna Saxe	Embodied carbon intensity reduction of single-family dwellings in the City of Toronto
Mehran Dadsetan	MIE	Murray Thomson	Novel approach for sustainable hydrogen production
Laura Jones	Biology (UTM)	Katharina Braeutigam	Towards solutions in a changing world: Understanding stress memory of weather extremes in trees
Garett Morgan	Dalla Lana School of Public Health	Blake Poland	Exploring equity in the climate action plans of the world's "most sustainable" cities
Rick Fu	Chemistry	Jik Chin	Guanidines as a Motif for Carbon Capture and Activation
Nina-Francesca Farac	Chemical Engineering	Tim Bender	Harnessing More Solar Energy with Green Chemistry: The Sustainable Design of Hybrid Organic Materials for Next-Generation Organic Solar Cells
Guangming Cai	Chemical Engineering	Cathy Chin	Kinetic Consequences of the Intercorrelations between Acid and Redox Sites on Metal Oxides for Drop-in Oxygenates Synthesis from Sustainable Bio-based Methanol
Valeria Morozova	Physical and Environmental Science (UTSC)	Alex Voznyy	Machine learning-enabled discovery of redox agents for electrochemical capture and
Sabrina Madsen	Physical and Environmental Science (UTSC)	Debra Wunch	Estimation of the city's vegetation to the carbon footprint
Shahzeb Mirza	MIE	Cristina Amon	Thermal Management of EV Power Electronics using Metallic Phase Change Materials

APPENDIX

Undergraduate Student Awards

Student	PI Department	Supervisor	Project Title
Michal Korteweg Davis	Civil Eng	Shoshanna Saxe	A Fine-Grained Dataset of Material Usage in Buildings to Increase Material Efficiency
Amalie Tara Wilkinson	Social Sciences	Donald Kingsbury	The dynamics of lithium mining for a clean energy transition in Québec, Canada
Karen Chen	Applied Science and Engineering	Greg Evans	The Holiday Effect: A Natural Experiment to Understand Anthropogenic Emission Sources and Reduction
Badr Karam Aziz Abbas	Chemical Engineering	Jay Werber	Transport of Medium Chain Fatty Acids through Rubbery Polymer Films
Amelie Julie-Anne Desroches	UTM Geography	Tenley Conway	Understanding the Social Benefits of Urban Trees
Xinyu (Katherine) Liang	Engineering science	Olivier Trescases	Improved Efficiency in Automotive Applications
Tobin Jeremiah Zheng	Engineering	Keryn Lian	Converting Tea Waste to Electrodes for Energy Storage
Matthew Michael Edghill	Chemical Engineering	Krishna Mahadevan	Artificially Evolving Bacteria to Consume Recyclable Feedstocks
Mishaal Kandapath	Physical and Environmental Science (UTSC)	Debra Wunch	Validating Satellite Measurements of Urban Emissions
Oluwatomisin Debbie Bamigbade	Architectural	Alstan Jakubeic	School of the Environment Photovoice Research

APPENDIX

CONTINUED

Post-Doc Fellows

Student	Department	Supervisor	Project Title
Da Huo	Civil	Daniel Posen	Modeling electric and hydrogen fuel cell pathways for Canadian light-duty vehicles to meet climate targets
Alexandre Tugirumabano	MIE	Aimy Bazylak	Enhancing Mass Transport in Polymer Electrolyte Membrane Electrolyzer for Effective Hydrogen production
Jinjin Chen	Chemical Engineering	Krishna Mahadevan	Sustainable carbon-negative biomining-coupled biofuel production using genetic engineered Acidithiobacillus ferridurans
Yishi Zhou	MIE	Kevin Golovin	Photothermal ice nucleation inhibiting coating for improved clean energy equity
Harrison Mills	Chemistry	Dwight Seferos	Chemical Recycling of Consumer Plastics by Visible Light-Mediated Photocatalytic Process
Pengfei Ou	ECE	Ted Sargeant	AI Driven Catalyst Research

Visiting Fellow

Student	Department	Supervisor	Project Title
Ian Hamilton	Public Health	Fiona Miller	Tracking the impacts of climate mitigation and energy transition actions on health in Toronto among vulnerable communities.

