



# THE STORY OF INDIA'S FIRST STATE-WIDE COOL ROOF POLICY

## Introduction

India, with its growing urban population and fast-growing economy, is striving to balance climate change with the rising need for cooling. Extreme heat in India is not merely an inconvenience; it seriously endangers public health. The Intergovernmental Panel on Climate Change (IPCC)'s 6<sup>th</sup> assessment report on Climate Change Impacts, Adaptation, and Vulnerability highlighted the intensifying heat and humidity in India, which could pose increasing challenges to human survival.<sup>1</sup> As per the study by Indian Meteorological Department (IMD) and Ministry of Earth Sciences, India, the average number of heat wave events had increased by 138% per year between year 2000–2019 as compared to year 1980–1999.<sup>2</sup> Rising heat brings with it the challenge of providing access to climate-friendly cooling solutions. Sustainable Energy for ALL's "Chilling Prospects" report identified India as having the largest number of people- 309.2 million - at high risk due to lack of access to cooling.<sup>3</sup>

With less than 10% of India's households having air conditioning, millions more are expected to purchase air conditioners, leading to soaring demand for electricity.<sup>4</sup> At the same time, India has nearly half a billion people living in densely populated cities, with skyrocketing development that converts green open space into paved, heat-trapping roofs and roads. These hot surfaces worsen the urban heat island effect (UHI)<sup>i</sup>, driving temperatures even higher and ratcheting up the



**Figure 1: Cool Roof Pilot Installation Underway in Hyderabad on Low-Income Household Roof, 2017.**

Credit: Administrative Staff College of India (ASCI)

need for even more electricity to keep cool with fans and air-conditioning.

In this scenario, cool roofs and surfaces provide a low-carbon, low-cost cooling solutions that can help people cope with extreme heat, reduce UHI effects, and mitigate the need for air conditioning. Cool roofs are installations designed to reflect solar radiation and prevent the absorption of heat onto a building's roof surface and keep indoor temperature lower than conventional roofs. Also known as solar reflective and high albedo roofs, these types of roofs have been widely studied and adopted globally.<sup>5</sup> When implemented at scale, cool roofs can help reduce the UHI effect and benefit the entire city.<sup>6</sup>

<sup>i</sup> An urban area that is significantly warmer than surrounding rural areas because natural land cover has been replaced by pavement and other surfaces that absorb and retain heat.



This factsheet highlights the experience of the Indian state of Telangana in pioneering a state-wide cool roofs policy.

## About Cool Roofs

Cool roofs are one of the simplest and most cost-effective ways to help people cope with extreme heat. The roof is an important component of a building, having a direct impact on the building's energy needs and ensuring thermal comfort to its occupants. Cool roofs function primarily by reflecting more sunlight incident on the roof back to the atmosphere compared to a regular, darker roof surface. These roofs are prepared, covered or coated with materials (Figure 2) that have special characteristics (high solar reflectance and high thermal emittance). Depending on various parameters (such as the location, type of roof, and reflectance of the cool roof's material), cool roofs can help keep indoor air temperatures lower by as much as 2.1 to 4.3°C as compared to traditional roofs.<sup>7</sup> Cool roofs require only limited maintenance, and a cool protective coating can be reapplied periodically depending on the product and the sub-surface. Cool roof coatings also typically increase the durability of the roof materials beneath the surface.

**Figure 2: Types of Cool Roof Materials**



ii Peri-urban areas (peripheral – around, about or beyond) are those non-urban landscapes adjacent to or surrounding metropolitan settlements.

Cool roofs are receiving increasing attention from India's policymakers as necessary components of a comprehensive national cooling strategy. In 2019, the Government of India released a national document titled the 'India Cooling Action Plan (ICAP),<sup>8</sup> providing an integrated vision and strategy towards meeting the country's cooling needs across sectors over a twenty-year time horizon. Reducing cooling energy demand is key to implementing the ICAP. The plan proposes an approach that reduces the cooling energy demand through climate-appropriate and energy-efficient building design and low-cost strategies such as cool roofs. Specifically, the ICAP recommends cool roof programs to provide thermal comfort for Economically Weaker Sections (EWS) and Low-Income Groups (LIG) through local Heat Wave Action Plans. Similarly, in India's National Mission on Sustainable Habitat<sup>9</sup> under the National Action Plan on Climate Change, cool roof techniques are recommended for all new constructions of more than 20,000 sq. m area in peri-urban areas.<sup>ii</sup>

