

# Abstract

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## **An overview of research projects investigating energy consumption in Multi-Unit Residential Buildings in Toronto.**

High-rise multi-unit residential buildings (MURBs) constructed in the 1960s and 70s are a prominent form of housing in Toronto comprising over 50% of the City's residential stock. The majority of MURBs have become problem 'hot-spots' due to aging structures, poor maintenance and inefficient energy use. Studies indicate that MURBs are responsible for emitting over 2.6M tonnes of eCO<sub>2</sub> annually. In 2004, Toronto's Tower Renewal Program was launched to address concerns surrounding MURBs, becoming a municipal initiative in 2008 bridging between various interested parties. This includes a team at Ryerson University, investigating MURBs from an energy-efficiency standpoint. This contribution illustrates the diverse nature of studies undertaken at Ryerson between 2010 and 2015 under the Tower Renewal Program, to understand various facets of energy use in Toronto MURBs. Studies undertaken are divided into two typologies. The first is aimed at understanding reasons underlying poor performance in MURBs. This includes conducting energy, water and solid waste benchmarking of up to 120 MURBs, and survey-based studies documenting tenants' self-reported behaviors. Finally an ANN model was developed to predict future energy use. The second typology of studies tests proposed solutions to achieve energy reductions. One proposition simulated building envelope retrofits to meet OBC 2012. A comparison between pre-and post-retrofit standards showed up to 40% reductions in energy use. Finally, as part of a tenant engagement program, an Internet-Of-Things platform was developed and tested to provide visual feedback to tenants about their energy use. Results showed that the program instigated an annual reduction by up to 14.5%.