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Research Projects and Opportunities at the Energy, Technology, and Architecture (η , or ETA) Lab for 2019

About the ETA Lab

ETA Lab is a new research group at UBC, based at the UBC Centre of Interactive Research on Sustainability (CIRS). The Lab seeks to develop and test state-of-the-art computational, data-driven techniques to assess and improve the design, construction, and operation of high-performance buildings and cities.

Available research topics for 2019

In 2019, the ETA Lab is looking to hire two post-doctoral research associates, and up to 6 graduate student researchers. ETA Lab will support post-doctoral research associates and graduate student researchers who have an interest in the following study areas:

- Performance evaluation of large energy-efficient building demonstration projects using data analytics and/or calibrated simulation models
- Detailed life-cycle cost and risk assessment of zero-carbon building construction projects in North America
- Development and application of learning-driven control processes for distributed energy systems that include building energy services and electric vehicle charging infrastructure
- Optimization of design and construction processes to deliver large, net-zero energy buildings.
- The use of Bayesian science to inform investment decision-making for low-carbon buildings and energy systems
- The use of wearable augmented reality (AR) devices for interaction with building design software (Rhino/Grasshopper), building sensor data, and building engineering control systems
- The study of climate change risks to future building energy performance and thermal comfort
- Simulation and experimentation with electric vehicle charging systems that are interconnected with building energy systems.

Other research topics are also applicable to the ETA Lab. See the current portfolio of research projects on the following pages.



Current Research Projects at the ETA Lab

Project	Project description
MURB_2030	MURB_2030 is a research, development, and demonstration RD&D project between the ETA Lab, UBC Campus and Community Planning, and UBC Properties Trust. The project will see design and construction of the largest net-zero energy residential building in Canada over 2020-2022 – a 5-storey multi-unit residential building constructed on UBC campus and occupied by university staff & faculty. ETA Lab researchers will develop and apply state-of-the-art research in informing how such a building should be designed and operated optimally. The research also seeks to translate the experience of constructing such a building to future industry practice.
Augmented Reality in the Built Environment (AR-BE)	The AR-BE project is examining how wearable augmented reality (AR) devices can improve the speed at which building designers and building facility managers have access to, and can manipulate, building information and data. For example, the AR-BE project is currently developing an AR building data navigator, whereby building managers and maintenance workers can visualize real-time building sensor data and maintenance information directly on location.
Data-driven building retrofits	The data-driven retrofits project is supported by the Pacific Institute for Climate Solutions (PICS). It seeks to study how deep datasets on existing building performance, coupled with machine learning processes and computational optimization algorithms can be used to inform decision-making on low-carbon building retrofits. The project has a particular interest to assess economic risk and uncertainty in decision-making processes, as well as incorporate future climate change projections in present-day retrofit decision-making.
Future Building Systems (FuBS)	The FuBS project is an experimental project to examine the use of machine learning processes that optimize, or altogether replace, the algorithms underlying typical building management systems (BMS). The project will engage with UBC's diverse portfolio of over 450 buildings, many of which are increasingly connecting their BMS' to the web, but also many of which are unlikely to be 'connectable' without the study and implementation of new Internet-of-Things (IoT) control devices and systems. The FuBS project also seeks to use building data to improve our understanding of how building occupants engage with building environmental systems, particularly how Bayesian statistics may improve our characterization of indoor environmental quality requirements. The FuBS project is contributing to the new IEA-ECB Annex 79 on Occupant-Centric Building Design.
Building-Integrated Transportation and Energy Systems (BITES)	The BITES project seeks to use physics and economics simulation models to design 'optimum' low-carbon building energy systems that most-economically deliver building energy services (heating, cooling, and electricity) and transport energy services (namely, electric vehicle charging). The project will particularly focus on combined-heat-and-power technologies as well as buffer thermal energy storage.



Graduate research degrees offered

ETA Lab is interdisciplinary research group that seeks to support a variety of researchers across the applied sciences. Dr. Rysanek is able to supervise research students in the following programs. Potential applicants are encouraged to enquire with Dr. Rysanek directly (arysanek@sala.ubc.ca). Note: all PhD and MAsc candidates will be offered a competitive research funding package to support their course of studies.

Graduate research program	Application procedure:	Deadline:
PhD in Mechanical Engineering	https://www.grad.ubc.ca/prospective-students/graduate-degree-programs/phd-mechanical-engineering	01.03.2019
PhD in Resources, Environment and Sustainability	https://www.grad.ubc.ca/prospective-students/graduate-degree-programs/phd-resources-environment-sustainability	31.12.2018
PhD in Interdisciplinary Studies	https://www.grad.ubc.ca/prospective-students/graduate-degree-programs/phd-interdisciplinary-studies	15.01.2019
Masters of Applied Science in Mechanical Engineering	https://www.grad.ubc.ca/prospective-students/graduate-degree-programs/master-of-applied-science-mechanical-engineering	01.03.2019
Masters of Advanced Studies in Architecture	https://www.grad.ubc.ca/prospective-students/graduate-degree-programs/master-of-advanced-studies-architecture	15.01.2019

General qualifications for all ETA Lab researchers.

ETA Lab encourages all of its researchers to be familiar with scientific programming languages (i.e., Python, MATLAB, etc.) and data management. Fluency in English, written and spoken, is a requirement. ETA Lab researchers will have the ambition and skillset to produce top-level publications for international conferences and high impact journals. Researchers should have strong interpersonal skills and first-hand experience in relating work to non-academic professionals in the buildings industry.

About research supervision and resources.

ETA Lab's research is supervised by Dr. Adam Rysanek, Assistant Professor of Environmental Systems at the UBC School of Architecture and Landscape Architecture and Associate Faculty at the Department of Mechanical Engineering, UBC. All ETA Lab researchers are provided dedicated workstations at the Center for Interactive Research on Sustainability on UBC Vancouver's campus.

About UBC and Vancouver

The University of British Columbia is consistently ranking among the 40 best globally, and now places among the top 20 public universities in the world. UBC strives to create an exceptional learning environment that fosters global citizenship, advances a civil and sustainable society, and supports outstanding research to serve the people of British Columbia, Canada and the world. It offers affordable, competitive tuition fees and a number of scholarships, awards, top-ups to external awards, entrance fellowships, Research Assistantships (RA's) and Teaching Assistantships (TA's) to its students. The Metro Vancouver area is an internationally-renowned city – and the 3rd largest in Canada. Consistently ranked one of the world's most livable cities, it is where snow-capped mountains meet the ocean, breathtaking views greet you around every corner, and a diversity of communities, cultures, and ethnicities meet you at its core.

For further information or questions about research opportunities at the ETA Lab, please contact Dr. Adam Rysanek, (arysanek@sala.ubc.ca).