MAKING TELANGANA A COOL STATE

STATE WIDE COOL ROOF PROGRAM

Conference on Green Rail
Green Building Congress 2019
27th September 2019
Hyderabad

NRDC's India Program

Vision
In India, NRDC has been working since 2008, towards its vision of supporting India in achieving a robust and low-carbon economic growth for its entire population, powered by expansive clean energy that provides affordable energy access, alleviates poverty, advances public health, reduces pollution, and strengthens community resilience to climate change.

India Program: Work Areas

CLEAN ENERGY FINANCE, JOBS & ACCESS

EVs, COOLING & EFFICIENCY

CLIMATE RESILIENCE: AIR POLLUTION & HEAT

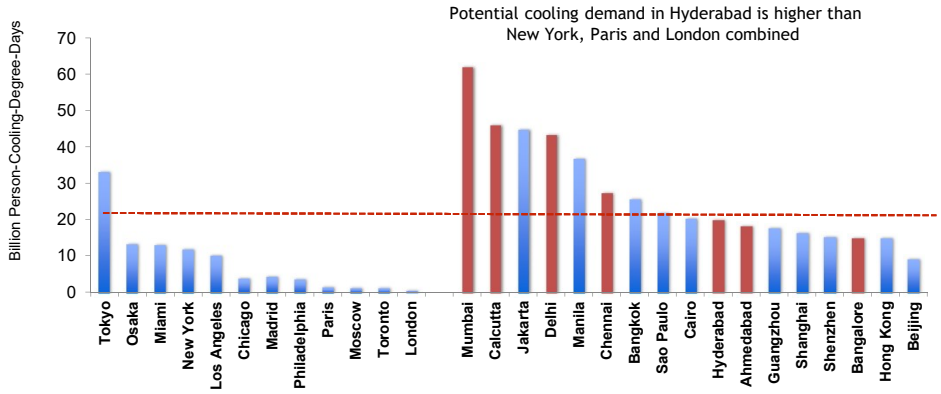
Partners

INDIAN INSTITUTE OF PUBLIC HEALTH GANDHINAGAR

SEWA

Cooling Demand in India

POTENTIAL OF COOLING DEMAND IN KEY CITIES



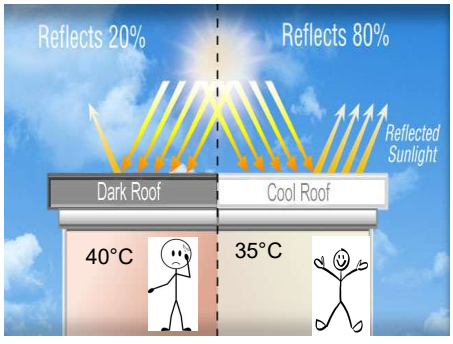
Based on: Sivak, M., 2009. Potential energy demand for cooling in the 50 largest metropolitan areas of the world: Implications for developing countries. Energy Policy 3, 1382-1384.

With rising temperatures, increasing consumer power, and rapid urbanization, the demand for cooling is growing in Indian cities. Extreme heat waves lead to loss of lives every year.

What is a Cool Roof?

Simple and cost-effective solution to urbanization challenges

A roof that stays cool in the sun by reflecting sunlight to (minimize solar absorption) and emitting thermal radiation (to help dissipate solar heat gain)



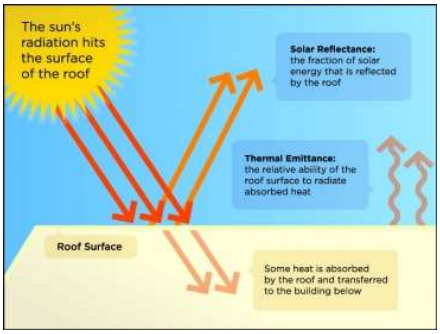
Source:www.coolcalifornia.org

A cool roof is defined by:

Solar Reflectance: The ratio of reflected to incident sunlight, higher numbers indicate greater reflectance

Thermal Emittance: The efficiency with which a surface cools itself by emitting thermal radiation

Solar Reflective Index (SRI): is a measure of the roof's ability to reject solar heat, as shown by a small temperature rise. The higher the SRI, the cooler the roof will be in the sun.



