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## NIGERIAN HOMES NEEDS INSULATION

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### ABSTRACT

Nigeria has a tropical climate because of its close proximity to the equator and the Atlantic Ocean. Generally, Nigeria has high temperatures. Nigeria has two main seasons, the rainy season and dry season. The coastal Southern region of the country is characterized by rainfall and humidity, and it is hot as well. While, the Northern region of Nigeria is characterized by very hot and dry weather, it is a desert climate. The desert climate in Northern Nigeria, is typically hot during the day and cold in the night. Therefore, Nigeria has hot temperature. Because of the hot temperature in Nigeria, and in view of the common building construction materials, which are the concrete masonry units, the zinc and the long span aluminum roofing sheet. Nigeria houses needs to be insulated against the hot climate. Nigeria is located in the hot tropical region, from sun rise to sun set, the radiation from the sun will be heating right on top of the roofs of Nigerian buildings. The roofs of the buildings are of zinc roofing sheets or long span aluminum sheets. These roofing sheets are heat conductors, hence, they permeate hot air down into the living spaces of the houses creating uncomfortable environment for the occupants. Therefore, the roof interior of these houses needs to be insulated to combat the intense sun heat radiation. The exterior walls of these buildings are constructed with concrete masonry units. Concrete blocks absorbs heat, it permeates heat transfer. Again, from sun rise to sun set, the exterior concrete masonry unit walls of these houses are exposed to the sun heat radiation. As the solar radiation hits the concrete block wall, the concrete block wall keeps on

absorbing the hot solar radiation throughout the day. The concrete masonry wall keeps on transferring the heat until it penetrates into the living spaces of the house, thereby, creating uncomfortable environment for the occupants. This happens because concrete masonry unit is a heat conductor and therefore, it needs to be insulated against the heat radiation from penetrating into the building living spaces.

**Keywords:** *Insulation, Material, Thermal Insulation, Solar Radiation, Hot Climate, Dry Climate, Winter, Summer, Desert, Temperature, Comfort, Cooling, Heating, Attic, Ventilation.*

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## INTRODUCTION

In hot, humid climates, the majority of the energy used to make the house comfortable is spent on cooling and dehumidifying the house. Houses must be insulated and sealed to try to keep the heat and humidity that surrounds the house from getting into the house. Another best practice is to have a vented air cavity directly under the roof. This allows a lot of the heat to be reflected and dissipated before it even gets to the roof insulation. Building insulation materials are the building materials which form the thermal envelope of a building or otherwise reduce heat transfer. Insulation may be categorized by its composition (natural or synthetic materials), batt, blankets, loose – fill, spray foam, and panels), resistance to heat transfer, environmental impacts and more. Radiation as well as Sometimes a thermally reflective surface called a radiant barrier is added to a material to reduce the transfer of heat through radiation as well as conduction. Providing thermal comfort without excess space conditioning cost is one of the primary requirements of buildings. Therefore, thermal control is an important aspect in almost all

buildings. Understanding heat transfer and the temperature distribution through building materials and assemblies is also important for assessing energy use, thermal movements, durability, and the potential for moisture problems. The control of heat flow in buildings requires insulation layers compromised with few thermal bridges, an effective air barrier system, and good management of interior heat generation. **John Straube. (2011).**

In hot, climates, the majority of the energy used to make the house comfortable is spent on cooling and dehumidifying the house. Houses must be insulated and sealed to try to keep the heat and humidity that surround the house from getting into the house. The hotter the temperature and the higher the humidity, the more there is a natural force driving the heat and humidity into your cool, relatively drier home. Think of how much cooler it is under a canopy or tree than in the direct sun. Like a canopy, a vented roof basically shades the rest of the House. **Eric Mac Inerney. (2011).** Thermal insulation in buildings is an important factor to achieving thermal comfort for its occupants, insulation reduces unwanted heat loss or gain and can decrease the energy demands of heating and cooling systems, in the narrow sense insulation can just refer to the insulation materials employed to slow heat loss. Unless your home was specifically constructed for energy efficiency, you can probably reduce your energy bills insulation to a newer home can pay for itself within a few years. Retrofitting an existing building can oftentimes be more cost – effective than building a new facility. Since buildings consume a significant amount of energy (40 percent of the nation's total U. S. energy consumption), particularly for heating and cooling (32 percent), and because existing buildings comprise the largest segment of the built environment, it is important to initiate energy conservation retrofit to reduce energy consumption and the cost of heating, cooling, and lighting buildings. But conserving energy is not the only reason for retrofitting existing buildings. The goal should be to create a high – performance building by applying the integrated,

