International Workshop on Heatwaves 2026

Strengthening Preparedness, Resilience and Risk Governance

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Proceedings of

International Workshop on Heatwaves 2026

Strengthening Preparedness, Resilience and Risk Governance

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National Disaster Management Authority (NDMA)
Government of India
NDMA Bhawan, A-1, Safdarjung Enclave, New Delhi-110029

Editorials

- Ms. Rita Missal, Member, NDMA
- Shri Manish Bhardwaj, Secretary, NDMA
- Ms. Mrinalini Shrivastava, Director, NDMA
- Ms. Anna DeGrauw, Senior Policy Advisor, CDP
- Shri Brahm Parkash Yadav, Senior Consultant, NDMA
- Shri Shishir Agarwal, Senior Consultant, NDMA
- Ms. Avani Gupta, Consultant, NDMA
- Ms. Shivani Das, Consultant, NDMA

Organizing Team

- Shri Vivek Jayaswal, Under Secretary, NDMA
- Shri Brahm Parkash Yadav, Senior Consultant, NDMA
- Ms. Avani Gupta, Consultant, NDMA

Rapporteurs

- Shri Brahm Parkash Yadav, Senior Consultant, NDMA
- Shri Shishir Agarwal, Senior Consultant, NDMA
- Shri Ranjan Bora, Senior Consultant, NDMA
- Ms. Avani Gupta, Consultant, NDMA
- Ms. Raashi, Consultant, NDMA
- Ms. Niyati, Consultant, NDMA
- Ms. Lena, Consultant, NDMA
- Ms. Neha Awasthi, UNEP
- Ms Tamanna Dalal, SFC
- Shri Ajay Ghosh, IRADe
- Ms. Prerna Ojha, CEEW
- Shri Mrinal Shrivastava, RMI
- Ms. Maria Fatima, ADRA
- Ms. Sayantani Ghosh, GIZ
- Ms. Ankita, PhD Student
- Shri Bharat Kumar Chauhan, EMC
- Shri Pradeep Dutta, EMC
- Ms. Shivani, EMC
- Ms. Anushka, EMC

MESSAGE
MEMBER & HOD, NDMA

Extreme heat is increasingly emerging as one of the defining climate and development challenges of the twenty-first century. Across many parts of the world, rising temperatures and prolonged heat events are placing growing pressure on public health systems, infrastructure networks, labour productivity, and economic activity. These trends call for stronger institutional preparedness, improved risk understanding, and coordinated action across sectors and governance levels.

The **International Workshop on Heatwaves 2026**, organised by the National Disaster Management Authority (NDMA), was convened to advance dialogue and collaboration on strengthening preparedness, resilience, and governance for extreme heat. The workshop brought together representatives from government institutions, international organisations, scientific bodies, and knowledge partners to exchange experiences and identify practical approaches for addressing the growing risks associated with heatwaves.

Discussions during the workshop highlighted the importance of strengthening Heat Action Plans, improving risk assessment and early warning systems, integrating heat resilience into urban development and infrastructure planning, and enhancing protection for vulnerable populations. The deliberations also underscored the growing relevance of Disaster Risk Financing Mechanisms, including anticipatory and risk-informed financing approaches, to ensure that resources and support systems are available to respond effectively and protect communities during extreme heat events.

As climate change continues to intensify extreme weather events, collective efforts and international cooperation will be essential to strengthen resilience and safeguard communities. NDMA remains committed to supporting States and Union Territories in enhancing preparedness, promoting evidence-based planning, strengthening risk-informed financing approaches, and advancing collaborative strategies for managing heat-related risks.

I appreciate the contributions of all participating institutions, experts, and partners whose insights have enriched the discussions. I am confident that the outcomes of this workshop will contribute meaningfully to strengthening heatwave preparedness and resilience in India and beyond.

Dr. Krishna S. Vatsa
Member & HoD , National Disaster Management Authority (NDMA), Government of India

MESSAGE
MEMBER, NDMA

The International Workshop on Heatwaves 2026 marks a significant progression in India's transition from preparedness to structured risk governance and financial resilience. Building on the momentum of previous engagements, this year's deliberations focused on translating policy intent into implementable frameworks to address the escalating challenge of extreme heat.

Heat is no longer a seasonal anomaly, it is a systemic development and fiscal risk affecting public health, infrastructure, labour productivity, agriculture, and urban systems. The workshop positioned heat within the broader Disaster Risk Reduction (DRR) architecture, aligning national priorities with global platforms such as the G20 High Level Principles for Investing in DRR.

Discussions underscored the evolution of Heat Action Plans from advisory documents into implementation ready governance tools supported by vulnerability mapping, localized analytics, institutional accountability, and standardized indicators. Equal emphasis was placed on strengthening heat health systems and protecting vulnerable populations, particularly informal workers and low-income communities, through improved mortality surveillance, occupational safety standards, adaptive social protection, and impact-based early warning integration.

The workshop also advanced structured disaster risk financing mechanisms, including ex-ante financing, parametric insurance, and blended finance models, reinforcing the importance of layered and proactive financial systems that ensure timely support reaches those most at risk.

NDMA remains committed to supporting States and Union Territories in mainstreaming heat resilience across planning, budgeting, infrastructure design, and social protection systems.

Ms. Rita Missal
Member, National Disaster Management Authority (NDMA), Government of India

FOREWORD
SECRETARY, NDMA

The International Workshop on Heatwaves 2026, organized under CoDRR-10, was convened to strengthen national and global dialogue on Extreme Heat by bringing together policymakers, practitioners, researchers, and financial experts to exchange knowledge, share operational experiences, and advance practical approaches for preparedness, resilience, and risk governance in the context of intensifying heatwaves.

As the frequency, duration, and intensity of heatwaves continue to rise, the need for systemic and forward-looking reforms has become increasingly urgent. This year's theme, "Strengthening Preparedness, Resilience and Risk Governance," underscores the imperative to integrate heat risk within development planning, fiscal systems, and sectoral policies to ensure sustained and coordinated action.

The workshop brought together global experts and national stakeholders to deliberate on institutionalizing heat governance, embedding resilience in infrastructure and urban systems, protecting health and livelihoods through adaptive social protection, and advancing disaster risk financing mechanisms to manage residual risk. The emphasis on ex-ante financing, improved delivery systems, and institutional convergence reflects a mature and practical approach to heat governance.

India's expanding Heat Action Plans, strengthened monitoring frameworks, and collaborative platforms demonstrate growing leadership in addressing one of the most complex climate risks of our time. NDMA will continue to promote cross-sectoral convergence, standardization of indicators, and evidence-based implementation at national and subnational levels.

These proceedings reflect a shared commitment to reducing heat-related mortality, safeguarding livelihoods, and building resilient systems capable of withstanding intensifying climate extremes. The insights captured herein will serve as a practical guide for strengthening institutional preparedness and advancing equitable, data-driven heat governance across the country.

Shri Manish Bhardwaj
Secretary, National Disaster Management Authority (NDMA), Government of India

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CONCEPT OF THE WORKSHOP

The International Workshop on Heatwaves 2026, convened by the National Disaster Management Authority (NDMA), Government of India, was designed as a global platform to advance practical, policy-relevant dialogue on extreme heat governance. The workshop was framed around the recognition that extreme heat is no longer a seasonal or episodic hazard but a systemic and rapidly intensifying risk with wide-ranging implications for public health, livelihoods, infrastructure systems, and economic productivity.

Recent years have witnessed unprecedented temperature extremes across regions, demonstrating that heatwaves represent a recurring global challenge requiring coordinated, multi-sectoral responses rather than isolated emergency measures. Unlike sudden-onset disasters, heat operates as a slow-onset yet high-impact risk that often remains under-recognized in disaster governance frameworks despite its significant social and economic costs.

