

International High-Performance Built Environment Conference – A Sustainable Built
Environment Conference 2016 Series (SBE16), iHBE 2016

Potential of upgrading federal buildings in the United Arab Emirates to reduce energy demand

Enas Alkhateeb^a and Bassam Abu Hijleh^{b*}

^a Faculty of Engineering & IT, British University in Dubai, UAE,

^b Faculty of Engineering & IT, British University in Dubai, UAE,

Abstract

The efforts of the United Arab Emirates' (UAE) government regarding sustainable developments are remarkable. However, the challenge relies within the existing buildings. Lately, many strategies and initiatives have been launched to manage energy demand, as well as energy supply. In this paper, a federal building in the UAE is chosen as a case study to assess the potential of upgrading its energy efficiency performance. Passive and active strategies are implemented in order to reduce the energy demand from grid electricity. This building is chosen to represent a broader message of the country's vision towards sustainability both locally and globally.

VE IES simulation software is used to assess the impact of each strategy from both categories (passive and active) on reducing energy consumption. Different scenarios are applied to highlight the optimal strategy for each category. The optimal retrofit approach is defined and assessed to reach the maximum reduction from grid electricity. The results reveal that implementing passive measures, such as shading elements and upgrading walls and windows' thermal insulation, provide 18.5 % saving of cooling energy consumption and 14.5% in total grid electricity consumption. Moreover, active measures, such as enhancing COP of cooling system and varying the cooling set-point, increase savings in electricity up to 65%. To form a complete image of a holistic retrofit, the results of a previous study conducted on the same building regarding the lighting system retrofit is considered in this study as well.

© 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee iHBE 2016

Keywords: Existing Buildings; Energy Retrofit Measures; Energy Simulation; Energy Demand Reduction; UAE

* Corresponding author. Tel.: +971-4-2791447

E-mail address: bassam.abuhijleh@buid.ac.ae

1. Introduction

In the last few decades, changes in the climate have been globally recognized as a hot topic that needed to be seriously addressed. The causes for these changes are varied and many theories highlight different key triggers for these changes. Eventually, the carbon footprint has been considered as a measurement tool to estimate the green house gases (GHG) levels [1]. Governments and policymakers worldwide were required to consider mitigating global warming and to provide initiatives to reduce GHG emissions. The built environment is responsible for 40% of global energy consumption, 25% of global water, 40% of global resources, in total producing around 1/3 of global GHG emission. This in turn makes the building sector the largest contributor to GHG emissions [2].

1.1. Energy profile in the UAE

In the last three decades, the UAE has witnessed an active development in the building construction sector. Unfortunately, the country was labeled as the highest ecological footprint worldwide. In 2006, the UAE's per capita footprint was found to be 11.68 global hectares compared to the average ecological footprint per person worldwide being 2.6 hectares [3]. As a result, the country adopted the Ecological Footprint Initiative (EFI) in 2007. Moreover, in the year 2010, the UAE's government decided to join the Copenhagen Accord and has shown commitment to reduce CO₂ [4]. Lately, the Ministry of Environment and Water announced that the UAE ecological footprint in 2014 was dropped to 7.75 hectares [5]; a reduction of 33.6% in only 8 years.

A research conducted of the UAE explained that tackling the built environment with serious regulations regarding energy consumption, as well as replacing fossil fuels with clean energy sources, could reduce the emission of CO₂ by 50% [6]. Therefore, government organizations developed standards and codes that regulate the newly constructed buildings, such as the 2010 Abu Dhabi's Estidama with its 1-5 Pearls rating system and the 2011 Dubai Green Buildings Regulations. However, the majority of these efforts have focused on new buildings, whilst the existing buildings were neglected. It is evident that considering retrofit for the existing buildings is a practical and effective way to reduce the CO₂ emission, as shown through Etihad super ESCO's accomplished work on refurbishing some projects. For instance, the executed project for lighting retrofit at DEWA power station in Jabel Ali and Al-Awir confirmed a saving of 75% compared to the previous consumption and a reduction of 6,286 tons of CO₂ [7]. Statistics in 2011 showed that governmental buildings (offices and facilities) in Abu Dhabi alone consumed around 21% of the total energy, followed by commercial buildings with 30%. The residential sector showed the highest consumption with 33%. Moreover, Figure 1 shows the percentage of the consumed electricity in the UAE of each building sector according to 2013 statistics.

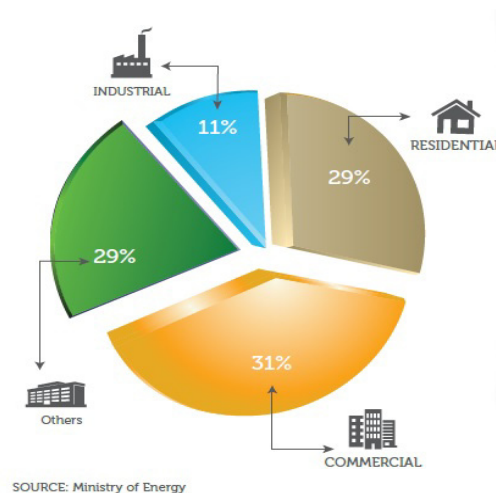


Fig. 1. UAE electricity consumption 2013 [8].

Download English Version:

<https://daneshyari.com/en/article/5028910>

Download Persian Version:

<https://daneshyari.com/article/5028910>

[Daneshyari.com](https://daneshyari.com)