

Keagan Hudson Rankin

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EDUCATION

University of Toronto **2021–present**
MAsc & PhD. Engineering Toronto, Canada
Supervisors: Shoshanna Saxe, I. Daniel Posen

University of New Brunswick **2017–2021**
BAsc. Civil Engineering Fredericton, Canada

RESEARCH INTERESTS

- Applying computational models (e.g. life cycle assessment, stochastic simulation, energy system optimization, machine learning) to decarbonize materials, energy, and infrastructure systems.
- Epistemic practices when using and interpreting those computational models.

EXPERIENCE

University of Cambridge, Centre for Sustainable Development **Sep 2024–Mar 2025**
Visiting Researcher Cambridge, UK

- Co-wrote CA\$25,000 NSERC International Catalyst grant to fund collaboration.
- Wrote *Nature Cities* paper on climate limits of 1000+ global cities.

City of Toronto, Planning, Sustainability Divisions **Sep 2022–Aug 2024**
Consultant & Researcher Toronto, Canada

- Won the top national housing research award for creating a new model ([link](#)).
- Developed method for quantifying infrastructure emissions of >7 million people in GTA.
- Informed laws in 2023 Toronto "Housing Options" zoning amendments.

University of Victoria, Faculty of Engineering **May 2019–Aug 2019**
Undergraduate researcher Victoria, Canada

- Co-developed new sustainability-focused course curriculum for 1st and 2nd year students.

University of New Brunswick, Canadian Rivers Institute **May 2019–Aug 2021**
Research assistant Fredericton, Canada

- Built data-collection and fourier-processing pipeline for drive-by monitoring of bridges.
- Created a regression model used by region's largest hydro plant to monitor water pollution.

TEACHING

University of Toronto, Faculty of Applied Science and Engineering **Sep 2021–Jan 2026**
Teaching Assistant: CIV1399 *Applied Methods for Industrial Ecology*

- Co-developed course content with professor for 1st offering of Masters/PhD level course.
- Marked quizzes and assignments.
- Prepared and taught tutorial on material-flow analysis.

Teaching Assistant: CME368 *Engineering Economics and Decision Making*

- Delivered lecture on time-value of money calculations to ~100 senior undergraduate students.
- Helped run office-hours style tutorial.
- Worked with instructor on experimental AI marking scheme for course assignments.

Teaching Assistant: CIV1321 *Large Scale Infrastructure & Sustainability*

- Ran two lectures for ~30 Master and PhD students.
- Marked presentations and semester-long research assignments.

Teaching Assistant: CIV100 *Mechanics*

- Planned, delivered lecture-style tutorials for 150+ 1st year undergraduate students.
- Ran weekly 2-hour office hours to provide general tutoring and feedback.
- Invigilated and marked 800 final exams.

Research Mentorship:

- Visting student James Reichenbach (2026): mentored on project where we refactored a building material database into SQL, and built a data ingestion pipeline.
- Undergraduate Qianyi Zhang (2024-2025): co-advised over two semester for capstone thesis on setting optimal emissions limits across interconnected economic sectors.

PUBLICATIONS

Journal Papers

- [1] Rankin KH et al. 2026. A call to ensure the reproducibility of machine learning in industrial ecology. (*Preprint*) in review
- [2] Rankin KH et al. 2026. The climate limits of construction in over 1,000 cities. *Nature Cities*
- [3] Rankin KH, Saxe. 2024. A future growth model for building more housing and infrastructure with less embodied greenhouse gas emissions. *Environmental Science and Technology*
- [4] Yoffe, Rankin KH, Bachmann, Saxe, Posen. 2024. A top-down assessment of GHG emissions in the Canadian construction sector. *Environmental Research: Infrastructure and Sustainability*.
- [5] Rankin KH, Arceo, Isin, Saxe. 2024. Embodied GHG of missing middle: residential building forms and strategies for more efficient housing. *Journal of Industrial Ecology*

Conference Papers/Presentations

- [6] Rankin KH, Saxe, Posen 2026. A simulation-optimization model for decarbonization in residential energy transitions. *INFORMS Annual Meeting 2026 - energy systems program*. presentation accepted but unable to attend conference.
- [7] Rankin KH, Saxe, Posen 2026. Modelling the impact of demand-side decarbonization in residential energy transitions. *ISIE-SEM conference/ISSST*.
- [8] Rankin KH, Serrenho, Bachmann, Posen, Saxe 2025. Carbon emissions and budgets for more than 1000 cities. *ISIE2025*.
- [9] Rankin KH, Arceo, Yoffe, Isin, Saxe. 2023. Forecasting embodied housing emissions and material efficiency scenarios to 2030 in Ontario, Canada. *ISIE2023*.
- [10] Rankin KH, Zhuo, Lei, Rizaee, Searle, Ene, Amuno, 2022. Pull-based simulation modeling for modular supply chain analysis: A case study in Northern Canada. *Proceedings of the Canadian Society of Civil Engineering Annual Conference*.
- [11] Froese, Bristow, Rankin K 2021. Towards a sustainability-centred design curriculum in civil

engineering. *Engineering Education for Sustainable Development (EESD)*.

