CHAPTER 5
THERMAL COMFORT AND CLEAN ENERGY IN NIGERIAN HOMES

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5.1 INTRODUCTION

Thermal comfort has recently become a major contending issue due its effect on human productivity coupled with changing climatic variables. The changing climatic variables have increased both the outdoor and indoor temperatures especially in the countries within the tropical region. Though the temperature level in the outdoor spaces dictates the indoor condition, more attention is concentrated on the indoors because that is where the bulk of human activities take place. Among different indoor spaces, residential spaces are predominantly designated for resting and other domestic activities; and, as such, require a high comfort level. Previous research indicates that elevated temperatures or overheating in homes can result in several adverse effects, such as sweating, fatigue, and skin allergies (Adunola & Aioli, 2016).

A greater demand for building energy mainly during operation, is targeted towards providing comfort for occupants. In 2019, building sector recorded the highest in terms of total energy consumption with about 35% of the world energy consumption and 39% of greenhouse gas emissions (Niza et al., 2022). Also, Gong et al., 2021, noted that a

greater quantity of this energy is used to achieve thermal comfort through heating, ventilation and air conditioning (HVAC), systems. The primary sources of this energy are hydrocarbon and fossil fuel based. These sources are non-renewable emit undeserved and unhealthy gases in the air. These gases which include carbon dioxide (CO_2) water vapour, ozone, methane (CH_4), and nitrous oxide (N_2O), are noted for their heat-trapping characteristics that result in climate change. For many years, awareness of greenhouse gases has sparked various world and international conferences and debates. Some of these organisations were involved in the debates, and their purpose is shown in Table 5.1 below.

Table 5.1 Some international organisations that championed the reduction GHG emissions

S/N	Name of Organisation	Main Focus/Purpose
1	Intergovernmental Panel for Climate Change (IPCC)	Concentrated on how of reduce quantity of greenhouse gases (GHGs) into the atmosphere globally. The activity of IPCC dated back since seventy's (70s) when the negative effect GHG emissions was notice especially developed countries.
2	United Nations Environmental Programme-Sustainable Buildings and Climate Change (UNEP-SBCI)	Emphasized that the building sub sector consumes greater percentage of world energy and equally emit higher GHG into the atmosphere. Also embarked in providing common forum for key stake holders in the building industry to key into the sustainability reform of world countries.
3	United Nations Framework Convention on Climate Change (UNFCCC)	Played supervisory role to UNEP-SBCI in supporting the building sector to reduce GHG emissions.

To some extent, the various international government agencies, in partnership with private organisations succeeded in creating global awareness of the environmental consequences of GHG emissions at the

earliest possible time. However, expected apparent reduction in greenhouse emissions and positive changes in the devastating effects of climate change is yet to be achieved. Some of the conceptual policies taken, like climate change mitigation and adaptation, sustainability and green world concepts, were all more remedial in the quantity of GHG emitted by non-renewable energy sources. A better approach could have been to fashion out an energy system that could replace non-renewable energy sources and aim at zero GHG gas emissions.

As heat-trapping gases are emitted into the atmosphere, global warming and climate change will continue to affect natural ecosystems and distort the ecological balance. This underscores the need to explore clean energy sources that are more sustainable and emit little or no greenhouse gases into the atmosphere. The objective of the paper is to evaluate the need to explore clean energy sources in providing indoor thermal comfort in residential buildings in the tropics possible alternative sources of energy.

5.2 INDOOR THERMAL COMFORT AND ENERGY DEMAND

Energy demand in the form of electricity in the building sector has been increasing mainly due to efforts to cushion the effects of global warming and climate change. Studies show that the building sector used approximately 60% of the net electricity consumption in OECD economies, primarily in residential and commercial buildings (EIA, 2003; Muhammad & Oraegbune, 2018). Worldwide, residential buildings and service sectors contribute to over one-third of global energy consumption and roughly 40% of total carbon dioxide (CO_2) emissions. (Nicol et al., 2020). No wonder the focus on the building industry is on most debates and discussions concerning reducing GHG emissions.

A large quantity of the building's energy demand is channelled towards improving indoor thermal comfort. To create a comfortable and acceptable indoor environment, heating, ventilation, and air-conditioning (HVAC) systems account for more than 50% of a