



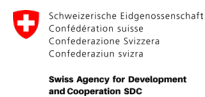
Mainstreaming Passive Cooling in Green Schools

Learnings from Tamil Nadu's Cool Roof Initiative

Under the Framework of



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Why Cool Roofs



Cool roofs are adopted as an effective passive cooling measure to reduce heat gain through the roof—the most heat-exposed part of a building—thereby lowering indoor temperatures and heat stress. A key advantage of cool roof interventions is their ease of installation, as they can be implemented quickly on existing buildings with minimal structural modification, limited site preparation, and low disruption to regular building use, making them especially suitable for rapid, large-scale deployment in occupied public facilities such as schools.

Tamil Nadu's rising temperatures and urban heat are intensifying heat stress in schools, where concrete roofs trap heat during peak learning hours. Cool roofs (Material with high Solar Reflective Index) offer a low-cost, scalable, and immediately deployable solution by reflecting solar radiation and reducing heat gain. Under the cool roof pilot initiative of the Green School Programme, classroom temperatures were reduced from 31–32°C (pre-intervention) to 26–28°C (post-intervention), maintaining thermal comfort for most school hours.



Reflective coatings and tiles bounce sunlight instead of absorbing it, keeping roofs cooler.



Cool roof retrofits under Tamil Nadu's Green Schools can lower classroom indoor temperatures and contribute to mitigating urban heat island effects.



A drop of 4–8°C indoors improves comfort and focus, reduces reliance on fans or cooling, and reduces electricity bills.



This supports student health, learning outcomes, and energy savings for schools and the government.

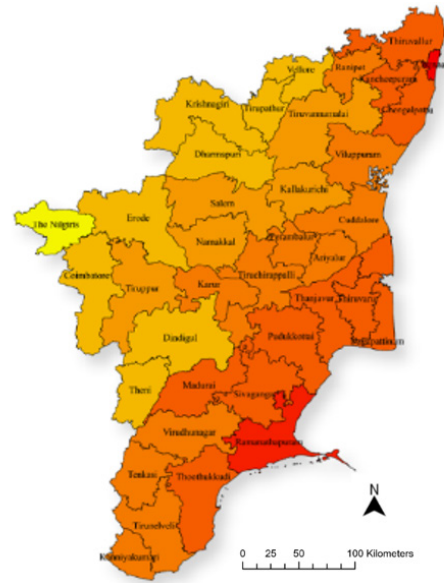


“Thermal comfort goes beyond cooling; it plays a critical role in supporting students’ attention, wellbeing, and learning outcomes.”

Tamil Nadu Heat Risk & School Vulnerability

Tamil Nadu Heat Exposure (2030–2050)

- Tamil Nadu is projected to face higher average temperatures and more frequent extreme heat days between 2030 and 2050 due to climate change and rapid urbanisation.
- In Chennai, India Meteorological Department records May temperatures of 37–39 °C, warm nights around 24–26 °C, and 70–80% humidity.
- Expansion of concrete-built areas and loss of green cover are intensifying urban heat island effects, keeping cities warmer during both day and night and increasing heat exposure risks.



Source: UNEP UHIE Study

Highest maximum temperatures recorded during April 2024 for Tamil Nadu - IMD 2024



Thermal Comfort Challenges in Schools

Many schools have poorly insulated concrete roofs that absorb and radiate heat into classrooms. High roof-driven radiant heat causes indoor temperatures to reach 38–40°C or higher during school hours, leading to prolonged thermal discomfort. Combined with high humidity, these conditions increase heat stress and reduce students' ability to concentrate, learn, and remain comfortable during peak academic hours

Cool Roof Implementation - Pilot School

Under the Green Schools Programme, a cool roof pilot was implemented at the Perunthalaivar Kamarajar Girls Higher Secondary School, Ambattur. A preliminary thermal comfort assessment was conducted by monitoring heat-exposed top-floor classrooms, with indoor air temperature, relative humidity and ceiling surface temperatures measured using data loggers and thermal imaging during pre- and post-intervention periods, and analyzed using IMAC adaptive comfort criteria. The intervention showed clear reductions in indoor and ceiling surface temperatures, validating the effectiveness of cool roofs through a demonstration-led approach. Based on these results, the initiative is now being scaled up to 300 government schools across Tamil Nadu under the guidance of the Hon'ble Chief Minister.

Building on this, UNEP, under the Be Cool Programme, will support scale-up through structured capacity building for Green Fellows and government officials across all districts, focusing on passive cooling strategies, thermal comfort audits and baseline assessments to enable wider replication across schools and public buildings.

Location of the pilot project - Ambattur, Chennai



Before cool roof



After cool roof



Ambattur School: Thermal Comfort Study

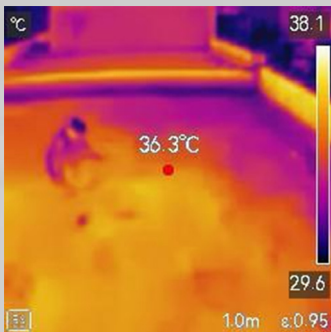
Before implementation:

Classrooms at the Ambattur pilot school experienced severe overheating, with indoor temperatures reaching 31–32°C and ceiling surface temperatures of 33–35°C during peak school hours, indicating high roof-related heat gain and thermal discomfort.