In this context, the workshop was conceived as a sustained international platform convened by India, shaped in collaboration with global partners, and built for countries facing extreme heat to exchange experiences, share evidence, and develop implementable solutions. It brought together governments, international organizations, scientific institutions, urban practitioners, and knowledge partners to move beyond awareness toward actionable frameworks for preparedness, resilience, and risk governance.

The two-day structure reflected a deliberate progression from strategy to implementation. Day 1 focused on strengthening operational heat governance through discussions on Heat Action Plans, resilient infrastructure and climate-smart urban development, heat-health systems, and data-driven decision-making tools. Day 2 concentrated on financing pathways, exploring disaster risk financing instruments, blended finance models, public-private partnerships, and delivery mechanisms that ensure resources reach vulnerable communities.

The workshop aimed to strengthen national and global collaboration on extreme heat preparedness; promote integrated, multi-sectoral approaches linking urban planning, public health, labour systems, and infrastructure; enhance the use of science, data, and digital technologies for decision-making; and support the translation of knowledge into practical implementation strategies.

Ultimately, the workshop reaffirmed that extreme heat is not merely an environmental concern but a developmental, governance, and economic priority. By convening diverse stakeholders and facilitating cross-sectoral dialogue, it sought to generate actionable recommendations, strengthen institutional capacity, and advance long-term collaboration to build resilient systems capable of managing one of the defining climate risks of the twenty-first century.

KEY THEMES, STRUCTURE, OBJECTIVES AND EXPECTED OUTCOME OF THE WORKSHOP

Key Themes

The International Workshop on Heatwaves 2026 was organised around an integrated set of thematic priorities designed to strengthen preparedness, resilience, and risk governance for extreme heat. These themes reflected both global evidence and India's operational experience in heat risk management and were structured across technical sessions that addressed governance, systems, and implementation dimensions.

Strengthening Heat Action Plans as Core Governance Instruments	• Evolution of Heat Action Plans from local preparedness tools to scalable national and global policy frameworks. • Integration of vulnerability mapping, urban heat analytics, and early warning systems into HAPs. • Improving contextual relevance, quality, and standardisation of plans across regions.
Heat-Resilient Infrastructure and Climate-Smart Urban Development	• Embedding thermal resilience in urban planning, housing, public infrastructure, and transport systems. • Role of passive cooling, nature-based solutions, and energy-efficient built environments. • Addressing urban heat island effects through planning, and land-use strategies.
Heat-Health and Human Systems Protection	• Strengthening health surveillance and monitoring of heat-related morbidity and mortality. • Protecting vulnerable populations including outdoor workers, women, elderly persons, and low-income communities. • Integrating labour, social protection, and occupational safety into heat risk management.
Data, Technology and Innovation for Heat Governance	• Leveraging forecasting, geospatial analytics, digital platforms, and decision-support tools. • Enhancing risk intelligence through composite heat indices and real-time monitoring systems. • Using science-based approaches to inform policy and operational decision-making.

Financing Heat Resilience and Risk Reduction	• Advancing layered financing strategies including public finance, private investment, insurance, and climate finance. • Developing pre-arranged and risk-based financing mechanisms. • Ensuring equitable delivery of resources to vulnerable communities and strengthening fiscal preparedness.
Role of institutional preparedness and governance:	• Governments across the world play a key role in addressing extreme heat. This encompasses regulation and enforcement of occupational health and safety standards, infrastructure planning for heat-resilient public assets, early warning systems through disaster management authorities, and critically, the design and delivery of adaptive social protection systems that can respond flexibly to multiple, compounding stresses. However, preparedness is not only about plans and warnings. It is also about whether institutions have the fiscal space, incentives, and systems in place to act early and consistently before heat becomes a crisis.
Financing approaches to protect against extreme heat:	• The event acknowledged that we must resist the temptation to view complex social and health challenges primarily through a financial lens. • Extreme heat is not fundamentally a financing problem requiring a financing solution. • It is a risk management and governance challenge where finance can play a valuable supporting role when thoughtfully integrated. Insurance cannot be viewed in isolation.
Alignment between risk reduction and addressing residual risk	• Heat represents an opportunity to look at the alignment between risk reduction and residual risk working together. • For example, reducing heat impact in workplaces (cooling mechanisms, shift adjustments), while also addressing residual risk by supporting income loss through adaptive social protection (parametric insurance, direct cash payments). • This is also taken at the policy level, such as through Heat Action Plans.

- **Role of employers**
  - There was consistent discussions on the role of employers in:
  - providing social protection for extreme heat for its workers, as well as abiding by legally mandated occupational health and safety (OSH) measures.
  - Employers also have a responsibility to look at the entire supply chain.
  - They can use insurance to protect food storage/ physical infrastructure of goods against extreme heat. However, gaps remain.
  - MSMEs face financial restrictions in accessing funding to mitigate extreme heat. It is difficult to expand adaptive social protection (ASP) coverage to workers in the informal economy. The experiences of MHT and SEWA illustrate possibilities, but financial sustainability remains a challenge.

These themes collectively reflected a shift from reactive response to anticipatory, systemic heat governance.

Structure

The workshop was conducted over two days and designed to move progressively from strategic understanding to operational implementation.

- **Inaugural and High-Level Sessions:** Set the global and national context for extreme heat governance and launched knowledge products supporting evidence-based planning.
- **Technical Sessions (Day 1):** Focused on governance frameworks, infrastructure resilience, human systems, and technological innovation, illustrating pathways for strengthening operational heat management.
- **Technical Sessions (Day 2):** Dedicated to financing mechanisms, disaster risk reduction strategies, and delivery systems required to sustain long-term resilience.
- **Interactive Discussions and Knowledge Exchange:** on both days, panel dialogues, case presentations, and multi-stakeholder discussions facilitated cross-country learning and peer exchange.
- **Poster Exhibition in collaboration with RMI:** Showcased emerging solutions and field experiences on urban heat risk, cool surfaces, passive cooling, and heat-resilient infrastructure, enabling interactive knowledge exchange among participants.
- **Closing Segment**: Synthesised key recommendations, identified collaborative pathways, and outlined follow-up mechanisms.

Objectives

The workshop aimed to:

- Strengthen national and global collaboration on extreme heat preparedness, resilience, and governance.
- Advance understanding of Heat Action Plans (HAPs) as foundational institutional tools for managing heat risk.
- Promote integrated multi-sectoral approaches linking urban planning, infrastructure, public health, labour, and environmental systems.
- Enhance use of science, data, and digital technologies in decision-making and early warning.
- Support translation of knowledge into implementable strategies and institutional arrangements.

Expected Outcomes

- The workshop was expected to generate practical and policy-relevant outcomes that support long-term heat resilience, including:
- Stronger alignment between national and international efforts on heat risk reduction.
- Actionable recommendations to enhance design and implementation of Heat Action Plans across governance levels.
- Identification of pathways for integrating technology, innovation, and financing into heat governance systems.
- Strengthened partnerships among governments, international organisations, research institutions, and private sector actors.
- Contributions toward building sustainable, long-term heat resilience and financing frameworks in the context of a warming climate.

These outcomes are intended to guide future policy, institutional coordination, and implementation efforts.

