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Poster Title: On residential energy benchmarks: the importance of occupancy over floorspace

Abstract: Buildings accounted for 39% of total U.S. energy consumption in 2017, and numerous efforts have been dedicated to gathering data and modeling building energy consumption for benchmarking purposes. However, many areas for improvement remain. Most predominant benchmarks can only be used to compare buildings with similar uses, climate, floorspace, and occupancy to determine relative performance. One commonly used energy benchmark is the energy use intensity (EUI), which measures building energy consumption per floorspace. In the commercial building sector, floorspace is a useful normalization because floorspace provides a reasonable measure of the business operations that can take place within a building, with variation in energy usage stemming largely from building type. EUI is thus a logical energy benchmark for similar commercial buildings types, since floorspace is the driver for meeting the business needs. While EUI may be logical for the commercial building sector, application of EUI in residential buildings becomes problematic. In the residential sector, the buildings provide places in which people reside, fulfilling needs for shelter, rest, a long list of basic human functions, and ever evolving modern requirements. Individuals vary greatly in their usage of and demands for floorspace, making occupancy a better normalization for the residential sector and leading to energy usage per person (EUP) as a logical energy benchmark. Moreover, EUI-based benchmarks, standards, and incentives in the residential sector encourage maximizing floor area to minimize EUI, resulting in an overall increase in energy consumption because thermal loads increase with building size. Despite the logic of EUP for the residential sector, it is not well understood or analyzed. This presentation will describe an exploration of EIA residential energy consumption survey (RECS) data to understand how EUP varies between climates, occupancy levels, and residential building types. This data will then be compared to residential building energy models to determine whether the models exhibit similar sensitivity to the RECS data.