

Accepted Manuscript

Title: Multiscale analysis and reduction measures of urban carbon dioxide budget based on building energy consumption

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PII: S0378-7788(17)31460-3
DOI: <http://dx.doi.org/doi:10.1016/j.enbuild.2017.07.084>
Reference: ENB 7824

To appear in: *ENB*

Received date: 23-4-2017
Revised date: 28-7-2017
Accepted date: 28-7-2017

Please cite this article as: Tzu-Ping Lin, Feng-Yi Lin, Pei-Ru Wu, Martin Hämmerle, Bernhard Höfle, Sebastian Bechtold, Ruey-Lung Hwang, Yu-Cheng Chen, Multiscale analysis and reduction measures of urban carbon dioxide budget based on building energy consumption, Energy and Buildings <http://dx.doi.org/10.1016/j.enbuild.2017.07.084>

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Multiscale analysis and reduction measures of urban carbon dioxide budget based on building energy consumption

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Abstract

As urban areas continue to develop and expand, carbon dioxide (CO₂) emissions from their energy use are growing exponentially. This has made carbon reduction a global concern. Previous studies have provided a limited understanding of carbon budgets because they have used top-down data on a single spatial or temporal scale. In this study, urban spatial and statistical data for metropolitan Tainan in southwestern Taiwan are used to explore inside and outside of the CO₂ system of the city and estimate the amount of CO₂ emissions from road traffic, the use of electricity and gas in buildings, and the amount of CO₂ absorbed by green spaces and water bodies within the system. Innovative annual and monthly carbon budget maps composed of 200 × 200-m grids are developed for the city through a geographic information system (GIS). An analysis of the highly detailed maps yields the following findings: First, CO₂ emissions are concentrated in over-urbanized areas, where the population density is higher than 5,000 people/km². Buildings account for the

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