University of Victoria

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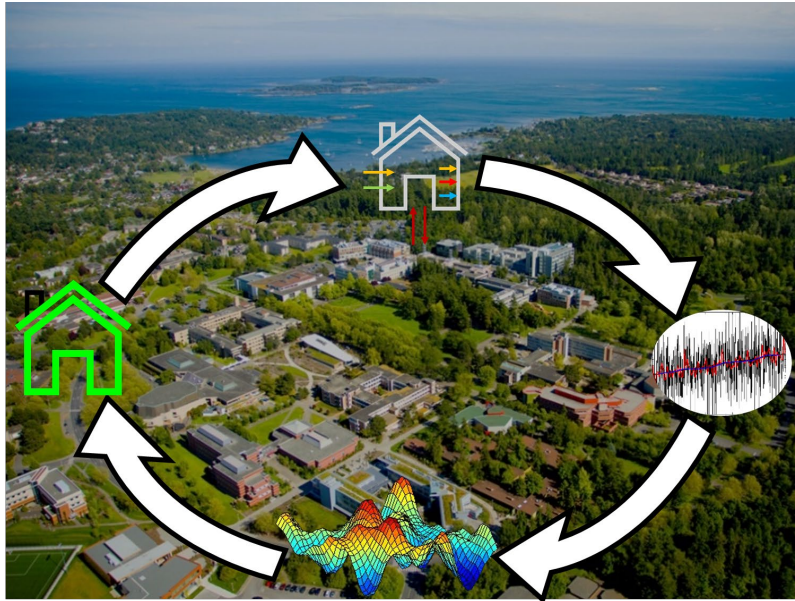
5 Masters/PhD positions and 2 Post-Doctoral positions available as part of the
ReBuild Initiative
Exploring Data-driven Building Energy Retrofit Solutions

Improving existing buildings is critical to achieving energy and carbon emissions reductions and increasing their resilience to climate change and other acute shocks (e.g., earthquakes). The opportunity is immense given that the building renewal rate (2-3%) is comparable to new construction. While some building energy codes and energy efficiency programs provide guidance on appropriate improvements, there is a plethora of options for owners to consider and a lack of clarity on the optimal path forward from the perspectives of technical performance, economic effectiveness, occupant well-being, and building durability. Energy utilities, all levels of government, efficiency program agencies and industry associations can help to address persistent market barriers by enabling beneficial choices through effective policies and programs to optimize investments that improve the whole building stock.

Overall, we need models that can be used to improve policy and guidance documents as well as to improve the ability to target upgrades to specific buildings. Each project in the ReBuild Initiative is undertaken with a solutions partner who will implement the research findings to achieve improvements to the building stock. The ReBuild Initiative will promote synergies between the methods used by professionals and service providers to recommend solutions for specific buildings and the stock-level tools used by policymakers to understand the interventions required. It will develop a common set of modelling approaches spanning archetype derivation, time-series analysis, portfolio analysis and retrofit decision analysis. A common set of interactive visual exploration tools will allow users to gain insights into the models developed.

The positions below will be supervised by Dr Ralph Evins in the Energy in Cities research group. The work will be carried out in the stimulating multi-disciplinary environment of the Institute for Integrated Energy Systems (IESVic) and the new green Civil Engineering department at the University of Victoria on Vancouver Island in beautiful British Columbia, Canada.

Masters or PhD positions

These positions require a Bachelor's degree (Masters applicants) or Master's degree (PhD applicants) in engineering, computer science, mathematics or physics. The following positions are available at either level.

1. **Resilience modelling for retrofit analysis**
   This project will combine analysis of energy efficiency improvements to reduce energy bills and GHG emissions with analysis of resiliency to climate change and extreme weather events.
   Tasks: Building energy model development; Future climate analysis; Building performance metrics; Overheating analysis; Robustness optimization regarding costs, climate and other factors; Resilience and adaptation assessment; Policy implications.
   Partner: [Pacific North-West Economic Region](#).

2. **Data-driven energy benchmarking and identification of retrofit design solutions**
   This project will identify and demonstrate design solutions for deep energy and emissions retrofits of existing industrial commercial, institutional, and multi-unit residential (ICI/MURB) buildings.
   Tasks: Data review, collation and statistical analysis; Methodology development for calibrated building energy modelling; Surrogate modelling and optimization; Solutions analysis and policy integration.
   Partner: [Building Owners and Managers Association of British Columbia](#).

