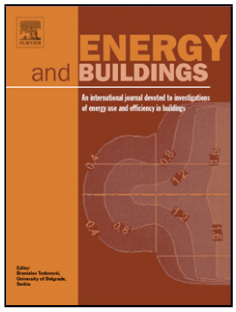

Title: Decent housing in the developing world: Reducing life-cycle energy requirements

Authors: Alessio Mastrucci, Narasimha Rao

PII: S0378-7788(17)30726-0
DOI: http://dx.doi.org/doi:10.1016/j.enbuild.2017.07.072
Reference: ENB 7812

To appear in: *ENB*

Received date: 4-3-2017
Revised date: 5-6-2017
Accepted date: 25-7-2017

Please cite this article as: Alessio Mastrucci, Narasimha Rao, Decent housing in the developing world: Reducing life-cycle energy requirements, Energy and Buildingshttp://dx.doi.org/10.1016/j.enbuild.2017.07.072

Decent housing in the developing world: reducing life-cycle energy requirements

Alessio Mastrucci, Narasimha Rao

International Institute for Applied Systems Analysis (IIASA) - Energy Program (ENE), Schlossplatz, 1 A-2361 Laxenburg, Austria.

Abstract

Developing countries face a crisis of deteriorating and unsafe human settlements conditions. Few studies examine the resources and energy required to provide everybody with decent housing. This study presents a generic methodology for the estimation of Life Cycle Energy (LCE) requirements to meet the housing gap and provide basic comfort to everybody in a developing country, based on standards of safety, durability and indoor temperature and humidity limits. The methodology includes the operationalization of this decent housing standard into materials and equipment; development of appropriate building archetypes; calculation of embodied and operating energy using a building simulation model; a parametric analysis to investigate the range of uncertainty in LCE and the attribution to different contextual conditions and energy savings measures.

Results for the test case India showed that LCE of decent housing can significantly vary depending on climatic conditions, building typology, construction materials, technical equipment for space cooling-dehumidification and user behaviour. Embodied energy accounts for 27-53% of the LCE, depending on the building type and climate. LCE savings up to -44% can be achieved by implementing low embodied energy materials, building envelope insulation, ceiling fans usage and improved energy efficiency of air-conditioning systems.

Keywords

Decent housing; Developing countries; Poverty; Policy decision support; Life cycle energy; Dynamic energy simulation; Energy savings; Uncertainty; Parametric analysis.

Abbreviations

A/C: Air Conditioning

COP: Coefficient of Performance

EE: Embodied Energy

LCE: Life Cycle Energy

OE: Operational Energy

PPD: Percentage of People Dissatisfied

PMV: Predicted Mean Vote

RC: Reinforced Concrete