



Towards green buildings: Glass as a building element—the use and misuse in the gulf region

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Abstract

The recent economic growth in the Gulf region notably in Dubai, United Arab Emirates (UAE) has led to a colossal number of buildings that has been constructed in the past 5 years. In the last decade, a total glazed building's façades became the icon of Dubai. This large area of glazing in each façade needs protection against overheating and sun glare in summer. According to leader in energy and environmental design (LEED) glass selection becomes a main element in this equation to contribute towards achieving a green building. The aim of this paper is to investigate the problems associated with misuse of glass, as a building element in UAE particularly in Dubai. Inadequate design with ill-selected glass/glazing type may lead not only to poor daylighting in building interiors but also contribute significantly to fatigue, insomnia, seasonal affective disorder (SAD) and above all increase CO₂ emission.

The purpose of the study is to specify the required improvements to permit natural, 'free' daylight to filter through the building façade into interior space, especially with the right type of glass. This paper examines the status of buildings in Dubai in terms of glass type, visible light transmittance, reflection (out/in) and relative heat gain. A quantitative analysis is conducted to assess the impact of glass on the building users' performance in terms of daylight environment. A recent built high-rise office building was selected in the investigation to assess whether selected glass provide the recommended daylight factor (DF) and daylight level (DL) according to IES standards. The results revealed that most the glass/glazing was misused in 70% of buildings in intermediate and low performance groups. The DF and DD in the selected office building were unexpectedly tremendous and found far beyond the recommended level due to the use of spectrally selective glazing (clear on both sides).

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1. Introduction

The worldwide relentless increase of CO₂ emission particularly in the Gulf region due to high consumption of energy for cooling buildings is signaling an alarm for architects to emphasis more on climate-responsive buildings (High Performance Green Building, HPGB) especially the façades and the right selection of glass/glazing to produce low-energy architecture. According to the international report on Environmental Sustainable Index (ESI) issued by policy makers (January 2005) revealed that the UAE, some North Africa and Middle Eastern countries are among the nations listed as lower ranking countries in terms of high CO₂ emission (Fig. 1). This ranking would also put more pressure on architects to be extra vigilant in their approach of designing buildings, especially glass selection in hot climate regions [1]. In winter this year, the UAE has experienced noticeable and unprecedented changes in its climate. Such change is mainly seen from a clear sky to dark cloudy in winter. This change causes poor daylighting availability in deep spaces and as a result, electrical lighting during daytime is excessively utilized to compensate for such poor daylight availability. This switch is unquestionably puts more demands on the grid during daytime hence, more CO₂ emission. According to the 2004 World Energy Report the world energy needs will increase by 60% by 2030 with two thirds of the additional needs will come from developing countries, therefore, more emphases on renewable energy are needed [2]. The growth in electricity consumption for cooling buildings and electrical lighting in the UAE has increased 10 times (from 5 to 50 billion KW/h) over the past 24 years [3]. In Dubai, this figure is rather peculiar due to the skyrocketing rate of building construction probably, the fastest in the world. The recent forecast issued by Abu Dhabi Chamber of Commerce and Industry (ADCCI) suggests that the investment in the construction development, in the next 3 years is estimated to be as high as US\$30 billion and by 2010 it will be amplified by 80% [4]. Such growth will definitely increase the dependence on fossil fuel as a source of energy to cool and light such massive stocks. Consequently, energy conservation in buildings is considered the most important factor in sustainability.

In general, buildings use energy in two different ways: first type is known as Envelope Load Dominated Building (ELDB) such as houses; and the second, Internally Load Dominated Building (ILDB) such as offices, schools, libraries, airports and stores [5]. The bulk of energy uses in the ELDB are lights, appliances and hot water whereas, ILDB mainly lights, computers, photocopying machines and air-conditioning. In offices, the artificial lighting accounts for about 50% of the total energy use and a significant portion of the energy utilized in other

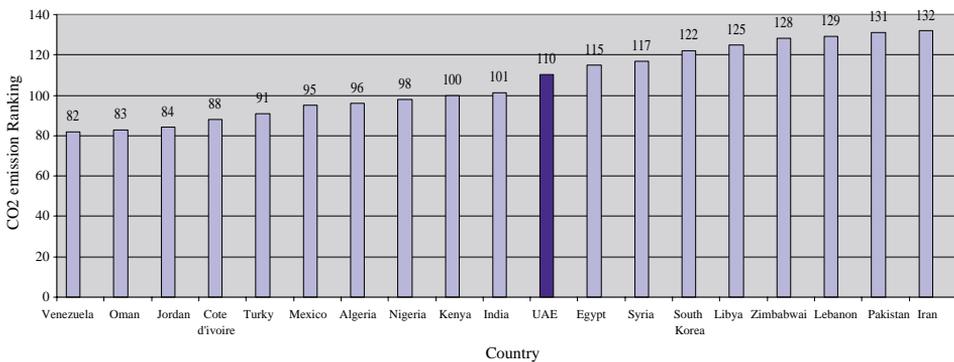


Fig. 1. Low ranking countries with high CO₂ emission.

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