TECHNICAL SCHEDULE OF THE WORKSHOP

Committee on Disaster Risk Reduction (CoDRR-10) International Workshop on Heatwaves 2026

Technical Program (Day 1: 11 February, 2026)

REGISTRATION (09.00-09.30 hrs)	
INAUGURAL SESSION: (09.20-10.40 hrs) **Setting the Global Agenda on Extreme Heat Governance** **Rapporteur: Mr. B.P. Yadav, Sr. Consultant, NDMA and Ms. Avani Gupta, NDMA**	
09:20 - 09:30	Inauguration of Exhibition Booth by Dr. Krishna S. Vatsa, Member & HoD, NDMA
09:30 - 09:40	Welcome Address and Recapitulation from Heatwave Workshop 2025: Shri Manish Bhardwaj, Secretary, NDMA
09:40 - 09:45	Launch of Knowledge Products: 1. Heat Impact Assessment (HIA) Framework by RMI 2. Extreme Heat Exposure Among Informal and Low-Income Workers in Delhi: A Preliminary Study Report by ADRA
09:45 - 09:55	Technical Address: Cristina Stefan, Head of Advisory, Centre for Disaster Protection (CDP)
09:55 - 10:05	Technical Address: Mr. Johannes Schneider, Economic Cooperation and Development, German Embassy, New Delhi
10:05 - 10:15	Technical Address: Dr Philippe Sas, Head of International Cooperation, Swiss Development Agency
10:15 - 10:25	Keynote Address: Dr. Krishna S Vatsa, Member & HoD, NDMA
10:25 - 10:35	Vote of thanks: Ms. Mrinalini Srivastava, Director IC & PRAG
10:35 - 10:40	Group Photo
High Tea (10.40- 11.00)	

TECHNICAL SESSION I (11.00 – 12.15)
Heat Action Plans from Local Tools to Global Practices

CHAIR: Dr. Krishna S Vatsa, Member & HoD, NDMA
Rapporteur: Ms. Niyati Aggarwal, Consultant, NDMA and Mr Rohan Mishra, NRDC

11:00 - 12:00	**Speakers (Slide 3-5):** • Mr. Abhiyant Tiwari, NRDC: Template for Heat Action Plans • Mr. Aditya Valiathan Pillai, SFC: Guidelines and Templates for SDMF/ NDMF Utilization for Heat Mitigation Projects • Mr. Tarun Garg, RMI India Foundation: Visualising Heat Impacts: A National Framework to Measure and Manage Extreme Heat • Dr Vishwas Chitale, Fellow, CEEW- Scaling heat action plan framework • Ms. Elizabeth Atwell, Head, Resilience, Infrastructure & Climate Adaptation Team, British High Commission, New Delhi Discussants: Telangana, Uttar Pradesh, Madhya Pradesh, Odisha
12:00 - 12:15	Q&A and Open Discussion

TECHNICAL SESSION II (12.15 – 13.30)
Heat Resilient Infra- Climate Smart Urban Development

CHAIR: NDMA Shri Amit Prothi, Director General, CDRI
Rapporteur: Ms. Lena, Consultant, NDMA and Ms. Neha Awasthi, UNEP

12:15 - 13:15	**Speakers (Slide 3-5):** • Mr. Benjamin Hickman, Program Manager, UNEP: Pilot Studies on Cool Roof: Tamil Nadu's UHIE Assessments-to-Delivery Model for Heat-Resilient Urban Development • Ms. Grace Lalrindiki Pachuau, Deputy Secretary, MoHUA • Mr. Ander Zozaya, ETH Zurich • Mr. Aun Abdullah, Lodha Foundation: Building Heat Resilient Cities in India • Ms. Emma Wright, Climate & Environment Adviser Indo- Pacific Regional Department, British High Commission • Mr. Sandeep Singh, World Bank Group
13:15 - 13:30	Q&A and Open Discussion

LUNCH BREAK (13.30 – 14.30)

TECHNICAL SESSION III (14.30 – 15.45)
Heat Health & Human System Protecting Lives & Livelihood

CHAIR: Ms. Rita Missal, Member, NDMA
CO- CHAIR: Mr. Gerald Guskowski, Programme Director and Cluster Coordinator, GIZ- India
Rapporteur: Mr. Shishir Agarwal, Sr. Consultant, NDMA and Ms. Sayantani Ghosh, GIZ

Speakers (Slide 3-5):

14:30 - 15:30

- Ms. Cristina Stefan, Head of Advisory, CDP: Adaptive Social Protection
- Mr. John Abo,Technical Lead- Emergency Preparedness, ADPC
- Dr. Ashok Gadgil, India Energy & Climate Center, Goldman School of Public Policy (GSPP), UC Berkeley
- Ms. Ritu Bharadwaj, Director, Climate Resilience, IIED
- Dr. Dileep Mavalankar, IIPHG: Challenges in developing and Implementing Heat Mortality Data Framework
- Dr. Yogindra Samant, Occupational Safety and Health Specialist, ILO

Discussants: MoH&FW, Department of Science and Technology, Dr. Ritu Parchure, Senior Research Fellow, Prayas Energy Group Pune, Ministry of Agriculture

15:30 - 15:45 Q&A and Open Discussion

Tea Break (15.45 – 16.00)

TECHNICAL SESSION IV (16.00– 17.00)
Data Technology and Innovation for Extreme Heat Governance

CHAIR: Dr. Dinesh Kumar Aswal, Member, NDMA
Rapporteur: Ms. Raashi, Consultant, NDMA and Ms. Maria Fatima, ADRA

Speakers (Slide 3-5):

- Mr. Alex, Third Derivative: Role of Innovations for Climate Smart and Heat Resilient Infrastructure
- Mr. Piyush Narang, UC Berkeley: Findings from Real Time Assessment of Extended Heat Index 350
- Dr. Sarah Perkins Kirkpatrick, ANU Canberra, Australia
- Mr. Chintan Shinde, Mahila Housing Trust
- Mr. Keshav Jha, ICLEI
- Mr. Harish, Indian Institute of Science

Discussants: IMD, IITM

16:45 - 17:00 Q&A and Open Discussion

Technical Program (Day 2: 12 February, 2026)

INAUGURAL SESSION (09.30 – 10.00)

Remarks (Slide 3-5):
Special Remarks (5 Minutes each):

09:30 - 10:00

- Dr. Krishna S. Vatsa, Member & HoD, NDMA
- Stefan Priesner, United Nations Resident Coordinator, India
- Mr. Ben Webster, Associate Director of Advisory, Training and Engagement, CDP

Introductory Session (10.00- 10.30)

High Level Principles for Investing in DRR-A G-20 Overview
Rapporteur: Mr. Ranjan Bora, Consultant, NDMA

10:00 - 10:30

Speaker: Shri Abhilash Panda, UNDRR

Discussants: Shri S Rakesh Kumar, JS PP, NDMA

High Tea (10.30- 11.00)

Technical Session I (11.00-12.15)
Disaster risk reduction financing mechanisms to address multi-hazard risks and Heat Resilience

CHAIR: Dr. Krishna S. Vatsa, Member, NDMA
Rapporteur: Shishir Agarwal, Sr. Consultant, NDMA and Mr Ajay Ghosh, IRADe

Speakers / Discussants (Slide 3-5):

11:00 - 12:00

- Mr. Mathieu Verougstraete, Head of Infrastructure and Finance for Resilience Unit UNDRR
- Mr. Amar Patel, Risk Finance Advisor, Centre for Disaster Protection
- Ms. Visala Annamalai, Climate Resilience for All
- Mr. Ashish Agrawal, President & Head - Agri Business, Bajaj General Insurance

11:00 - 12:15 Q&A and Open Discussion

Technical Session II (12.15 – 13.30)
Financing for Risk Reduction through Heat Resilient Infrastructure

CHAIR: Lt Gen Syed Ata Hasnain, Member
Rapporteur: Ms. Avani Gupta, Consultant, NDMA and Ms. Prerna Ojha, CEEW

Speakers/ Discussants (Slide 3-5)

12:15 - 13:15

- Ms Shubhra Singh, SUN GROUP, Khemka Foundation
- Mr. Brij Mohan, Senior Climate Change Officer and Country Climate Focal, Asian Development Bank
- Dr. Ramesh Subramaniam, Global Director, CDRI
- Mr. Bhaskar Padigala, Climate Advisor (UK Representative)
- Ms. Mandakini Balodhi, Director in Dept. of Fin. Services

13:15 - 13:30 Q&A and Open Discussion

Lunch (13.30-14.30)