Posters

- [12] Rankin KH, et al. 2026. ML Reproducibility in Industrial Ecology: Surveyed Studies Have Issues — and Citations Don't Care. *Gordon Research Conference in Industrial Ecology*.
- [13] Rankin KH, Saxe, Posen. 2024. Carbon budgeting: research challenges and city-level decarbonization. *Gordon Research Conference in Industrial Ecology*.
- [14] Rankin KH, Arceo, Yoffe, Isin, Saxe. 2023. The potential for missing middle to provide more housing with less embodied emissions: quantifying and optimizing material efficiency in low-rise, multi-unit housing. *ISIE Biannual Conference*.
- [15] Yoffe, Rankin, KH, Bachmann, Posen, Saxe. 2023. A Top-Down approach for downscaling sectoral emission budgets. A case study of Canada's construction sector. *ISIE Biannual Conference*.
- [16] Rankin, KH, Isin, Arceo, Saxe. 2023. Evaluating the material intensity of missing-middle *Gordon Research Conference in Industrial Ecology*

Reports and White Papers

- [17] Ruiz, Zuluaga, Rankin KH, Saxe (2026) Embodied Greenhouse Gas Emissions in Transit-Oriented Development Scenarios. *School of Cities & Canadian Urban Institute*. link.
- [18] Rankin KH, Posen, Saxe. (2025). Setting a Carbon Budget for Toronto's Construction Sector. *City of Toronto*.
- [19] Hudgins, Haralampides, Dolan, Rankin K, Yamazaki (2019). Results and analysis of the 2018 suspended solids field program in the Mactaquac headpond, Saint John River, NB. *Canadian Rivers Institute*.

AWARDS & HONOURS

National

NSERC Vanier Scholarship	Apr 2025
CMHC National Gold Roof Award for Housing Research	Jan 2025
TAC Esch Foundation Scholarship	Sep 2020
NSERC Undergrad Research Award 3x	Jun 2018, 2019, 2020

Graduate

University of Toronto Doctoral Excellence Award	Aug 2026
Francis Bradfield Fellowship in Environmental Engineering	Nov 2024
David Scrymgeour Community Bursary	Aug 2023
OGS/QEII Scholarship in Science and Technology 2x	Sep 2022, 2023, 2024
Graduate Studies Conference Grant 2x	Apr 2022, Apr 2024
CW Bowman Scholarship in Energy Research	Apr 2022
NSERC Alexander Graham Bell Award CGSM	Sep 2021
CIVMIN top-5 incoming students award	Sep 2021

Undergrad

D. Malcolm Jeffrey Memorial Prize - highest engineering GPA over 4 years	Apr 2021
Capstone design project, 1st prize in department	Apr 2021

Speaking

ISSST Student Speaker Award [7] (5 awarded out of >100 presentations)	June 2026
GRC Poster Award [13] (2nd out of >100 presenters)	June 2024

INVITED TALKS AND MEDIA

Invited Talks

The mis-education of machine learning models – a reproducibility crisis in applied science Massey College Junior Fellow Lecture Series. Toronto, Ontario. **2025**

Scenario modelling of urban metabolism – recent progress and research trends. ISIE-SEM Perpetual Conference **2024** [recording link](#)

Building more housing with less embodied greenhouse gas. School of Cities Embodied Emissions Symposium. Toronto, Ontario. **2024.** [recording link](#)

Carbon capture's make or break role in climate-change mitigation. Massey College Junior Fellow Lecture Series. Toronto, Ontario. **2024**

News & Press

Urban Construction Boom Threatens Climate Goals. Forbes. **2026** [link](#)

We must completely change the way we build homes to stay below 2°C. New Scientist. **2026.** [link](#)

How to build more with less: New model shows how Canada can reconcile its housing and climate targets by adopting established sustainable construction practices. University of Toronto Engineering News. **2024.** [link](#)

Can we build more affordable housing while meeting Canada's climate commitments?. The Varsity. **2024** [link](#)

SERVICE AND OTHER ACTIVITIES

Clare College Cambridge

2024–2025

Associate Member of the MCR

- Rowed in Clare Boat Club 1st men's boat, earned Lents blades and finished 3rd on river.

Campus Cooperative Residence Inc (CCRI)

2023–2025

Board of Directors

- Elected by membership to board for 2-year period. Helped operate coop of over 200 members.
- Assisted planning >CA\$2mil budget for hiring, payroll, capital investments and repairs.
- Helped resolve formal membership disputes and modernized policy.

International Society for Industrial Ecology

2022–present

Member

- Co-organized 'IE day' 2026 session "How are Generative AI tools being used in IE research?"
- Co-organized 'IE day' 2025 session "AI for IE: Emerging Trends, Best Practices, and Applications of Artificial Intelligence for Industrial Ecology".
- Co-organized ISIE2025 special session on artificial intelligence for industrial ecology, attracted 100+ attendees.

Massey College

2022–2026

Junior Fellow

- Elected to competitive fellowship for University of Toronto graduate students.
- Co-organized 60th anniversary sustainability conference featuring international speakers.
- Co-Editor of 2023 edition of Audeamus (college literary journal).

Association for Professional Engineers and Geoscientists NB **2021–present**
 Engineer in Training (EIT)

Shad Valley **2021–2022**
 Student Mentor

- Gave feedback to secondary students completing an engineering design project as part of a summer learning program at the University of New Brunswick.

Peer Reviewer **2022–present**

- IOP Science – Environmental Research: Infrastructure and Sustainability
- Building & Environment
- Journal of Industrial Ecology

Other

- Languages: English (native), French (proficient)
- Citizenship: Canadian