

Effect of White Roofing on Refrigerated Buildings

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Abstract : The deployment of white or cool (high albedo) roofing is a common energy savings recommendation for a variety of buildings all over the world. Here, the effect of a white roof on the energy savings of an ice rink facility in the northeastern US is determined by measuring the effect of solar irradiance on the consumption of the rink's ice refrigeration system. The consumption of the refrigeration system was logged over a year, along with multiple weather vectors, and a statistical model was applied. The experimental model indicates that the expected savings of replacing the existing grey roof with a white roof on the consumption of the refrigeration system is only 4.7 %. This overall result of the statistical model is confirmed with isolated instances of otherwise similar weather days, but cloudy vs. sunny, where there was no measurable difference in refrigeration consumption up to the noise in the local data, which was a few percent. This compares with a simple theoretical calculation that indicates 30% savings. The difference is attributed to a lack of convective cooling of the roof in the theoretical model. The best experimental model shows a relative effect of the weather vectors dry bulb temperature, solar irradiance, wind speed, and relative humidity on refrigeration consumption of 1, 0.026, 0.163, and -0.056, respectively. This result can have an impact on decisions to apply white roofing to refrigerated buildings in general.

Keywords : cool roofs, solar cooling load, refrigerated buildings, energy-efficient building envelopes

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