Technical Session III (14.30 – 15.45)
Addressing residual risk for extreme heat through money in mechanisms

CHAIR: Krishnan Narasimhan, Lead Specialist and Programme Manager, Climate Disaster Risk Financing and Insurance, UNCDF
Co-Chair: Ms Cristina Stefan, Head of Advisory, Centre for Disaster Protection
Rapporteur: Ms. Niyati, Consultant, NDMA and Mr. Mrinal Srivastava, RMI

Speakers / Discussants: (Slide 3-5)

14:30 - 15:30

- Ms. Kamna R Sharma, Additional Commissioner, Pradhan Mantri Fasal Bima Yojna (PMFBY)
- Mr. Dipankar Munshi, IBISA
- Mr. Mangesh Patankar, Munich Re India
- Mr. Chandan Verma Head of Agriculture, Swiss Re, India
- Mr. Aavrit Singhal (Actuary, EX AIC Re), Partner InRisk
- Mr. Anuj Kumbhat, Founder, Weather Risk Management Services

15:30 - 15:45 Q&A and Open Discussion

Tea Break 15.45-16.00

Technical Session IV (16.00- 17.00)
Financing mechanisms to reach communities most at risk

CHAIR: Shri Manish Bhardwaj, Secretary, NDMA
Moderator: Ms. Anna DeGrauw, Senior Policy Advisor, Centre for Disaster Protection (CDP)
Rapporteur: Ms. Rashi Mukund, Consultant, NDMA, Ms Tamanna Dalal, SFC

16:00 - 16:45	**Speakers / Discussants: (Slide 3-5)** • Ms. Bhawana Ahuja, Programme Lead, WRI India • Mr. Amar Patel, Lead Risk Advisor, Centre for Disaster Protection **Discussants:** • Dr. Sahil Hebbar, Sr. Coordinator, Self Employed Women's Association • Ms. Bhavna Maheriya, Programme Manager, Mahila Housing Trust • Ms. Bharti Birla, ILO Enterprise Specialist • Ms. Ritu Bhardwaj, Director of Climate Resilience, Finance, Loss and Damage, IIED
16:45 - 17:00	Q&A and Open Discussion

Wrap-up Session (17.00 – 17.30)

CHAIR: Dr. Krishna S Vatsa, Member & HoD, NDMA
Rapporteur: Shishir Agarwal, Sr. Consultant, NDMA

17:00 - 17:30	• **Key Take Aways:** Ms. Mrinalini Srivastava, Director, NDMA • **Way Forward:** Dr. Krishna S. Vatsa, Member & HoD, NDMA • **Closing Remarks:** Mr. Ben Webster, Associate Director of Advisory, Training and Engagement, CDP

INAUGURAL SESSION

A dedicated Poster Gallery was curated as part of the workshop to showcase emerging solutions, research insights, and implementation pathways for addressing extreme heat risks across India. Supported by RMI India Foundation, the gallery featured a diverse range of thematic exhibits covering urban heat risk assessment, cool surface technologies, passive cooling strategies, heat-resilient housing design, and data-driven decision support tools.

The gallery provided participants with an opportunity to engage with practical examples of heat mitigation and adaptation interventions being piloted across cities and institutions. It served as an interactive knowledge-sharing platform, enabling exchange between policymakers, practitioners, researchers, and industry stakeholders, and highlighting scalable approaches that can support mainstreaming of heat resilience within urban planning, infrastructure development, and disaster risk reduction systems.

WELCOME AND CONTEXT SETTING

Welcome Address

Manish Bhardwaj, Secretary, NDMA

The Secretary, NDMA, delivered the welcome address. He extended his sincere gratitude to the dignitaries and partners present, including Dr. Krishna S Vatsa, Member and Head of Department NDMA, among other members of NDMA; representatives from the Centre for Disaster Protection (CDP), UNDRR, United Nations Capital Development Fund (UNCDF), United Nations Environment Programme (UNEP), diplomats from various embassies, esteemed speakers, representatives from national and international organizations, State governments, Central Ministries, knowledge partners, and participants. He warmly welcomed all to the International Workshop on Heat Waves 2026.

In setting the context, he underscored that extreme heat has emerged as one of the most severe and rapidly intensifying global risks, with far-reaching implications for health, livelihoods, infrastructure, and urban systems. It is no longer an episodic hazard but must now be addressed as a systemic risk requiring coordinated governance, integrated planning, and sustained institutional commitment.

Rapporteurs:

Mr. B.P. Yadav Sr. Consultant, NDMA, and Ms. Avani Gupta, Consultant, NDMA

Highlighting India's efforts, he noted that the country has taken important strides in institutionalizing heat wave preparedness and mitigation, particularly through:

1. *The expansion of Heat Action Plans and strengthened multi-sectoral coordination.*
2. *Progressing from national action to demonstrated international leadership by organising annual workshops on heatwaves.*

Based on this, he noted that the present workshop has been convened as a global platform to move from awareness to actionable frameworks that strengthen preparedness, resilience, and long-term risk governance. He highlighted the appropriateness of the workshop title, "Strengthening Preparedness, Resilience and Risk Governance," and stated that this workshop established continuity by building upon the priorities and outcomes of the workshop convened in 2025. This includes reflecting on the 6 priority areas identified last year (including early warning services; Heat Action Plans from the Indian perspective; advancing city-level Heat Action Plans with emphasis on multi-sectoral adaptation for resilient communities; heat-health adaptation; mitigating heat impacts on infrastructure, particularly housing; and financing Heat Action Plans). Further, taking ahead the key recommendations including institutional strengthening and governance; expanding and standardizing Heat Action Plans; strengthening early warning systems and risk communication; enhancing financing and resource mobilization; advancing research, innovation, and capacity building; and strengthening global and regional collaboration.

He emphasized that this year's workshop translates those recommendations into structured thematic discussions, moving the discourse from strategy to implementation and from preparedness toward resilient systems. Laying out the structure and intent of this year's workshop, he emphasised that the two-day deliberations are designed to move from preparedness to resilient systems and from strategic intent to implementable solutions, with focused discussions across governance, infrastructure, health, data, and financing dimensions of extreme heat risk.

- **Day 1- From Preparedness to Resilient Urban Systems:**

  Focused on strengthening operational heat governance through discussions on the evolution of Heat Action Plans as foundational coordination instruments; embedding resilience in infrastructure and climate-smart urban development; addressing heat-health impacts and protecting lives and livelihoods; and leveraging data, forecasting, geospatial analytics, and digital innovation for anticipatory risk management - demonstrating the transition from reactive response to integrated, forward-looking resilience frameworks.

- **Day 2- Financing Solutions for Extreme Heat:**

  Dedicated to advancing sustainable financial strategies covering disaster risk financing, resilient infrastructure investment, residual risk mechanisms such as insurance and public-private partnerships, and financing pathways that ensure impact reaches vulnerable communities -emphasizing instruments, institutions, and delivery systems that support both immediate response and long-term mitigation.

  In his concluding remarks, he stated that the workshop reflects a growing global recognition that extreme heat is not merely an environmental challenge but a governance, development, and economic priority. By bringing together governments, scientific institutions, international organizations, and practitioners, the workshop reaffirms a shared commitment to building proactive, data-driven, and resilient systems. He expressed confidence that the deliberations would generate actionable insights, strengthen partnerships, and contribute meaningfully to shaping the future of heat risk governance in India and globally, and wished the workshop every success.

Launch of Knowledge Products

Following the Welcome Address, two key knowledge products developed through NDMA's collaboration with technical partners were formally launched.

The first***, Heat Impact Assessment (HIA) Framework,*** was developed by RMI India Foundation. The second, ***Extreme Heat Exposure Among Informal and Low-Income Workers in Delhi:*** A Preliminary Study Report, was prepared by Adventist Development and Relief Agency (ADRA).

