HOUSING
byPeople
IN ASIA

Newsletter of the Asian Coalition for Housing Rights

Number 24, March 2026

SMALL CHANGES, COOLER HOMES: COMMUNITY-LED RESPONSES TO HEAT

Heat has become one of the defining forces affecting life in low-income urban settlements. In neighborhoods where metal roofs trap heat and narrow alleys radiate it back into homes, extreme temperatures strain health, income, and dignity. The previous edition of the ACHR newsletter documented these realities, highlighting how communities cope through improvisation, everyday resilience, and shared knowledge.

The work then shifted from documenting heat to testing solutions. Communities collectively identified the most vulnerable households, balancing needs and local priorities. Cooling strategies were co-developed through workshops, prototyping, and hands-on construction. Rather than importing standardized models, solutions were shaped by local climate, materials, and building traditions, from reflective roof treatments and natural insulation to ventilation upgrades, shaded alleys, kitchen exhaust systems, and greening.

Implementation became part of the learning process. Residents contributed labor and coordinated supplies; savings groups explored financing mechanisms for maintenance and expansion; simple measurements tracked changes in temperature and comfort. In several cities, evidence generated through these pilots is already strengthening dialogue with local governments around housing and climate adaptation.

This newsletter brings together those experiences, not as fixed blueprints, but as adaptable approaches. The solutions presented here are grounded in local capacity, offering inspiration for other communities facing similar heat pressures. Cooling does not need to remain a distant aspiration dependent on expensive technology. It can begin with collective action, practical design, and confidence in the knowledge already present within communities.

COLLECTIVE DESIGN

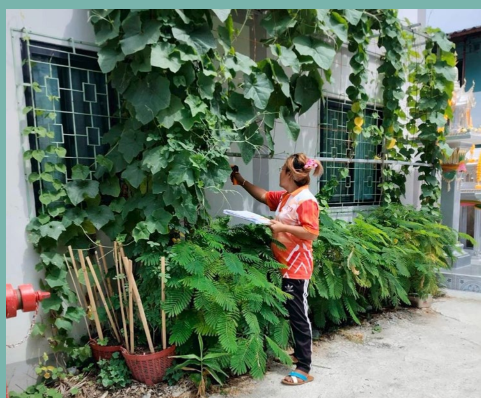
Cooling modifications began with conversations, building a shared understanding of where heat enters homes. Residents shared their coping strategies and worked with technical teams to imagine changes that could make houses more livable.

BUILDING TOGETHER

Ideas quickly moved from discussion to action. Families, local masons, and community teams worked side by side to test materials, adjust designs, and construct solutions that fit dense settlements and limited budgets.

HOMES REIMAGINED

Cooling took many forms, from small ventilation openings to raised roofs and insulated ceilings. Each intervention reflects a balance between comfort, affordability, and how people use their homes.



MEASURING CHANGE

Communities did not stop at construction. Residents measured temperatures, compared results, and documented what changed. By generating their own evidence, they turned homes into learning spaces for climate adaptation.

COOLING OUR CITIES

Passive Cooling Solutions from the Ground Up

Looking back: where this work began

The special issue **Holding the Heat: Making the Case for Cooling in Poor Communities** (ACHR Newsletter #23) set the foundation for this journey.

Access it here.

It started by asking a simple but critical question: *why does heat hit low-income communities differently*? Across cities, the answer was clear. Tightly built settlements, heat-absorbing materials, limited ventilation, unstable electricity, and lack of access to cooling all combine to intensify heat exposure. What might be manageable elsewhere becomes overwhelming in these conditions.

Beyond temperatures, the first phase explored how heat shapes day-to-day life. Communities traced how heat affects sleeping patterns, the ability to work or study, and the costs of keeping homes livable, revealing how it cuts across multiple aspects of life and deepens vulnerabilities that are rarely captured in formal data.

At the same time, communities shared how they are already responding. From daily adjustments to improvised fixes and creative adaptations, these practices revealed a wealth of local wisdom. While many are short-term coping strategies, they point toward directions for change: greening small spaces, blocking direct heat, enhancing airflow, and rethinking how homes function in hot climates. This body of experience became the starting point for the next phase: testing and building solutions together.

ACHR, together with partner organizations, local leaders, and grassroots groups, is engaged in the processes described in this newsletter as part of the project "A Regional Approach to Passive Cooling Solutions for Urban Poor Households in Asia" (2024–2026), supported by the ClimateWorks Foundation.

Heat in the Neighborhood: Why we started

In many cities in Asia, heat is no longer experienced only as an occasional extreme. For families living in dense, low-income settlements, high indoor temperatures have become a constant, shaping daily routines and care responsibilities, while also influencing longer-term outcomes in health, education, and livelihoods. Homes that once cooled down at night now remain hot well into the early morning hours. In these conditions, heat functions as a structural feature of everyday life.

This newsletter builds on the first phase of the Cooling Project, documented in *Holding the Heat: Making the Case for Cooling in Poor Communities* (ACHR Newsletter #23). That earlier issue focused on how communities experience rising heat and the many ways households already cope. This edition begins where that story reached a turning point.

When coping reaches its limits

In the first phase of the project, households across ten cities described the strategies they had developed to live with heat. Fans ran for most of the day and night. Floors, roofs, and cloths were wetted to create short moments of relief. Cooking and other daily tasks were shifted to early mornings or late evenings. When possible, people slept outdoors, on rooftops, or near doorways to catch any available breeze. These practices reflected creativity, discipline, and resilience. They also revealed clear limits.

Despite constant effort, indoor temperatures often remained high, especially in the afternoon and at night, when heat absorbed by roofs and walls was slowly released into living spaces. Electricity costs rose sharply, placing additional pressure on already tight household budgets. Poor sleep became routine, contributing to exhaustion, health problems, and reduced ability to work. For many families, coping meant redistributing discomfort rather than reducing it. Over time, a shared realization took hold: individual coping strategies alone could not overcome the way heat was embedded in the structure of the house itself.

From endurance to intention

This realization marked an important shift. Instead of asking how to endure another hot season, communities began asking different questions. *How does heat enter the house? Where does it accumulate? Which materials, layouts, or design features make it worse, and which might help reduce it? What can realistically be changed, given limited space, money, and access to formal infrastructure?*

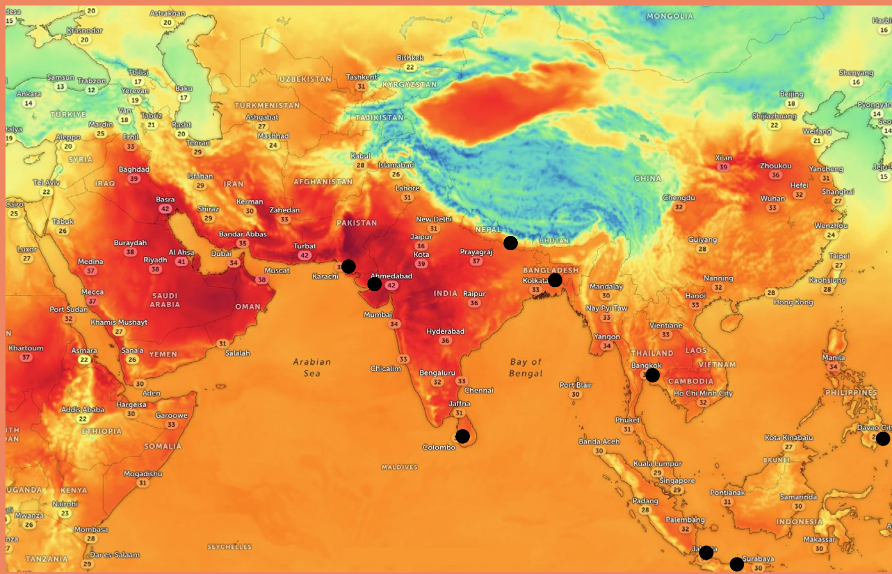
These questions signaled a move from reaction to intention. Heat came to be understood as a condition that could be addressed through changes to the built environment, not only through daily behavior.

This shift did not come from outside expertise alone—neither from public awareness campaigns nor from one-off technical inputs. It grew out of lived experience, collective discussion, and the recognition that small, targeted changes, if carefully designed and validated, could offer more lasting relief than short-term coping.

A shared condition, diverse contexts

While the initial research phase covered ten cities, pilot interventions were implemented in nine, with efforts in Bangladesh concentrated in Dhaka. These nine cities—Bhuj, Karachi, Jeetpursimara, Colombo, Dhaka, Bangkok, Jakarta, Yogyakarta, and Davao—span very different climates, housing types, and governance systems. They include crowded informal settlements, upgraded kampungs, relocation sites, and low-income neighborhoods shaped by incremental construction. Yet across this diversity, communities faced a shared condition: homes that trap heat and offer little opportunity for recovery from daily thermal stress.

Whether under tin, asbestos, or concrete roofs; whether attached on three sides or stacked vertically; whether located near rivers, railways, or industrial zones, many houses performed poorly in increasingly hot climates. The similarities in experience made it possible to learn across contexts, even as solutions needed to be adapted locally.



Along the canals of Yogyakarta's kampungs, dense housing and high humidity combine to intensify heat, with limited airflow and moisture-laden air making already hot conditions feel even more oppressive.

Clusters of tin-sheet houses in Dhaka absorb and radiate heat throughout the day, turning entire neighborhoods into heat traps where both indoor and outdoor spaces remain uncomfortably warm well into the evening.

In upgraded Baan Mankong housing in Bangkok, improved construction quality does not always translate into thermal comfort—without shade or greenery, brick and concrete homes continue to store and reflect heat as temperatures rise.

Why solutions, and why now

This newsletter documents what happened when communities decided to move beyond coping and begin deliberately shaping cooler homes. It focuses on how solutions were identified, developed, tested, and implemented through co-design processes involving residents, community organizations, technical teams, and local partners.

The goal was to explore a range of cooling approaches, not produce a single model. Alongside technical modifications, the practical conditions that make implementation possible come into focus: how households are selected, how materials are sourced, how costs are shared, and how financing systems can support incremental improvements.

The result is both a set of design ideas and a body of lessons from the ground about what works, what needs to be adjusted, and how solutions can be sustained and gradually expanded. By documenting both process and outcomes, this issue aims to support other communities, practitioners, and policymakers seeking ways to respond to heat at the scale of the home and neighborhood.

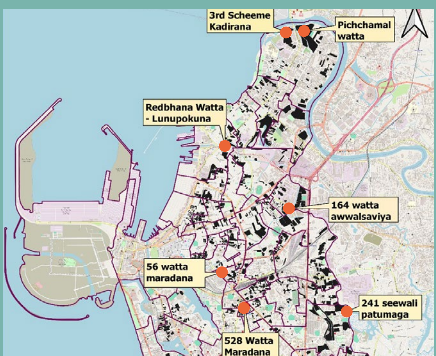
> **"I wanted to make a window, a small window, not even with shutters, just an opening with mesh. The man who owns the neighboring plot did not allow that though, even though the plot is vacant. 'No, you can't open any window on my side!' So we suffer because there is no window in the room."**
>
> *—Khimiben, a resident of an informal settlement, Bhuj*

Designing for learning: diversity of house types, visible pilots, and transferable examples

Alongside social vulnerability and willingness to participate, communities also selected households with an eye toward **learning value**: choosing houses and settings that could produce a useful range of examples for others to take note, compare, and reproduce. Rather than concentrating only on what was easiest to retrofit, teams tried to work across different settlement conditions and building typologies—different roof types, layouts, densities, and degrees of attachment—so that the pilot phase could generate a broader "menu" of workable modifications.

This approach played out differently across cities. In Jakarta, selection emphasized visibility: households were grouped in a continuous strip along a shared alley, so changes could be seen immediately and discussed collectively, turning the pilot into a shared reference point for the wider kampung. In Karachi and Colombo, pilots were distributed across multiple settlements, reflecting the reality that housing conditions vary widely even within one city. This also helped test whether similar ideas could work under different layouts, materials, and constraints.

In Bhuj, households were selected across contrasting roof conditions, so teams could compare how different roof types responded to heat and what combinations offered the best value for replication. In Bangkok, pilot communities were also selected for their potential to function as learning spaces, hosting visits and helping other communities see solutions in practice.



A settlement survey across Colombo revealed a range of communities increasingly exposed to heat stress. From this, seven settlements were selected for pilot interventions, each acting as a learning ground for approaches that can be adapted and taken up across the city.

> **"We want to facilitate collective learning. We selected different housing typologies—single houses, twins, rowhouses, low-rise buildings—and created clusters. Each cluster has examples that people in the area can visit and learn from."**
>
> *—Muang, Community Organizations Development Institute / Crosss, Bangkok*

How Households Were Selected:

From need to collective priorities

Turning the urgency of extreme heat into replicable solutions required careful choices about *where* to intervene and *with whom*. Across the nine cities involved in this project, communities and partner organizations faced a shared challenge: resources were limited, while the scale of need was overwhelming. Selection, therefore, was not merely a technical exercise, but a collective process shaped by vulnerability, feasibility, trust, and the potential for learning.

Instead of applying a standardized formula, each city developed its own selection process, rooted in local realities and organizational structures. Yet across these diverse contexts, a set of common considerations consistently guided decisions. These choices reveal how community-led selection can bring together fairness, effectiveness, and the ambition to scale.

From heat exposure to layered vulnerability

The starting point for selection was the same: extreme indoor heat. Families living in poorly ventilated houses, in settlements with little vegetation, were experiencing temperatures far beyond what official weather reports capture. In some places, selection explicitly followed temperature monitoring and household observations; in others, heat exposure was understood through housing conditions that residents and community leaders already knew to be unbearable.

Heat alone, however, was never the sole criterion. In practice, communities emphasized that vulnerability is layered. Elderly residents, people with disabilities, women-headed households, families with young children, and households relying on unstable daily wages were often prioritized, recognizing that heat compounds existing social and economic pressures. In Bhuj and Jeetpursimara, these considerations were discussed openly in community meetings, while in Colombo and Bangkok they were built into a structured set of social indicators developed jointly with community leaders.

This attention to vulnerability reflects a broader understanding shared across the project: heat is not experienced equally, even within the same settlement. Selection aimed to reach households where interventions could meaningfully reduce risk, not those already better equipped to cope.

> **"We are from marginalized communities, so there are not many resources available to help each other."**
>
> *—Arief, a resident of Kampung Muka, Jakarta*

Participation as a condition, not an outcome

Willingness to participate was treated as a prerequisite. Passive cooling solutions are not plug-and-play technologies delivered to households. They require sustained engagement in design, construction, budgeting, monitoring, and maintenance. Selection therefore prioritized households with the capacity and readiness to engage in what is, in reality, a labor-intensive process. Participation took multiple forms, reflecting the different ways households could contribute.

ENGAGEMENT IN LEARNING AND CO-DESIGN. Households were involved from the outset in documenting heat conditions, discussing priorities, and shaping interventions. Families participated in sites visits, temperature monitoring, co-design workshops, and prototype discussions, sharing lived knowledge about how heat moves through their homes and what changes were realistic.

CONTRIBUTION THROUGH PHYSICAL LABOR. In several cities, households contributed directly to construction, assisting with material preparation, installations, and finishing works, and reducing costs while strengthening ownership.

FINANCIAL PARTICIPATION AND COLLECTIVE SAVINGS. In most cities, households joined or strengthened savings groups as part of the process, linking cooling interventions to collective financial systems. In several cases, small monetary contributions helped complete works or cover gaps, reinforcing shared responsibility.

INVOLVEMENT IN IMPLEMENTATION AND MANAGEMENT. Participation also extended into procurement, budgeting, and oversight. Residents compared prices, sourced materials, and monitored construction quality—tasks that required coordination and responsibility often invisible in short-term projects.

Participation also meant being realistic about constraints. Where a house could not safely or meaningfully be upgraded, communities discussed this openly, maintaining transparency while avoiding unsustainable interventions.

Emphasizing participation was not about excluding those in need. It was about recognizing that meaningful, sustained upgrading depends on **active partnership**. Communities repeatedly stressed that without this level of engagement, solutions would not endure beyond the pilot phase.

The role of organized community structures

One of the strongest common threads across all sites was the presence of organized community structures in the selection process. Savings groups, cooperatives, homeowners' associations, community development committees, and urban poor networks all played active roles.

In Jakarta, kampung cooperatives "pitched" their settlements and upgrading plans within the citywide urban poor network, collectively deciding how to narrow the selection to one participating community. In Jeetpursimara, the Community Resilience Group worked with ward offices to develop selection criteria, verify households, and finalize the group of participating households. In Bangkok and Colombo, long-standing settlement organizations and community leaders guided the identification of households across multiple settlements, ensuring local knowledge shaped decisions. In Davao, homeowners' associations played a central role in endorsing households and assessing their readiness to manage loans.

These structures did more than facilitate selection. They provided accountability, mediated disagreements, and anchored the project within existing systems of collective action. Where such structures were strong, selection processes tended to be more transparent and broadly accepted.