3. **Automated identification of heat pump adoption opportunities for commercial buildings**
   Data-driven methods are needed which use smart meter and building data to generate actionable energy and carbon solutions, for example heat pump adoption, tailored to a specific site.
   Tasks: Exploration of portfolios of building energy data; Development of machine learning methods for opportunity identification; Implementation of methods into energy auditing workflows.
   Partner: [SES Consulting Inc.](#)

4. **Archetype-based building stock retrofit analysis and optimization**
   Building stock data can be combined with archetype modelling to obtain retrofit policies highly targeted to specific building types, evaluated for the building inventory of the city.
   Tasks: Identification of building archetypes; Development of building energy models; Calibration to known energy uses; Exploration of retrofit solutions; Integration into climate solutions pathways.
   Partner: [City of Victoria](#).

5. **Urban emissions reduction framework bridging buildings and transportation**
   There is a need for a framework to allow municipalities to identify and prioritise climate solutions that span the domains of buildings and transportation, to enable the fair comparison of disparate solutions.
   Tasks: Development of a municipal-level emissions modelling framework; Integration of building and transportation solutions; Exploration of future scenarios; Integration into climate solutions pathways.
   Partner: [City of Victoria](#).

Post-Doctoral positions

Post-doctoral positions are available which bring together the research areas above, assisting with the supervision of students and conducting research on the various methods underpinning the projects.

1. **Data and modelling of building energy retrofit solutions**

   This position bridges the technical domains that define the ReBuild Initiative, namely building energy simulation and machine-learning based data-driven methods. These methods must be developed to work in harmony, which will require significant methodological improvements as well as rigorous evaluation via application to specific problems. This position would suit a candidate with a background in both building energy simulation and machine learning methods.

2. **Policy roadmap to resilient ultra-low energy buildings**

   This position brings a strong policy angle to the technical research of the ReBuild Initiative. There is a need for a roadmap that distills the research of the ReBuild Initiative into three or more pathways reflecting various policy trade-offs through to 2050. A 'roadmap' with milestones of key policy interventions will be prepared under the auspices of the Canadian Academy of Engineering (CAE) [Roadmap to Resilient, Ultra-Low Energy Buildings with Deep Integration of Renewables in 2050](#) project. The CAE roadmap includes unprecedented engagement of key influencers from across Canada. This position would suit a candidate with a background in public policy, codes and standards.

General tasks for Post-Doctoral Researchers will include:
- Working with stakeholders and industry partners to facilitate use and dissemination of research results.
- Software development coordination, project management and research administration.
- Opportunities to contribute to undergraduate and graduate teaching.
- Opportunities to develop additional funded projects.

The positions requires a PhD in engineering, computer science, mathematics or physics, along with a substantial publication record. Experience of software development and project management is desirable. The positions are initially for 1 year, renewable for 2 further years.

How to apply

General requirements

A good working knowledge of Python is highly desirable for all positions (for an exceptional candidate an expert level in another programming language could be acceptable). Experience with at least one of machine learning, building energy simulation and meta-heuristic optimization is highly desirable. Mastering the English language is required.

Start dates of May or September 2020 are preferred. Positions are funded at a level comparable with NSERC scholarships [(Master's](#); [Doctoral](#); [Post-doctoral](#)). Holders of these or similar fellowships are eligible for significant top-up funding.

The Energy in Cities group specifically encourages applications from persons with disabilities, visible minorities, Aboriginal Peoples, people of all sexual orientations and genders, and others who may contribute to the further diversification of the University.

Email iesvic.admin@uvic.ca with subject Evins ReBuild Initiative + title of position, attaching the following:
- a **1 page cover letter** explaining your fit for the position and describing programming expertise and previous research experience, and stating your preferred start date.
- a **detailed curriculum vitae**, including grades and English test score if applicable
- names and contact information for at least **two professional or academic references**.

Review of applicants will begin soon, but applications are welcomed until this advert is removed from [here](#).
If you have previously applied for a position, do not reapply.
Only apply for one position - you will be considered for all open positions.