Ms. Akshima Ghate, Managing Director, RMI India Foundation, and Mr. Imran Majid, Director, ADRA, joined the inaugural panel for the release of their respective publications. These knowledge products represent important contributions toward strengthening evidence-based planning and operational preparedness for extreme heat.

Technical Address

Ms. Cristina Stefan, Head of Advisory, Centre for Disaster Protection (CDP)

Ms. Cristina Stefan thanked the Government of India and the NDMA for the opportunity to deliver technical remarks and support the International Workshop on Heat-Waves 2026. She noted that extreme heat is no longer a future risk but a present and accelerating reality in India and globally, and highlighted India's leadership in international policy discussions, including through the G20 and BRICS.

She highlighted three key points:

- **Heat as an "Invisible Disaster":**

  Unlike sudden-onset disasters, extreme heat operates in less visible ways - through gradual mortality, declining productivity, and compounding inequalities related to gender, income, and age. Existing disaster financing frameworks, designed for clearly bounded events, struggle to address heat's chronic and cumulative nature. Heat rarely triggers formal emergency declarations, limiting access to traditional emergency finance. This underscores the need for pre-arranged, preventive, and systemic approaches embedded within everyday governance.

- **Institutional Preparedness:**

  Governments play a central role through regulation, occupational safety standards, resilient infrastructure planning, early warning systems, and adaptive social protection. She recognized India's progress, including NDMA's heat wave guidelines, the expansion of Heat Action Plans, and strengthened early warning systems through the India Meteorological Department. However, preparedness must also ensure fiscal space, incentives, and delivery systems to act before heat escalates into crisis.

- **Role of Pre-arranged Financing:**

  Pre-arranged financing, approved in advance and released against predefined triggers, can support vulnerable populations, particularly when embedded within social protection and labour systems. While insurance solutions have generated interest, evidence suggests that standalone micro-insurance may be overemphasized for heat risk. Instead, adaptive social protection with flexible, pre-arranged funding can enable incremental support such as temporary income assistance or health interventions during high-risk periods.

In conclusion, she emphasized that extreme heat is fundamentally a risk management and governance challenge, with finance playing a supportive role. She called for balanced, system-based approaches that prioritize prevention, address residual risk, strengthen underlying systems, and remain grounded in the lived realities of the most vulnerable.

Mr. Johannes Schneider, Head of Economic Cooperation and Development, German Embassy, New Delhi

Mr. Johannes Schneider described extreme heat as one of the most urgent and underrecognized challenges of our time, noting how heat waves have increasingly entered everyday conversations and are reshaping routines, work patterns, and public services. He emphasized that extreme heat is no longer only a climate issue, rather it is fundamentally a governance and development challenge.

He observed that heat, once viewed as a predictable and manageable seasonal hazard, has become a systemic global risk affecting human health, economic productivity, infrastructure systems, and social stability across continents. From South Asia and the Middle East to Europe, North America, and Africa, extreme heat is disrupting labour markets, straining power grids, accelerating water scarcity, and disproportionately impacting vulnerable populations.

Mr. Schneider underscored that global risk governance frameworks have traditionally prioritized floods, cyclones, earthquakes, and pandemics, while heat remains insufficiently integrated into disaster risk architecture. Preparedness, he stated, must move beyond emergency response to preventive and

institutional governance, with clear mandates across ministries and supported by real-time data and coordinated decision-making platforms.

He stressed the need to embed resilience in urban design and infrastructure, including green and blue infrastructure, passive cooling, heat-resilient housing standards, and energy-efficient buildings. At the same time, resilience must address human and economic dimensions through heat-safe labour standards, income protection, targeted public health interventions, and community-based cooling solutions.

Highlighting the importance of measurement and financing, he called for integrating heat into risk assessments, fiscal planning, and climate finance frameworks. He emphasized international cooperation, through multilateral institutions, city networks, and bilateral partnerships, as essential, stating that extreme heat cannot be governed in isolation. He concluded by urging collective action with urgency, coordination, and political leadership to safeguard lives, livelihoods, and development gains.

Dr. Philippe Sas, Head of International Cooperation, Swiss Development Agency

Dr. Philippe Sas congratulated NDMA for convening a timely and important discussion, noting that heat waves, though seasonal, are a recurring and intensifying reality. He emphasized that extreme heat is severely impacting public health across India, particularly in states facing high temperatures combined with humidity. Citing global estimates of over 500,000 heat-related deaths annually, he underlined that heat stress aggravates cardiovascular diseases, diabetes, asthma, infectious diseases, and mental health conditions, disproportionately affecting vulnerable populations including women, outdoor workers, and low-income communities. He emphasized as heatwaves become more frequent and intense, cooling is not a luxury but a necessity. Heat, he stated, must be treated as a medical emergency requiring preparedness and collective action.

Highlighting international cooperation, Dr. Sas noted Switzerland's focus in India on promoting passive cooling in the built environment. He referred to India's Cooling Action Plan of 2019 and ongoing state-level efforts on climate-responsive building design and heat mapping. Dr. Sas emphasized the importance of science-based planning, including heat mapping and evidence-driven decision-making, appreciating India's progress under the India Cooling Action Plan and state-level Heat Action Plans. He noted that Swiss Agency for Development and Cooperation (SDC), in partnership with UNEP and NDMA under the BeCool project, is currently supporting work across five states (Tamil Nadu, Maharashtra, Delhi, Odisha, and Uttar Pradesh) and 20 cities, strengthening preparedness through technical assistance, innovation, capacity building and access to financing.

He shared examples from Switzerland, including climate-sensitive urban design in Bern, the Green City Zurich initiative promoting green roofs and energy-efficient buildings, and Geneva's lake water-based cooling system reducing energy use and emissions. Swiss institutions such as ETH-Zurich, EPFL, and EMPA are actively engaged in developing adaptable solutions, including in India.

Concluding, Dr. Sas emphasized science-based heat mapping, regional collaboration, adequate financing, and private sector participation to scale integrated heat management solutions. He reiterated Switzerland's commitment to practical, scalable passive cooling solutions through sustained cooperation with NDMA, UNEP, and other partners.

Keynote Address

Dr. Krishna S. Vatsa, Member and Head of Department, NDMA

Dr. Krishna S. Vatsa welcomed distinguished delegates, international partners, and experts, noting that heat waves have become an increasingly severe and recurring hazard. Referring to 2023, 2024, and 2025 as the three warmest years on record, he observed that heat waves are lasting longer, occurring more frequently, and significantly affecting livelihoods, daily routines, and critical infrastructure. He emphasized that sustained mitigation and adaptation efforts are now essential.

He highlighted that the annual workshop is strategically organized ahead of the summer season to provide states and districts adequate time to strengthen preparedness, particularly through Heat Action Plans (HAPs). The growing participation of national and international experts reflects expanding recognition of heat risk and the need for collaborative solutions.

Key Priorities Emphasized:

- **Formal Recognition of Heat Wave as a Hazard:**

  NDMA has enabled consideration of heat wave under mitigation funding. The 16th Finance Commission has recommended its notification as a disaster, which would unlock access to institutional financial mechanisms and strengthen implementation.

- **Strengthening Sectoral Preparedness:**

  - Transportation: Railways and related systems are adapting operations to manage extreme temperatures.
  - Energy: Addressing rising peak electricity demand and grid resilience.
  - Education: Beyond rescheduling school hours, improving thermal comfort within school infrastructure.
  - Health: Enhancing monitoring of heat-related morbidity and mortality in coordination with the Ministry of Health and Family Welfare.

- **Improved Risk Assessment:**

  Moving beyond temperature thresholds toward development of a composite heat index combining heat and humidity, in collaboration with the India Meteorological Department and academic institutions.

