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ET THE ECONOMIC TIMES

Smart Surfaces for Cooler Cities

Greg Kats and Megha Behal

Downtown Jaipur (Vyacheslav Argenberg / http://www.vascoplanet.com/)

Synopsis

Global warming cannot be limited to 1.5° C without global citywide cooling through citywide adoption of smart surfaces. Smart surfaces manage sun and rain much more effectively than conventional dark, impervious surfaces such as asphalt. City refl1ectivity can be doubled through smart surfaces adoption, re1flecting much more sunlight, with much of the heat exiting the atmosphere. This process, negative radiative forcing, has a cooling effect that counters anthropogenic global warming.

With temperatures finally cooling down this week, India hopefully is out of the brutal and life-threatening heatwaves many parts of the country faced this summer. But let not the relief take away from the grim reality that India's urban heatwaves are going to get worse. According to McKinsey, India is on track to become one of the first inhabited areas in the world to experience heatwaves that cross the survivability limit of 35° C wet bulb temperature (wbt) - the temperature read by a thermometer covered in water-soaked cloth over which air is passed - even for healthy individuals resting in the shade.

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At every level of government, India is developing strategies for managing heat and heatwaves. But these efforts are fragmented and not yet effective. At the national and state levels, multiple initiatives are underway to address rising city temperatures. These are yet to cohere into city-wide cooling strategies.

The National Disaster Management Authority (NDMA) developed heatwave guidelines and national disaster management plans, while Ahmedabad became the first South Asian city to prepare a heat action plan. Since its rollout in 2013, the plan has prevented about 1,100 deaths each year. 23 states and 100 cities and districts in India have developed or are adopting heat plans. But these are limited to guiding extreme heat planning, issuing an early warning system and, in the longer term, implementing reflective, less-heat absorbing materials on roofs. These are important steps but remain inadequate.

Countrywide, 26% of India's population is 14 years old or younger. Which means over 300 million children are at increasing risk of potentially deadly heatwaves. Due to greater body surface-to-lung volume ratios, children are the most susceptible to heat stress and mortality.

This threat will be exacerbated by continuing urbanisation, as cities are hotter than the surrounding countryside. The urban-rural temperature differential – the Urban Heat Island effect - results from high densities of dark, heat-absorbing surfaces and declining greenery in cities.

Indian cities should adopt a citywide cooling strategy. The only viable cost-effective strategy is a set of surface solutions called smart surfaces. This includes integrated implementation of reflective, porous and green surfaces, trees and solar photovoltaic (PV) technology.

Smart surface strategies include increasing albedo (reflectivity) of roads, parking lots and roofs; deploying porous surfaces allowing rain to pass through and recharge groundwater while reducing flood risk; and increasing tree coverage and solar PV.

Many of these strategies have traditionally been used in much of India, but too often have been forgotten. Adoption of smart surfaces on a citywide basis would allow Indian cities to cool by 3-5° C, with even larger cooling in lower-income, darker neighbourhoods. Cities that adopt this strategy will experience declining peak summer temperatures, lower energy bills, less air pollution, improved health and less urban flooding.

The growing risk of extreme heat is greatest for lower-income populations. These areas are darker and have fewer trees and are 4-7° C hotter than wealthy, tree-lined parts of cities. To cope with heat, air-conditioning is the preferred choice for those who can afford it.

But since only 10% of Indians have air-conditioning, this pathway will impose enormous costs, accelerated urban and global warming, and misery for the majority of India's urban population. Power grids are most likely to fail when electricity demand from air-conditioning is greatest, which is during the worst heatwaves. Relying on private air-conditioning - rather than on citywide cooling - is a recipe for disaster.

Global warming cannot be limited to 1.5° C without global citywide cooling through citywide adoption of smart surfaces. Smart surfaces manage sun and rain much more effectively than conventional dark, impervious surfaces such as asphalt. City reflectivity can be doubled through smart surfaces adoption, reflecting much more sunlight, with much of the heat exiting the atmosphere. This process, negative radiative forcing, has a cooling effect that counters anthropogenic global warming.

The Smart Surfaces Coalition (SSC) is working with partners like The Energy and Resources Institute (Teri) to develop cost-benefit analysis tools for smart surfaces for India, with the objective of supporting the strategy as an Indian urban design norm. With India scheduled to shift from extreme heat to flooding monsoons in July, smart surfaces offers a very effective - and cost-effective – way to protect cities and make them more liveable.

Kats is CEO, Smart Surfaces Coalition, and Behal is consultant, The Energy and Resources Institute (Teri), New Delhi.