## Accepted Manuscript

A Data-driven Approach for Building Energy Benchmarking Using the Lorenz Curve

Yibo Chen, Hongwei Tan, Umberto Berardi

 PII:
 S0378-7788(18)30174-9

 DOI:
 10.1016/j.enbuild.2018.03.066

 Reference:
 ENB 8452

To appear in: Energy & Buildings

Received date:	18 January 2018
Revised date:	20 March 2018
Accepted date:	26 March 2018

Please cite this article as: Yibo Chen, Hongwei Tan, Umberto Berardi, A Data-driven Approach for Building Energy Benchmarking Using the Lorenz Curve, *Energy & Buildings* (2018), doi: 10.1016/j.enbuild.2018.03.066

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



## A Data-driven Approach for Building Energy Benchmarking Using the Lorenz Curve

Yibo Chen<sup>a,b</sup>, Hongwei Tan<sup>a,b,c,\*</sup>, Umberto Berardi<sup>d</sup>

<sup>a</sup> School of Mechanical Engineering, Tongji University, Siping Road 1239, shanghai, 200092, China <sup>b</sup> UNEP-Tongji Institute of Environment for Sustainable Development, Siping Road 1239, shanghai, 200092, China.

<sup>c</sup> Research Center of Green Building and New Energy, Ruian Building of Tongji University, Siping Road 1239, shanghai, 200092, China.

<sup>d</sup> Department of Architectural Science, Faculty of Engineering and Architectural Science, Ryerson University, 325 Church Street, Toronto, ON, M5B 2K3, Canada.

\* Corresponding author (hw\_tan@tongji.edu.cn)

Email addresses of co-authors:

yb\_chen77@163.com (Y. Chen), uberardi@ryerson.ca (U. Berardi)

## ABSTRACT

A building energy benchmark indicates the reasonable level of energy demand, and it facilitates the policy making when facing with uncertain information at the planning stage. Traditional benchmarks are established based on statistical indicators or physical simulations of prototype buildings, while the diversified consumption levels of various buildings are rarely considered carefully. Pointing to this, a data-driven benchmarking methodology is explored based on the Lorenz curve, which is a specific measurement tool of income inequality. In this paper, the Lorenz curve is used to identify the distribution inequality of energy consumption among buildings. In particular, the Lorenz curves of energy consumption were firstly derived from 195 buildings of three building types in Beijing. Afterwards, a variable was extracted from the fitting Lorenz curve, in order to quantify the nonlinear distribution principles of energy use intensity along with the accumulative building area. Finally, empirical benchmarking formulae for the three building types were achieved together with stepwise applications. The validation showed that relative errors of accumulated energy consumption for offices, hotels and shopping malls were -5.27%, 3.57% and -3.56% respectively. This data-driven approach is developed based on the limited information, and it attempts to assist energy-policy planners in establishing energy benchmarking targets and promoting energy efficiency.

**Keywords**: building energy benchmarking; distribution inequality; data-driven; regional energy planning; Lorenz curve.

Download English Version:

## https://daneshyari.com/en/article/6728089

Download Persian Version:

https://daneshyari.com/article/6728089

Daneshyari.com