Shared considerations across contexts

Despite differences in scale, governance, and methodology, selection processes consistently reflected a shared set of considerations:

1. **Severe indoor heat exposure**, often linked to housing materials and density
2. **Social vulnerability**, including age, health, gender, income, and livelihood insecurity
3. **Willingness to participate** in design, monitoring, savings, or construction
4. **Technical feasibility** for low-cost, incremental cooling interventions
5. **Connection to organized community groups**, enabling collective decision-making and sustainability

While not applied as a rigid checklist, these considerations formed a common foundation for decision-making across sites.

Bangkok's decalogue for choosing houses

1. **Clear heat stress in the house:** The house experiences significant heat problems that affect daily life.
2. **Household need and vulnerability:** Priority is given to households facing greater constraints and likely to benefit most from support.
3. **Willing and engaged homeowner:** Strong co-operation and openness from the household throughout the process.
4. **Potential for meaningful impact:** Conditions allow for changes that can bring noticeable improvements.
5. **Possibility to address multiple issues together:** The house allows for combining cooling measures with other needed adjustments.
6. **Do no harm:** Interventions should not create new problems (structural, social, environmental).
7. **Role model potential:** Households and communities agree to act as learning sites, open to visits, exchange, and demonstration.
8. **Hands-on community involvement:** Local residents commit to supporting implementation and working with community builders.
9. **Collective learning and peer-to-peer sharing:** Selection spans different areas to enable access and learning across communities.
10. **Diversity of housing types:** Selection reflects different house typologies (single, row, twin, low-rise).

"We have limited resources and can support only a small number of families. But the need is very high. So we want the community to see these solutions and learn from them, so others can replicate them."

—Vishram, Setu organization, Bhuj

Households were identified through close observation of how heat builds up inside ordinary living spaces.

In Dhaka, residents came together to discuss and agree on which households should be prioritized.

Selection often unfolded over multiple meetings, as communities revisited and refined decisions.

Women played a key role in these discussions, bringing forward experiences of heat inside the home.

In Jeetpursimara, the final list of selected households was shared with the community, formalizing a process built on transparency and collective agreement.

Living with heat: The realities behind selection

The households selected for this project were not defined only by income, density, or exposure to rising temperatures. They were selected because heat had become a defining feature of everyday life inside their homes, affecting comfort, limiting rest, and shaping how spaces could be occupied and adapted throughout the day. Many had reached the limits of what individual effort could achieve within existing constraints. At the same time, they demonstrated a strong willingness to engage: to observe, discuss, assess, and rethink how their homes functioned.

The following profiles offer a closer look at how these conditions unfold in practice. They highlight different contexts and housing types, while showing how households navigate similar challenges and begin to identify pathways toward more livable conditions.

❋ Fatema's household, Dhaka

Fatema lives in Korail in a joint household of eleven people, made up of two nuclear families sharing one small home. She and her husband have three school-going children; her husband's brother and his wife have three as well. Both men work outside the settlement, while the women manage the household full time, alongside caring for an elderly mother-in-law. In this crowded arrangement, domestic spaces—especially the kitchen—are under constant pressure.

Cooking took place in a tight area directly beside the main living rooms. With limited ventilation, heat and smoke would quickly spread through the house, affecting everyone. On hot days, it became difficult to sit, rest, or help children study while cooking was underway. During the monsoon season, water regularly entered the cooking area, sometimes rising several inches and disrupting daily activities altogether. Meals had to be prepared in large quantities several times a day to serve the extended family, placing continuous pressure on the space.

Heat was something that structured each day, shaping when and how food is prepared, where family members can sit, and how the house is used.

❋ Laxmi's household, Jeetpursimara

Laxmi lives with her husband and four children in Chhatapipara Ram Tole, Jeetpursimara. She was married at a young age and moved to the settlement shortly afterward. Following difficulties within her extended family, the couple built a small hut on a vacant plot close by and began living there. Over time, the structure—made of plastic sheets for walls and a tarpaulin roof—became increasingly fragile and difficult to maintain.

The shelter offered little protection from heat, rain, or cold. During the hot season, the plastic walls trapped heat, making the interior stifling; during the monsoon, rain and dampness entered easily. Laxmi suffers from asthma, and the combination of heat, dust, and poor ventilation made daily tasks more difficult, especially as she continued working long hours as a daily wage laborer in nearby fields to support her children.

Economic pressures, fragile housing, and health challenges became closely intertwined. With limited resources and an unstable situation, making even small improvements to the house was not something the family could easily manage on their own. For Laxmi's household, heat was part of a broader set of constraints that shaped how the family lived, worked, and coped from day to day.

> **"Our house could not protect us from the heat, the rain, or the cold. Every day was difficult, especially with the children. A house is not just walls; it is our dignity and our future."**
>
> *—Laxmi, a resident in Jeetpursimara*

✻ Lanchana's household, Colombo

Lanchana lives with her husband, their three children, and her elderly father-in-law in Awwalsaviya Watta, a low-income settlement in Grandpass, Colombo. The family shares a compact two-story house, where space is limited and routines are closely shared across generations. While the men work outside the home, Lanchana and the children spend most of the day indoors, so the conditions inside the house matter a great deal.

The upper floor, where most activities take place, had a low ceiling, an asbestos roof, and very limited ventilation. Only one small window served the entire space. Indoor temperatures rose quickly during the day, making it difficult to rest, carry out household tasks, or care for the children. During each pregnancy and after each childbirth, Lanchana and her infant struggled with the heat, dealing with rashes and disturbed sleep. To cope, electric fans ran for up to 20 hours a day, adding pressure to already stretched household expenses.

Heat was a constant presence, shaping how rooms were used, how long the family could stay indoors, and how much of their monthly income went toward making the space even slightly more bearable.

✻ Mam Sri's household, Yogyakarta

Mam Sri, a widow, lives with her two adult children in a single-room dwelling in Kampung Notoyudan, where sleeping, cooking, and daily life all take place within just 12.5 square meters. The small attached bathroom had no window, and the front door was the only source of ventilation. With no separation between functions, privacy was minimal and airflow was poor.

The heat in the room was made worse by the work Mam Sri does at home. She prepares and fries food to earn a living, using a stove placed close to where the family sleeps. The cooking added to the heat in an already confined space. During hot periods, the room became stifling, making rest difficult and leaving everyone more tired by the end of the day.

Because her home is also her workplace, Mam Sri could not simply avoid the heat by changing her schedule. Cooking is essential to the family's income, yet it exposed them to prolonged heat every day. Her situation reflects the reality of many kampungs, where housing, livelihood, and heat stress are closely intertwined.

Selection as a learning process

Selection was not a one-time decision but an iterative learning process. In several cases, households withdrew due to changing circumstances, construction constraints, or inability to continue participation. Instead of treating this as failure, teams adapted, revised lists, and documented lessons. This flexibility reflects a clear reality: community-led selection is inherently dynamic. Lives change, constraints emerge, and projects must respond without undermining trust or fairness.

Ultimately, selection was about more than identifying participants. It was about creating the conditions in which modifications could be tested, refined, and shared. Grounded in community knowledge, layered vulnerability, and collective organization, the process established a strong foundation for co-creating passive cooling solutions. The selected households became partners in experimentation, evidence-gathering, and learning. Their homes function not only as sites of intervention, but as living reference points for neighbors, practitioners, and policymakers seeking pathways toward cooler, more livable housing.

Numbers at a glance

City	Settlement type	# housing units	# common infrastructure
Dhaka	Informal settlement	11	1 community center
Bhuj	Informal settlement	25	1 community center
Jakarta	Informal settlement	9	1 green zone
Yogyakarta	Informal settlement	7	1 green zone
Jeetpursimara	Informal settlement	140	
Karachi	Informal settlement & relocation site	10	
Davao	Relocation site	6	
Colombo	Informal settlement	8	
Bangkok	Government-assisted housing	20	5 green & shaded zones
	Total	**236**	**9 interventions**

◀ A note on numbers and scale

The figures in this table reflect housing units selected or planned as part of the cooling interventions in each city. Many of these units house extended families or support multiple livelihoods, so the number of households and people affected is often higher than the figures suggest. Implementation has taken place in phases, shaped by local conditions, labor availability, and community processes, and some units are still in the final stages of completion. Here, the emphasis is not on completion status, but on illustrating the range of contexts, scales, and approaches through which communities are making homes and neighborhoods cooler.

Discussions with residents helped surface heat challenges and define priorities.

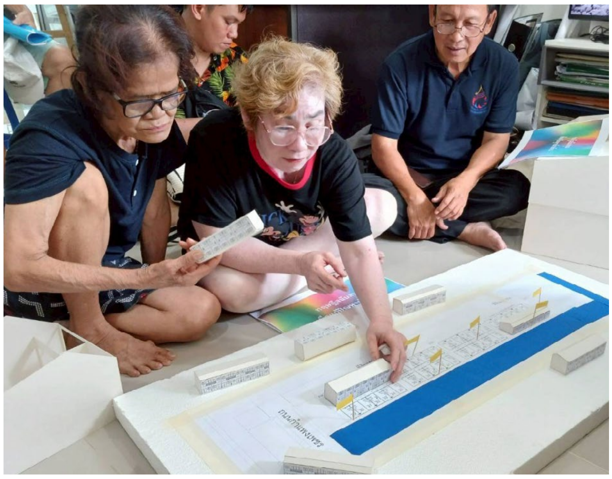
Participatory mapping made invisible patterns visible, linking heat exposure to materials and layouts.

In Yogyakarta, detailed house drawings helped residents pinpoint where heat builds up.

Community workshops created space to test ideas together, compare options, and shape solutions.

In Davao, performance analysis (using the EDGE system) helped teams compare design options and improve energy efficiency.

> **"As we worked through the design process together, people began to see how heat connects to everyday design choices—openings, orientation, materials—and started asking how to improve their homes."**
>
> *—Vishram, Setu organization, Bhuj*



Co-Creating Cool:

From household realities to buildable solutions

Designing effective passive cooling modifications in low-income urban settlements is not a matter of applying ready-made technical fixes. Solutions were developed through a careful design process that moved step by step from everyday conditions in the home to buildable interventions. While each context followed its own rhythm, the underlying approach was shared: understand the house in detail, identify where heat enters and accumulates, explore options together, apply them, and fine-tune solutions until they were practical, affordable, and acceptable to the household.

Teams focused on how individual homes actually function—spatially, socially, and materially—and how small, well-targeted changes could make a meaningful difference.

Understanding the house, not just the temperature

The design process began with close engagement at the household level, grounding the discussion in lived experience. Residents and technical teams spent time inside homes, observing daily routines, movement patterns, and how spaces were used at different times of day. Kitchens doubling as living rooms, sleeping areas directly under overheated roofs, home-based livelihoods adding internal heat—these realities shaped the design agenda far more than abstract climatic data.

In Bangkok, Dhaka, and Colombo, this took the form of group discussions and awareness workshops that linked everyday experience to broader conversations about climate change and health. In Bhuj, Karachi, and Davao, house-by-house visits and informal conversations helped identify specific construction elements that were driving overheating. In Jeetpursimara, large-scale socio-economic and housing surveys, supported by trained local youth, captured both technical conditions and lived impacts of heat across entire settlements.

Architects and technical teams documented houses in detail, preparing measured drawings, section cuts, and diagrams to understand roof structures, ceiling heights, openings, and materials. In Yogyakarta, households worked with millimeter grid paper to draw their own house plans, mapping how spaces were used throughout the day and where activities placed the most pressure on indoor conditions.These drawings became shared working tools: they were discussed on-site with households, adjusted through conversation, and used to clearly identify where heat entered and why it remained trapped.

This shift from measuring heat to mapping problem areas within the house allowed the design process to focus on actionable interventions.

Translating experience into design options

Once key problem areas were identified, teams worked with households to explore multiple design options. Architects played a critical role here, translating observed patterns of use into visual form. Computer-based drawings, exploded axonometric views, and physical or scaled models were used to show how air might move, how an extra layer could block radiant heat, or how a ceiling or buffer space could change indoor conditions.

These visual tools were especially important in dense settlements where changes were incremental and spatial margins were tight. Rather than presenting a single proposal, teams often developed several alternative scenarios, allowing households to compare trade-offs like cost, complexity, durability, and disruption to daily life.

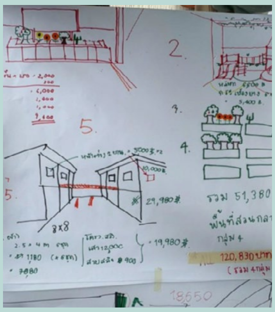
This process was explicitly collaborative, with households acting as co-designers, questioning assumptions, rejecting impractical ideas, and proposing adaptations based on their own experience. Nothing moved directly from drawing into construction. In Yogyakarta, for example, an inspiration gallery was curated to show that local and recycled materials could deliver durability and quality, gently challenging the widespread perception that only factory-made products signaled modernity. As options were tested, proposals circulated back to households for discussion and adjustment, with decisions ultimately resting with the communities themselves. This back-and-forth was essential to align technical reasoning with household realities.

In Karachi, technically plausible options—like white reflective roof paint—were reconsidered once households pointed out how roofs were used for sleeping, evening gatherings, and daily chores. Reducing heat could not come at the cost of losing functional space. In Jakarta and Bangkok, households questioned solutions that appeared thermally effective but would complicate maintenance or increase costs beyond what neighbors could replicate. In Davao, technical assessments were also matched with what households could realistically afford, using income and expenditure tracking to help prioritize feasible modifications.

Through this process, design options were narrowed not only by thermal performance, but by social acceptance, buildability, maintenance capacity, and long-term affordability. What emerged were not "optimized" technical solutions in isolation, but **negotiated solutions** that balanced comfort, cost, culture, and practicality. This negotiation is what allowed cooling strategies to remain realistic and replicable, not aspirational or externally imposed.

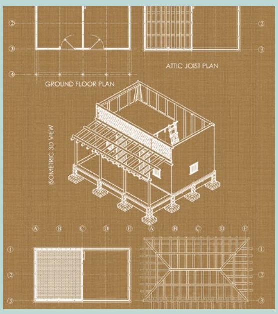
From these...

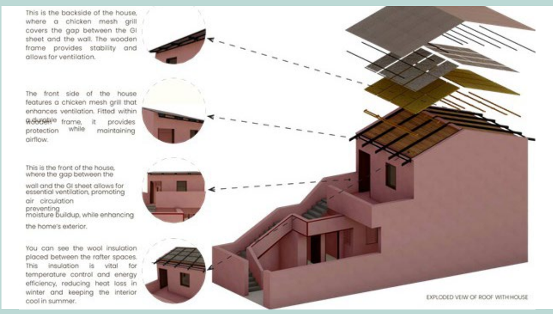
Early sketches, rough models, and flipcharts captured ideas in motion, helping residents explore possibilities and shape responses together.



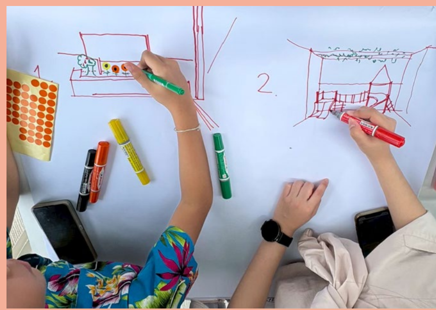
To these...

These ideas were translated into detailed drawings, turning shared discussions into precise plans ready for construction and implementation.





Plans were reviewed together, turning technical drawings into shared decisions about spaces.



Workshops opened space for all voices, as even children sketched ideas for cooler, more livable homes.

Models made ideas tangible and allowed residents to see how changes might feel before building begins.

Community architects and residents worked side by side, translating discussion into grounded solutions.

Scale models became shared tools and brought families into the process to test and refine design decisions together.

Working with what exists: The material intelligence of cooling

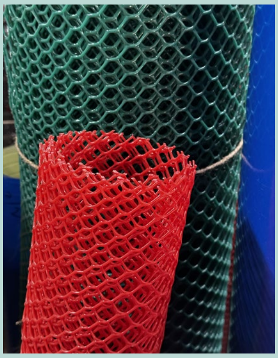
Artisans in Jeetpursimara improved how they treat bamboo, increasing its durability.

The search for cooling responses quickly became a search for the right materials. Without relying on specialized products or imported technologies, communities and architects began by looking carefully at what already existed around them, both in the landscape and in local markets.

In several places, solutions grew directly from the surrounding environment. In Jeetpursimara, households collected thatch from nearby fields and dried it in bundles before installing it as false ceiling panels beneath corrugated roofs. Stabilized mud, mixed with natural additives such as husk and cow dung, was also used to improve floors and wall surfaces. This approach draws on long-standing building traditions while strengthening durability and moisture resistance. In Bhuj, sheep wool, traditionally used in local construction, was adapted as a roof insulation layer. Bamboo, abundant across many regions, appeared in multiple forms: woven ceiling panels, ventilation screens, and lightweight structural frames. These materials are familiar, repairable, and culturally embedded, making them easy for families to adopt and maintain.

Mud mixed with husk and cow dung was applied to bamboo walls in Jeetpursimara to enhance insulation.