Source: http://heatisland.lbl.gov/glossary, http://energy.lbl.gov/coolroof/ref_01.htm
Image Source: http://www.gsmroofing.com/

Benefits of Cool Roofs

Benefits for Air Conditioned Buildings

- Improve comfort, reduce cooling demand, money and energy savings
- Increase energy access by reducing peak cooling load on the grid
- Extended roof life
- Reduced roof maintenance

Benefits for Unconditioned Buildings

- Provides thermal comfort, protects vulnerable people
- Improves comfort for homes, schools, hospitals, and public buildings. Enhances productivity
- Cheaper than air conditioning- reduce the need for air-conditioning
- Extended roof life and reduced roof maintenance

Benefits at City Wide Level

- Implemented on a large scale, works to reduce the urban heat island effect (UHI)
- Offsets CO2 and delays global warming
- Lowers air pollution by reducing atmospheric temperatures

TYPES OF COOL ROOF MATERIALS

Types of Cool Roof Materials

Cool roof materials are available for all types of steep-sloped and low-sloped (nearly horizontal) roofs

- Whitewash (lime based)
- Tarp-like plastic material
- White China mosaic tiles
- Acrylic resin coating
- Other coatings (modified resin, PU, silicone)

Indicative Costs and Payback

S.No	Material	Cost per sq.ft (in rupees)	Payback
1	Coatings	20-40	20-30 kWh/m2/Year -2 years
2	Cool tiles	50-100	25-40 kWh/m2/Year - 2 years
3	Membranes	20-55	20-30 kWh/m2/Year -2.5 years

Source: IIIT-H market survey

IMPACTS OF COOL ROOFS: CASE STUDIES AND RESEARCH

Impacts of Cool Roofs

Source: LBNL, SPM Thermoshield (USA and India), Satyam, IIIT Hyderabad

Conditioned building: Satyam Learning Centre -Hyderabad

Black to white (0.70-0.10 = 0.60):

- Annual savings 20-22 kWh/m^2, Percentage savings from 14-26%
- Reduction in utility bills at Rs.9.40/kWh for 20 m^2 roof (Rs. 4136)
- Annual CO_2 emissions reduction 11-12 Kg of CO_2 per m^2 of roof area. A 20 m^2 potential to save quarter ton of CO_2 per year

Concrete to white (0.70-0.30 = 0.40)

- Annual savings 13-14 kWh/m^2, Percentage savings: 10-19%

Source: Cool Roof for Low Income Group Housing: Master's Thesis, Saumya Ranjan Sahoo

Low Income Housings-Ahmedabad

- Reduction in mean radiant temperature of over 3°C in peak summers

Impacts of Cool Roofs

Noticeable increase in comfort in unconditioned buildings

Unconditioned building: ZPH School, Mucherla Village

- 2.1°C, 5.0°C and 12.3°C average reduction across classroom and 4.3°C, 10.0°C and 26.3°C maximum reduction in indoor air, roof underdeck & roof overdeck surface temperatures for the room with "cool roof" coating
- April - 23% increase in the number of comfort hours (comfort range 22 to 30°C)
- May - 13% increase in the number of comfort hours

Source: IIIT-Hyderabad

Reduction in the Urban Heat Island

Google satellite view of the whitewashed greenhouse roofs in Almería, Spain.

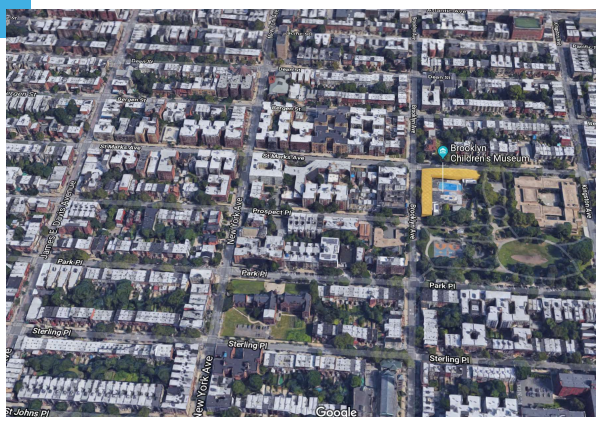
- The greenhouses cover approximately 350 square kilometers of this region.
- Over the last 20 years, temperatures in the Almería region have fallen by 0.3°C, in contrast to a 0.5°C, increase in temperatures in surrounding regions that do not have highly reflective greenhouses.

