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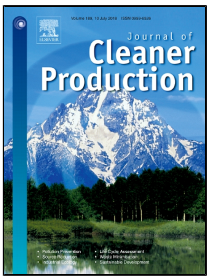

Life cycle energy consumption and greenhouse gas emissions of urban residential buildings in Guangzhou city

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Life cycle energy consumption and greenhouse gas emissions of urban residential buildings in Guangzhou city

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Highlights

- Technical coefficient matrix of Guangdong Province is converted into the Guangzhou city level based on the cross industry location quotients.
- This study takes all the life cycle stage of urban residential buildings in consideration to evaluate the whole amount of energy consumption and CO_2 emissions.
- The overall life cycle energy consumption and CO_2 (eq.) emissions for the studied building, constructed in 2012, were approximately 72,591.98 GJ and 12,637.32 t.
- Operational CO_2 emissions (81.42%) accounted for the greatest proportion of the total.

Abstract: Carbon emissions are derived mainly from the building, industrial, and transport sectors. Buildings are responsible for more than 40% of global energy use and for as much as 33% of global greenhouse gas emissions. By the end of 2016, 57.4% of the total population lived in urban areas in China, a dramatic increase from 26% in 1990. It is essential to study and analyze both energy consumption and carbon emissions of buildings. Taking Guangzhou city of China as an example, this study applied a hybrid life cycle assessment approach to quantify both the energy consumption and CO_2 emissions throughout the life cycle of an urban residential building. The data was collected from the Guangzhou input–output (IO) table of 2012, Guangzhou Statistical Yearbook of 2013, China Electric Power Yearbook of 2013, and statistical data of the studied building. Results showed that the overall life cycle energy consumption and CO_2 (eq.) emissions for the studied building, constructed in 2012, were approximately 72,591.98 GJ and 12,637.32 t, respectively. The largest CO_2 (eq.) emission factor was oil and the smallest one was electricity. The CO_2 emissions of steel, concrete, brick, and cement together accounted for 76.69% of the total emissions which are related to building materials in the preparation stage. This research not only promotes the construction of eco-cities or eco-communities, but also provides decision makers with comprehensive data on the energy consumption and environmental impacts of residential buildings. The findings are of considerable importance in terms of energy saving and emissions reductions for society as a whole.

Key words: energy consumption, greenhouse gas emissions, life-cycle analysis, residential buildings, Guangzhou city

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