Local markets provided another important source of possibilities. In neighborhoods where large, specialized suppliers are absent and materials are sourced in small quantities, households explored what was already available and affordable. Printed foam rolls in Dhaka, thermocol insulation boards in Karachi, and ordinary construction supplies in neighborhood hardware shops in Davao all became part of the palette for cooling modifications. These products may not be marketed as "climate adaptation technologies," but in practice they form the building blocks of incremental upgrading.



Locally available translucent sheets inspired daylighting solutions in Dhaka, reducing indoor lighting needs.

At the same time, teams were constantly experimenting with new combinations and ideas. In Bangkok, lightweight sandwich panels were introduced to create insulated ceiling systems. In Dhaka, the team explored alternative materials such as "jutin", a corrugated sheet developed in Bangladesh from jute fibers and resin as a rust-proof alternative to traditional corrugated iron. Lightweight and designed with low thermal conductivity, the material offers interesting possibilities for reducing heat transfer from the roof.

Not all experiments were carried forward. However, these explorations helped teams better understand what could realistically work within the constraints of local markets, construction skills, and household budgets.

Finding the right material was rarely a purely technical decision. Thermal performance had to be considered alongside cost, availability, ease of installation, and cultural acceptance. As Mahmuda, a community architect with the Platform of Community Action and Architecture in Dhaka, reflected: "*We often have many ideas, but the challenge is working with what is actually available in the local markets. We have to design solutions that people can really find, afford, and use.*"

This process reveals an often overlooked form of knowledge: **material intelligence**. Communities and local builders understand how materials behave, how they age, how they can be repaired, and where they can be purchased. By building on this knowledge, cooling solutions remain within reach for many more households.

In some cases, less familiar materials were tested, including insulated sandwich panels in Bangkok and experimental jute-resin composite sheets in Dhaka.

From testing and prototyping to cooling solutions

A defining feature of the project was the use of prototyping and material testing before wider implementation. Instead of assuming performance, teams examined how materials behaved in real conditions.

In Jeetpursimara, this approach was taken to scale. Leveraging experience from India, the Lumanti Support Group for Shelter team worked closely with Hunnarshala Foundation to explore bamboo-based construction techniques suitable for the local climate. Communities, local artisans, and technical partners tried out multiple false ceiling options, including thatch panels, grass mats, straw, and bamboo lattices, drawing on traditional knowledge. Pilot houses were used to compare performance and workability before a preferred solution was agreed upon and replicated across 140 houses.

Similar cycles of testing and refinement occurred elsewhere. In Bhuj, early retrofitted houses became demonstration sites, allowing households and builders to see results before committing. In Jakarta, proposed layouts were translated into 1:1 scale mock-ups using strings, enabling residents to physically experience spatial changes before construction.

In Bangkok, model-making workshops allowed households to explore how small spatial changes might affect airflow and daylight. In Dhaka, the team developed compact kitchen prototypes with locally fabricated, cost-effective hoods, while also trying out lightweight wall and roof insulation panels to assess installation feasibility and performance before scaling up.

This iterative process ensured that solutions were not only thermally effective, but also compatible with local skills, supply chains, and maintenance practices.

> **"We focus mostly on locally available and natural materials. There are many insulation products in the market, but they are too expensive or difficult to transport. We want materials that people can install and repair themselves."**
>
> *—Shristina, Lumanti Support Group for Shelter, Nepal*

From design to construction

After cycles of observation, discussion, and testing, each household arrived at a set of agreed strategies. These were translated into implementation drawings and step-by-step plans, tailored to the specific conditions of each house. No two solutions were identical: variations in layout, materials, household needs, and budget meant that each intervention was adjusted before moving into construction.

Design did not end with drawings. Implementation required organizing materials, coordinating labor, and sequencing works within tight spaces and ongoing daily routines. In many cases, timelines were adjusted to accommodate household conditions, allowing families to remain in their homes while construction was underway.

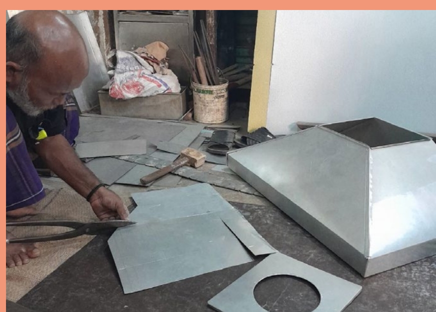
In Jeetpursimara, families assembled thatch panels, prepared mud mixes, and applied plaster to walls. In Bhuj and Davao, households sourced materials through local markets and coordinated fabrication and deliveries with nearby suppliers. In Yogyakarta, residents tracked material deliveries and construction progress using simple pocket notebooks, helping keep works organized and transparent. In Bangkok, community members of all

Hunnarshala Foundation from India visited Jeetpursimara, sharing hands-on experience in bamboo construction with local communities and builders.

There, residents and artisans worked together to test different thatch panel options for ceilings.

In Dhaka, inexpensive insulation panels were tested as removable layers to reduce heat gain.

A kitchen design with an exhaust hood was first explored using small-scale cardboard models.



Local artisans then fabricated and tested the kitchen hood, adjusting dimensions and materials.

ages took part in greening activities—planting, arranging shaded areas, and helping transform shared spaces into cooler environments.

In most locations, skilled construction workers were brought in for specific tasks, particularly where structural changes were involved. Even then, residents remained closely engaged, overseeing the work and often carrying out finishing tasks themselves. This helped ensure that details were executed as intended and adapted where needed during construction.

The scale of intervention also varied. Some houses were substantially upgraded, with parts rebuilt to address structural and thermal conditions together. Others involved more targeted measures, such as ceilings, ventilation openings, or shading elements, allowing improvements without major disruption to daily life. This range made it possible to respond to different needs while keeping construction manageable.

Implementation, in this sense, was a continuation of the design process. Decisions were adjusted on site, materials were adapted as needed, and solutions were refined through building itself.

What this process makes possible

These varying levels of involvement were foundational. Participation built ownership and trust between households and technical teams. It ensured that solutions aligned with how homes are used in practice. And it strengthened skills such as budgeting, material sourcing, and construction oversight, that remain long after the formal project cycle ends.

For many communities, this process was as important as the physical upgrades themselves. It showed that cooling is not a specialized technical service delivered from outside, but a capacity that can be built, adapted, and expanded locally. The value of the design process lies, therefore, in the **collective knowledge and confidence** generated along the way.

By centering the design process on households, materials, and buildability, the project moved beyond abstract notions of "passive cooling." By the time modifications were finalized, they were no longer "proposals" but shared agreements. This iterative and collective approach is what allows solutions to travel across contexts without losing relevance.

The solutions presented in the next pages are not one-size-fits-all templates. They are the outcome of careful translation between lived experience and technical possibility.

Where function meets identity

In Dhaka, families selecting materials for cooling upgrades did more than solve a technical problem—they shaped the character of their homes. Families had the chance to visit material shops, walking through the market, comparing options, touching materials, and choosing what felt right for their space. These moments mattered. Instead of an engineer deciding what the ceiling should look like, residents made those choices themselves. In one such shop, rolls of patterned foam sat among ordinary building supplies, later reappearing beneath tin roofs as part of the interior of the house. Small choices like these show how "technical" improvements can also carry beauty, identity, and care.

Who was involved and why it mattered

Across all cities, the design process brought together a deliberately broad set of actors, each serving distinct but complementary roles.

- **Participating households and communities** were the primary knowledge holders. They identified heat problems, proposed ideas, monitored conditions, and evaluated what felt workable.
- **Community organizations, cooperatives, and savings groups** anchored the process institutionally, organizing meetings, managing funds, coordinating labor, and ensuring accountability.
- **Community architects** and technical teams translated ideas into buildable designs, tested feasibility, and introduced alternative materials or configurations.
- **Local artisans, masons, and builders** played a key role in adapting designs to local skills and experimenting with construction techniques.
- **Universities and experts** (where involved) contributed research, measurement, and critical reflection, helping teams understand what tools were useful and which were not.
- **Local government actors** participated in several contexts, offering legitimacy, guidance, or alignment with existing housing and climate policies.

This mix of actors ensured that solutions were socially legitimate, technically sound, and institutionally grounded.

> **There are many limitations—small plots, large households, and the need to build quickly and at low cost. Cooling is often overlooked. But through this project, communities can learn, and architects can begin to consider it more carefully in future designs.**
>
> *—Ruengyuth, Community Organizations Development Institute, Bangkok*

From Ideas to Action:

A practical guide to passive cooling solutions

All this work with communities led to a wide range of concrete interventions. What emerged across the nine cities was a "menu" of passive cooling strategies, each responding to specific housing conditions and everyday practices.

Four entry points for cooling

To make these solutions easier to navigate, they are grouped into four interconnected areas: roof and ceiling interventions; improvements to walls, openings, and airflow; reducing heat sources indoors; and cooling at the neighborhood scale, including microclimate and public space strategies.

Together, these categories reflect the main points where heat enters, accumulates, and can be reduced across low-income housing, from the roof above to shared spaces beyond the house.

Roof & ceiling interventions: Managing heat from above

In closely built settlements where houses are attached on multiple sides, the roof often becomes the primary entry point for solar heat. Materials and low ceiling heights intensify heat accumulation. As a result, many of the interventions focused upward. Communities experimented with a range of approaches, from reflective treatments and ceiling layers to ventilation openings, adapting both local and industrial materials. While the specific methods vary, they share a common aim: to reduce heat buildup at roof level and limit how much of it reaches the space below.

Walls, openings & airflow: Enabling air movement

If the roof governs heat entry, walls shape how air moves or fails to move through the house. In tightly packed neighborhoods, walls often block airflow and trap humidity. Interventions in this category focused on improving air movement through small but strategic changes, such as adding or adjusting openings, introducing permeable elements, or reworking partitions. These adjustments are rarely purely technical. They must also respond to privacy, security, cultural norms, and structural limits. Cooling here depends as much on negotiation as on airflow.

Reducing heat sources indoors: Kitchens and daily activities

Kitchens repeatedly emerged as concentrated heat zones. Cooking generates intense heat, smoke, and moisture, particularly in small, enclosed or shared spaces. Many households therefore focused on releasing heat directly at the source, using a mix of simple openings and locally fabricated systems. Alongside this, better access to daylight helped reduce reliance on electric lighting, easing both energy use and indoor heat buildup.

Neighborhood microclimate: Extending comfort beyond the house

Cooling strategies did not stop at the household threshold. In settlements where concrete paving and dense construction amplify heat, neighborhood-level efforts played a critical role. Communities introduced vegetation, shade structures, and shared cooling spaces that reduce heat exposure while supporting day-to-day activities. Individually modest, these interventions become more effective when combined, making lanes, courtyards, and gathering areas more comfortable places to spend time.

A toolkit, not a blueprint

Altogether, these interventions form a grounded toolkit rather than a universal template. Many households combined multiple strategies—roof improvements paired with ventilation changes, shading with kitchen modifications—gradually adapting their homes according to resources and seasonal needs.

What makes these solutions transferable is not uniformity, but adaptability. They rely on materials that can be sourced locally, skills that already exist in communities, and construction methods that support incremental upgrading, avoiding large, one-time investments.

The pages that follow present a selection of these modifications in detail, organized for clarity, illustrated through city examples, and designed to support adaptation in other contexts facing similar heat pressures.

> **Communities already address these issues in their own ways, but often it is not documented or analyzed. By combining community knowledge with research and data, we can identify better solutions.**
>
> *—Ranjith, Sevanatha Urban Resource Center, Colombo*

QUICK FACTS

What this solution does well

- Reduces solar heat absorption at the roof surface
- Low-cost upgrade with minimal disruption
- Works across different roof types without structural changes
- Can be applied without specialized skills

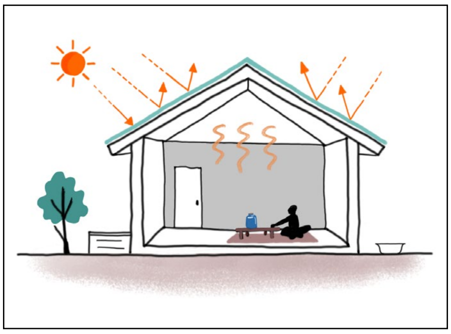
Typical material forms

- White or reflective roof paint
- Light-colored or pre-coated roofing sheets
- Reflective surface coatings for metal or concrete roofs

Typical contexts

- Metal or CGI roofs exposed to strong sun
- Concrete roofs with high heat retention
- Areas with limited shade and strong solar exposure

Roof & Ceiling: Reflecting solar heat



Reducing how much heat the roof absorbs in the first place can significantly improve indoor comfort. Reflective roof treatments work by bouncing part of the sun's energy away from the roof surface before it is converted into heat. Materials such as white coatings, reflective paints, or light-colored roofing sheets keep roof surfaces cooler during peak sun hours, which in turn reduces the heat transferred into the room below. This is particularly effective in dense settlements directly exposed to intense solar radiation with little shading from surrounding structures.

Because these measures are lightweight and quick to apply, they are well suited to incremental upgrading. Households can often incorporate them during routine roof repairs or maintenance without altering the structure of the house. Application does not require specialized skills, making it accessible for self-building or community-led upgrades.

While reflective treatments do not remove heat that has already accumulated indoors, they significantly reduce the amount of heat entering the building. Their performance improves when combined with other measures such as ventilation or ceiling layers. Even on their own, however, reflective surfaces can deliver noticeable results quickly and at a cost many households can realistically manage.

uPVC roofing with air gap

Jakarta, Indonesia

In kampung neighborhoods in Jakarta, households were concerned about the health risks posed by aging asbestos roofing. Meanwhile, these roofs absorbed large amounts of heat during the day. When families began exploring cooling improvements, replacing asbestos sheets with safer materials became an opportunity to address both concerns at once.

In several upgraded houses, asbestos sheets were replaced with uPVC (Unplasticized Polyvinyl Chloride) roofing panels. The lighter-colored surface helps reflect some of the sun's heat, while a small air gap between the roof and ceiling allows heat to dissipate before reaching the rooms underneath.

Households favored the solution because it offers better thermal performance while also providing safer and more durable roofing, combining multiple benefits in a single step. In addition to reducing heat transfer, uPVC panels are rustproof, fire-resistant, and able to hold up better in the long run, even in humid conditions.

Reflective paint for metal roofs

Davao, Philippines

In Davao's housing projects, metal roofing sheets were directly exposed to strong afternoon sun, causing indoor temperatures to rise sharply during the hottest hours of the day. Instead of replacing the entire roof, households and builders looked for simpler ways to reduce how much heat the roof takes in.

Damaged sections of the existing roof were repaired and then coated with white reflective paint. The lighter surface helps reflect much of the sunlight before it is absorbed by the metal sheets. Because less heat builds up in the roof during the day, less heat is transferred into the interior.

Residents appreciated this modification because it can be done as a simple surface upgrade without disrupting the structure of the house. It also allows for periodic maintenance, as the coating can be reapplied to keep it working well. Repairing damaged roof sections before painting is important to ensure good adhesion and help the coating last longer.

Reflective coating for concrete roofs

Bhuj, India

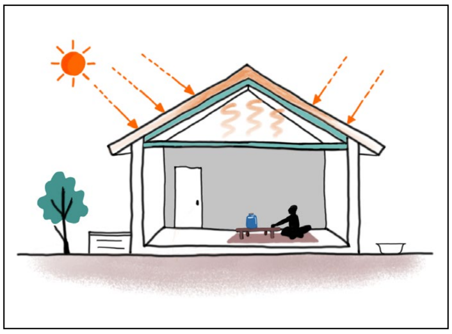
The same approach was adopted in houses in Bhuj, responding to a different type of roof. Unlike lightweight metal sheets, many homes here are built with reinforced concrete slabs that are directly exposed to intense sun for long hours. In this hot, dry climate, roofs receive continuous solar radiation throughout the day, gradually absorbing and holding heat within the structure.

To reduce this buildup, households applied a white, weatherproof reflective coating directly onto the roof surface. By reflecting a significant portion of incoming solar radiation, the coating limits how much heat is absorbed by the slab in the first place. This reduces the amount of heat retained in the structure and released indoors later, helping keep the space cooler.

The application itself is straightforward, allowing households to carry it out quickly without major preparation. In many cases, it was combined with ventilation improvements, helping the different measures work together for a stronger overall effect.

Roof & Ceiling: Insulating or separating roof

Another way to reduce heat entering the house is to create a protective layer beneath the roof. Adding a ceiling layer introduces a barrier between the hottest part of the building and the living space below. This works through two complementary effects: insulation slows the movement of heat through the roof structure, while the air space between the roof and ceiling acts as a buffer that delays heat reaching the room.



Lightweight materials can already have an immediate impact when installed with a consistent air gap. Because many ceiling systems rely on simple framing and panel fixing, they can often be installed using local skills and materials, adapting to different house layouts and roof types. In many cases, components can be added incrementally, allowing households to upgrade as resources allow.