- **Expansion and Improvement of Heat Action Plans:**

  Over 250 HAPs have been developed. The focus now is on:

  - Universal coverage across districts and cities
  - Improving contextual relevance and quality
  - Simplifying templates for faster implementation
  - Avoiding replication and ensuring local customization

- **Long-Term Mitigation Measures:**

  Emphasis on passive cooling strategies, microclimate improvements, and enhanced thermal comfort in built environments.

Dr. Vatsa also underscored the role of artificial intelligence tools, strengthened technical capacity, international cooperation, and improved access to finance as critical enablers for scaling heat resilience. He concluded by expressing confidence that the workshop deliberations would yield practical and constructive outcomes to strengthen national preparedness.

Vote of Thanks

Ms. Mrinalini Shrivastava, IPS, Director (International Cooperation), NDMA

Ms. Mrinalini Shrivastava expressed sincere gratitude to the esteemed dignitaries on the dais, Members and Secretary of the NDMA, distinguished delegates from partner countries, senior officers from the Government of India and State Governments, representatives of embassies in New Delhi, international organizations, civil society institutions, technical partners, and all participants.

She noted that India is honoured to convene this important global platform dedicated to strengthening preparedness, resilience, and risk governance for extreme heat. On behalf of the NDMA, she thanked all participating countries and their embassies for their continued partnership and commitment to advancing collective climate and disaster risk resilience.

She extended heartfelt appreciation to international organizations, civil society groups, and academia, whose field-based experience and community engagement remain critical in protecting vulnerable populations from the growing risks of heat waves. She also acknowledged the exhibition organized alongside the workshop, showcasing collaborative efforts and achievements.

Ms. Shrivastava conveyed special thanks to valued technical partners, including CDRI, UNEP, UNDP, CDP, RMI India Foundation, NRDC, ADRA, SFC, the University of Berkeley, and other collaborating institutions for their sustained knowledge support. She made special mention of the Swiss Agency for Development and Cooperation (SDC) for its cooperation in advancing passive cooling and cool roof initiatives in Delhi and Tamil Nadu, and GIZ under Indo-German technical collaboration for implementing Integrated Climate Risk Management initiatives in Delhi and Maharashtra.

TECHNICAL SESSION-I

HEAT ACTION PLANS - FROM LOCAL TOOLS TO GLOBAL PRACTICES

Opening Remarks

Dr. Krishna S. Vatsa, Member and Head of Department at NDMA, highlighted that Heat Action Plans (HAPs) are central to India's efforts to manage extreme heat. He emphasized the need to scale these plans across the country and ensure their effective implementation with support from states and urban local bodies. He noted that HAPs should evolve from seasonal preparedness measures into long-term governance tools to address growing heat risks.

Chair:

Dr. Krishna S. Vatsa, Member & Head of Department, National Disaster Management Authority (NDMA)

Rapporteurs:

Ms. Niyati Aggarwal, Consultant, NDMA and Mr Rohan Mishra, NRDC

Session Overview

Technical Session I focused on Heat Action Plans as the primary governance mechanism for addressing extreme heat risks. The session explored how localized planning tools are increasingly evolving into structured, scalable, and globally relevant governance models. It brought together practitioners, researchers, policymakers, and international partners with extensive experience in designing and implementing HAPs across diverse climatic and institutional contexts.

The deliberations emphasized the need to transition from reactive emergency responses toward anticipatory planning supported by robust risk assessments, institutional accountability, sustainable financing, and data-driven decision-making.

Evolution of Heat Action Plans: Lessons from Practice

Speaker: Mr. Abhiyant Tiwari, NRDC

Drawing on his experience in developing South Asia's first Heat Action Plan in Ahmedabad during 2012-13, Mr. Tiwari described how early city-level initiatives have since informed planning efforts in multiple urban centres including Nagpur, Jodhpur, Varanasi, and Ayodhya. He stressed that effective heat governance must begin with an understanding that heat is fundamentally a local phenomenon. Temperature thresholds, humidity levels, night-time exposure, and public risk perceptions vary significantly across geographies; therefore, Heat Action Plans must be grounded in localized climatology and forward-looking projections.

Key components identified for robust HAP design included:

1. Comprehensive heat vulnerability and risk assessments
2. Identification of intra-city hotspots
3. Prioritization of limited resources toward high-risk wards
4. Alignment of preparedness, mitigation, and response strategies

Mr. Tiwari outlined a phased planning approach:

1. **Short-term measures:** strengthening early warning dissemination, establishing cooling shelters, enhancing hospital preparedness, and revising working hours during extreme heat events.
2. **Medium-term measures:** improving institutional coordination, expanding community outreach, and strengthening inter-agency collaboration.
3. **Long-term measures:** advancing urban design reforms, expanding green cover, retrofitting infrastructure, and embedding climate-resilient planning within development pathways.

Highlighting the importance of institutional ownership, he cautioned that without a central coordinating authority, Heat Action Plans risk remaining "paper exercises." The appointment of a nodal officer, often conceptualized as a Chief Heat Officer, was identified as a best practice for ensuring continuity, accountability, and inter-departmental convergence.

Institutional Accountability and Governance Structures

Speaker: Dr. Vishwas Chitale, Council on Energy, Environment and Water (CEEW)

Dr. Chitale emphasized that translating Heat Action Plans into effective action requires strong governance architecture supported by clearly defined institutional roles. Presenting the Thane City Heat Action Plan (2022) as a model, he illustrated how structured governance mechanisms can enhance operational readiness.

Key features of the Thane model include:

1. A Heatwave Task Force chaired by the Municipal Commissioner
2. Mandatory participation of all relevant departmental heads
3. A clearly articulated responsibility matrix outlining roles and deliverables

These mechanisms, he noted, help institutionalize accountability and ensure that heat resilience is embedded within administrative processes rather than treated as an ad hoc response.

Dr. Chitale's intervention reinforced that governance design, encompassing leadership structures, coordination platforms, and monitoring systems, is as critical as technical planning in strengthening adaptive capacity.

Financing Heatwave Mitigation through Structured Frameworks

Speaker: Shri Aditya Valiathan Pillai

Shri Pillai presented the National Framework for Heatwave Mitigation along with guidelines for utilizing the State Disaster Mitigation Fund (SDMF) and National Disaster Mitigation Fund (NDMF), aimed at establishing a foundation for systematic mitigation actions. He noted that current efforts across states largely emphasize short-term emergency responses such as awareness campaigns, water distribution, cooling centres, and adjustments to school and work timings. While necessary, long-term interventions often remain incidental and insufficiently targeted toward the populations most at risk.

The framework promotes key principles including decentralization, community participation, collaborative implementation, flexibility in solutions, and a multi-sectoral approach to preparedness. It outlines critical building blocks such as hazard localization, vulnerability assessments, identification of mitigation options, institutional coordination mechanisms, and monitoring frameworks.

Projects seeking funding must be embedded within local Heat Action Plans and anchored in risk assessments. Financing is envisioned through a blended architecture combining SDMF and NDMF resources with state and city budgets, convergence with central schemes, and contributions from private sector, CSR, and donor agencies. This approach reflects a broader policy shift from post-disaster expenditure toward proactive investment in risk reduction.

Measuring and Governing Heat Risk

Speaker: Shri Tarun Garg, RMI India Foundation

Shri Garg highlighted the growing macroeconomic implications of extreme heat, noting that it has evolved from an episodic hazard into a chronic economic threat. Projections indicate potential GDP losses of 2.5-4.5 percent by 2030, while 247 billion labour hours were lost globally in 2023 due to heat exposure.

He introduced the National Heat Impact Assessment (HIA) Framework, designed to institutionalize accountability by establishing standards, indicators, and data mandates. The framework supports operational decision-making through dashboards, enables resource deployment, and generates state-level heat risk reports across national, state, and city tiers. The presentation underscored the importance of transitioning from managing individual heat events toward governing heat risk through structured data ecosystems and coordinated institutional action.