APPENDIX

CONTINUED

CPC-CPE Grants

PI	Department	Value	Theme	Project Title
Ben Hatton and Alstan Jakubiec	Materials Engineering, Architecture	$100,000	Energy Efficiency	Active, fluidic windows for energy savings, load management and enhanced daylighting on U of T campus
Eric Miller, Marianne Hatzopoulou, Daniel Posen, Khandker Nurul Habib, Heather MacLean, Sham Gamage, Junshi Xu, Matt Adams, Karen Chapple , Steven Farber	Civil Engineering, UTM Geography, UTSG Geography, UTSC Geography	$100,000	Health, well-being and behaviour	Decarbonizing the UofT community: How can we enable more sustainable and equitable personal choices across the three campuses?
Shashi Kant, Yue Li, Soo Min Toh, Cynthia Goh, Jim MacLellan	IMI and Forestry, UTM Management & Rotman, Chemistry, UTSC Physical and Environmental Sciences	$100,000	Emissions Accounting	Scope 3 Emissions: A Conceptual Accounting Framework for Post-Secondary Institutions and Measurement of Selected Categories of Emissions
Cynthia Goh, Sanjeev Chandra	Chemistry, MIE	$100,000	Renewable Energy	Solar panel coating for increased power output of PV installations at U of T
Seungjae Lee and Chi-Guhn Lee	Civ MIN and MIE	$50,000	Energy Efficiency	Grid-Interactive Smart Campus Buildings

APPENDIX

CONTINUED

Knowledge Mobilization Grant

PI	Department	Value	Project title
Shoshanna Saxe, Elias Khalil, Chris Essert, Daman Panesar, Evan Bentz, Heather MacLean, Daniel Posen	Civil and Mineral Engineering, Mechanical and Industrial Engineering, Law	$50,000	Centre for the Sustainable Built Environment
Amrita Daniere, Joanna Kocsis; Try Thuon	Geography and Planning; Sustainable Urban Planning and Development	$46,600	Just Mitigation?: Applying a climate justice approach to the implementation of mitigation policies in growing cities in Southeast Asia
Robert McMillan	Department of Economics	$50,000	How to Decarbonize Automobile Transit: Lessons from Norway
John Robinson, Heather Dorries	Munk, Geography and Planning	$50,000	Grounding models: co-creating agent-based models to understand TransformTO goals

APPENDIX

CONTINUED

Commercialization Grant

PI	Department	value	Project title
Kevin Golovin	MIE	$50,000	Smart de-icing coatings enabling efficient, year-round wind turbine energy production
Jik Chin	Chemistry	$50,000	Manufacturing Unnatural and D-Amino Acids using Green and Recyclable Chemistry
Swetaprovo Chaudhuri	Institute for Aerospace Studies	$50,000	Developing a carbon capturing combustor-reactor powered by hydrogen generated in-situ from thermally coupled pyrolysis of natural gas
Ulrich Fekl	Chemical and Physical Sciences, UTM	$50,000	Fertilizer and Plastics Precursor, Greenhouse Gas-Free, using Air and Sunlight

APPENDIX

CONTINUED

City of Toronto Grant

PI	Department	Value
Laura Tozer	Physical and Env Sciences UTSC	$220,000
Matthew Hoffman	Physical and Env Sciences UTSC	
	Munk	
Imara Rolstan	Dalla Lana	
Mary Elizabeth Luka	Arts and Media UTSC	
Jeffrey Brook	Dalla Lana	
Michael Classens	School of Env	
Fikile Nxumalo	OISE	
Imre Szeman	UTSC	

APPENDIX

CONTINUED

Just Transition Grant

Name of principal investigator:	Department of principal investigator:	Title of proposal:	Project theme	value
Fedor A. Dokshin	Sociology	Performance matters: Augmenting analyses of residential solar PV deployment and distribution with system performance data	4. Policy recommendation to accelerate the just and equitable transition to net zero	$42,610
Teresa Kramarz	School of the Environment, Munk	Accounting for the Extractivist Footprint of EVs: A Comparative Analysis of Local and Transnational ESG Standards Governing Lithium Production	5. Corporate governance and ESG	$53,400
David Sinton, Michael Ross, Kate Neville	Mechanical and Industrial Engineering, NEI, Yukon University; Political Science and School of the Environment	Assessing opportunities in carbon capture and conversion to fuel technologies for empowering Indigenous-led clean energy projects and Northern utilities	1. Climate, Energy and Indigenous Peoples	$50,000
Robert Soden, Samar Sabie, Steve Easterbrook	Computer Science / School of the Environment, Computer Science, Computer Science + School of the Environment	Exploring Gaps and Requirements to Support More Just Engagement with Energy Modelling for Building Retrofits	3. Climate modelling as it relates to severe weather conditions on infrastructure, assets and supply chain for example, the electrical grid.	$49,8000
Paul Kushner, Oya Mercan, Daniel Posen, Marianne Touchie, Karen Smith, Sam Markolf	Physics, Civ/Min FASE, DPES/UTSC, UC Merced	Application of the University of Toronto Climate Downscaling Workflow to the Just Energy Transition	3. Climate modelling as it relates to severe weather conditions on infrastructure, assets and supply chain for example, the electrical grid.	$43,000
Zubin Austin, Annalise Mathers, Fiona Miller, Jamie Kellar	Pharmaceutical Sciences, Leslie Dan Faculty of Pharmacy, Leslie Dan Faculty of Pharmacy and Dalla Lana School of Public Health	Development of a climate resilience and environmental sustainability toolkit for pharmacists	2. Training – new skills for the decarbonized economy	$49,750

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