

Accepted Manuscript

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PII: S0378-7788(16)31957-0
DOI: <http://dx.doi.org/doi:10.1016/j.enbuild.2016.12.056>
Reference: ENB 7235

To appear in: *ENB*

Received date: 9-3-2016
Revised date: 16-12-2016
Accepted date: 18-12-2016



Please cite this article as: Yang-Seon Kim, Jelena Srebric, Impact of occupancy rates on the building electricity consumption in commercial buildings, Energy and Buildings <http://dx.doi.org/10.1016/j.enbuild.2016.12.056>

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Impact of occupancy rates on the building electricity consumption in commercial buildings

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Highlights

- Electricity consumption has a significant correlation with the occupancy rates
- Plug-loads have an even stronger correlation with the occupancy rates
- Occupants' impact on the electricity consumption depends on the building function
- We calculated a value of kW/person for a building with its area usage type and size
- kW/person correlation allowed to predict electricity consumption in a test building

Abstract

Approximately 10% to 40% of the energy can be saved, if the occupants' presence/absence is factored into the building operation based on a dozen different case studies conducted in commercial buildings. Two campus buildings, CB1 with 0.3 kW/person and CB2 with 0.2 kW/person, as well as one additional office building, OB1 with 1.0 kW/person, served as data collection sites for occupancy rates and electricity consumption. The analysis results showed that both the total electricity consumption ($R^2 = 50\%-80\%$) and plug loads ($R^2 = 70\%-80\%$) are significantly correlated with the occupancy rates in the studied buildings. This study also found that the impact of occupants on the building electricity consumption is directly proportional to the building area usage distribution. This finding enabled development of a linear equation to estimate the normalized occupants' impact on the electricity consumption in kW/person. For a third campus building, CB3, used as a demonstration building, the electricity consumption calculated with the previously calibrated linear equation predicted the kW/person to within 7% of the actual measured 0.53 kW/person. The electricity consumption per

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