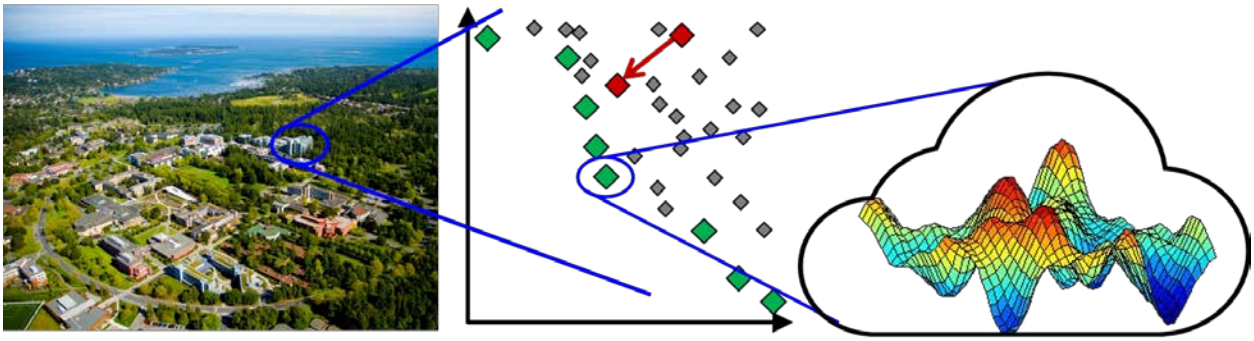
University of Victoria

Dr Ralph Evins | Energy Systems and Sustainable Cities group
ECS 422 PO Box 1700 STN CSC Victoria BC V8W 2Y2 Canada
250-472-5845 | revins@uvic.ca | http://web.uvic.ca/~revins

6 Masters/PhD positions and 2 Post-Doctoral positions available in Building Optimization and Machine Learning



Designing high-performance, low-energy, comfortable, cost-effective, robust and climate resilient buildings requires a new generation of computational tools to effectively address these challenges. These will blend aspects of physics-based building energy simulation, black-box optimization, machine learning and design space visualization. These positions will develop advances in all these areas, which will be combined into an online platform to be used by practitioners in industry and policy-makers in government to deliver better building designs that meet stringent new targets in British Columbia.

The positions available (see next page) will be supervised by Dr Ralph Evins (previously of Imperial College London and ETH Zurich) in his Energy Systems and Sustainable 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.

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 between January and September 2019 are available. 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.

How to apply

Email iesvic.admin@uvic.ca with subject Evins NetZero + 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 in October, but applications are welcomed until this advert is removed from here. If you have recently applied for a position, do not reapply. Only apply for your preferred position - you will be considered for all open positions.

The University of Victoria is an equity employer and 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.

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. **Machine learning for building design optimization**
   This project will use machine learning methods to fit surrogate models (statistical approximations of the design space) to simulation and optimization data, and explore their use in the design process. These surrogate models will be integrated directly in the optimization process in the platform.
   Desirable skills: building simulation, machine learning
2. **Robust optimization of high-performance buildings**
   High-performance building designs must be resilient to variations in user behavior and changes in future climate, or able to be easily adapted to these changes. This project will research more effective robust optimization procedures to be embedded in the platform.
   Desirable skills: building simulation, meta-heuristic optimization
3. **Modelica-based optimization of high-performance buildings**
   Modelica is a new paradigm for building simulation using acausal networks of differential equations, giving unprecedented access to the computational methods used. This project will explore how this new approach can be used with design optimization and surrogate modelling.
   Desirable skills: building simulation, Modelica
4. **Visualization and usability of building design tools**
   Effective data visualization approaches are needed to derive benefit from the optimizations conducted. This project will research the usability of interactive visual design exploration tools, including analysis of the unique data collected on how tools in the platform are used in practice.
   Desirable skills: building simulation, visualization methods, data analysis, survey design
5. **Finding meaning in hourly building energy data using machine learning**
   This project will apply data analysis methods and machine learning models to hourly building energy use data from smart meters, assessing common patterns of behaviour within a building and across multiple buildings, to identify common threads and recommendations for improvements.
   Desirable skills: data analysis, machine learning, building energy analysis
6. **Probabilistic modelling of buildings and energy systems**
   This project will apply the latest developments in mathematical stochastic modelling techniques to problems in building and urban energy systems to help account for fluctuations due to climate, occupancy and use patterns on solar and wind availability and building thermal loads.
   Desirable skills: probabilistic analysis, building energy analysis, energy systems modelling

Post-Doctoral positions in Building Optimization and Machine Learning

Two 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 platform.
Other tasks will include:

- Working with industry partners and other stakeholders to facilitate use of the platform to tackle building design challenges.
- Software development coordination, project management and research administration.
- Contributing to undergraduate courses.
- Working to develop additional funded projects.

These positions require 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.