Beyond reducing heat, ceiling layers also change how indoor space is experienced. They create a more finished interior by concealing roof structures, exposed wiring, and uneven surfaces, improving both safety and durability. While not always the lowest-cost intervention, they offer long-term benefits and are particularly valuable in houses with exposed metal or concrete roofs where heat buildup is most intense.

QUICK FACTS

What this solution does well
- Reduces heat transfer from roof to interior spaces
- Reduces peak heat exposure during the day
- Improves interior finish and durability

Typical material forms
- Suspended or false ceilings (plywood, bamboo, fiber cement)
- Bio-based insulation (thatch, wool, bamboo matting)
- Industrial insulation (thermocol, rockwool)
- Lightweight framing systems

Typical contexts
- Rooms directly exposed to roof heat
- Metal or concrete roofs without ceiling layers
- Spaces with sufficient height to add a ceiling layer

Thatch false ceiling under CGI roof

Jeetpursimara, Nepal

In Jeetpursimara, thatch has long been valued as a roofing material because it keeps houses noticeably cooler than metal or tile roofs. The drawback is durability: when exposed directly to rain and sun, traditional thatch roofs wear out quickly and need frequent replacement.

To combine thermal comfort with durability, households began experimenting with placing thatch panels beneath a corrugated iron (CGI) roof. Thatch panels are first assembled on the ground using bamboo frames and then fixed beneath the roof structure, leaving a small air gap between the two layers. Bamboo purlins and CGI sheets are installed above the thatch layer to shield it from rain and sun.

This layered system slows down how heat moves from the roof into the room below. Residents felt confident adopting the approach because it builds on skills and materials they already know well. When protected beneath the metal roof, the thatch layer can last many years while continuing to keep the house cooler.

Suspended ceiling with thermocol

Karachi, Pakistan

In Karachi's settlements, houses are often attached on three sides to neighboring buildings, making structural modifications difficult and sometimes unsafe. At the same time, flat concrete roofs serve many daily functions—sleeping during hot nights, drying clothes, or household work—so residents preferred modifications that would not interfere with roof use.

The intervention therefore focused on reducing heat from inside the room. A suspended ceiling system was installed beneath the existing roof slab using metal rods fixed along the walls to form a lightweight grid. Gypsum ceiling tiles were placed within this grid to create a finished surface, while thermocol insulation sheets were laid above the tiles to help block heat, without requiring structural changes.

Families appreciated the solution because it could be installed without the hassle of major construction or disruption. Once in place, it created a clean, finished ceiling, making the room feel more complete and easier to live in.

Under-roof insulation layer

Bhuj, India

In Bhuj, houses are built with a wide variety of roof types, from corrugated metal sheets to clay tiles and cement panels, each responding differently to the region's intense summer heat. Rather than proposing a single standardized solution, the team explored a range of insulation options that could be adapted to different roof structures and budgets.

A secondary support frame was installed beneath the existing roof structure to create space for an insulating layer. Materials tested included mineral wool, locally sourced sheep wool, and bubble-sheet insulation. After the insulation was placed, a plywood panel was fixed underneath to form a finished interior ceiling.

By testing multiple materials within the same construction approach, the solution allows households to choose what works best for them, based on cost, availability, and performance needs. Natural materials such as sheep wool proved to be effective insulation, provided they are treated to prevent pests and last longer.

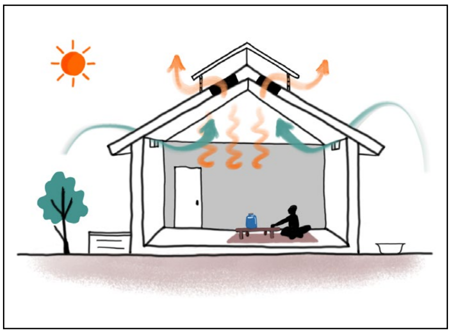
QUICK FACTS

What this solution does well
- Releases trapped hot air from roof cavities and upper zones
- Improves airflow where side openings are limited
- Works passively or with small amounts of energy support

Typical material forms
- Roof ventilation cages or chimneys
- High-level vent openings
- Exhaust fans near ceiling level
- Stack ventilation shafts

Typical contexts
- Limited or no cross-ventilation through walls
- Roof structures that retain heat during the day
- Houses where high-level openings can be added safely

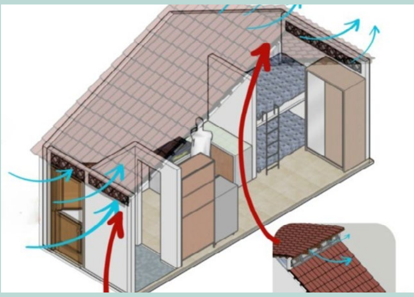
Roof & Ceiling: Roof ventilation & hot air escape



In addition to limiting how much heat enters, it is equally important to release the heat that builds up under the roof. Warm air naturally rises and collects beneath roofs and ceilings. When there is no outlet at the top of the house, this heat becomes trapped and gradually spreads downward into the living space. Roof ventilation strategies address this by creating escape points at the highest parts of the building, where heat concentration is most intense.

Most systems rely on the stack effect. As hot air exits through roof vents or elevated openings, cooler air is drawn into the house through doors, windows, or lower wall openings, creating continuous airflow. This upward movement helps release the heat that accumulates under the roof during the day and improves nighttime comfort.

In buildings where roof slabs retain large amounts of heat, small exhaust fans can assist this process by accelerating air movement. A steady airflow helps flush stored heat from the upper zones of the house, reducing the intensity and duration of heat exposure indoors. Proper detailing is important: ventilation openings should be protected from rain, insects, and debris while remaining unobstructed. When positioned correctly, even small vents can make a difference.



Roof openings for air circulation

Yogyakarta, Indonesia

In tightly packed kampungs in Yogyakarta, houses often share walls on both sides, leaving little opportunity to add windows or side openings. In these conditions, the roof becomes the most effective place to improve airflow, allowing hot air to escape from the highest points of the house.

Several households modified their roof structures to introduce small openings that let trapped warm air escape and keep air moving through the house. In some cases, the roof edge was slightly raised at the front or rear of the house, creating a narrow ventilation gap beneath the roofline. In others, households paired these ventilation improvements with glass roof tiles inserted between clay tiles, using the same roof modifications to also bring daylight into interior spaces.

With careful placement, these openings helped keep air moving through the house, making indoor conditions feel less heavy and more usable during the day.

Roof heat flush system

Bhuj, India

Concrete roofs store large amounts of heat during the day and release it slowly after sunset. In Bhuj, residents explained that even when outdoor temperatures begin to fall, indoor rooms often remain uncomfortably warm well into the night. This delayed heat release can make sleeping difficult during the hottest months.

To address this problem, the team experimented with a simple assisted ventilation system. Two exhaust fans were installed: one directing cooler air toward the ceiling surface and another extracting warm air from the room. When operated in the evening—once outdoor temperatures begin to drop—the system helps draw heat out, allowing the house to cool down more quickly.

The approach uses much less energy than air conditioning or evaporative coolers, as it takes advantage of cooler evening temperatures. Earlier in the day, when outdoor air is still warm, the effect is more limited, making it well suited to climates with large day–night temperature differences.

Roof ventilation cage

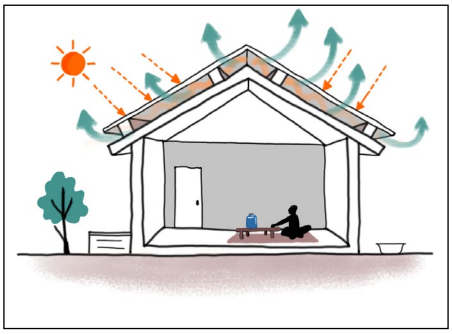
Colombo, Sri Lanka

In settlements in Colombo, houses are often built wall-to-wall on small plots. With limited windows and almost no side openings, warm air easily accumulates indoors, especially beneath the roof where heat tends to gather. Instead of altering the walls of the house, residents and architects explored ways to create a new outlet for this trapped air.

A small raised structure, known locally as a ventilation cage, was installed on top of the roof. Built with a lightweight metal frame and open or perforated sides, the structure allows hot air rising from the interior to escape upward. As this air leaves the house, cooler air is drawn in through doors or lower openings, keeping air moving through the space.

Because the intervention sits above the main living space, it creates an escape point for heat without taking up wall space or reducing privacy. This makes it particularly suited to compact houses where adding new openings is not easy or structurally safe.

Roof & Ceiling: Spatial roof buffers



A further step builds on this principle by creating space for heat to accumulate away from where people live. Spatial roof buffers reduce heat transfer by inserting an additional air layer between the roof and the living space. Instead of relying only on insulation materials, these solutions create a physical separation where heat can collect above occupied areas, reducing direct heat exposure below.

External buffers place a second roof above the original one. This upper layer shades the main roof surface while allowing air to circulate between the two roofs. Wind moving through the gap carries away heat before it reaches the lower roof structure, significantly lowering surface temperatures. Internal buffers work in a similar way but inside the building, using attic floors or intermediate levels to create an upper zone where warm air can collect while the main living space remains cooler.

These buffer spaces often serve additional functions—storage platforms, sleeping areas, or the base for future house extensions—making them well suited to incremental housing. Good ventilation of the buffer zone is essential; without airflow, the cavity can trap heat. When properly ventilated, however, these layered roof systems can provide substantial and long-lasting improvements in indoor climates.

QUICK FACTS

What this solution does well

- Reduces heat transfer using a ventilated air layer
- Shields roof surfaces from direct sun exposure
- Creates additional usable space

Typical material forms

- Secondary double roofs above existing roofs
- Elevated shade structures above reinforced concrete slabs
- Attic floors or mezzanine levels
- Storage-integrated ceiling buffers

Typical contexts

- Flat concrete roofs that store heat
- Houses with potential for vertical expansion
- Homes with sufficient internal height (around 3 m)

Double roof with ventilated air gap

Bhuj, India

In Bhuj, pitched roofs made from corrugated metal sheets, clay tiles, or asbestos cement absorb intense solar heat throughout the day. Without replacing the roof entirely, households explored whether an additional protective layer could be added above the existing structure.

A lightweight metal roof was installed above the original roof using a steel support frame. The new roof sits several centimeters above the existing surface, creating a ventilated air gap between the two layers. Open edges allow wind to pass through this space, carrying heat away before it reaches the roof below and the space beneath it.

Because the intervention takes place above the house, construction can be carried out without disturbing daily life inside. The added layer also shades the original roof, reducing how much heat it absorbs during the day. The edges of this structure can be covered with wire mesh to prevent birds and pests from entering, while still allowing air to move freely through the gap.

Shaded roof for future expansion

Bhuj, India

In the same context, and working with a different roof type, reinforced concrete roofs offered a different opportunity. Their flat, solid structure made it possible to add a second layer above the slab—reducing heat exposure while also creating extra usable space for daily use and future needs.

A steel frame was installed above the existing roof slab and covered with lightweight metal sheets. The elevated roof shades the slab and lets air move between the two layers, preventing it from absorbing as much solar heat over the course of the day.

Over time, the structure can also serve as the base for a future room extension. Families may gradually add walls or partitions if they choose to expand their homes upward. This dual function makes the intervention particularly appealing in contexts where space is limited and housing evolves. Simple upkeep, such as repainting the metal frame, helps prevent corrosion and keeps the structure in good condition.

Bamboo attic floor as thermal buffer

Jeetpursimara, Nepal

In the upgraded houses of Jeetpursimara, higher roof structures created additional space beneath the roofline. Rather than leaving this area unused, local artisans introduced a lightweight bamboo attic floor that functions both as a thermal buffer and as an extra level within the house.

The attic floor is constructed using treated bamboo members fixed at mid-height within the house structure. Bamboo strips are woven across the frame to form the floor surface. This intermediate layer creates separation between the roof and the space underneath, allowing heat that builds up under the roof during the day to remain in the upper zone.

Families quickly adapted the attic: some households use the space for storage, while others sleep there during cooler evening hours. By turning a passive buffer zone into an active living space, the solution makes better use of the house while keeping the rooms below more comfortable. Regular checks of the bamboo joints help keep the structure strong in the long run.

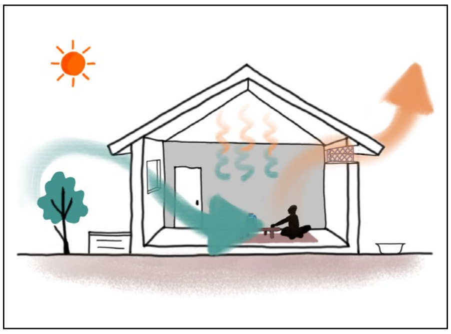
QUICK FACTS

What this solution does well
- Removes trapped hot air and humidity
- Improves indoor air quality
- Works in attached or semi-attached homes
- Low-cost and incremental
- Can respond to privacy and security needs

Typical material forms
- High-level awning windows
- Louvers / jalousies
- Vent blocks in masonry
- Small stack windows
- Permeable boundary walls

Typical contexts
- Wall-to-wall or closely spaced housing
- Limited or no side openings
- Single-aspect rooms (openings on one side only)
- Houses relying on doors for airflow

Walls & Windows: Cross-ventilation openings



As much as insulation and shading help keep heat out, ventilation remains essential for letting it escape. Cross-ventilation works by creating a clear pathway for air to move through the house. Openings at different heights and positions allow cooler air to enter while warm air escapes, helping reduce indoor heat and humidity. Well-placed openings can greatly improve comfort, especially when aligned with prevailing winds or daily airflow patterns.

This strategy is especially useful where houses are tightly packed and side windows are limited. High-level openings allow trapped hot air to leave the room without compromising privacy, while lower or wind-facing openings help draw in fresh air. In many cases, the most effective modifications are not large windows but small, well-positioned vents built into walls, doors, or upper façade areas, making use of overlooked surfaces within existing structures.

Because these interventions rely on familiar carpentry or masonry techniques, they can often be introduced gradually as families upgrade their homes. On their own they do not block solar heat, but when combined with roof shading or insulation they can significantly improve indoor conditions, enhancing the overall effectiveness of other passive cooling measures.

High-level awning windows

Dhaka, Bangladesh

Dense housing in Dhaka leaves little opportunity for side windows, and even where space exists, residents may hesitate to open their homes to public view. During community discussions, it became clear that ventilation could still be improved by introducing small openings higher up, where heat can escape without affecting privacy.

In response, awning-style windows were integrated into existing walls using locally available materials. With simple wood frames and plain sheets, local masons can make them in different sizes, adapting to household needs and available wall space. The outward-tilting panel allows air to pass through while keeping rain out.

Where side walls are limited, windows can be placed above the door frame, maintaining airflow even when the door remains closed. Because they are positioned above eye level, these windows preserve privacy while allowing continuous ventilation, making them a good fit for inward-facing homes.

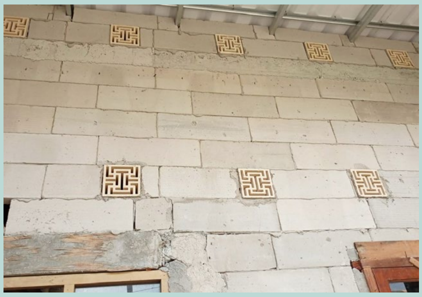
Bamboo lattice & small windows

Jeetpursimara, Nepal

Improving airflow became a key priority in the redesigned houses of Jeetpursimara as well, where many older homes had limited openings and poor ventilation. The new design introduced a combination of small windows and breathable bamboo wattle wall elements that work together to keep air moving.

Each room includes a small wooden window positioned opposite the main door whenever possible. Meanwhile, sections of the bamboo wattle wall are left partially open or covered with bamboo lattice panels. These permeable surfaces allow air to pass through while still providing enclosure and shade. A larger bamboo lattice installed on the upper part of the façade helps warm air rise and escape more easily.

By combining multiple small openings, the system allows air to move more evenly through the house while still giving families flexibility in how they use the space. Regular oiling of the timber frames and simple cleaning of the bamboo lattice help keep the elements in good condition.



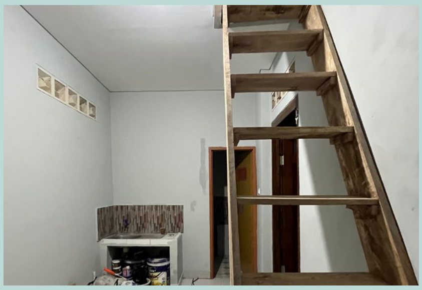
Vent blocks for heat release

Jakarta, Indonesia

In Jakarta's Kampung Muka, side openings are often limited, and much of the day's heat accumulates in the upper part of the house. As part of the upgrading, the team explored whether small permanent vents could release this trapped heat before it spread.