## Telangana's Focus on Cool Roofs and Heat Mitigation

The State of Telangana, home to about 40 million people, is situated on the centre-south stretch of the Indian peninsula on the high Deccan Plateau and is vulnerable to heatwaves owing to its geographic and topographical context. The state is witnessing an increasing number of heat events with nearly 120% increase in the average number of heat wave days reported in Telangana during years 2010-2019 as compared to year 2000-2009.<sup>10</sup>

Telangana is the 3<sup>rd</sup> most urbanised state in the country, with 47% of its population as urban.<sup>11</sup> Hyderabad, the state capital, is one of the fastest-growing cities in India, with a population of about 3.9 million.<sup>12</sup>

Telangana initiated a cool roofs pilot in 2017 in collaboration with Natural Resources Defense Council (NRDC), Administrative Staff College of India (ASCI), International Institute of Information Technology-Hyderabad (IIIT-H) and Plaksha University. Led by Telangana's Municipal Administration and Urban Development (MA&UD) and Greater Hyderabad Municipal Corporation (GHMC), the program involved developing citizen awareness of cooling technology and cool roof installation in low-income areas.<sup>13</sup> With the success of the initial pilots, Telangana began efforts to

develop a state-wide Cool Roof Policy and establish an implementation framework to facilitate broader efforts. The development of this policy involved key stakeholders, including real estate developers, architects, engineers, and Indian and international experts. Telangana's 2021 Heat Action Plan included a draft cool roofs policy as a recommendation for action to build resilience to extreme heat. Incorporating inputs on the draft policy, in 2023, Telangana became the first Indian state to launch a Cool Roof Policy and commenced a five-year plan for mitigating UHI effects.

## TELANGANA COOL ROOF POLICY

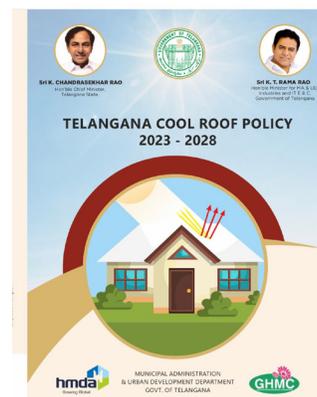
With a vision to make Telangana a heat-resilient state, Telangana's Cool Roof Policy<sup>14</sup> centres around four key objectives:

- Driving widespread adoption of cool roofs across the state
- Establishing a robust institutional framework for policy implementation
- Identifying financing mechanisms and conducting awareness campaigns
- Supporting workforce development and training for cool roof installations

The policy mandates cool roofs for all government, non-residential, and commercial buildings. Residential buildings with a plot area of 600 sq.yds. or more are also required to have cool roofs, while smaller residential buildings have the option to adopt them voluntarily. To ensure compliance, the government has integrated cool roofs into the Telangana State Building Permission Approval and Self-Certification System,<sup>15</sup> where the respective Urban Local Body ensures the cool roof installation before issuing the occupancy certificate. For cool roof implementation in low-income households not covered under government-funded low-income

housing projects, a program of implementation will be led by city-level authorities through the Heat Action Plans.

Telangana's Cool Roof Policy covers a period from 2023 to 2028, and will have a multifaceted impact, including mitigation of UHI effects through city-wide installations. Within its first two years, the state policy aims to install 20 sq.km of cool roof within the Hyderabad city limits and an additional 10 sq.km across the rest of the state, with a total target of 30 sq.km. By 2028, the vision extends to 300 sq.km of cool roof in the state, with 200 sq.km in Hyderabad and 100 sq.km beyond the capital city's limits.



## SAVINGS AND IMPACT

As noted in the Telangana Cool Roof Policy report, preliminary estimates indicate that the implementation of cool roofs on 300 sq.km of roof area over a five-year period could potentially result in an annual electricity savings of approximately 600 million units (kWh) for the state of Telangana. Additionally, research studies have shown that retrofitting 100 sq.km of roof space has a radiative forcing effect equivalent to a one-time reduction of 10 tonnes of CO<sub>2</sub>



**Table 1: Annual Targets of Cool Roofs under the Telangana State Cool Roof Policy**

Year	Hyderabad Cool roof area (sq.km) targets for respective years	Rest of Telangana Cool roof area (sq.km) targets for respective years	Annual Total Target for Telangana (sq.km)
2023-24	5	2.5	7.5
2024-25	20	10	30
2025-26	40	20	60
2026-27	60	30	90
2027-28	75	37.5	112.5
<b>Total Aggregated Area by 2028-2029</b>	200	100	300

emissions. Consequently, the installation of cool roofs across 300 sq.km in Telangana over five years could lead to a one-time carbon offset of 30 million tonnes of CO<sub>2</sub> emissions.<sup>16</sup>

## Guiding Steps for State Cool Roofs Policy Development and Implementation

The development of the state cool roofs policy consisted of six overlapping steps spread over two years (Figure 3).