Source: http://www.coolrooftoolkit.org/wp-content/pdfs/CoolRoofToolkit_Full.pdf

Cooling Roofs New York City Program

- Launched in 2009- aim of coating 1 million sq.ft of rooftops every year
- Resulted in >5 million sq. ft of cool roofs in NYC by 2013
- NYC CoolRoofs is a collaboration between the NYC Department of Buildings and NYC Service

- Collaborated with 8-10 partners
- An RfP issued to invite coating vendors and manufacturers to participate in the program
- Training and skills to applicants leading to full employment
- Vendors listed on the website and provide discounts to program applicants



City of Ahmedabad received an award for HAP and Cool Roofs

City of Ahmedabad and New York amongst the seven recipients of the Ashden Honor at the Climate Week this week for implementation of the Heat Action Plans and Cool Roofs!!

TELANGANA COOL ROOFS PROGRAM

Cities in India Can Lead the Way

- In 2017 and 2018, the cities of Ahmedabad and Hyderabad initiated pilot cool roof programs.
- In Telangana, MAUD and GHMC piloted the cool roofs program focused on 25 low-income households. Dupont India supplied an High-density Polyethylene (HDPE) cool roof coating membrane, Tyvek

- **Time is now for scale up**
- **The Telangana Cool Roofs Program proposed as a:**
  - *Target-based program*
  - *Three main strategies* for different building types
  - *Phased out implementation plan*

Making Telangana a Cool State

Objectives

- Driving rapid state-wide adoption of cool roofs to save energy, strengthen heat resilience, increase thermal comfort and enhance productivity.
- Support inter-agency coordination
- Identify financing frameworks and outreach and awareness building tools
- Support workforce development and training programs for cool roof application

Three main program areas:

1. **Government & Commercial Program**: mandatory cool roofing for all municipal, government-owned, and commercial buildings covered under the state building efficiency codes in the cities
2. **Residential Program:** Voluntary cool roofing for residential and smaller buildings in the cities, in new and major upgrades
3. **Vulnerable Communities Program:** Cool roofing for all low-income housing related to the city's Heat Action Plan

Cool Roofs are Required by the Code

- The TS Energy Conservation Building Code (TS ECBC) includes cool roof and its testing standard.
- The code states that if a project follows the prescriptive method, then it is necessary to have a cool roof.
- The code allows using high reflectivity in energy simulation when the project takes the whole building performance method.

Program Design by Building Type

Building Type	Regulatory/Policy tool	Funding Mechanisms
Government (offices, educational and healthcare)	Announcement through a GO mandating all government buildings to retrofit roofs with cool roofs mandatory installation in new construction	Government budgets
Commercial (offices, retail complexes, hotels, industrial, private educational and healthcare)	Modify ECBC to include mandatory cool roofs in new construction and voluntary in existing buildings or a GO mandating any air-conditioned commercial building with a connected load of 100 Kw or more to install cool roofs.	Self-funded For un-airconditioned private small hospitals and educational institutes a potential subsidy or full support can be provided by the government.

Building Type	Regulatory/Policy tool	Funding Mechanisms
Residential	Voluntary Awareness on benefits of cool roofs and encourage them to apply	• Incentive mechanisms • Self-funded by developers of residential complexes
Low income/slum areas	TSHCL GO on mandating cool roofs in government low income housing projects. Implementation under the heat action plan by GHMC	• Government budgets (heat action plan and slum free city plan)& inclusion of cool roofs material in their procurement criteria • CSR

Program Targets and Activities

Telangana

Year 1 Target:

- 100,000 sq.m of cool roofs in state (assuming its only Hyderabad)

Year 5 Target:

- 83,00,000 sq.m

Year 10 Target:

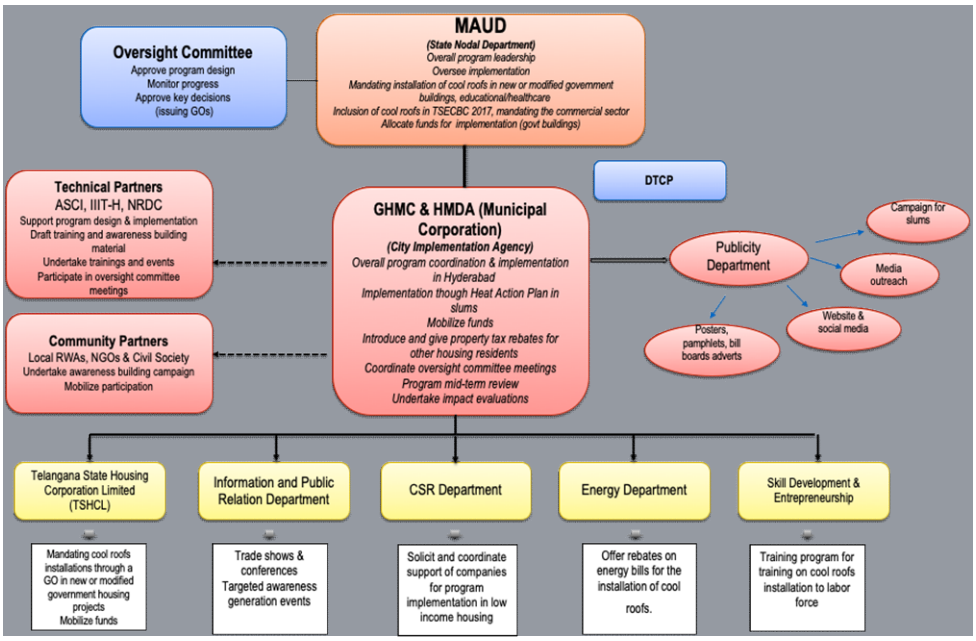
- 300,30,000,000 sq.m (300 sq.kms)

Upcoming conference:
5th International Conference on Countermeasures to Urban Heat Islands (IC2UHI)
02 - 04 December 2019
Hosted at: International Institute of Information Technology - Hyderabad, India
For more details:
http://heatislandcountermeasures.org

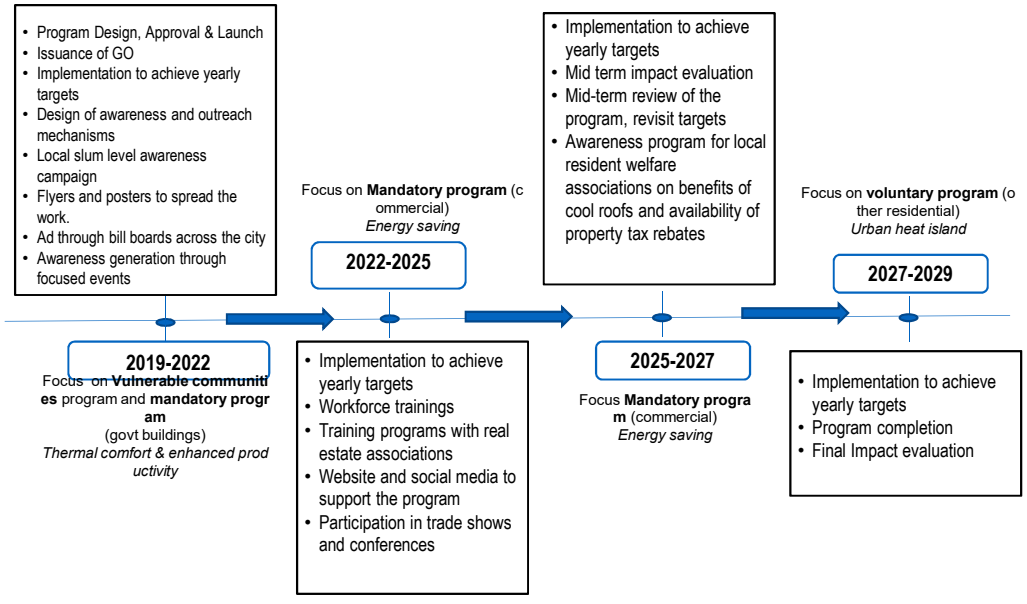
Examples of Activities under the Program

- Creation of *institutional mechanism* for implementation
- Creation of a potential *cool roof council* at state level (for ratings etc) and *test lab* for materials (e.g at IIIT-H)
- *Outreach and awareness program* at different levels
  - Slum campaigns
  - Resident welfare associations
  - Spreading the word: flyers, posters, hoardings, website and social media
  - Technology guide on materials and vendors
- *Events:* trade shows, conferences etc

Program Partners and Institutional Mechanism



Implementation Plan



Becoming Cool Roofs Champions: *a call to all developers*

- Evidence base exists; time for implementation
- Visibility as **prominent developers** implementing cool roofs- highest sq meters cool roofed
- CSR: **adopting slums** for cool roofing

Developers perspective is important

- What are the likely challenges?
- What king of government and regulatory support is required?
- What kind of outreach and awareness is required? And what are the platforms?
- What are the incentives required to trigger action?

THANK YOU

PRIMA MADAN
LEAD- ENERGY EFFICIENCY & COOLING
NRDC INDIA PROGRAM
EMAIL: PMADAN@NRDC.ORG