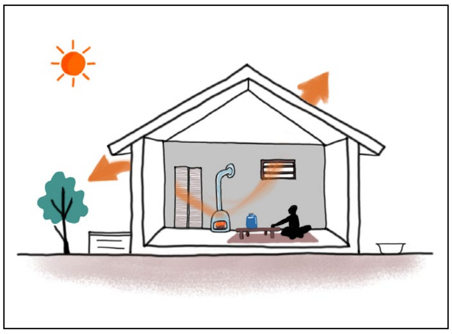
The solution uses perforated vent blocks installed within the wall at different heights and in varied configurations, with particular attention near the roofline. These masonry elements create permanent openings that allow hot air to pass through while still maintaining privacy and security. As warm air rises toward the upper parts of the house, it can escape through the vents instead of building up inside.

Because they are fixed and built into the wall, vent blocks provide continuous ventilation without requiring user operation. Although once common in older buildings, this feature has gradually disappeared from many newer houses and is now being brought back in an updated form.



Indoor Heat: Kitchen heat & smoke exhaust

Within the home, one of the main sources of added heat is the kitchen, where cooking concentrates heat, smoke, and moisture in a small area. When this heat is not released quickly, it spreads into living and sleeping spaces, making the home hotter and less healthy, especially with extended cooking. Kitchen exhaust strategies work by removing heat and smoke as close as possible to the source, before they can disperse throughout the house.



Passive systems—such as perforated screens, wall louvers, or high-level openings—allow warm air to rise and escape naturally. As this air leaves, fresh air is drawn in from lower gaps, improving airflow without electricity. In more congested kitchens where passive airflow alone is not enough, simple hoods with small fans can help capture and remove heat and fumes more quickly, making airflow more reliable regardless of external conditions.

These interventions are especially valuable in homes where kitchens are integrated into the main living space. Because they target heat at its source, they can improve both thermal comfort and indoor air quality with relatively small and low-cost changes, while also reducing exposure to smoke and cooking-related pollutants.

QUICK FACTS

What this solution does well

- Removes heat, smoke, moisture, and cooking fumes at the source
- Improves indoor air quality and respiratory health
- Reduces heat spread to adjacent spaces
- Can function passively or with minimal mechanical support

Typical material forms

- Perforated façade panels or screens
- Fixed exhaust louvers
- Vertical PVC or metal vent pipes
- Metal exhaust hoods

Typical contexts

- Kitchens without windows or cross-ventilation
- Cooking areas integrated into living spaces
- Homes with limited openings for airflow

Perforated kitchen façade

Dhaka, Bangladesh

Improving kitchen conditions in Dhaka began with simple passive strategies that keep air moving during cooking. In homes where kitchens need to remain enclosed for shade, privacy, or protection from rain, ventilation depends on creating a more porous, breathable envelope.

In this setup, bamboo lattice panels are installed within the kitchen wall or door frame. Thin bamboo strips are cut and assembled into a perforated surface that allows air to pass through while still providing enclosure. Similar effects can be achieved using materials such as wire or plastic mesh, or by introducing small cutouts in the façade. These openings release hot air and smoke, making the space feel cooler.

What makes this approach effective is its ability to improve conditions at the source without relying on mechanical systems or added energy use. It builds on familiar spatial practices, giving households a flexible way to improve comfort using materials and techniques they already know.

Locally fabricated kitchen hood

Dhaka, Bangladesh

Where passive ventilation alone is not sufficient—particularly in enclosed or shared kitchens with heavy, continuous use—more direct extraction at the source becomes necessary to prevent heat and smoke from spreading.

The solution introduces a locally fabricated kitchen hood installed above the stove. Made from metal sheets by a neighborhood craftsman, the hood is fitted with a small electric fan and a duct pipe that carries heat, smoke, and fumes outdoors. As warm air rises during cooking, the hood captures it immediately before it spreads into the rest of the space.

By removing heat and smoke at the point of generation, the system helps keep shared cooking areas more comfortable and easier to use, even during peak cooking periods. Regular cleaning of grease buildup helps the fan work efficiently and prevents smoke from drifting back into the room. This makes the hood a reliable complement in situations where passive openings alone cannot keep up.

Thermal exhaust louver & vent pipe

Colombo, Sri Lanka

In homes where cooking areas are integrated into the main living space, the priority shifts to controlling how heat escapes without disrupting the rest of the room. Here, even small amounts of trapped heat and fumes can quickly spread, making more targeted ventilation essential.

A fixed exhaust louver is installed in the wall near and above the stove area, sometimes paired with a short vertical vent pipe to strengthen upward airflow. As heat rises, the louver provides an outlet for warm air and smoke to escape outdoors. The angled blades allow continuous airflow while keeping rain out. Because the louver is placed at an elevated height, it captures heat close to where it is generated.

The system requires only a small wall opening and durable materials such as aluminium or cement louvers, making it suitable for kitchens where windows cannot easily be added. The same idea can also be used in bathrooms or other small rooms, where ventilation is often limited.

QUICK FACTS

What this solution does well

- Improves access to natural daylight
- Reduces electricity use
- Lowers internal heat from artificial lighting
- Makes interiors easier to use during the day

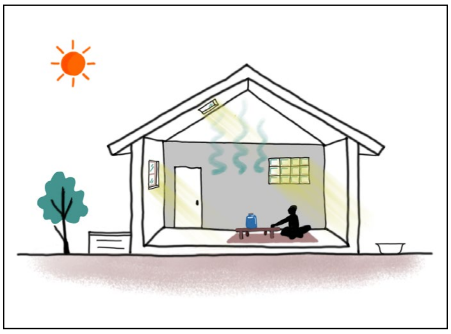
Typical material forms

- Transparent corrugated fiber sheets
- Glass roof tiles or skylight inserts
- Small solar-powered lighting systems

Typical contexts

- Dense settlements with limited wall openings
- Narrow lanes blocking side windows
- Homes relying on electric bulbs during the day
- Areas with unreliable grid electricity

Indoor Heat: Daylighting to reduce heat load



To reduce heat indoors, households looked at all the ways it is generated inside the home in the first place. When closely packed buildings block daylight, households often rely on electric bulbs even during the day. While these lights improve visibility, they also increase electricity costs and add a small but constant source of indoor heat. Daylighting strategies reduce this burden by bringing natural light into the house through roofs or upper wall surfaces.

Transparent roofing sheets, glass roof tiles, and similar inserts allow daylight to enter interior spaces while maintaining the protective function of the roof. When positioned carefully, they brighten rooms without requiring major structural changes, helping distribute light more evenly across the space. Daylighting does not directly stop external heat from entering the building, but by lowering dependence on artificial lighting it reduces internal heat loads and household energy costs. In homes with limited wall openings, this also makes interior spaces easier to use during the day.

Conversely, after dark, lighting can support how people use space to cope with heat. In some cases, solar-powered lights help make outdoor or semi-open areas usable into the evening, particularly where electricity access is limited or unreliable.

Translucent corrugated panels

Dhaka, Bangladesh

In Dhaka's dense settlements, limited access to daylight often means that interior rooms remain dim throughout the day, increasing reliance on electric lighting. This creates both additional costs and a steady buildup of indoor heat.

To improve this, small sections of transparent corrugated fiber sheets are inserted into roofs or upper wall surfaces. These panels allow daylight to enter while keeping the roof or façade weather-resistant. Even a relatively small translucent section can noticeably brighten the space, reducing the need for electric bulbs during the day.

The panels are installed alongside standard corrugated roofing or incorporated into wall openings by local masons. Because they can be inserted in small sections, the panels allow households to introduce daylight gradually without altering the overall structure of the house. In some cases, small window bands near the roofline offered a similar way to bring in light, while maintaining privacy and security.

Glass roof tiles for daylighting

Yogyakarta, Indonesia

In Yogyakarta, a similar lack of daylight is addressed differently, shaped by the widespread use of clay tile roofs. These roofs form a layered, modular system where individual tiles rest on a timber or bamboo frame. In tightly attached kampung housing, where wall openings are limited, the roof becomes the most viable surface for introducing light.

In this solution, selected clay tiles are replaced with glass tiles of the same size. These are inserted directly into the existing grid, resting on the same supports as the surrounding tiles. Because the roof is made of overlapping elements rather than a continuous sheet, the swap can be done without altering the overall structure.

When placed strategically—above darker interior zones and away from direct sunlight—the glass tiles allow daylight to filter in while limiting heat gain. Careful positioning and proper overlap are important to prevent leaks. With only a few tiles replaced, the intervention remains low-cost and easy to replicate within existing roofing systems.

Solar lighting for reduced heat load

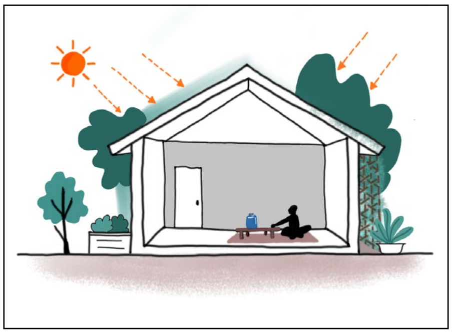
Davao, Philippines

Another approach focuses not on bringing more daylight in, but on how to bring light to the spaces people use to cope with heat. In Davao, this meant supporting the use of outdoor and semi-open areas where residents often move in the evening to cool down after a hot day.

Solar-powered lights were installed in porches and exterior spaces, making these areas usable after dark for sitting, resting, and carrying out daily activities. Using pre-assembled units with integrated solar panels and batteries, households could install them with minimal tools and maintenance. By improving visibility and safety, the lights help extend the use of cooler outdoor spaces into the evening hours.

While the lights don't directly reduce indoor heat, they support a shift in how space is used, allowing households to spend more time in less heat-exposed areas when indoor conditions are uncomfortable. At the same time, they reduce reliance on grid electricity, lowering costs for households already under pressure.

Neighborhood: Community greening



Finally, cooling extends beyond the house itself, into the shared spaces of the neighborhood. Plants cool settlements in two main ways: by creating shade and by releasing moisture into the surrounding air. Their leaves block sunlight from reaching walls, roofs, and ground surfaces, while the moisture they release helps lower nearby temperatures. In places where concrete, paving, and buildings dominate the environment, introducing greenery can make outdoor spaces feel clearly more comfortable, particularly along frequently used pathways and shared areas.

Nature-based cooling works especially well when it is introduced collectively. Potted plants, creepers, and small planted pockets can be added gradually along alleys and courtyards without major construction, using available surfaces such as walls, fences, or simple support structures. Unlike heavy structural upgrades, these interventions are flexible, low-cost, and easy for communities to maintain together, often building on existing care practices and local knowledge.

On their own, single plants may have only a modest cooling effect. But when many small green elements are added across a settlement, they can begin to improve the local microclimate, soften the streetscape, and create more inviting shared spaces, enhancing regular use of outdoor areas.

QUICK FACTS

What this solution does well

- Provides shade for walls, roofs, and outdoor spaces
- Reduces heat reflected from paved surfaces
- Helps cool the surrounding air
- Supports well-being, social interaction, and small-scale food growing
- Highly participatory and easy to maintain

Typical material forms

- Creepers and vertical greenery systems
- Potted plants and movable greening
- Edible and livelihood-supporting plants

Typical contexts

- Areas with extensive concrete or paved surfaces
- Streets and alleys exposed to direct sun
- Places where permanent or structural changes are limited

Small green community pockets

Bangkok, Thailand

In many communities in Bangkok, residents noticed that large areas of paving and exposed concrete were making alleys and gathering spaces increasingly hot. Rather than breaking up the pavement, which would require significant labor and cost, they began introducing small pockets of vegetation to help soften the microclimate.

Clusters of planting pots were placed along alleys, building walls, and small shared spaces, creating green pockets that cool the surroundings. Creepers provide shade for walls and sitting areas, while broad-leaf plants help reduce heat reflected from nearby hard surfaces.

The approach requires only basic materials such as pots, soil, and light supports. Because residents take turns watering and caring for the plants, maintenance becomes part of shared daily routines, while gradually improving comfort. This has also begun to spark interest in planting fruit trees and edible crops, linking cooling efforts with improved nutrition and small income opportunities.

Portable green corridor

Jakarta, Indonesia

In Kampung Muka, along Jakarta's railway line, residents wanted to improve the comfort of a narrow corridor used every day for movement, sitting, and social interaction. But because permanent structures are not allowed near the tracks, any intervention had to remain light, movable and temporary.

Working with community architects from AKUR, residents reorganized the corridor using modular elements that could be adapted over time. Potted plants, seating areas, and solar lighting are combined with small pergola structures that provide shade, helping create a cooler, more welcoming space. Vegetation is arranged in raised beds and containers that can be shifted or rearranged as needed.

Reused materials such as plastic pallets, water containers, and reclaimed wood were incorporated into these elements, helping keep costs low. The system is modular and portable, showing how shared spaces can be greened even in places where permanent construction is restricted.

Vegetated alley canopy

Yogyakarta, Indonesia

In Yogyakarta's kampungs, narrow alleys are not only circulation routes but also social spaces where people pass through, and gather throughout the day. Yet these passages often lack shade, allowing heat to build up on walls and paving. Because ground space is limited, planting trees or creating gardens is rarely possible.

The community responded by creating a vegetated alley canopy. A lightweight overhead structure spans the passage and supports climbing plants that gradually form a shaded green corridor. Planter boxes made from masonry or recycled containers provide soil at ground level, while hanging fabric planting pockets line the walls. The system can be extended section by section, allowing the canopy to expand along the alley, gradually transforming its character.

What was once an exposed passage becomes a shaded, more livable part of the neighborhood, where people can pause, interact, and use the space more freely at different times of the day, especially during hotter hours.

"It's often the small details that make the difference: how to catch the breeze without letting in too much heat; a window on the southwest side, opened in the evening and closed in the morning; a panel on the roof. These are things people can manage and adjust on their own."

—Mahavir, Hunnarshala Foundation, Bhuj

Beyond categories: Other cooling solutions

Not all solutions fit neatly into categories. Across the different cities, some responses to heat emerged outside the main archetypes, shaped by very specific constraints, materials, and ways of building. These distinct, context-driven modifications may be less widely seen, yet they are no less relevant, underlining the diversity of possible cooling approaches.

In some cases, this meant working with the vertical dimension of the house, as in Colombo, where raising wall height created space for heat to rise and disperse within a larger volume. In others, it involved drawing on deeply rooted building traditions, like mud plaster in Jeetpursimara, which combines thermal performance with cultural familiarity. Elsewhere, solutions extended beyond the house itself, as in Bangkok, where shading shared spaces helped reclaim outdoor areas for social use.

These examples highlight the flexibility and breadth of community-led approaches. They show that effective cooling does not depend on a fixed set of solutions, but on the ability to respond creatively to local conditions, using whatever materials, knowledge, and opportunities are at hand.

Increasing ceiling height

Colombo, Sri Lanka

In Colombo, many houses are small, with low ceiling heights that make heat feel more oppressive. Built wall-to-wall, they also leave little room for ventilation, as surrounding structures block airflow on all sides. With only a single opening, heat accumulates quickly and remains trapped indoors.

To respond, some households adopted a more structural approach: raising the height of existing walls and rebuilding the roof at a higher level. By increasing the internal volume of the house, hot air can accumulate higher above the occupied zone, reducing the intensity of heat where people live and move. Where possible, small openings near the ceiling can be introduced to help release this trapped heat, further improving air movement.

Although more invasive than typical retrofits, the intervention provides a lasting improvement in thermal comfort. By increasing the interior height, it also makes the space feel more open and allows the room to be used more flexibly.

Mud plaster for cooler walls

Jeetpursimara, Nepal

In Jeetpursimara, many homes are built with bamboo walls that offer little protection from heat and humidity. In settlements where mechanical cooling is not an option, residents rely on locally available materials. Mud plaster, long used in traditional construction, has become a key solution for improving indoor temperatures.

Applied by hand over bamboo lattice walls, the mud layer, typically around 4 inches thick, acts as both insulation and a breathable surface. At this depth, it helps moderate day–night temperature swings, keeping interiors cooler during the day and more stable over time. Its permeability also allows moisture to pass through, reducing dampness in hot and humid conditions.

Because the technique is part of existing building practice, it can be implemented and maintained easily by households. Often, women lead the application as part of seasonal routines such as pre-festival home repairs. Low-cost and rooted in local wisdom, mud plaster offers a reliable and grounded way to cool the space.

Shading for shared spaces

Bangkok, Thailand

In several Bangkok communities, narrow lanes and small open spaces serve as extensions of the home—places where people sit, talk, cook, and spend time together. Yet under strong sun, these shared areas quickly become too hot to use, especially during the middle of the day, limiting social life to mornings and evenings.

To address this, residents introduced shading systems using lightweight nets stretched across alleys and gathering spaces. Suspended between houses or supported by basic frames and poles, the nets block a large portion of direct sunlight while still allowing air to circulate freely underneath. This reduces heat buildup on walls and ground surfaces, creating cooler conditions within exposed spaces.

By extending the usable hours of these shared areas, the shading systems help bring social life back into outdoor spaces during the day. They also create better conditions for a range of uses, from informal gatherings to routine household tasks.

When "new" solutions came from old knowledge

Cooling strategies did not come from a search for new materials or complex systems alone. In many cases, the knowledge was already there. What this work brought into focus is how ordinary building practices—often taken for granted—can be adjusted, strengthened, and carried forward to respond to rising heat.

