DAYLIGHTING

Viable to Reduce Energy Demand in Residential Homes

Researchers find that daylight-linked lighting controls in residential homes lead to energy savings, economic benefits, and environmental sustainability.

Power outages have become a fact of life in South Africa. The persistent energy crisis due to aging power plants and increasing demand has made energy an issue of availability rather than affordability. While several demand-side management initiatives such as the mass rollout of compact fluorescent lamps (CFLs), solar water heater rebate programme, and the introduction of geyser blankets have helped to reduce the overall energy demand from the residential sector, much still needs to be done to reduce energy consumption without compromising the comfort of residents.

NRF-affiliated researchers from the University of Fort Hare investigated the potential of introducing daylight-linked lighting controls in residential homes and the resultant energy savings, economic and environmental benefits. The study was conducted using a prototype single-family energy-efficient low-cost house designed with its major glazing area facing north to ensure maximum infiltration of solar radiation during the winter season for space heating. According to the study, the use of natural energy sources has been proven to minimise energy consumption and reduce pressure on the grid.

By measuring the illuminance in the energy-efficient low-cost house, the researchers found that daylighting resulted in:

- 47% energy savings in the house. This translated into daily cumulative energy savings of 0.24 kWh.
- Monetary saving of 46 % during low-demand season and 44% in high-demand seasons.
- 47% reduction across all environmental elements including carbon dioxide, nitrogen dioxide, and sulphur dioxide, used, and emitted by a coal-fired power plant in generating the light energy consumption.

According to the researchers, the use of daylighting is mainly viable during clear sky days. During the daylight period (07:00 to 17:00), the house's indoor light level was found to be above the minimum illuminance threshold for domestic visual activities, unlike when measured on cloudy days. Therefore, electric lighting is required indoors on an overcast sky day to achieve visual comfort.

UNIVERSITY OF FORT HARE

Given that loadshedding is inevitable until sufficient power generation capacity is achieved, the researchers recommend that the active practice of daylighting is a viable option that can be integrated in the South African residential sector to help reduce the overall energy demand in the domestic sector, as well as to promote energy security without compromising service level or occupants' visual comfort.

> Daylighting resulted in daily cumulative energy savings of 0.24 kWh. Active practice of daylighting led to 47% reduction across all environmental elements

In conclusion, future research on this work is set to extend the initiative to traditional housing design and commercial buildings in South Africa, as this study was limited to passive solar housing design. The researchers believe that this is likely to result in significant amounts of energy savings since typical commercial buildings' operating hours coincide with peak daylight period and uses more light fittings. SM