Solar Chimney with Wind Catcher in High-Rise Multi-Unit Residential Buildings (*New - Winter 2019* Immediate start)

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Using natural ventilation techniques to improve occupant comfort in the built environment is increasingly important as GHG emissions are becoming more problematic. Further intensifying this issue is the movement of societies into dense living environments, such as high-rise condominiums, which do not have the same cross-ventilation opportunities as freestanding homes. One method to improve natural ventilation in buildings involves using a wind catcher, which uses an air intake to re-direct outdoor airflow into the interior space of a building. A second method involves using a solar chimney, which utilizes a solar collector to heat air that then rises due to buoyancy effects, and pulls air out from interior spaces. However, each of these systems have drawbacks when either wind or solar availability is limited. This project investigates combining these two systems, in the context high-rise residential buildings, to mitigate these availability issues and further improve the comfort of occupants within the building.

This project will focus on model development and a parametric analysis of the combined system. First, the fundamental equations for both solar chimneys and wind catchers will be combined to determine overall system performance. Next, a software tool will be developed to carry out a parametric analysis of the system as a function of different wind speeds, wind directions, building heights, duct dimensions, and dwelling locations. These results will then be used to create basic design guidelines for the combined system, which will also be used to guide further research. Following the completion of these analyses, it is also anticipated that a journal article will be written to publish the findings.

Required Skills: Ability to use MATLAB (or similar) to create analysis algorithms. Background in basic fluid mechanics. Understanding of HVAC fundamentals.

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Research area: Building Energy and Environmental Engineering