In Jeetpursimara, bamboo lattices, high-level openings, and breathable wall systems have long been part of how houses are built. These elements allow air to move through the structure and give heat a way to escape, while still maintaining privacy in closely spaced settlements. The upgrades did not replace these patterns but worked *with them*, reinforcing wall systems, optimizing ventilation points, and improving durability while keeping the house able to "breathe."

Sheep wool sourced locally is prepared and assembled into roof insulation, linking cooling solutions with local livelihoods.

In Bhuj as well, insulation did not rely only on manufactured materials. Wool sourced through local shepherd networks was introduced as a thermal layer, responding not only to heat but also to what is locally available and familiar to work with.

Meanwhile, in Yogyakarta, traditional roof forms such as the Panggang-Pe were revisited to understand how shade, volume, and airflow were balanced in earlier building practices. These insights were then adapted to kampung conditions, where space is limited and houses are closely packed.

Across these examples, the direction is consistent. Cooling responses grow out of what people already know and use, combined with new ideas where needed. Local materials, construction habits, and everyday spatial practices remain central to how solutions take shape. When communities lead the process, this continuity becomes more visible and the results are often more grounded, more adaptable, and easier for others to build on.

> **"I used to think that a modern house was the solution to the heat issue. But as we participated in different discussions, I have come to realize that using vernacular techniques is actually a better way to respond to these changing conditions. So this approach and awareness are very important for the youth and the local community."**
>
> *—Rabi, a community member in Jeetpursimara*

Above, traditional bamboo lattice allows air movement while filtering light and visibility. Below, the upgraded design mirrors traditional patterns while strengthening durability.

Rumah Kebaya, the traditional Betawi house, and Panggang-Pe, a characteristic Javanese roof, show how form supports cooling, even when adapted to dense kampung conditions.

When knowledge stays with the community

Building on the revival and adaptation of local building knowledge, an equally important question is *what happens to that knowledge over time*. When upgrading is carried out by external contractors alone, the results may be visible, but the knowledge often leaves with them once the work is done. Techniques are applied, but not necessarily understood, adapted, or carried forward. In this project, the approach was different. The work was done with the people who live and build in these settlements, drawing on existing practices, testing ideas together, and refining them through hands-on experience. In many cases, what emerged was not entirely new, but a reworking of familiar methods, strengthened through collaboration with architects and technical teams.

As a result, the knowledge does not remain tied to a set of pilot houses. It stays with the community. Local masons, carpenters, bamboo workers, and residents were directly involved in construction, and in several places received targeted training—for example on bamboo treatment, roof detailing, or preparing and applying mud plaster. These are skills that can be reused and shared within and across communities. Because the people who carry out the work are the same people who will continue building and repairing homes, the learning does not stop with the project. It becomes part of an ongoing process, supporting future improvements long after the initial interventions are complete.

> When we study why people built their houses in certain ways, we learn what works and what doesn't. Communities already have knowledge—we just need to understand and build on it.
>
> *—Ruengyuth, Community Organizations Development Institute, Bangkok*

Small details, lasting ownership

After the cooling interventions were completed in one community in Bangkok, the team returned for a follow-up visit. What they noticed was a small change in front of one house—easy to overlook, but worth noting.

At the entrance of the house, rows of hanging air plants had appeared, neatly arranged along the façade. The residents explained that after construction, a few hundred baht remained from the project budget. Instead of letting it go unused, they chose to spend it on plants, adding shade, softness, and a visible sense of care to their home.

It was a simple decision, with clear meaning. It showed that the house was no longer just a site of intervention, but a space people continued to shape and take pride in. This is what **community ownership** looks like in practice: not only maintaining what was built, but carrying it forward through small choices that extend the life and value of the work.

Cooling as an ongoing practice

What stands out across these solutions is their diversity and how closely they are tied to everyday life. Adjustments such as lifting a roof edge, inserting a vent, or redirecting kitchen heat come from careful attention to how spaces are used, how heat builds up, and when discomfort is most felt. Cooling, in this sense, is not a one-time fix. It is a continuous process of observing, testing, and refining.

Many of the approaches drew on knowledge that already exists within communities. People understand how materials perform and how shade shifts over the course of the day. The collective process helped bring this knowledge into focus, making it easier to compare experiences across households and build confidence in trying new combinations. Gradually, these small changes accumulate, especially as ideas circulate between neighbors and across settlements.

These examples also show that comfort is shaped by social realities. Decisions about openings are influenced by privacy and safety. Material choices depend on cost and availability. Construction processes reflect who has time, skills, and the ability to take part. Modifications are more likely to last when they work within these conditions.

As temperatures continue to rise, the challenge is to support this ongoing capacity to adapt. The solutions presented here are part of a growing shared practice. They continue to evolve as communities try out, adjust, and exchange ideas in response to changing climates.

"The room used to be unbearably hot from the roof—we couldn't sleep or use it and often had to stay outside. After the intervention, we feel the difference and now spend most of our time indoors."

—Uroosa Raja, a resident of the Korangi Christian Colony, Karachi

Measuring What Changed:

From construction to evidence

What happens after construction is just as important as what is built. Once the first houses were completed, attention shifted to a different question: how these changes perform under real living conditions. Monitoring became part of the journey, serving as a way for communities and teams to understand, verify, and learn from what was happening inside the houses.

Beyond implementation: Why evidence matters

Installing solutions was only one step in a longer process. From the beginning, the question was not only what can we build, but *what difference does it actually make*? If passive cooling is to be taken seriously by households, practitioners, city governments, and funders, it must demonstrate measurable impact under real living conditions.

Across the nine cities, interventions were implemented in occupied homes, often during peak heat periods. Families continued cooking, sleeping, working, and hosting visitors while changes were introduced. What followed was a collective effort to observe, measure, compare, and interpret the results in real time.

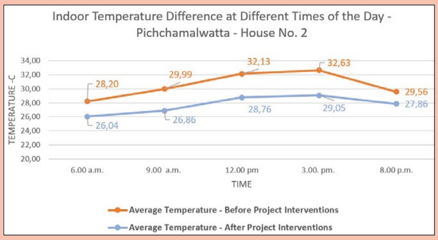
The goal was twofold: to understand how effective the modifications were, and at the same time to build locally grounded evidence that communities themselves could use in future negotiations around housing and climate adaptation. Impact was assessed through a combination of temperature monitoring, household observation, and lived feedback. While methods varied by city, a consistent pattern of change began to emerge.

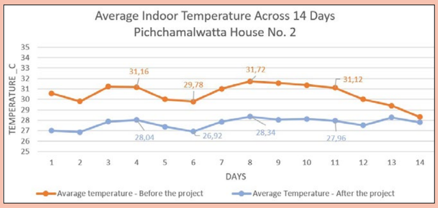
Quantitative change: What the numbers show

The measurement tools were simple—thermometers, humidity meters, surface temperature guns, and data loggers—but the results were striking.

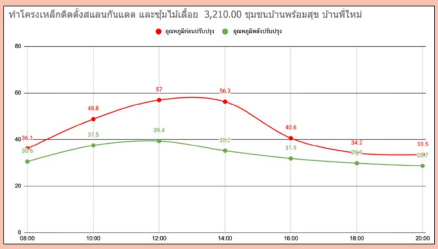
In Colombo, community members recorded indoor temperatures for 14 days before the intervention, taking measurements at different times of the day to identify peak heat periods and establish a clear baseline. These were later compared with post-intervention readings. The data shows consistent reductions in indoor temperatures, with differences of nearly 2.5°C at midday and close to 3°C during peak afternoon hours. Across the monitoring period, average indoor temperatures remained around 3°C lower than before. Because the measurements were taken by residents themselves, these figures are not just numbers on a chart—they reflect a change that households can directly feel.

In Bhuj, the team installed data loggers in both retrofitted houses and nearby control houses during peak summer conditions. Each control house, representing how the home would perform without improvements, was carefully selected to match the corresponding upgraded one in materiality, layout, orientation, and sun exposure, allowing for a fair comparison under the same conditions. Both were then monitored continuously over one week during the hottest period of the season. Indoor air temperatures in the retrofitted houses were 4–7°C lower, while roof surface temperatures dropped by 10–12°C from outside to inside, indicating a significant reduction in heat gain.





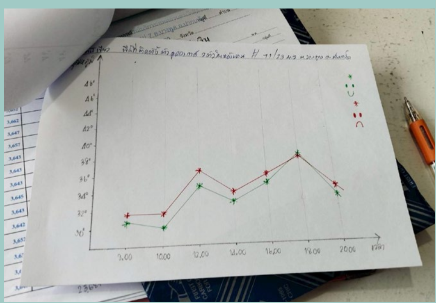
The graph above shows indoor temperature variation throughout the day, while the graph below compares averages over the 14-day monitoring period, before and after the interventions in Colombo.



In Bangkok, surface temperatures were measured before and after the interventions. The graph shows reductions of up to 20°C around midday, with lower temperatures recorded throughout the day.

When communities measure for themselves

One of the most significant outcomes was not just the data itself, but *who collected it*. In Bangkok, when the team arrived to discuss post-intervention monitoring, residents had already begun measuring temperatures independently. Driven by curiosity, they used thermometers to track changes, drew hand-made graphs, and created their own temperature curves to compare before-and-after conditions. Measurement became a collective learning activity.



This spirit of experimentation went beyond numbers. In one house, immediately after installing an exhaust fan, the homeowner quickly reached for a piece of paper and held it near the louver openings at the bottom of the door to see if the airflow would pull it inward. It was a simple way to check whether the system was working. Residents were testing and adjusting the solutions as they went, becoming their own everyday scientists.

In other cities as well, community members recorded and interpreted changes under regular living conditions. They repeatedly compared readings, and their discussions around cooling became more informed and exploratory, gradually building shared understanding. While monitoring is still ongoing, this process has already strengthened the ability to understand heat as a **measurable and modifiable condition**, and not an unavoidable reality. When communities measure their own environments, they shift from passive recipients to active interpreters of evidence.

In Jeetpursimara, comparisons across housing types were equally revealing. At 1:00 pm in summer, houses with CGI roofing and no ceiling reached around 39°C indoors. Pilot houses with improved ventilation and ceiling modifications stayed near 32°C, almost matching the performance of traditional thatched houses. The introduction of false ceilings reduced surface temperatures by 8–10°C.

In Karachi, post-intervention measurements recorded indoor temperature reductions of 2–5°C during peak summer hours. Ceiling insulation slowed heat accumulation and moderated indoor temperatures, particularly in the early afternoon when heat stress is most acute. In Bangkok, residents used handheld infrared thermometers to measure surface temperatures before and after the interventions. The differences were especially pronounced during peak heat: at noon, surface temperatures dropped from 57°C to 39.4°C—a reduction of 17.6°C—while by early afternoon they fell from 56.3°C to 35.2°C.

These are not controlled laboratory results, but readings taken in lived-in houses during real heat conditions. Across cities and housing types, roof, ceiling, and shading interventions consistently reduced peak heat levels.

Beyond the thermometer: How daily life shifted

Temperature reductions tell only part of the story. But what changed inside these homes is best understood through daily tasks and patterns of use. To understand these changes, teams returned to the houses repeatedly after implementation, speaking with residents, looking at how spaces were used at different times of day, and asking how heat was experienced across ordinary activities. These conversations, combined with observation, helped translate temperature data into lived experience. Cooling did not just lower degrees; it altered how homes could be used, how bodies felt at the end of the day, and how families navigated heat across seasons.

1 Comfort and the return of usable space

Across the board, families described a shift from endurance to usability. Rooms that were once abandoned during peak heat are now occupied again. Kitchens that felt suffocating during cooking hours have become manageable, and afternoon rest has returned as a small but meaningful possibility.

In one household in Colombo, a woman who spends most of her day cooking to sell food explained how a modest ventilation improvement transformed her routine. Heat from the stove, once trapped indoors, now escapes more easily, making long hours in the kitchen bearable again. As she put it, "*I spend most of my day at the stove. After the ventilation cage was built, I don't have to sweat and cook like I used to. Now I'm less tired and the kitchen is less hot.*"

These shifts are echoed elsewhere. In Karachi, several residents described how ceiling installations turned rooms that had once been unusable into spaces that families now occupy comfortably throughout the day. One woman explained how this changed not only comfort but how activities are distributed in the home: "*We used to spend most of our time in the courtyard, and I sometimes taught neighborhood children there because the room was too hot to use. There was no comfortable space for our family indoors. After the improvement, the room has become usable, allowing us to stay inside.*"

In Jeetpursimara, Manju Devi described how family schedules have opened up again: "*Before, we had to finish cooking and eating by 10 in the morning because it got too hot after that. Now, we enjoy being at home. Our favorite place is the room under the attic.*" And in Bhuj, Khimiben described being able to take a short afternoon rest during summer—something that was previously impossible. Even modest reductions of a few degrees can mean the difference between avoiding a space and living in it.

Importantly, these improvements have been achieved without compromising other essential aspects of daily life. In Dhaka, for example, upper-level ventilation allows airflow even when doors remain closed, improving comfort while maintaining privacy—an important concern in closely built settlements. In Davao, new window openings were designed to improve airflow while also addressing safety concerns. As one resident, Redemptor, noted, "*We definitely feel more comfortable and safer now.*"

2 Health and well-being

These shifts extend beyond comfort into health and well-being. Residents described changes in sleep, energy levels, and the frequency of heat-related illness in ways that reshaped their days and nights.

Improved ventilation and reduced indoor heat translated into better rest at night and more stable routines during the day. As one woman explained, "*We could not sleep properly … which reduced our work the next day. After the construction of our new homes, it feels much cooler and I am able to sleep well.*" In Colombo, mothers shared that infants now sleep longer and more comfortably. In another household, a young woman described how the family used to sleep in a single shared space, as this was the only option available, while some male members would leave the house at night in search of cooler conditions; this is no longer the case.

For many families, the changes also meant fewer recurring illnesses. Ajaya Ram from Jeetpursimara reflected on this shift: "*I have elderly parents and three children. Earlier, family members would fall sick one after another. But after we built our new house with better ventilation, we get sick much less often.*" Parents in Bhuj similarly noted that children are less restless during peak heat hours, with fewer heat-related symptoms.

The effects are also visible in daily rhythms. In one household in Jeetpursimara, improved airflow made an immediate difference to breathing conditions. As Lilgunti Majhi explained, "*Before, even the fan used to blow warm air, which made it very hard to breathe. Now, with better ventilation, we can feel a cool breeze just by opening the windows.*" A student in Colombo described how these changes affected her ability to concentrate: "*It used to be very hard to study at home. I kept sweating, felt tired, and couldn't remember anything I read. Now I can study for much longer, and it's much easier to concentrate.*"

Altogether, these are not theoretical improvements. In environments where heat builds up day after day, better sleep, improved air quality, and reduced illness have ripple effects, influencing caregiving, productivity, learning, and overall well-being.

3 Economic relief and reduced energy dependence

Heat also carries a financial burden that many households were already managing long before the interventions. Electricity costs are a major part of this, but not the only one: coping with heat also means higher spending on healthcare, lost productivity, and at times, missed income.

After the implementation of diverse cooling measures, many families reported a noticeable shift in energy use. Fans are still used, but more selectively—mainly during peak heat hours rather than throughout the day and night. Some households that previously relied on multiple fans now manage with only one, lowering overall electricity use. Meanwhile, improved daylight has reduced the need for artificial lighting, helping bring down electricity bills further. In Davao, these changes are already visible. After installing a fiber-cement ceiling, one resident, Sarah, described being able to sleep comfortably without a fan for the first time: "*There has been a big change in the temperature now that my house has a proper ceiling… I can already sleep without using an electric fan, which was unthinkable before.*"

Beyond energy savings, households also report wider financial benefits. More bearable indoor conditions make it easier to work from home, carry out regular tasks, and use space more effectively, contributing to more stable incomes and reduced costs. Improved sleep and reduced fatigue also support more consistent livelihoods, as people are better able to work, care for others, and maintain their income. For many households, the economic effects extend further. Reduced illness means fewer medical expenses and less strain on how households manage day to day. As Ajaya Ram from Jeetpursimara explained, "*Because my family is not getting sick as often as before, I've been able to save the money I used to spend on hospital visits.*"

While monitoring of energy use and cooling-related expenses is still ongoing, these early observations point to meaningful reductions in household costs. For families managing tight budgets, even small savings matter—and when combined with improved health and comfort, they reinforce the value of these changes.

"When the project started, I didn't really understand how it could make my house cooler. Honestly, I just wanted to install air conditioning. But after trying the ventilation fans, I saw how they pull cool air into the house, remove humidity from the bathroom, and push hot air outside. Now I think it's a very good solution and I would like other houses to use this approach."

—P' Yoot, a Baan Mankong resident, Bangkok

From measured change to lived impact

Taken together, these shifts go beyond technical performance. They show up in how homes are used again—rooms that can be occupied, kitchens that are easier to work in, and nights when people can finally rest. Sleep improves, health stabilizes, and pressure on household budgets begins to ease. These are small changes, but they matter in very real ways.

