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Editorial: Cool Roofing Technologies for Sustainable Buildings

*Ming Chian Yew**

Department of Mechanical and Material Engineering, Lee Kong Chian Faculty of Engineering and Science, University of Tunku Abdul Rahman, Kajang, Malaysia

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Editorial on the Research Topic

Cool Roofing Technologies for Sustainable Buildings

Innovative cool roofing technologies are a future trend that will enable us to progress towards a low-carbon cleaner planet, as energy management over building has acquired crucial significance to the environment. The combination of innovative active and passive cooling roof technology systems plays an important role towards workable and sustainable development goals. The sustainability valuation of buildings is becoming essential for justifiable development, especially in the construction sector.

There are four published articles with nine authors who have contributed to the research topic: "Cool Roofing Technologies for Sustainable Buildings" mainly providing an overview of the cool roofing technology systems. Apart from that, Tatiana and co-workers have been investigating screen wall fire resistance using the finite element method, which was highlighted on the high temperature or flame on the screen wall (Eremina et al.). Based on the results, a new functional dependence in the form of a multiple regression equation has been established, which makes it possible to determine the actual fire resistance limits of screen walls by the thickness of the inner heat-and-burn resistant material, ensuring the prevention of fire propagation, as well as their geometrical parameters without large-scale fire tests.

An innovative cool roofing technology system that endorses a combination of passive and active cooling approaches on the reduction of attic temperature of the building has been developed to assess the outcome of numerous roof model designs on heating load to launch the capability of a cooling roof system by keeping the thermal comfort level for residents in the buildings (Yew et al., 2013; Yew et al., 2018). There are four major features in making the cool roof models: i) metal deck roofing, ii) lightweight foam concrete roof tile, iii) moving-air-cavity (MAC) air circulation, and iv) solar-powered fan have been extensively studied and evaluated by researchers (Yew et al.). An innovative cool roof system with the incorporation of lightweight foam concrete tile, MAC, and solar-powered fans has efficiently lowered attic temperatures by 6.0°C compared to the ordinary roof model. Consequently, this innovative integrated cool roofing model design encompasses the ability to improve the comfort level of residents towards long-term sustainable growth with the deployment of renewable energy to preserve and maintain environmental ecosystems.

Another study also discusses a cool roof technology system, using rainwater harvesting systems by integrating the smart sensor to cool the roof and attic temperatures for the improvement of the comfort level of building occupants (Yew et al.). Three main components of the cool roof system were introduced: 1) moving-air-cavity (MAC) ventilation, 2) solar-powered fan, and 3) rainwater harvesting system (Yew et al.). These three main components are integrated and control the cool roof system. The experimental work was conducted indoors by using a halogen light as a substitute for solar radiation, while the ambient heat is monitored at about 29.8°C throughout the test. The

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Edited and reviewed by:
Andrew Wright,
De Montfort University,
United Kingdom

Correspondence:
Ming Chian Yew
yewmc@utar.edu.my
yewmingchian@gmail.com

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temperatures of the rooftop surface, MAC aluminum tube, and attic region were measured by K-type thermocouples to evaluate the performance of the cool roof designs. To accelerate the airflow rate within the cavity, the solar-powered fans were integrated into the MAC by rejecting the hot air away before transferring it to the attic area. Meanwhile, an innovative rainwater collecting system was executed to cool off the rooftop temperature rapidly by lessening the rate of heat transmission to the attic region. The result of this inventive cool roofing technology system has successfully lowered the attic temperature by 10.8°C compared to the normal metal deck roofing model. The findings of the project revealed that the integrated cool roofing technology system contributed to the comfort of building occupants whilst also providing a long-term sustainable development for a better world.

The energy impact of roofs has mainly been studied by Blackhurst using theoretical models (Blackhurst). Nevertheless, empirical approaches are required for validation. This analysis used combined empirical systems to assess the effect of whitening on the current roofs. A statistical survey has been done with the data of 2 years of hourly site cooling energy use, which was accumulated for 114 residences in Austin, TX. The observed results are mixed and are restricted due to the small treated sample size. The significant impact of whitening varied from a 14 to 49.2% reduction in daytime site cooling. Energy use and a 9.7% increase to a 40.3% decrease in night time site cooling energy use mainly contributed from the individual household comparisons. However, the advantages of whitening are only robust for older roofs and longer service lives for the coating. Finally, most simulations reflect net benefits if the coating lasts at least 5 years for roofs older than 10 years of age.

In conclusion, this research topic has received scientist's invaluable contribution by sharing their experimental and theoretical research knowledge on wide-ranging aspects of cool roofing technology systems as well as screen wall fire resistance modeling to compare with the actual fire resistance limits of screen walls. The main aims of emerging building cooling technologies are to diminish the reduction of critical resources, resulting in a lesser carbon footprint, to stop the environmental degradation caused by amenities, organization, and greenhouse gas emissions; and to create built environments that are harmless, industrious, and efficiently employ renewable energy. These articles contain a comprehensive investigation of the cool roofing technology systems that make a significant contribution to mitigating global warming. Installing an innovative cool roofing technology instead of a conventional roof lessens the total heat flow into the building. Significantly, this ideal cool roofing system benefits not only buildings, occupants, and cities but also our planet. Based on the research outcomes, it is clear that the cool roofing technology system could play a crucial part in sustainable development goals for future generations.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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