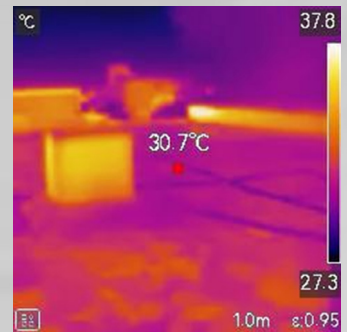
After implementation:

The cool roof intervention reduced indoor temperatures by 3–4°C and ceiling surface temperatures by 4–5°C, keeping classrooms mostly below 29°C and within acceptable thermal comfort ranges during occupied hours.

Before – Roof Surface Temperature



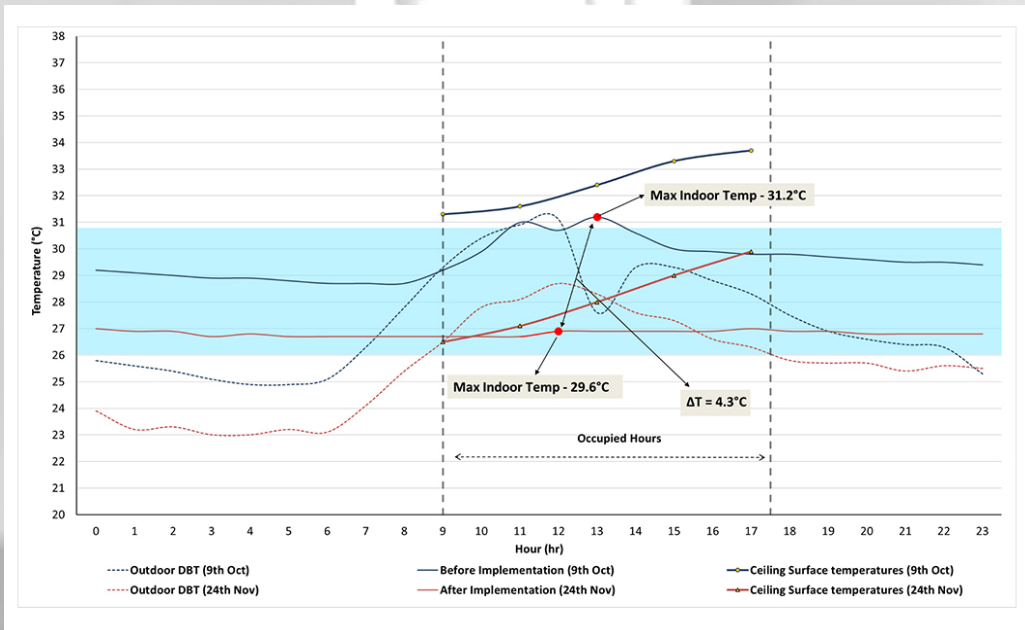
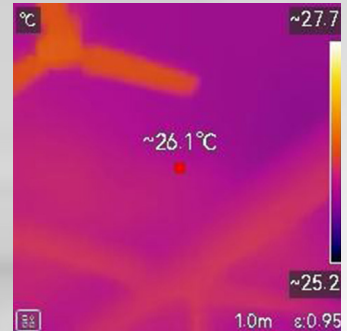
After – Roof Surface Temperature



Before – Ceiling Surface Temperature



After – Ceiling Surface Temperature



Peak indoor air temperature reduced to ~27°C (≈4.2°C drop), while ceiling surface temperature reduced to ~29°C (≈4.3°C drop).

Scaling Opportunities

Tamil Nadu has 37,754 government schools serving 52.75 lakh students, of which 300 schools have been covered under the Green Schools Initiative across four phases, benefiting over 1.48 lakh students. As part of this initiative, baseline assessments were undertaken for nine pilot schools to test integrated passive cooling measures across four phases: Phase 1 – Cool Roofs, Phase 2 – Passive Building Elements (shading, natural ventilation), Phase 3 – Site-Level Interventions (vegetation and green cover), and Phase 4 – Solar Energy Integration.

The assessments show that cool roofs are just one solution and deliver maximum benefits when combined with other passive cooling interventions. This integrated approach, led by the Department of Environment, TNGCC and UNEP, demonstrates the feasibility of scaling passive cooling strategies across hundreds of schools statewide, with clear scope for further expansion in future phases.



Executive Overview

Under the Green Schools Programme, the Environment, Climate Change and Forest Department (ECCFD), Government of Tamil Nadu, in collaboration with UNEP, is undertaking a one-year monitoring study at the Ambattur Green School to evaluate the seasonal performance of cool roof interventions. This document presents an executive overview of the study's objectives, framework, and methodology, situating the intervention within Tamil Nadu's broader climate resilience and heat-mitigation efforts.







On-site monitoring is currently underway, with early observations from October to December indicating indoor temperature reductions of up to 3–4°C, with higher reductions anticipated during peak summer months. These initial results highlight the potential of high-Solar Reflectance Index (SRI) cool roofs as a low-cost, scalable passive cooling solution and support their expansion across 297 Green Schools in Tamil Nadu under the Climate Change Mission. The findings will be validated through continuous seasonal monitoring, with a detailed technical report to be published at the end of the study, and will inform the phased integration of complementary measures such as shading, vegetation, and rooftop solar systems, with technical support from UNEP.



Thiru M.K. Stalin

The Hon'ble Chief Minister of Tamil Nadu

The cool roofing initiative under the Green School Programme has been incorporated into the Tamil Nadu Climate Change Mission's Action Plan for 2025–26. At the Perunthalaivar Kamarajar Government Girls Higher Secondary School in Ambattur, high solar-reflective cool roof coatings were applied. Thermal monitoring showed measurable reductions in classroom temperatures. Based on these findings, the initiative is now planned to be scaled across government schools in Tamil Nadu.

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