The thermometer records the difference. What people do in their homes shows what that difference means.

At the same time, these improvements raise practical questions. If such changes are possible, *how can more households access them? How can upgrades be financed, maintained, and expanded over time?* Addressing these questions requires looking beyond the house itself to the financial systems that make these improvements possible.

"Our homes are cooler now and look beautiful. People passing by often ask about them, and it makes us feel proud of what we've created."

—Chintadevi, a resident of the Ram Tole community, Jeetpursimara

"People who have just finished paying their housing loan may not want another loan immediately. But if they have the knowledge, they can implement improvements gradually according to what they can afford."

—Ruengyuth, Community Organizations Development Institute, Bangkok

Keeping It Cool:

Financing community-led cooling solutions

Communities quickly realized that designing cooling responses was only part of the challenge. Even the most modest passive cooling measures require upfront investment—and for many low-income households, financial barriers can be as decisive as technical ones. At the same time, these interventions came to be understood not merely as housing improvements, but as long-term investments in health, productivity, and household stability. This reframing was critical. The question was no longer only what solutions to implement, but how to make them financially accessible in contexts shaped by limited and often unpredictable incomes.

Making cooling financially possible

Different approaches emerged organically across cities, shaped by local economic realities and levels of vulnerability, and negotiated through collective decision-making. In some places, the priority was reaching households facing extreme hardship. In others, communities already had savings groups or cooperatives that could manage loans and circulate funds. In certain cases, cooling solutions were folded into broader housing programs already underway.

Across these diverse contexts, three broad financing pathways took shape: targeted **grants** for urgent need and early learning; community-managed **revolving funds**; and **blended financing systems** combining grants, savings, and public support. These pathways show that financing cooling is less about applying a universal model and more about responding to local conditions and strengthening community systems that can make modifications accessible, manageable, and sustainable.

Cooling as an investment, not a monthly expense

In many low-income settlements, families already spend significant amounts coping with heat, even if they never call it a "cooling investment." Electricity bills from running fans day and night, medical costs linked to heat stress, and productivity losses are recurring expenses that add up over time, even if they are rarely accounted for.

Passive cooling solutions introduce a different financial logic. Instead of paying every month to cope with heat, households can invest once in improving how their homes perform, reducing indoor temperatures by several degrees without ongoing energy costs. For families living with constant financial pressure, this shift is not obvious or easy, as upfront costs still matter. But when cooling upgrades are supported through community savings, revolving funds, shared labor, and collective decision-making, they become less risky and more accessible.

Seen this way, cooling is not a luxury. It is a form of long-term protection for health, income, and well-being—one that continues to pay back long after construction ends.

1 Grants as catalysts for urgent need & learning

In several cities, interventions were entirely covered by project funds dispersed as grants, either to reach households facing acute vulnerability or to support early pilots that communities could later replicate on their own terms.

In Colombo, passive cooling upgrades for eight households were fully supported through grants, with a total investment of around three million Sri Lankan rupees (US$ 9,700). Two households added small personal contributions for minor improvements, but the core interventions were grant-funded to ensure that the most heat-affected families could participate without financial risk.

A similar logic guided the work in Karachi, where cooling upgrades costing approximately 48,000 Pakistani rupees (US$ 170) per household were provided entirely as grants. In a context of extreme heat, rising electricity costs, and very limited incomes, even small loans would have been a burden. Grants made it possible to act quickly and reach families who would otherwise be excluded.

In Bangkok, project funds were also provided as grants: 100,000 Thai baht (US$ 3,000) for each of the three pilot communities. What distinguished this case was how communities collectively decided how to use them, debating whether to invest in individual houses, shared spaces, or small experiments others could learn from. The grant thus became a collectively managed resource, covering both individual home upgrades and communal infrastructure.

"We always try to keep solutions economical. If something costs 30,000 rupees, we ask if it can be done for 25,000. The goal is not one perfect solution—it is making something affordable so more people can adopt it."

—Mahavir, Hunnarshala Foundation, Bhuj

In Bhuj, grants were used strategically to develop and assess early prototypes. Contributions to each household ranged from 20,000 to 28,000 Indian rupees (US$ 215–300), depending on house size and intervention type. Families able to contribute from their own savings were encouraged to do so, allowing larger grants to be directed toward the most vulnerable. This approach built confidence and created locally tested models that could later be expanded.

Across these cities, grants functioned less as one-off assistance and more as learning investments—lowering risk, enabling experimentation, and demonstrating what was possible.

2 Revolving funds and community finance systems

In other cities, cooling upgrades were deliberately embedded within community savings and loan systems, often combining grants with repayable components. Here, the aim was not only to improve current houses, but to ensure that funds could continue circulating and support future upgrading.

In Yogyakarta, cooling upgrades were financed through a collaboration between project solidarity funds and the Kalijawi community cooperative. Each household received 50% of the intervention cost as a grant, while the remaining 50% came from cooperative savings and loans, with household investments ranging from three to fourteen million Indonesian rupiah (US$ 180–840). By structuring finance this way, approximately half of the funds flow back to the cooperative through loan repayments, becoming capital for future improvements.

In Davao as well, cooling interventions combined household loans with homeowners' association savings. Loans averaged around 60,000 Philippine pesos (US$ 1,000) and are repaid over 18 months, with households contributing savings equivalent to 20% of the loan amount, typically covering labor and small improvements. Detailed affordability assessments helped tailor loan terms to household capacity, reducing default risk and strengthening collective accountability.

In Dhaka, funds were channeled through a newly established community savings group, which converted external grants into blended grant–loan packages. Households could access up to 60,000 Bangladeshi taka (US$ 490) per upgrade. Of this amount, 75% was repaid interest-free, while 25% functioned as a grant. In addition, households contributed 2% of the total project cost to the savings group itself, further strengthening collective financial capacity while keeping repayments manageable.

A similar revolving approach was used in Jakarta, where funds were managed through cooperatives linked to the Urban Poor Network. Loans of up to 50 million Indonesian rupiah (US$ 3,000) per household were distributed through the national-level cooperative to the settlement-level cooperative of Kampung Muka. The cooperative used these funds to purchase materials in bulk and manage construction directly. Once households complete their repayments, the funds return to the national-level cooperative and are reinvested in further housing upgrades.

These examples show how cooling solutions can become part of long-term community housing finance, moving beyond isolated project expenses.

3 Blended financing and collective cost sharing

In Jeetpursimara, communities combined multiple funding sources to embed cooling responses within broader housing and development efforts, offering the clearest example of blended financing at scale in this initiative. Cooling features were integrated into a wider housing reconstruction program supporting 140 families, led by Lumanti with support from external donors. A fully upgraded house cost approximately 350,000 Nepali rupees (US$ 2,500), with cooling-specific measures accounting for around 156,000 rupees (US$ 1,100) per household.

Municipal participation was secured through a combination of factors: Lumanti's long-term engagement in the region helped anchor collaboration, while active community involvement and existing donor funding created a strong basis for partnership. Of the total cooling-related costs, roughly 29% came from municipal grants, 60% from donor funds, and 11% from families themselves—largely through non-monetary contributions such as labor and locally sourced materials. Municipal funding supported the structural base through foundations and plinth-level construction, while combined donor funds and community contributions supported the rest of the construction, including the thermal improvements.

This layered financing approach allowed cooling modifications to be embedded within long-term housing security, while strengthening trust between communities, local government, and technical partners. It highlights a key lesson emerging across cities: cooling interventions are most effective when they are woven into wider housing, livelihood, and community development processes, rather than treated as stand-alone upgrades.

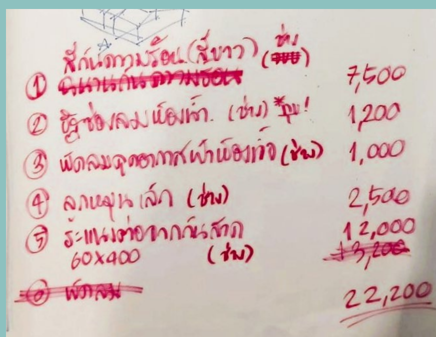
Choosing together: How communities stretch limited funds in Bangkok

When communities in Bangkok received a fixed amount of project funding, the first challenge centered on collective decision-making.

As Muang, a community architect working closely with the groups, explained when talking about the design workshops:

> *"At the start of the design, there may be fifteen things people want to do. But once we calculate the costs, it becomes clear the budget won't cover everything. So the discussion begins: what is really essential? What can we cut? What can we do differently?"*

In many cases, communities refused to drop important ideas. Instead, they looked for ways to make them possible. If a key intervention was short by a few thousand baht, residents might suggest using community builders instead of outside contractors, contributing their own labor, or simplifying details to reduce costs.



Another conversation often followed:

> *"If this money only helps one house, is that the best use? Or should we invest in the community center, so everyone can learn and benefit?"*

These were not easy decisions. They involved debate, negotiation, and compromise. But they also strengthened something less visible than roofs or walls: shared responsibility and a sense of collective ownership.

In this process, project funds remained the only external financial input. What multiplied their impact was community financial management—careful budgeting, shared problem-solving, and a willingness to think beyond individual households. Cooling solutions became both physical upgrades and exercises in cooperation and solidarity.

Community contributions:
Cutting costs & building ownership

Across sites, households and communities contributed far more than money. Their involvement in sourcing materials, negotiating purchases, contributing labor, and managing construction was central to reducing costs, improving quality, and strengthening long-term ownership of cooling interventions.

1) Data collection and local knowledge
Communities played an active role as researchers, documenting conditions inside their homes, taking temperature measurements, and mapping layouts. By carrying out this work themselves—without relying on external teams—households helped reduce costs while keeping responses closely tied to how homes are actually used.

2) Local material sourcing and resourcefulness
Communities identified and secured materials through local networks and familiarity with what is available. By working with accessible and widely used materials, they kept solutions both cost-effective and well adapted to local conditions.

3) Collective purchasing and better deals
Instead of buying individually, communities pooled demand to negotiate better prices and stretch limited budgets. Collective purchasing enabled direct engagement with suppliers and builders, lowering unit costs and simplifying orders. Procurement became a social process, building trust while improving value for money.

4) Labor as a shared investment
Households contributed time and effort, either directly in construction or by supporting skilled workers. From Jeetpursimara to Colombo, families took part in building components, installing improvements, and managing construction with support from neighbors and relatives, helping make the most of available resources.

5) Community-led construction oversight
Communities also played an active role in monitoring construction. Basic tracking tools and collective oversight helped manage progress, materials, and spending, improving transparency and accountability. This day-to-day involvement reduced inefficiencies, prevented cost overruns, and reinforced collective responsibility.

These practices point to a consistent lesson: when communities lead decisions on materials, finances, and construction, resources are used more effectively and benefits extend further. Ownership deepens, learning spreads, and investments are more likely to support the wider neighborhood, beyond individual households.

Scaling cooling through community systems

Perhaps the most important lesson from these financing experiments is that cooling solutions scale and endure most effectively when they are embedded within community systems and supported as part of ongoing housing investment.

Keeping resources circulating inside communities

Revolving and community-managed funds ensure that support does not end with a pilot intervention. As households repay loans, resources return to savings groups or cooperatives and are reinvested in further housing improvements. This circulation reduces long-term dependence on external funding while strengthening collective capacity to manage upgrading independently.

Building confidence in "young" savings groups

In places where community finance systems were newly formed, cooling projects provided an entry point for learning-by-doing. Managing small loans, tracking expenses, and monitoring construction helped build trust, financial discipline, and confidence. These experiences are already encouraging expanded membership and deeper participation, turning cooling upgrades into training grounds for stronger community institutions.

Sustaining improvements through local skills

Maintenance and continuation were intentionally linked to local skills and institutions rather than external technical teams. Households were involved in construction, learned how systems worked, and received guidance on upkeep. Pilot communities now act as informal learning hubs, where residents observe modifications, exchange knowledge, and take up improvements using their own resources.

In practice, these principles are already taking shape. In Jakarta, Yogyakarta, and Davao, community financing systems were structured so that repayments feed back into shared funds, supporting ongoing housing improvements. In Dhaka, newly formed savings groups set aside part of loan repayments for maintenance, while the rest supports improvements for additional households. In Bangkok, the Community Builders Network has played a key role in spreading knowledge, with pilot communities acting as open learning spaces where residents share what they have tried. In these ways, responsibility remains rooted in community practice, reducing long-term costs and reinforcing local capacity.

Together, these pathways show that financing cooling is not just about how much money is available, but about *who controls it, how it circulates*, and *what capacities it builds along the way*. When cooling interventions strengthen savings groups, cooperatives, and community governance, they lay the groundwork for climate-resilient housing systems that can grow well beyond the life of a project.

City	Financing mechanism	Non-monetary household contribution	Replication pathway
Dhaka	25% grant + 75% loan (via savings group)	Supervision	Savings groups + revolving fund
Bhuj	100% grant (+ minor hh contribution)	Labor and self-collected materials	Savings groups + new donor funds
Yogyakarta	50% grant + 50% loan via cooperative	Material procurement, supervision	Revolving fund via cooperative
Jakarta	100% loan via cooperative (+ minor hh contribution)	Material procurement, supervision	Revolving fund via cooperative
Jeetpursimara	29% municipal subsidy + 60% grant + 11% hh contribution	Labor and self-collected materials	Savings groups
Karachi	100% grant	Supervision	NGO-led replication
Davao	100% loan via HOA (+ minor hh contribution)	Material procurement, supervision	Revolving fund via HOA + donor funds
Colombo	100% grant (+ minor hh contribution)	Supervision	Savings groups
Bangkok	100% grant (+ minor hh contribution)	Material procurement, supervision, labor	CODI-led replication

Strategic Outcomes:

Unlocking opportunities beyond the houses

What began as a set of small, household-level interventions has started to open up a wider field of action. As cooling solutions were introduced, monitored, and fine-tuned in real homes, their effects did not remain contained within the walls of those houses. They began to influence conversations, relationships, and decisions beyond the immediate sites of implementation.

The project has helped reposition urban heat—not only as a condition to cope with, but as a shared challenge that can be addressed through locally grounded solutions. The combination of lived experience and measurable results has created a new kind of entry point, allowing communities, practitioners, researchers, and authorities to engage with heat in concrete and actionable ways.

These changes are still taking shape, but they suggest how progress can begin: through partnerships, growing awareness, and the gradual alignment of different actors around a common issue.

Building new partnerships around urban heat

One of the most important outcomes of this work has been the formation and strengthening of partnerships that connect community-led responses to urban heat with institutional actors. By demonstrating tangible improvements inside ordinary living spaces, the project created a credible basis for engagement across sectors that do not often work together around housing and climate adaptation.

At the level of local government, several cities are already seeing early forms of interest. In Jeetpursimara, municipal authorities have recognized the value of passive cooling strategies and bamboo-based construction, committing support for continued climate-adaptive housing development and exploring how these approaches could inform local guidelines. In Sri Lanka, the Colombo Municipal Council has supported the initial stages of the project and is expected to engage further as the documentation of cooling solutions is consolidated.

In Davao, the City Housing Office is considering adopting cooling measures to support additional housing units, marking an important step toward institutional uptake. And in Bangkok, the team is actively exploring how cooling principles could be integrated into existing upgrading systems, particularly through the Baan Mankong program, with growing involvement from local authorities and city committees in incorporating these approaches into future housing processes and construction guidance.

Meanwhile, links with technical and academic institutions have helped deepen and validate the work. In Bhuj, work with experts, including connections to the Massachusetts Institute of Technology, has strengthened understanding of heat performance and material behavior. In Dhaka, exchanges with researchers from BRAC University have sharpened frameworks used to assess cooling features. In Jeetpursimara, collaboration with partners working on earth construction, including organizations such as CRAterre, has supported context-responsive building approaches. In Jakarta, long-standing relationships with Universitas Indonesia have contributed to research and design, while newer engagement with Greenpeace is opening pathways for future work on urban heat and climate-responsive housing.

Altogether, these established and emerging partnerships are beginning to create the institutional connections needed to move from experimentation toward broader adoption. They do not yet guarantee scale, but they signal that the work is starting to resonate beyond the communities where it began.

Raising awareness: From everyday experience to shared understanding

Alongside partnerships, the project has played an important role in making urban heat more visible, both within communities and in wider public discussions. In many contexts, heat has long been experienced as an everyday hardship, yet rarely framed as a collective issue that can be addressed through design, planning, or policy. A range of awareness activities began to shift this perception.

In Karachi, teams organized discussions in neighborhoods, schools, and clinics, opening conversations about heat stress, housing conditions, and practical ways to improve thermal comfort. In Colombo, locally produced leaflets and outreach activities helped communicate strategies, while also promoting ideas such as reducing clutter inside homes ("less is cool") to improve airflow and usability of space. In Jakarta and Yogyakarta, public dialogues brought together community members, policymakers, academics, and practitioners to discuss heat in relation to low-carbon housing and urban development. These efforts were not only about sharing information, but about translating lived experience into something that could be collectively understood and acted upon.