- Implementation: community members teams partnered with ASCI, IIIT, and NRDC to design, install and monitor results, with inputs from Hyderabad officials
- Materials and Costs: Dupont India supplied a high-density polyethylene cool roof membrane, Tyvek, for the pilot.
- Results: indoor air temperature was lower by an average of 2°C (3.6°F) in the homes with cool roofs compared to similar homes without cool roofs.
- Resident Feedback Survey: 76% of the trial group



Figure 3: Steps for Development of State Cool Roofs Policy

### STEP 1: ESTABLISHING A LOCAL EVIDENCE BASE THROUGH DEMONSTRATIONS

In 2017, GHMC and partners ASCI, IIIT-Hyderabad, and NRDC implemented a cool roof pilot in Devarakonda Basti, Hyderabad. Key project details:

- Pilot Size: 25 city roofs in one low-income neighbourhood with an additional 15 households serving as a control group

residents expressed enthusiasm for the cool roofs. The pilot inspired several other houses in the neighbourhood to apply makeshift cool roof membranes to replicate cool roofs

In addition to this pilot project, the project team conducted additional case studies, including cool roof monitoring at Garden Housing Society in Kompally, the application of cool roof coating with Nippon Hydroshield Damp Proof coating, and the installation



Figure 4: Mosaic Roof Installation in Kompally, Hyderabad, Telangana.

Credit: Aga Khan Agency for Habitat

of cool roof tiles at a residence in Hyderabad. These case studies collectively contributed to the local evidence base documenting the benefits and viability of cool roof technologies. The results of these pilots were documented and presented to various stakeholders in the state to build support for cool roofs implementation.

## **STEP 2: STAKEHOLDER CONSULTATION ON ADOPTION OF COOL ROOFS**

Project collaborators organized multiple discussions involving a range of stakeholders in Telangana, including the state Energy Department, Roads and Buildings Department, Housing Department, Directorate of Town and Country Planning, Urban Local Bodies, real estate developer bodies such as the Confederation of Real Estate Developers Association of India (CREDAI), and The National Real Estate Development Council (NAREDCO). These consultations were pivotal in addressing the technical aspects of implementing cool roofs and building the confidence of real estate developers in the benefits of the technology.

Technical discussions at these workshops delved into critical aspects of cool roof implementation and user needs, including the selection of appropriate roofing materials, installation techniques, and maintenance requirements. Additionally, energy efficiency, environmental impacts, and the financial aspects of cool roof installation were thoroughly examined. The policy was shaped and tailored to meet the specific needs of the community based on the stakeholders' input received in these technical discussions.



**Figure 5: ASCI, NRDC and IIIT-H in discussion with state stakeholders on the implementation of cool roofs in Telangana, organized by GHMC**

Credit: Administrative Staff College of India (ASCI)

## **STEP 3: DRAFT POLICY AND OPEN PUBLIC CONSULTATION**

NRDC, ASCI and Plaksha University, working closely with MA&UD after extensive stakeholder consultations and technical discussions, developed a comprehensive draft of the cool roof policy. This draft policy underwent rigorous refinement through expert input, where architects, engineers, and environmental specialists provided valuable insights. Additionally, MA&UD and the Energy Department of Telangana made the draft cool roofs policy available online for public comments. This iterative process ensured that the final policy for cool roofs was well-informed, inclusive, and reflective of the needs of the people of the state.

## **STEP 4: AMENDMENTS IN REQUISITE GOVERNMENT PROVISIONS**

In 2018, the Government of Telangana mandated the energy conservation building code (ECBC) rules, known as Telangana ECBC, for commercial buildings with a plot area of 1,000 square meters or more, or a built-up area of 2,000 square meters or more. The state has an online system for building permits, which includes Telangana ECBC (TSECBC) requirements. This implied that commercial buildings must follow TSECBC, including using cool roofs in new construction.

A special provision enabled the adoption of cool roofs in residential buildings and commercial buildings not covered by TSECBC. MA&UD issued a Government Order instructing regional offices, local bodies, and district collectors to take necessary action, with a copy to the Director of Town & Country Planning, Hyderabad. Empanelled ECBC Third Party Assessors are responsible for confirming cool roof compliance for TSECBC buildings, and ULB officials will verify it for others before issuing occupancy certificates.

