

## Architectural history offers clues to low-carbon relief from the heat

By Sarah Wessler on Aug 8, 2019

**As demand for air conditioning grows in the developing world, nature-based design could provide climate-friendly alternatives.**

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Hawa Mahal. (Photo credit: Annie Spratt)

The Hawa Mahal, a striking five-story palace in Jaipur, India, dates back to 1799, long before the invention of air conditioning. Built for use during the hot summer months, when local temperatures can climb well over 100 degrees Fahrenheit, it features dozens of enclosed balconies whose diminutive window openings direct a cooling breeze into the building's interiors – hence the building's translated name, “Palace of the Winds.” The balconies also minimize the amount of surface area directly exposed to the sun, preventing heat from building up indoors.

The Hawa Mahal is one of countless examples of naturally cooled spaces found in traditional Indian architecture. Throughout history, buildings in India, [as around the world](#), evolved to provide comfortable environments by harnessing forces like sunlight and wind – a strategy now referred to as passive design.

The invention of “active” building systems (e.g., air conditioning, artificial lighting) fundamentally changed the way buildings and neighborhoods are constructed. Instead of prioritizing appropriateness for the local climate, builders began to rely on active systems to keep occupants comfortable. Because these systems run mainly on fossil fuels, building operations became a major source of emissions.

This transition has happened faster in some parts of the world than in others. Over the past century, climate-controlled buildings became the norm in wealthy nations. In other regions, they remain largely aspirational: In India, for example, fewer than 10% of households have air conditioning. But things are changing, as the fast-growing middle class increasingly demands home A/C.



Air conditioners on a New Delhi high rise. (Photo credit: Milind Kaduskar)

Given India's massive population, experts fear that widespread A/C adoption will cause a dramatic spike in greenhouse gas emissions. "There's an old saying that when Paris sneezes, France catches a cold," said [Anjali Jaiswal](#), the director of the India Climate and Energy Program at the Natural Resources Defense Council in San Francisco. "If [cooling] is not solved in a climate-friendly way in India, the rest of the world, in addition to India, will suffer the consequences."

### Urbanization and globalization

Passive design provides an important opportunity to lower India's demand for A/C while providing much-needed relief from the heat. This opportunity is particularly timely – the nation is urbanizing rapidly, and much of the building stock it will need in the coming decades has yet to be built.

According to Manit Rastogi, a New Delhi-based partner of architecture firm [Morphogenesis](#), the most important question may be not whether passive design can provide climate-friendly cooling solutions, but why the world moved away from it in the first place.

"There is no downside to passive design. It's not like if you do passive design it will cost you more, or take longer to build," he said. "Passive design, in its fundamental nature, will provide comfort conditions, or close to comfort conditions – or reduce the need for air conditioning, or heating, if it's a cold climate – [thereby] reducing the cost of operations, but also reducing the cost of construction. So it's really a win-win."

Rastogi said that India's architects are typically highly skilled in passive design, which is emphasized during university training and employed by default on projects whose clients often don't have reliable electricity or a budget for round-the-clock A/C. The national preference for indoor/outdoor living rather than sealed, climate-controlled environments also encourages passive techniques, he said.

But as designers get bigger commissions, these design drivers tend to change. "They're hit with this phenomenon of clients in India wanting to replicate Western models of architecture. How do you take a building with vision glass on all four sides and then apply principles of passive design?" he said. "Passive design has its own architecture, has its own aesthetic."

### Lessons from architectural history

Examples of this aesthetic can be found in traditional building styles that evolved over centuries in response to local environments and cultures. In India's warm, humid regions, builders gravitated toward thin-walled structures with raised floors in order to promote air flow. In the country's hot, arid zones, thick, windowless walls were used to keep out the sun's heat, while courtyards promoted ventilation and fountains provided evaporative cooling.



A village in the Indian state of Rajasthan built for hot summer weather. (Photo credit: Arie Kamphorst)

According to Deepa Parekh, a Mumbai-based architect at [Environmental Design Solutions](#), modern building techniques and construction materials can make it challenging to apply some of these cooling strategies today. For example: historically, “we were building walls which were maybe 12 feet thick, because that’s a way to avoid the heat ingress inside the building. But now, the technology enables you to create very thin walls, and so you can build tall structures,” she said. “But we forget that the heat is going to travel very soon [through those walls].”

One building that has gained international attention for its application of traditional Indian cooling strategies is Morphogenesis’s Pearl Academy of Fashion, located in Jaipur. Drawing on [the historic form of the stepwell](#), Manit Rastogi and his team created a series of ground-level pools that bring cool air into the occupied spaces above. The [traditional jali](#), or window screen, was reinterpreted as a perforated skin stretching across the building’s exterior, letting in filtered daylight while blocking solar heat. Another time-honored passive strategy, orienting the building based on the sun’s path through the sky, keeps interior spaces shaded during the hottest months.

## Ratings and regulations

But individual projects go only so far. To push for broader change in India’s design industry, Rastogi has helped develop GRIHA, [the nation’s answer](#) to popular U.S. green building rating system LEED, and advocated for building codes that nudge projects toward passive strategies by setting limits on energy consumption.

While significant progress has been made, there’s much more to be done, he said. “What’s really, really good about a lot of the codes in India now: It is pretty much mandatory for buildings of a certain size to comply. However, in my personal opinion, these codes need to get harder and more stringent.”

As part of her work on climate-friendly cooling in India, NRDC’s Anjali Jaiswal has also spent years pushing for stronger building codes. Her team helped the nation’s [Ministry of Environment, Forests and Climate Change](#) develop the recently released [India Cooling Action Plan](#), establishing a framework with both passive and active strategies for sustainable cooling in buildings.

## Cool roofs

One focus of Jaiswal’s work has involved cool roofs. The idea behind this architectural element is simple: Dark colors absorb sunlight, light colors reflect it. On hot days, light roof surfaces can be 50-60 degrees Fahrenheit cooler than their darker counterparts. This, in turn, lowers temperatures in the occupied spaces below. One study conducted in the city of Hyderabad found that cool roofs reduced indoor air temperatures by up to 9 degrees Fahrenheit.

Cool roofs were once common in India, but tar and other heat-absorbing materials have become the norm in many areas. In an attempt to reverse this trend, Jaiswal’s team helped incorporate cool roofs into a new national building code for commercial buildings.

NRDC also played a key role in the development of innovative cool roof programs in the city of [Ahmedabad](#) and the state of [Telangana](#), devoting particular attention to the potential for cooling in slum communities.