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Cooling Future Urban Habitats: Technology Based on Human Body?

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Synopsis

What is the likely scenario when demand for global housing increases amid rising global temperatures? How do we create sustainable habitats to survive in an increasingly warming planet?

Commentary

BASED ON United Nations estimates, the global population is growing by 1.18 percent annually or an additional increase of 83 million people every year. In short, the world's population is projected to increase by more than one billion people within the next 15 years, reaching 8.5 billion in 2030, and to increase further to 9.7 billion in 2050 and 11.2 billion by 2100.

According to UN Habitat the number of slum dwellers is estimated at 863 million by 2014 account, compared to 760 million in 2000 and 650 million in 1990. They account for around 33 percent of urban populations. Combine these two, add increasing global temperatures to the mix, and humanity stands on the brink of global crises: an ever-increasing urban population, the need to meet global housing demands and unprecedented consumption of energy to accommodate the numbers.

Add Global Warming Trends - A Perfect Storm

The release of NASA's mid-year climate analysis concluded that the year 2016 could have been the hottest on record (at least based on the first six months). The World

Meteorological Organisation confirmed this at the Marrakech Climate Change Conference in November 2016. If one were to examine the data over the past 50 years, the average global temperature has increased at the fastest rate in recorded history. And, since 2000, experts have observed that the trend is accelerating: all but one of the past 16 years were the hottest years in NASA's 134-year record.

The ticking 'time bomb' created by global warming and global housing demand (due to population growth) creates an urgency to search for a solution to house people in decent and energy-efficient living quarters in major urban centres, especially in developing Asian countries.

Recognising temperature increases, the global community has recently concluded a landmark deal in Kigali, Rwanda, on limiting hydrofluorocarbons (HFCs) used in, among other things, air-conditioners and refrigerators. This has both positive and negative impacts. An article in the New York Times emphasises how the use of airconditioning is both a boon and a bane when it comes to saving lives vis-à-vis climate change.

A recent study states that the number of deaths as a result of very hot days in the United States declined by up to 80 percent from 1960 to 2004, thanks to the adoption of airconditioning. In contrast, hot days in, for example India, have significant impacts on mortality, especially for each additional day where the temperatures increase beyond 35 degrees Celsius.

Biomimicry: Learning From Human Body's Design

However, given that airconditioning is also responsible for the release of greenhouse gases, it leaves very little room for developing countries to use critical adaptation tools, like air-conditioning, in an increasingly warming world. As such, the way out of this conundrum for developing countries such India and China is to search for some form of technological breakthrough to mitigate impacts of global warming.

Studies of how human body reacts in hot environments could provide some insights into creative engineering design in constructing sustainable dwellings. Normally, the body cools itself by opening pores on the skin and releasing water and salts. As the water evaporates, it transfers the body's heat to the air. Because water has a high latent heat, which is the heat required for changing liquid to gas, this process usually carries away enough heat to do a good job of cooling the body.

This 'technology' has already been adapted in food storage to reduce wastage by the creators of the Evaptainer, a storage device that uses evaporative cooling to store food, without the use of electricity. Similar technology albeit on a larger scale may be the solution to installing 'air-conditioning' to homes with minimum energy consumption.

The Future Sustainable Home

The future sustainable home will need to be built in a way that allows it to withstand extreme temperatures. This is especially important when we address housing needs

of the millions in Asia who now have no proper dwellings. Cost is an important factor that is difficult to overcome given the number of houses that need to be constructed.

We suggest upscaling the technology behind *Evaptainers* by incorporating the technology in housing design. Further research is needed to identify appropriate materials for this. With modification in design, one could even replace water with other suitable insulating materials to retain heat for winter months.

This technology can, without the use of electricity, act as an effective adaptation tool against temperature extremes. Such building design could effectively function like *Evaptainers* for residential housing.

Meeting housing demands in the urban centres of Asia is a challenge, especially in terms of cost. This particular design attempts to alleviate the cost to some extent, especially in terms of stabilising indoor temperatures, which could very well make the difference between life and death for some in the future. This would be most effective in public housing or in government housing projects for disadvantaged communities who will feel the brunt of climate change.

This technology could potentially be used for larger commercial buildings with the aim of reducing energy consumption or even in automobiles of the future, like driverless vehicles.

There is a need to provide decent energy-efficient housing to help the millions who are now without proper homes. The impacts of climate change make this need even more pressing. Evaporative cooling technology has great potential in meeting this challenge especially where social needs demand solutions from science and technology.

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