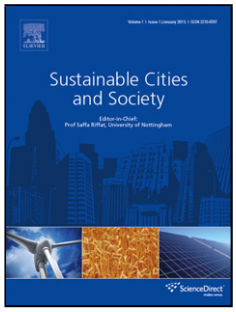

Title: Energy Productivity Evaluation of Large Scale Building Energy Efficiency Programs for Oman

Author: Moncef Krarti Kankana Dubey

PII: S2210-6707(16)30628-X
DOI: http://dx.doi.org/doi:10.1016/j.scs.2016.11.009
Reference: SCS 539

To appear in:

Received date: 17-6-2016
Revised date: 4-11-2016
Accepted date: 18-11-2016

Please cite this article as: Krarti, Moncef., & Dubey, Kankana., Energy Productivity Evaluation of Large Scale Building Energy Efficiency Programs for Oman.*Sustainable Cities and Society* http://dx.doi.org/10.1016/j.scs.2016.11.009

Energy Productivity Evaluation of Large Scale Building Energy Efficiency Programs for Oman

Moncef Krarti[a,b], PhD, PE, LEED, and Kankana Dubey[b],

[a]University of Colorado at Boulder, Colorado, USA
[b]KAPSARC, Riyadh, KSA

(*) Correspondent Author: krarti@colorado.edu

Abstract:
This paper outlines the benefits of large scale energy efficiency programs for new and existing buildings in Oman. In particular, an energy productivity analysis for these programs is carried out to encompass their overall impact for Oman's economy. Over 75% of the total electricity consumed in Oman is attributed to buildings with almost 50% is due to household. First, a comprehensive optimization analysis is carried out using whole-building energy simulation to determine the best energy efficiency measures suitable to improve the energy performance of buildings in Oman. The economic and environmental benefits of a wide range of energy efficiency measures technologies are then evaluated. In particular, the impacts of different energy efficiency retrofit levels of existing buildings are the estimated on the energy productivity indicators for the building sector of Oman. The results of the analysis indicate that the implementation of a government funded large scale energy retrofit program for the existing residential building stock is highly cost-effective. In particular, it is found that a basic large scale energy efficiency retrofit program can provide a reduction of 957 GWh in annual electricity consumption and 214 MW in peak demand as well as over 660 kilo-ton per year in carbon emissions.

Keywords: Building Retrofits; Energy-Efficient Measures; Energy Productivity; Life Cycle Cost; Optimization; Oman

Introduction

In order to assess the effectiveness of large scale energy efficiency programs, energy productivity analysis approach has been recently considered (KAPSRAC, 2015). In particular, it has been argued that energy productivity can provide better measure of a country's economy, energy, and environmental performance (KAPSARC, 2014). The energy productivity for any sector of an economy such as the building sector, EP_B, can be estimated as the ratio of the value added, VA_B, and the total final energy consumption, TFC_B, attributed to the sector:

$$EP_B = \frac{VA_B}{TFC_B} \quad (1)$$

The energy productivity indicator, as defined by Eq. (1), can be utilized to assess how energy resources can be allocated to optimize the sector economic growth (KAPSARC, 2015). Based on combined IEA and IMF data, Figure 1 shows the annual variation of the energy productivity of three sectors representing buildings, industry, and transport sector in Oman (IEA, 2016; IMF, 2016). As indicated in Figure 1, the energy