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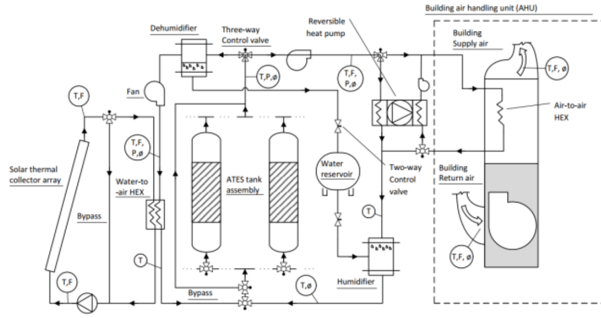


Design of a solar-driven thermochemical energy storage system for residential heating applications in Canada's remote northern communities

MASc and PhD Positions available

Project Description:

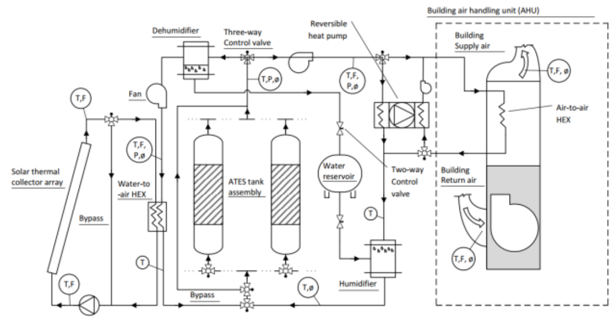
Several technologies have been considered in Canada's northern remote communities for reducing fossil fuel related CO_2 emissions. Solar thermal collectors are one such technology that can capture heat from the sun and use it for displacing residential heating fuel. However, as these locations receive minimal sunlight during the winter months when heating demands are the greatest, these collectors must be coupled with a seasonal storage device to harness and store heat during the summer months.

Thermal energy storage via physical adsorption (*e.g.* using adsorbent materials such as Zeolite 13X) is demonstrated to be a more compact mode of thermal energy storage than sensible and latent heat technologies. Heat is 'stored' in the adsorbent material by using hot dry air to drive off the adsorbed water vapour (and the process is reversed to release this stored heat). The on-going research at Carleton University aims to develop a novel solar-driven adsorption thermal energy storage (ATES) system for residential space and domestic hot water heating applications in Canada's northern remote communities. The research outcomes will increase the wellbeing of Canadians by providing pathways to better health, cleaner air and water, lower-cost energy, and greater energy security. Graduate students will gain practical insights from numerical analysis and experimentation of lab-scale ATES devices and field-testing of a custom prototype installation in a real remote community application (*i.e.*, heating a building in Cambridge Bay, Nunavut). Key areas of research will focus on the synthesis and characterization of alternative low-cost carbon-based adsorbent materials, the design and construction of appropriate experimental apparatus, and the numerical analysis of ATES tank configurations to optimize the overall geometry and internal fluid flow configuration. In addition to the technical aspects of the work, students will have the opportunity to travel to Cambridge Bay to conduct field work, and will be expected to attend conferences, and publish their work in peer-reviewed journals.

- Project media link: *https://newsroom.carleton.ca/story/solar-powered-heating-tech-northern-communities*

The Research and Engineering Skills You Will Strengthen and Acquire:

Operating principles, design and numerical modelling of state-of-the-art ATES systems; optimization for engineering applications; materials characterization methods (*e.g.*, XRD, BET, SEM, TGA), experimental testing; instrumentation and data acquisition; liaison and communication skills outside of academia (the project involves federal, territorial, and municipal government partners).



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The Ideal Candidate:

Bachelor (or Master) in Mechanical/Materials/Chemical Engineering; exposure to systems modelling, and simulation; exposure to adsorption kinetics, fluid mechanics, heat transfer, and thermodynamics; familiar and comfortable with Matlab and Simulink and other programming languages and interfaces such as LabVIEW, C++ and Python; familiar with CFD analysis tools such as COMSOL Multiphysics; experience with materials characterization and data acquisition; motivated and willing to expand their array of technical and research skills; interest in developing a publication record in prestigious engineering journals and conferences; excellent communication skills in English; and three academic references.

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What is Offered:

Qualified candidates will receive:

- a generous funding package which includes RA, TA, and scholarship contributions.
- Additional funds to cover travel to remote community, and domestic and international conferences

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Who to Contact:

Please email (in a single pdf file) your CV, transcripts, a writing sample, and a cover letter describing how your skills and qualifications fit the position to the project's principal investigators: Prof. Jean Duquette (jeanduquette@cunet.carleton.ca) or Prof. Ron Miller (ronmiller@cunet.carleton.ca) of Carleton University's Mechanical and Aerospace Engineering Department.

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