whole – building design process, to the project during planning or charrette phase that ensure all key design objectives are met.

**Richard Paradis, P. E. (2016) Retrofitting buildings.**

In hot climates, the roof attic needs to be properly ventilated, because, ventilation will reduce the heat of the entire roof system. I mean, it will reduce the temperature of the ceiling and roof. For the most part, Nigerian homes have adequate roof cavity (attic) cross ventilation system, therefore, if the roof attic has a combination of insulation system and ventilation system, it will provide a maximum cooling effect for the building. In fact, the most effective way to combat the solar radiation on the building roof is to install insulation material directly on top of the roof purlins before the roofing sheets, in addition to applying insulation above the ceiling plus the ventilation system, if finance will not be a problem. The ventilation system is usually along the eave soffit as it is done on Nigeria houses and there should be insulation material along the eave line as well. In hot climates, the primary purpose of ventilation is to expel solar – heated hot air from the attic or roof to reduce the buildings cooling load and to relieve the strain on air- conditioning systems. In mixed climates, ventilation serves either role, depending on the season. Most building codes require that your house be equipped with soffit vents. The standard code formula requires 1 square foot of net free ventilation area for every 300 square feet of attic floor area, assuming that half of the openings are located in the soffit, half along the ridge. If a roof has only soffit vents and no ridge vents, most codes require 1 square foot of net free ventilation area for every 150 square feet attic floor area. **Martin Holladay. (2013).**

So much information has been devoted to the subject of roof venting that it's easy to become confused and to lose focus. So, I'll start by saying something that might sound controversial, but really isn't: A vented attic floor, is one of the place, where insulation is placed on an air – sealed attic is one of the most underappreciated building assemblies that we have in the history of building science. It's hard to

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screw up this approach. A vented attic works in hot climates, mixed climates, and cold climates. It works in the Attic and in the Amazon. It works absolutely everywhere, when executed properly. **Joseph Lstiburek. (2011).**

While the control of moisture is practically a universal requirement for buildings, the importance of the control of heat transfer tends to become more critical as the severity of climate, either hot or cold, increases. Managing heat flows is critical to occupant thermal comfort, energy efficiency, durability, and increasingly, thermal resilience during periods of extended power outages. **Ted J. Kesik. (2017).**

Nigeria homes are built of concrete masonry unit walls, both interior and exterior walls. They are usually plaster finished with cement mortar and paint over the plaster work. After the plaster and painting exercise, the exterior walls of the building are left exposed to the solar radiation day-in, day-out. The exterior walls needs thermal insulation and finished material such as brick veneer, stone, stucco or some other less expensive finished material.

In the Western World, the cold regions of the world, building insulation is paramount. Building insulation in the United States of America for example, is not only to combat cold winter weather, it is also to combat the hot summer weather. During the cold winter period the insulation system on the exterior wall and in the roof attic prevents the cold to some extent, from entering into the building interior. Insulation material slows down heat loss. This allows to achieve a maximum heating of the building interior that adds to the overall comfort of the people living in the home. The insulation system that envelopes the building helps to lower monthly bills from usage of utilities. The perimeters of windows and doors house needs to be insulated too, because it will reduce air leakage, or air infiltration thereby maintain consistent temperature in the house. The insulation system provides effective barrier between the house

and outside the exterior environment. A well – insulated house is like dressing for the weather. A wool sweater will keep you warm if the wind is not blowing and it is not raining. On a windy day, wearing a nylon shell over your wool sweater helps keep you reasonably dry and warm. A house is similar, on the outside, underneath the brick or siding there is an air barrier that does the same thing as the nylon – it keeps the wind from blowing through. Then there is the insulation (like your sweater) and a vapor barrier, which helps keep moisture away from the house structure where it can do damage. **Doug Wastell. (2013).**