The session underscored that a substantial proportion of districts across India are exposed to high to very high heat risk, highlighting the urgent need to scale resilience interventions nationwide. It noted that coordinated programmatic efforts are already underway to support hundreds of cities and districts in developing and operationalizing Heat Action Plans through localized data collection, field validation, targeted technical assistance, and structured monitoring systems. These initiatives reflect a broader transition toward evidence-based governance, enabling authorities to identify priority hotspots, allocate resources more efficiently, strengthen institutional preparedness, and implement context-specific strategies to manage escalating heat risks.

International Perspectives on Climate Adaptation

Speaker: Ms. Elizabeth Atwell, British High Commission

Ms. Atwell emphasized the importance of integrating infrastructure resilience, climate adaptation, and climate finance within national planning frameworks. She highlighted that international partnerships can accelerate innovation, strengthen institutional capacity, and facilitate knowledge exchange, thereby supporting countries in addressing increasingly complex climate risks.

Discussant Interventions and Interactive Deliberations

As indicated in the official programme, Technical Session I featured discussant interventions from state representatives of Telangana, Uttar Pradesh, Madhya Pradesh, and Odisha, who shared implementation experiences from the field.

The discussant segment provided grounded administrative perspectives that complemented the technical presentations, demonstrating how HAPs are being operationalized across diverse governance contexts. Collectively, the interventions illustrated that while conceptual frameworks and templates for HAP development are rapidly advancing, the primary challenges now lie in financing, institutionalization, and local adaptation.

Representative from Government of Uttar Pradesh

Ms. Dwivedi highlighted Uttar Pradesh's large-scale implementation experience, noting that the state has prepared HAPs across all 75 districts using standardized templates and technical partnerships.

She emphasized that the state has moved beyond district-level planning and initiated municipal-level HAP development, with multiple municipal corporations already preparing localized plans. The state has institutionalized HAP implementation as a year-round governance process rather than a seasonal exercise, incorporating monitoring and periodic review mechanisms to ensure continuous improvement.

At the same time, she identified resource constraints as a key barrier and underscored the need for structured national guidance on financing mitigation measures such as cool roofs and urban adaptation infrastructure. Her intervention reinforced that scaling HAP implementation requires both technical frameworks and predictable financial mechanisms.

Representative from Government of Odisha

The Odisha representative informed participants that the state formally declared heatwave a state-specific disaster as early as 2015, reflecting a proactive governance approach and early recognition of heat as a systemic risk.

The discussant emphasized that formal hazard recognition strengthened administrative prioritization, enabled interdepartmental coordination, and improved monitoring systems. Odisha's experience demonstrated that policy recognition often serves as the first institutional step toward operational preparedness and structured risk management.

Representatives from Telangana and Madhya Pradesh

The participation of state representatives from Telangana and Madhya Pradesh underscored the growing momentum of subnational innovation in heat governance. Their interventions highlighted the importance of peer learning across states and demonstrated that localized experimentation is helping refine implementation models.

The collective insights from these states highlighted three practical lessons:

- Heat Action Plans must be locally contextualized rather than centrally standardized.
- Institutional ownership improves when departmental roles are clearly assigned.
- Partnerships with technical and research organizations accelerate implementation readiness.

Representative from UNICEF

The UNICEF representative emphasized the importance of evidence-based implementation and field validation in scaling heat adaptation solutions. Drawing on pilot initiatives undertaken with state governments, the intervention highlighted that demonstrating measurable impacts on the ground is critical for building confidence among policymakers and enabling wider adoption of heat mitigation strategies.

The discussant stressed that data-driven approaches and demonstration pilots help translate policy concepts into actionable programs. Evidence generated through localized interventions not only informs decision-making but also strengthens institutional credibility and supports resource mobilization.

Open Discussion

The open discussion segment brought forward critical governance, implementation, and equity-related concerns. Participants noted that although HAPs are increasingly institutionalized across states, major gaps remain in financing, labour protection, community participation, and technical standardization.

Discussions highlighted that institutional ownership becomes visible when cities allocate dedicated budget lines for heat action activities. It was further emphasized that while response funding can be supported through disaster relief funds, long-term mitigation requires integration with central schemes, state programmes, and municipal development financing.

Participants discussed language and drafting of HAPs, agreeing that plans should be prepared in regional languages for local usability while also maintaining English versions to enable cross-learning across jurisdictions. It was also observed that early plans often replicated national templates without contextualization, reinforcing the need to involve local knowledge partners such as academic institutions, civil society organizations, and research agencies.

A discussion on labour advisories highlighted practical constraints in implementing mid-day work restrictions for informal workers. Participants identified gaps in enforcement capacity, limited awareness among small contractors, and weak worker empowerment to demand compliance.

Participants also emphasized that advisories alone are insufficient and that occupational heat safety must be embedded within labour regulations and compliance mechanisms.

An intervention questioned the framing of vulnerable populations as passive recipients rather than active agents in planning. Participants noted that many HAPs still follow top-down approaches and suggested participatory planning methods, including community-based representation and integration with broader resilience frameworks.

Key Takeaways from the Session

- HAPs have emerged as the cornerstone of India's strategy for managing extreme heat and must evolve from seasonal preparedness documents into long-term governance instruments capable of reducing systemic climate risk.
- There is a critical need to transition from reactive emergency response toward anticipatory, risk-informed planning supported by robust vulnerability assessments, institutional accountability, sustainable financing, and data-driven decision-making.
- Heat is fundamentally a local phenomenon; therefore, HAPs must be grounded in localized climatology, intra-city hotspot identification, and targeted resource deployment to effectively protect high-risk populations.
- Strong governance architecture is essential for effective implementation. Clearly defined institutional roles, leadership structures, and coordination platforms, such as dedicated task forces and nodal officers, are necessary to ensure accountability and translate plans into measurable outcomes.
- Structured financing frameworks are vital, requiring a shift from post-disaster expenditure toward proactive investment in mitigation through blended funding models that leverage national and state funds, city budgets, private sector participation, and donor support.
- The introduction of standardized indicators and data systems, including the National Heat Impact Assessment framework, represents a significant step toward institutionalizing heat risk governance, enabling operational decision-making and strengthening preparedness.
- The session signalled a clear evolution in India's heat governance discourse, from managing individual heat events to governing long-term climate risk, with localization, financing, institutional ownership, and data-driven tools forming the foundation for scaling resilience nationwide.

Conclusion

Technical Session I reaffirmed that Heat Action Plans constitute the backbone of India's extreme heat governance architecture. While substantial progress has been made in developing localized plans, the next phase must focus on strengthening implementation, embedding institutional accountability, and aligning financing with long-term mitigation priorities. The session signalled a clear shift in national discourse, from reactive heatwave response toward anticipatory, risk-informed governance. Transforming Heat Action Plans into dynamic and continuously evolving instruments will be critical to safeguarding lives, protecting livelihoods, and sustaining economic productivity in the face of intensifying climate extremes.

TECHNICAL SESSION-II

HEAT-RESILIENT INFRASTRUCTURE: CLIMATE-SMART URBAN DEVELOPMENT

Opening Remarks

Shri Amit Prothi, Director General of the Coalition for Disaster Resilient Infrastructure (CDRI), emphasized that infrastructure must be planned and designed to withstand rising temperatures and other climate risks. He highlighted the importance of adopting integrated and climate-resilient approaches in urban development as cities continue to expand.

Chair:

Shri Amit Prothi,
Director General, Coalition for Disaster Resilient Infrastructure (CDRI)

Rapporteurs:

Ms. Lena, Consultant, NDMA and Ms. Neha Awasthi, UNEP

Session Overview

Technical Session II focused on infrastructure and urban systems as the frontline of heat resilience, examining how housing, transport, power systems, urban planning, cooling demand, and regulatory frameworks must integrate extreme heat considerations into infrastructure development.

