A Practical Guide to Cool Roofs and Cool Pavements

Executive Summary

Read *A Practical Guide to Cool Roofs and Cool Pavements* at:

www.CoolRoofToolkit.org

World temperatures are rising at an unprecedented rate.

According to the Intergovernmental Panel on Climate Change, the Earth's average temperature is on track to increase by between 2 and 7 degrees Celsius (4 to 13 degrees Fahrenheit) this century. This dramatic change in temperature will produce a climate never before experienced by human civilization. Cities are often significantly warmer than the surrounding landscapes due to the summer "urban heat island effect." Addressing this heating effect will only become more important because the world is rapidly urbanizing—within 50 years an estimated 80 percent of the world's population will live in an urban area.[1]

Higher temperatures adversely affect our health, our energy consumption, and our environment.

Rapidly increasing temperatures stress ecosystems, increase the frequency and duration of heat waves, and exacerbate air pollution. Together, these factors are creating serious health risks to people around the world. In addition, increasing wealth in the developing world is spurring the rapid deployment of air conditioners, which burden electrical grids with their energy demands.

Cool roofs and pavements can help cool down buildings and cities. Replacing roofs and pavements with more reflective materials could reverse the urban heat island effect. Cool, reflective roofs and pavements are readily available, typically pay back within one year when the roof is ready to be replaced, and help cities both mitigate and adapt to climate change while making them more desirable and comfortable places to live.

Benefits of cool buildings*

- Cooling energy savings of 10 to 20 percent on the top floor of the building by reducing air conditioning needs—a cost savings potential of $735 million per year in U.S. commercial buildings alone [2]
- More comfortable indoor air temperatures
- More comfortable and functional for residents of regions where the roof is used as living space
- Likelihood of improved roof and equipment life due to reduced thermal expansion
- Cost-effective investment versus a traditional technology that often pays back immediately when a roof is going to be replaced anyway

Benefits of cool cities

- Better air quality—an annual economic benefit of nearly $1 billion annually in the U.S.[3]
- More resistant to heat and pollution related illness and death
- Reduced peak energy demand
- Healthier, more comfortable and enjoyable urban spaces

Benefits to the planet

- Avoids CO_2 emissions by reducing cooling demands
- Offsets the warming effect of approximately 1 year's worth of global CO_2 emissions[4]

There are straightforward policies and programs with proven track records that leaders may adopt to make their regions cooler. Foundational Activities, below, describe the basic requirements to launching successful cool roof and pavement programs. Implementation Activities, also below, describes policies and programs that have been field-tested around the world and shown to be effective at deploying cool surfaces.

* Cool buildings incorporate reflective materials, along with appropriate levels of insulation and good windows to make them more efficient and comfortable.

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1 Crutzen, P. J. (2004). New directions: The growing urban heat and pollution "island" effect – impact on chemistry and climate. *Atmospheric Environment, 38*(21), 3539–3540.; Akbari, H., Rosenfeld, A., and Menon, S. 2009. Global cooling: Increasing world wide urban albedos to offset CO2. *Climate Change*, *94*(3–4). 275–286.; Levinson, R., Akbari, H., Konopacki, S. & Bretz, S.E. (2005). Inclusion of cool roofs in non-residential Title 24 prescriptive requirements. *Energy Policy, 33*, 151–170.

2 Levinson, R. & Akbari, H. (2010). Potential benefits of cool roofs on commercial buildings: conserving energy, saving money, and reducing emission of greenhouse gases and air pollutants. *Energy Efficiency, 3*, 53–109.

3 Akbari et al. (2009).

4 Ibid.