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Understanding energy consumption in high-performance social housing buildings: A case study from Canada

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1 UNDERSTANDING ENERGY CONSUMPTION IN HIGH-PERFORMANCE 2 SOCIAL HOUSING BUILDINGS: A CASE STUDY FROM CANADA

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7 8 **Abstract**

9 This paper presents a case study of a recently built high-performance Canadian social
10 housing building with the aim of comparing the expected and measured energy
11 consumptions and to identify the parameters affecting the most the energy need. A
12 monitoring system compiles at a 10-minute frequency information related to the energy
13 use and the thermal conditions observed in the building and its HVAC system. The
14 building has the particularity of comprising two symmetric sections made of different
15 timber structure systems. No significant differences of energy consumption were detected
16 between the two parts of the buildings. However, a large variance was observed when
17 comparing each dwelling individually regardless of their structures. The orientation of the
18 dwelling also exhibited a minimal influence compared to these variations, suggesting that
19 occupant behavior is the dominant factor explaining dwelling-to-dwelling variability and
20 is thus critical for understanding energy use in residential buildings. Regression analysis
21 showed that specific occupant actions, such as opening windows in winter or using
22 electrical appliances, have a great impact on the energy balance of the apartments. In
23 2016, the performance gap between measured and expected total energy demand of the
24 building was 74%. With the use of the large dataset coming from the building, it was
25 possible to determine the causes behind this large gap for the reference building.

26
27 *Keywords:* Building energy consumption; Energy performance gap; Monitoring
28 measurements; Regression analysis; Occupant behavior; Cold Climate

29 30 **Nomenclature**

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