The need to keep the building interior comfortable for human use during the cold winter, is unavoidable, and it is also unavoidable to provide comfortable interior living environment during the hot summer months. During the hot summer months, in the United States of America, people die of heat wave, it gets very hot in the day time. Consequently, the hot weather affects the building due to the heat radiation. The long input of heat from the sun during the day, the surrounding hot air goes through the building walls into the interior of the house. This heat transfer has to be stopped by means of insulating the building exterior walls, the roof attic and perimeters of window opening and exterior doors of the building, just as applicable at cold winter period. At hot climate regions and during summer periods in the cold weather regions, one of ways of keeping the interior of homes cool is to prevent the solar radiation from entering the living spaces by covering the windows with heavy window drapes. This will definitely reduce the heat from the solar radiation. Therefore, it is very important to insulate buildings so as to achieve human thermal comfort in the living space. The insulation system in the building reduces heat loss or cooling loss. Thermal insulation in buildings is an important factor to achieving thermal comfort for its occupants, insulation reduces unwanted heat loss or gain and decreases the energy demands of heating and cooling system. In a narrow sense insulation can just refer to the insulation materials employed to slow heat loss. Insulation doesn't care about

directions, whatever keeps a house warm in a cold climate will help keep it cool in a hot climate. Vapor barrier are different – my understanding is that the vapor barrier should go on the side of the wall that sees the most humidity. But insulation simply slows down heat transfer in all directions, so as long as you have a way to cool off the interior, whether it's AC or a cool night breeze, an insulation will hold the day's heat at bay. **Evan Johnson. (2013) Insulation.**

## CONCLUSIONS

People living in the warm climates, especially the tropical Africa as in Nigeria the concept or the idea of building insulation in their thinking is only required to be done or needed only in the cold regions of the world. They do not understand that the solar radiation needs to be insulated against just as the buildings in the cold regions are insulated against the cold weather. Also, they do not understand that the very insulation system used in insulating against the cold in the western world is also the same insulation system that is used in insulating against the solar radiation on the buildings during the hot summer weather in the western climate. In the western world people spent so much money on their homes to achieve comfortable living environment in the buildings by providing solar radiation insulation system during the hot summer season of the year.

Here in Nigeria and Africa as a whole, just because we are lucky that there are no natural disasters such as the hurricane the tornado and that there is no cold weather, people feel relax and comfortable. People settled to live in consonance with the hot climate without concerns about the indoor uncomfortable heat from the sun's radiation. Nigerian homes needs to be insulated against the hot solar radiation in order to achieve indoor comfortable living environment. It will involve some additional cost to insulate the house, but the thermal comfort it will provide and reduction of cooling cost, outweighs that extra cost of insulating the house. Another way of achieving indoor comfortable environment is to orientate the building with reference to the solar movement, and it is very

important. The sun rises from the East and sets in the West, therefore, the building has to be oriented in a way that the less used spaces in the building during the morning hours has to face the East axis. This is because occupants will be out of the building to work in the morning, therefore, they will not be bordered with the solar radiation heat problems. In the morning period, for example, the kitchen, dining room, and living room are minimally used. These spaces are mostly used after work hours when the solar is already on the West face of the building. By the time the occupants are back home from work, the solar is already setting in the West axis, at this point, the spaces in the East direction be optimally used comfortably until the next morning without having problem from the solar radiation. Evergreen trees should be planted around the building, especially, on the East and West side of the house to help provide shade or block the solar radiation of the Nigerian hot climate. This is energy efficient design process, it is energy balancing design.

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