Universitas Brawijaya

Effect of Cool Roof Paint Application on Metal Roof Surface Temperature and Indoor Air Temperature in Tropical Climates

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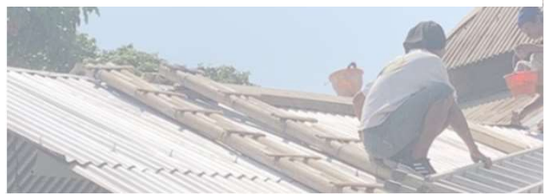

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Introduction

- Cool roofs have great potential to mitigate UHI due to the high percentage of roof cover in urban areas.
- Nutkiewicz et al. [1] observed that using a cool roof might reduce heat stress in tropical areas by up to 91%, outperforming models with fan ventilation or additional shading devices.
- Cool roofs are also more successful at lowering the material's max. surface temperature than green roofs, up to 1.2-1.4°C lower [2].
- Cool roofs has the ability to reduce roof surface temperature by up to 20°C [3,4], the ceiling's interior surface temperature by up to 6.8 °C [5], and the indoor air temperature by up to 2.3°C [5].

Introduction

Before cool roof paint application

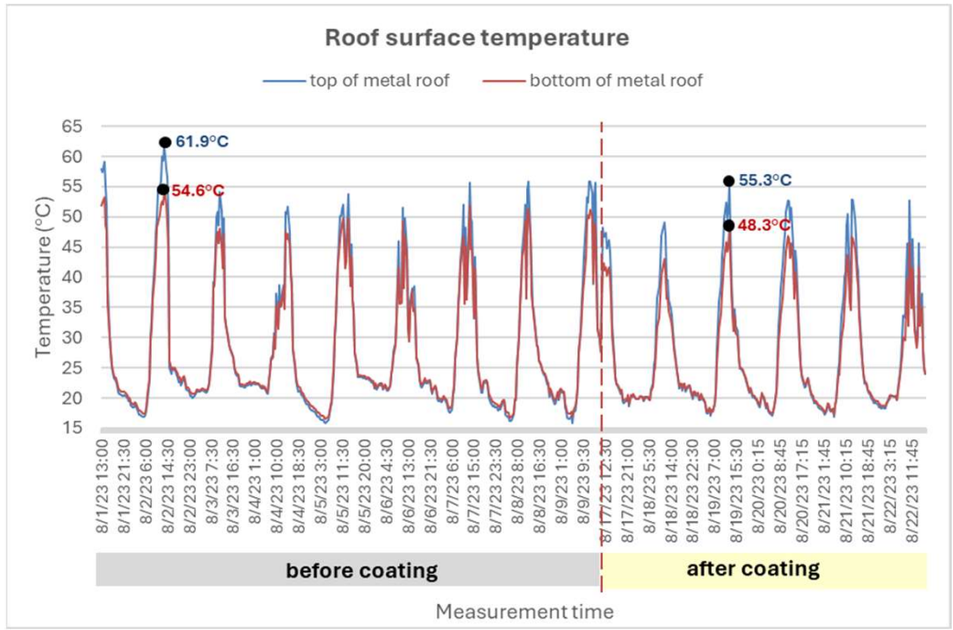
After cool roof paint application

- Cool roof products generally include paint, membrane, and tile.
- However, among the numerous types, cool roof paint is the most commonly used due to its ease of application and lower cost when compared to other alternatives.
- This research aimed to observe how cool roof paint affected the surface temperature of metal roofs and the indoor temperature of buildings in tropical climates.

Method

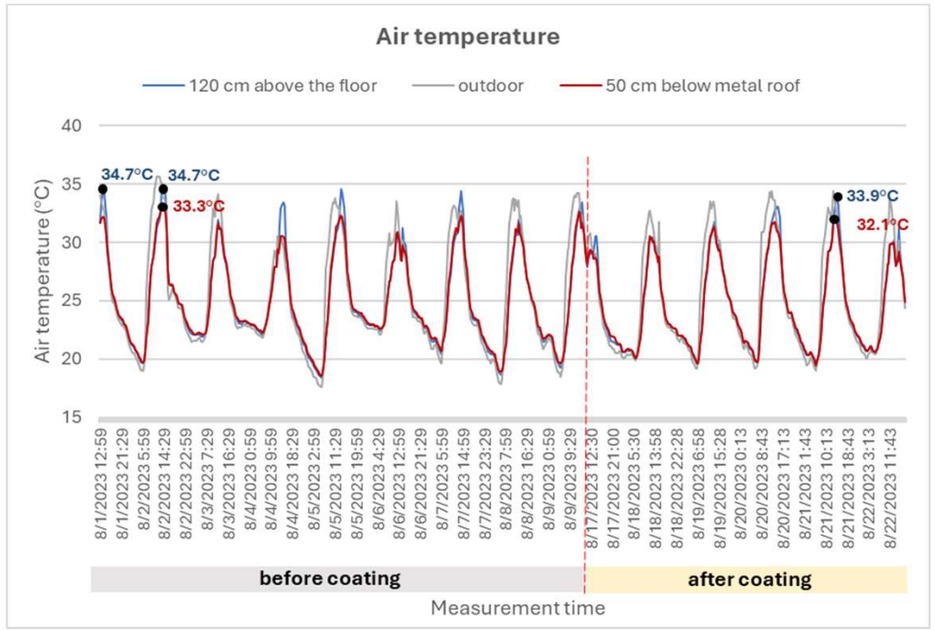
- Field measurement during August 2023 on a community center (*Balai RW*) with a metal roof in Malang, Indonesia.
- Measurement before & after coating the metal roof with cool roof paint.
- Five measurement points:
  1. Two for roof surface temperature
     - Above the metal roof
     - Under the metal roof
  2. Three for air temperature
     - Outdoor
     - Indoor: 50 cm below the roof
     - Indoor: 120 cm above the floor

Result and Discussion



A decrease in the maximum temperature of the roof surface after coating with cool roof paint.

- Up to 6.6°C on the top surface
- Up to 6.3°C on the bottom surface.



A decrease in the maximum indoor temperature.

- Up to 1.20°C at 50 cm below the roof
- Up to 0.80°C at 120 cm above the floor

Result and Discussion

The measurement results shows reduction in metal roof surface temperature and indoor temperature for both maximum and average temperature.

			Temperature (°C)		
			Before coating	**After coating**	**Temp. reduction**
Metal roof surface temperature	Max.	Top of the roof	61.90	55.30	6.60
		Bottom of the roof	54.60	48.30	6.30
	Avg.	Top of the roof	28.53	27.91	0.62
		Bottom of the roof	28.01	26.59	1.43
Air temperature	Max.	120 cm above the floor	34.70	33.90	0.80
		50 cm below metal roof	33.30	32.10	1.20
	Avg.	120 cm above the floor	25.02	24.61	0.41
		50 cm below metal roof	25.02	24.55	0.46
		Outdoor (control)	25.43	25.15	0.28

Conclusion

- The application of cool roof paint on building with metal roof in Malang, Indonesia was proven to be able to reduce the roof surface temperature and the indoor air temperature.
- Recommendations for longer-term research to determine whether the same benefits of cool roof coating extend throughout the year, in both rainy and dry seasons.

References

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