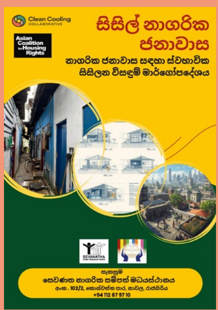
In parallel, an equally important shift took place within communities themselves. As households engaged in measuring temperatures, observing changes, and discussing results with neighbors, heat began to be understood not just as an unavoidable condition, but as something that can be modified through design and collective action. This growing awareness has been critical in building confidence, interest, and the willingness to experiment further. In this way, awareness has moved in two directions at once: outward, toward institutions and public discourse, and inward, strengthening community understanding and agency. Together, these shifts lay the groundwork for broader engagement and future scaling.

Generating knowledge for others to build on

As experiences accumulated across cities, teams began translating what they had learned into tools that others could use. While each context is different, a common direction has emerged: documenting solutions not as fixed designs, but as adaptable approaches.

Teams are developing toolkits, guidebooks, and technical notes that capture both the *how* and the *why* of passive cooling. These materials bring together construction details, material choices, costs, and step-by-step processes, but also reflect the decision-making behind them: how households prioritized improvements, how constraints were navigated, and how modifications were adjusted over time.

In several cities, these efforts are already taking shape. In Colombo, a guidebook is being prepared to document cooling solutions for urban poor settlements. In Indonesia and Thailand, toolkits are being developed to support communities and upgrading processes. In Bhuj and Jeetpursimara, the focus includes linking cooling strategies with traditional knowledge, local materials, and craftsmanship, ensuring that what is documented is not only technically sound, but culturally grounded.



In Nepal, this work is beginning to connect directly with public systems. The municipality has signaled plans to formalize these practices into guidelines for wider use, highlighting sustainable construction methods, traditional techniques, and cooling interventions that can be applied in both new and existing homes.

These tools matter because they extend the life of this work beyond the pilot phase. They allow knowledge to travel across neighborhoods, between cities, and into institutions. Instead of remaining isolated examples, the responses tested through the project begin to form a shared reference point for communities, builders, practitioners, and local governments working toward more climate-responsive housing.

Unlocking resources and expanding investment

Beyond everything else, the project has also begun to unlock resources that can support further implementation. While the initial interventions were relatively small in scale, their visibility and effectiveness have helped build confidence among partners and open pathways for additional investment.

In Bhuj, this momentum is already visible. Based on the success of the pilots, funding has been secured to extend cooling improvements to around 70 additional households—a substantial expansion from the initial set of 25 houses. The next phase will also explore applications in housing for migrant workers, adapting the approach to different forms of vulnerability within the city.

In Davao as well, new resources are beginning to flow through multiple channels. Funding has been secured for an additional four households to adopt similar cooling measures through a collaboration between local teams and Slum Dwellers International. Alongside this, LinkBuild—one of the local partner organizations—has begun exploring the application of similar upgrades in at least ten more houses, building on the initial experience.

In Jeetpursimara, while large-scale expansion funding is still developing, the project has already gained strong institutional backing. Recognizing the value of combining bamboo construction with passive cooling strategies, the municipality has committed to supporting the continuation and completion of housing efforts under this approach. This kind of endorsement is critical, as it signals the potential for integrating these methods into broader housing programs.

Elsewhere, smaller but equally important financial pathways are taking shape. Community savings groups, revolving funds, and local financing mechanisms are being strengthened, enabling households to continue upgrading their homes incrementally, even in the absence of large external funding streams.

These developments show that scaling does not depend on a single source of funding. It emerges through a combination of community finance, institutional support, and targeted external investment. What this experience has begun to demonstrate is that when solutions are affordable, visible, and drawn from real needs, they create the conditions for resources to follow.

From pilots to demand: When solutions gain ground

One of the clearest signs that these approaches are working is not only what the measurements show, but how people respond. As soon as the first houses were completed, attention began to grow—first among neighbors, then across communities.

In several cities, this process is already in motion. In Davao, what began as a small set of interventions has already started expanding through homeowners' associations. After seeing both the gains in comfort and the affordability of the accompanying loan scheme, neighboring groups expressed interest in applying similar upgrades. The initiative has already extended to one additional association, with others preparing to follow, showing how structured community systems can support gradual scaling.

In Jeetpursimara and Colombo, demand is also expressed directly, with households beyond the initial participants requesting support to replicate these measures, while community leaders are discussing how these approaches could be introduced more widely across settlements. Visits to upgraded homes allow residents to see and assess the results for themselves, helping build momentum. In Dhaka and Bangkok, this demand is also beginning to take shape, as residents and builders adopt techniques from the pilot houses and look to apply similar solutions in their own homes.

What is striking across these examples is that this demand is not driven by external campaigns or technical persuasion. It emerges from lived experience. When a room becomes usable again, when sleep improves, when costs decrease, people notice and they ask how to do the same.

Because the solutions rely on simple construction techniques, locally available materials, and incremental investment, they are seen as achievable. Households recognize that these are not one-off interventions, but steps that can be adapted and implemented little by little. What began as individual improvements is gradually becoming a shared direction.

"By bringing cooling into our Community Action Plan, we've been able to better understand our challenges and take action ourselves. At the same time, we are working hand in hand with the municipality, sharing our process and helping them see the value of what communities can do."

—Abdul, Lumanti Support Group for Shelter, Jeetpursimara

Taking Cooling to Scale:

From small experiments to cooler cities

As interest grows and ideas begin to travel from one household to another, a larger question comes into view: *how can these solutions take root more widely?* In places where heat is becoming harder to escape, these experiences point not only to what works, but to how such efforts can expand step by step, through the same processes that made them possible in the first place. The same pathways that enabled these first interventions—collective decision-making, small investments, and ongoing adaptation—offer a foundation for broader expansion.

Heat is rising, and cities are not ready

While these ideas begin to circulate, the pressures they respond to are also intensifying. Global climate projections indicate that average temperatures could increase by up to 4°C over this century if current emission trends continue. Rising temperatures and more frequent heatwaves are already making urban heat an urgent challenge in Asia, with higher averages and more extreme events expected in the coming years.

Dense construction, disappearing vegetation, and expanding paved surfaces are creating environments where heat is difficult to escape. For families living in small homes inside crowded settlements, heat builds up day after day, shaping how people rest, move, and manage life indoors.

Meanwhile, the conditions around energy are becoming more uncertain. Electricity costs are rising, supply is often unreliable, and large-scale dependence on air conditioning is neither affordable nor sustainable. Cooling cannot remain a solution only for those who can pay for it. The question is no longer how to cool a few houses, but how entire neighborhoods and eventually whole cities can stay livable as temperatures continue to climb.

This is where the scale of the challenge becomes clear. What would it mean if many houses, across a settlement, could release heat instead of trapping it? If roofs reflected rather than absorbed, if air could move again, if shaded outdoor spaces allowed people to sit, work, and rest without exhaustion? When improvements begin to spread, the effect is not only inside individual homes—it starts to change how heat is experienced across the city.

What has been tested here starts from that premise. Instead of importing ready-made solutions, the process builds on what people are already doing—adjusting roofs, walls, openings, and daily routines—and strengthens these practices through small, practical interventions. Communities, builders, and technical partners work together, testing, adjusting, and sharing what works, house by house.

How small changes begin to scale

Scaling does not begin with a single solution, but with a way of combining and prioritizing small ones. In many cases, households did not try to improve everything at once. A family with several members might focus first on the room everyone shares at night. A mother spending many hours a day cooking for a large family may focus on making the cooking area more usable. A household running a small business from home may concentrate on the area where work happens, where heat directly affects income.

As more households began experimenting, solutions were not simply repeated—they were **adjusted, combined, and sequenced** over time. A ceiling might be added first, followed by ventilation or shading when resources allowed. In other cases, two smaller changes were introduced together to make a space usable again. What matters is not the order itself, but the ability to respond to immediate needs while keeping future improvements open.

This is how scaling takes shape in practice. It allows limited resources to go further, starting with one room, one surface, or one activity, and expanding step by step. Rather than waiting for complete solutions, households build them incrementally, linking small changes into larger shifts that reflect how homes are used and how improvement can realistically unfold.

"No single principle is enough—orientation must balance sunlight, ventilation, and community life. The challenge is to layer ideas and respond to multiple needs at once."

—Muang, Community Organizations Development Institute / Crosss, Bangkok

Principles for community-led passive cooling

From Colombo to Jakarta and from Bhuj to Davao, communities have tested many different ways to deal with heat. The solutions vary, but the underlying logic begins to repeat. Certain approaches consistently make a difference, keeping spaces cooler, making improvements more affordable, and allowing them to spread from one house to the next.

What follows draws out these shared principles. They are not fixed designs or technical prescriptions, but practical guidance shaped through use. They show how cooling can take hold in real homes, under real constraints, and how small changes can be combined, adapted, and scaled over time.

"Conditions may differ from one context to another, but the same principles can be adapted to reduce heat and improve comfort."

—Ruengyuth, Community Organizations Development Institute, Bangkok

1 AFFORDABILITY COMES FIRST

Cooling solutions only spread when they are within reach. For households managing tight budgets, even modest improvements must compete with other urgent needs. Successful interventions therefore rely on low-cost materials and simple construction techniques that can be introduced gradually, without requiring large upfront investments. They also allow households to improve their homes little by little, aligning costs with what they can realistically afford at any given time. This makes cooling not a one-time expense, but part of an ongoing process of incremental upgrading. Because cooling improvements are often combined with other housing needs, such as repairs or extensions, keeping costs low becomes even more important if solutions are to spread beyond a few pilot houses.

2 WORK WITH WHAT ALREADY EXISTS

Homes in informal settlements are rarely blank slates. They have been built step by step over many years, often sharing walls with neighboring houses and relying on structures that are difficult to alter. Rather than introducing entirely new building systems, many of the most effective solutions focused on improving what was already there. Adding insulation beneath roofs, introducing ventilation openings, installing reflective layers, or modifying small parts of the building envelope proved both practical and achievable. By building on existing structures instead of replacing them, cooling features can be introduced gradually without interrupting ongoing use.

3 COMMUNITIES LEAD THE DESIGN PROCESS

Cooling responses work best when households are actively involved in shaping them—from identifying problems to deciding what to implement and how to adapt it over time. Residents know their own spaces, priorities, and constraints, and are best placed to make decisions about what is feasible and worth investing in. At the same time, these decisions are strengthened when they are discussed and negotiated collectively. Within communities, households compare experiences, weigh options, and agree on approaches that make sense across different homes. Such a shared process helps ensure that solutions are accepted and able to spread. It also creates a form of expertise rooted in practice: the ability to prioritize, combine improvements, and make the most of limited space and resources. When both individual and collective knowledge shape the design process, modifications are more grounded, more efficient, and more likely to last.

4 COOLING MUST FIT EVERYDAY LIFE

In dense settlements, homes and everyday life are shaped by overlapping uses and limited space. Cooking, sleeping, working, and studying often take place in the same room, sometimes at the same time. Shared kitchens, narrow passages, and tightly packed neighbors further shape how space can be used. Cooling strategies need to work within this complexity without disrupting routines or overlooking these constraints. Cultural preferences also play a role. Choices about materials, colors, and house appearance often reflect local traditions and personal pride, while expectations around privacy and openness influence how spaces are used. Introducing new ideas therefore requires careful dialogue to ensure that improvements remain compatible with how people want their homes to look and feel. Designing with these realities in mind greatly increases the likelihood that cooling solutions will be embraced and maintained.

5 LOCAL MATERIALS AND SKILLS MAKE SOLUTIONS SUSTAINABLE

Local materials play a central role in shaping and sustaining cooling solutions. Whether drawn from the surrounding environment or from everyday materials available in local markets, like roof tiles, insulation sheets, and shading nets, these can be adapted to improve airflow and reduce heat gain. Working with what is already available keeps costs manageable and ensures that repairs can be carried out using resources at hand. It also builds on vernacular knowledge embedded in local building practices. Within this context, local craftsmanship allows these solutions to take hold and spread. Builders understand how these techniques work and can begin applying them in other houses. Over time, knowledge moves through everyday construction practices, as builders refine their skills, adapt what they learn, and maintain continuity within the communities where they live and work.

6 SIMPLE SOLUTIONS TRAVEL FURTHER

The ideas that spread most quickly are usually the simplest ones. When cooling responses rely on straightforward construction methods and familiar materials, households feel confident they can implement them without outside assistance. Because the designs are easy to grasp and adapt, neighbors begin trying them out in their own homes, adjusting details as they go. This simplicity allows solutions to move organically through communities. Keeping the designs practical and accessible ensures that passive cooling strategies can reach far beyond the original project sites.

7 SEEING THE EVIDENCE BUILDS CONFIDENCE

Temperature measurements played an important role in building confidence in the cooling solutions. Residents participated directly in documenting conditions before and after the interventions, tracking changes throughout the day. When people could see the numbers—and feel the difference inside their homes—the impact became undeniable. A few degrees of temperature reduction may sound modest on paper, but for families living through intense heat, the improvement is immediately noticeable. Evidence gathered by communities themselves also became a powerful way to explain the benefits to neighbors, visitors, and local organizations interested in adopting similar approaches.

8 FLEXIBILITY OPENS THE DOOR TO INNOVATION

Perhaps the most valuable lesson was the importance of leaving room for experimentation. As households began implementing cooling solutions, many adapted the ideas to suit their needs, budgets, and available materials. These small variations often produced creative new approaches that might never have emerged through rigid planning. Constraints like limited space, tight finances, or unusual house layouts often pushed residents to think carefully and work creatively with what they had. Allowing this flexibility helped transform the initiative into a shared learning process, where communities continuously optimized the solutions together.

“Because we experienced the results ourselves, we can now confidently share these ideas with others.”

—Judy, a resident of the SAMASOL HOA, Davao

What is needed to scale community cooling

If these principles are already being demonstrated in practice, the challenge is not to keep inventing new solutions, but to create the conditions that allow them to spread further and faster.

PUBLIC POLICY: Recognizing heat as a housing and health priority
Local governments have a critical role to play by recognizing urban heat as a serious public health and planning challenge. Housing upgrading programs, settlement improvement initiatives, and climate adaptation strategies all offer entry points to integrate passive cooling approaches. Supporting improvements through technical expertise, incentives, and appropriate financing mechanisms can significantly improve living conditions without requiring large-scale redevelopment.

PRACTICE AND DESIGN: Shifting how housing is improved
Housing practitioners, architects, and planners also have an opportunity to rethink how homes are designed and upgraded in hot climates. Greater attention can be given to design strategies that reduce heat through orientation, shading, ventilation, and material choices, rather than relying primarily on mechanical cooling technologies. Working with existing structures, materials already in use, and incremental processes will be key to making these ways of working viable at scale.

FINANCE: Enabling small investments at large scale
There is a clear role for funding institutions, development banks, and public programs to recognize that these interventions are low-cost yet high-impact. Developing financing mechanisms that enable household- and neighborhood-level improvements can unlock large-scale change. Flexible funding, blended finance, and investment in community-based systems can help extend these solutions to many more people. At the same time, accessible local financing remains essential. Community savings groups, small housing loans, and cooperative mechanisms enable households to upgrade their homes gradually, spreading costs over time and reducing financial risk.

KNOWLEDGE AND RESEARCH: Strengthening and refining practice
Researchers and academic institutions can contribute by continuing to document and measure the impacts of passive cooling strategies. Simple evidence, such as temperature measurements and household experiences, helps demonstrate effectiveness and strengthen the case for wider adoption. Alongside this, research into materials, construction techniques, and technical guidelines can help refine these approaches, provided it remains tied to real living conditions.

COMMUNITY NETWORKS: Driving learning and spread
Community networks remain the most powerful drivers of change. When residents share their experiences with neighbors, visitors, and other communities, ideas travel quickly. Demonstration houses become learning sites, and knowledge spreads through conversations and construction practices. It is through these networks that small improvements begin to move beyond individual homes.

From pilots to systems change

Cooling cities is not only about lowering temperatures. It is about creating homes and neighborhoods where people can live with dignity, health, and comfort even as the climate changes. Many of the most practical and adaptable solutions are emerging from the very communities most affected by heat, and least responsible for its causes. This is not accidental. Working within tight constraints of space, income, and materials, residents develop approaches that are inherently efficient, affordable, and closely aligned with daily life—qualities that externally designed solutions often struggle to achieve.

The experiences documented in this newsletter show that meaningful change can begin with grounded interventions that respond to real living conditions. When supported and connected, these efforts can begin to shift wider systems: how housing is designed, how upgrading is financed, and how climate responses are understood and implemented at the local level. What is needed now is recognition, stronger collaboration, and sustained support so that these efforts can grow into broader changes, making cities cooler and more livable for everyone.

Toward cooler homes and fairer cities . . .

"Passive cooling is not only about improving individual houses—it's about improving whole communities. To make it work at scale, we need collective action, support from government, and the belief that change cannot happen house by house, but together."

—Ainun, a community leader in Yogyakarta

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Asian Coalition for Housing Rights

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