These provisions helped ensure compliance with cool roofs implementation through online building permits and verification during occupancy checks. Additionally, the relevant authorities create a list of agencies that handle cool roof, including installations, operations and maintenance, and make this list available on their websites. Builders and developers have the flexibility to choose any of the enrolled agencies for installation.

## STEP 5: RELEASE OF THE COOL ROOFS POLICY

Government of Telangana officially launched the Cool roofs policy in April 2023, an important milestone for the states and a promising step forward in scaling up this low-cost, passive cooling solution for strengthening extreme heat resilience across the country.

## STEP 6: IMPLEMENTATION PLAN

The cool roofs initiative is led by the MA&UD in Telangana, with the responsibility for policy implementation resting with ULBs. The policy's design and oversight will be the responsibility of a Cool Roofs Committee, which will be formed by the MA&UD and include representatives from various key agencies: Energy Department, Roads and Buildings Department, Housing Department, Directorate of Town and Country Planning, ULBs, Real estate developer bodies like CREDAI and NAREDCO, and academic experts such as ASCI, IIIT-H, NRDC, Plaksha University and any other members/agencies as decided by the MA&UD. The MA&UD appointed three nodal agencies that direct program execution, enforce cool roof mandates, and fund implementation. For Hyderabad, implementation falls to ULBs such as GHMC and Hyderabad Metropolitan Development Authority, and for the rest of the state by Directorate of Town and Country Planning. ULBs engage with knowledge and community partners, city departments, and residents to ensure effective policy enforcement and to implement awareness campaigns. MA&UD issued a circular Cool Roof Policy Circular for all ULBs in the state, mentioning the district-level targets for cool roofs to be implemented by the respective ULB.

## Key Factors for Effective Implementation

The release of the Telangana Cool Roofs Policy will encourage the buildings sector to adopt innovative, low-cost, and low-carbon passive cooling solutions. Key factors for successful implementation of this policy include the following:

- **Availability of materials, vendors, and skilled workforce:** The roofing industry's current readiness to produce and install cool roof materials on a larger scale is limited. Cool roof technologies require careful consideration of material type, reflectivity, thermal emittance, solar reflective index and colour. There are

different types of tiles, membranes, and coatings available. Determining the correct material for a building can be complex and necessitate technical expertise and guidance. Training and capacity building is required to ensure a skilled workforce capable of implementing these technologies. Though most cool roof paint manufacturers provide implementation services along with the product, thus ensuring the proper application and effectiveness, there is still a need for greater skill development and training.

- **Locally available testing facilities:** Ensuring cool roof policies achieve their intended goals effectively requires ongoing monitoring and evaluation, including measuring cool roof impacts on indoor temperatures and energy consumption. Currently, there are limited facilities to test the performance of cool roof materials. Manufacturers often need to submit their products for independent testing by labs in other states.
- **Robust data on the performance of materials after natural exposure:** Cool roof materials have different wear and tear patterns that affect their lifespan and maintenance requirements. Ensuring the long-term durability and reliability of cool roof solutions is crucial through standard testing protocols.
- **Incentives for the urban poor:** Cool roof materials and technologies can be more expensive upfront than traditional roofing options. This can deter building owners, especially the urban poor, from adopting cool roofs. Cost-effective solutions and mechanisms to make cool roof installations more financially attractive to builders and consumers through government incentives and subsidies can be highly impactful.

The groundbreaking Telangana cool roofs policy, offers important lessons, especially for other states that are considering development of their cool roofs policies. Effective public outreach and awareness campaigns are essential to encourage adoption. It is also important to identify certifying agencies that ensure compliance with the policy. Existing zoning regulations, building codes, and other local policies may not always accommodate or incentivise the use of cool roofs. Overcoming regulatory barriers to their adoption will require collaboration amongst policymakers, industry stakeholders, and relevant agencies.

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# Highlighted Reports



**Climate change and 2030 Cooling Demand in Ahmedabad, India: Opportunities for Expansion of Renewable Energy and Cool Roofs**



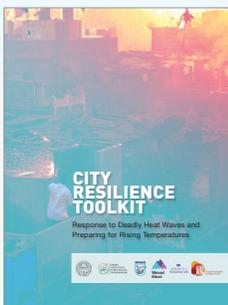
**KEEPING IT COOL: How cool roofs program, protect people, saver energy and fight climate change**



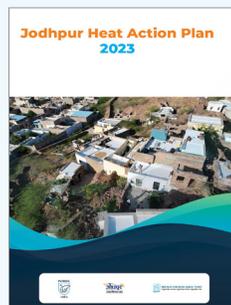
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