The central premise was that infrastructure forms the backbone of urban life, and extreme heat directly stresses this backbone. With the past decade being among the hottest in recorded human history, preparedness is no longer optional but central to safeguarding lives, livelihoods, and development gains. As India stands at a critical juncture of rapid urban expansion, the session explored how cities can avoid locking in future heat risks through informed policy, design innovation, regulatory reform, and financing mechanisms.

Mainstreaming Heat into Urban Infrastructure

Mr. Benjamin Hickman, Programme Management Officer, UNEP

Mr. Hickman presented UNEP's work across five Indian states under the BeCool Project funded by SDC, aimed at embedding long-term heat mitigation within development control regulations and master plans. He highlighted that most local building regulations currently lack mandatory passive cooling provisions, particularly in buildings used by vulnerable populations. Urban master plans, he noted, often insufficiently incorporate heat resilience and access to nature. He therefore stressed the need to move beyond Heat Action Plans as emergency tools toward integrating mitigation measures within statutory planning frameworks.

Importantly, he cautioned that unhampered growth in air conditioning can worsen urban heat island effects and compromise power system reliability. A passive-first approach, prioritizing building design, shading, ventilation, and materials, can reduce energy demand, lower consumer costs, and provide protection to populations that may not have access to air conditioning for decades. Drawing from implementation experience, he highlighted the Tamil Nadu demonstration model, which operates across six departments and illustrates multi-departmental convergence beyond disaster management authorities, enabling simultaneous progress on urban heat mitigation and sustainable cooling. Additional planning insights emphasized linking urban heat analysis with targeted greening, cool surfaces, permeable materials, water-sensitive urban design, updated building regulations, and retrofits in public buildings such as schools and housing programmesHe noted that tools like, AI-enabled heat mapping, and graded levels of technical support (LOD1–LOD4 of UNEP-CEPT UHI Methodology) can help cities act within realistic budget constraints. He cautioned that protecting the power system is essential to protect lives during heatwaves and that passive cooling and efficiency are the strongest levers to balance cooling needs - alongside greater efforts in digitalisation and smart grids.

He informed participants that more than 50 cities in India have signed up to COP30 Presidency and UNEP BeatTheHeat implementation drive. This initiative will scale robust UHI assessment, linking heat risk diagnostics to passive cooling interventions. Evidence suggests that at least a 35% reduction in energy use in air-conditioned buildings can be unlocked by using basic passive cooling interventions.

Policy and Urban Missions: Ministry-Level Interventions

Ms. Grace L. Pachuau. Deputy Secretary, Ministry of Housing and Urban Affairs (MoHUA)

Representing the Ministry, Ms. Pachuau outlined several policy instruments embedding climate considerations into urban development. These include the URDPFI Guidelines, model building bylaws incorporating cool roofs and green building norms adopted in over 30 cities, and the Climate Project Preparation Facility under NIUA. She highlighted national missions such as AMRUT, which supports water supply improvements and rejuvenation of over 4,000 water bodies, alongside initiatives like "Women for Trees," involving more than 35,000 self-help group members in plantation and park maintenance. These interventions were presented as dual-benefit strategies, reducing urban heat while improving physical and mental well-being.

The Ministry emphasized that while policy contours and financial support are provided at the national level, Urban Local Bodies must contextualize and implement locally appropriate solutions. Coordination across NDMA, environment ministries, power departments, and state governments was identified as essential, as working in silos is no longer viable.

Digital Tools, AI and Urban Climate Modelling,

Mr. Ander Zozaya, ETH Zurich – Cooling Singapore Initiative

Mr. Zozaya presented the concept of a Digital Urban Climate Twin, a modelling platform integrating anthropogenic heat emissions, building energy use, transport heat contributions, wind corridors, and green infrastructure to simulate urban design scenarios at city and district scales.

The tool combines heat exposure maps with socio-economic datasets to determine district-level vulnerability and evaluate mitigation strategies such as additional greenery, reflective materials, and enhanced wind flow.

He noted that projections for future climate scenarios indicate approximately an additional 1.5°C of heating in certain urban regions, shaped by spatial growth and prevailing wind conditions.

While emphasizing the accelerating role of AI in modelling, he cautioned that "not necessarily more data is always better," stressing the importance of clearly defining planning questions and prioritizing usability for decision-makers over technical complexity.

Building Heat Resilient Cities

Shri Aun Abdullah, Lodha Foundation

Shri Abdullah presented the role of integrated township development in designing heat-resilient urban futures. He emphasized that sustainable urbanization is a defining imperative for India's growth story, particularly in the face of escalating climate risks and projected increases in extreme heat intensity.

He outlined key contributors to urban heat, including man-made surfaces, urban geometry, reduced green spaces, vehicles, and buildings, and proposed mitigation strategies such as large vegetated zones, reflective materials, layouts enabling wind flow, and reduced waste heat generation.

Preliminary SUHI assessments show that Lodha's townships recorded 3–5°C lower daytime surface temperatures and 2–3°C lower ambient temperatures compared to adjacent organic settlements, indicating improved indoor thermal comfort and reduced energy consumption.

He further emphasized the importance of establishing living laboratories with on-ground measurements to capture diurnal performance variations and develop micro-scale thermal comfort databases. Such efforts help overcome spatial and temporal limitations of satellite data and strengthen evidence-based deployment of mitigation solutions.

The proposed Urban Heat Mitigation Hub is positioned as a blueprint for sustainable urbanization, enabling cities to better understand microclimate dynamics while lowering operational carbon emissions.

Comparative thermal mapping presented during the session illustrated surface temperatures below 30°C under tree canopy, compared to up to 80°C on exposed car surfaces, reinforcing the value of green infrastructure.

International Perspective: Impact-Based Forecasting and Coalitions

Ms. Emma Wright, Climate & Environment Adviser, British High Commission

Ms. Wright emphasized the importance of coalition-building and cross-border learning under the UK's Climate Action for a Resilient Asia-Pacific programme. She highlighted initiatives such as the WISER programme and the South Asia Hydro-Met Forum, which promote impact-based forecasting, predicting not just weather conditions but their real-world consequences.

She stressed that early warning must translate into localized, actionable decision-making at city and workplace levels, ensuring that alerts trigger predefined responses and strengthen disaster risk reduction outcomes.

Financing Resilient Infrastructure

Shri Sandeep Singh, International Finance Corporation (World Bank Group)

Mr. Singh presented tools including EDGE green building certification, the Building Resilience Index, and the APEX Green Cities Tool. He emphasized that scaling resilient infrastructure depends on credible and transparent data frameworks capable of attracting private finance and enabling evidence-based investment decisions.

Discussant Interventions and Interactive Deliberations

The discussant segment deepened the session's technical deliberations by introducing operational, sectoral, and systems-level perspectives on infrastructure resilience under extreme heat conditions.

Contributions from experts representing energy systems, infrastructure planning, aviation, and policy research highlighted the multidimensional nature of heat risks and underscored the need for integrated approaches spanning engineering, governance, and financing.

Collectively, the interventions reinforced that heat-resilient infrastructure is not limited to physical design solutions but requires coordinated institutional frameworks, risk-informed investments, and cross-sectoral planning.

Representative from Prayas Energy Group

Ms. Shweta presented a critical systems perspective on the strain extreme heat places on power infrastructure. She highlighted how rising temperatures significantly increase electricity demand due to cooling loads, placing stress on transmission and distribution systems. Evidence shared during her intervention indicated that approximately **10 percent of transformers experienced failures during peak heat conditions in 2024,** demonstrating the vulnerability of power infrastructure to temperature extremes.

She further explained that heat reduces thermal efficiency in generation systems and affects renewable energy output, including solar and wind performance, thereby compounding system stress. These factors, she noted, can trigger cascading grid failures if not addressed through integrated planning.

Her intervention emphasized that resilience strategies must extend beyond expanding supply capacity toward integrated demand management, building efficiency standards, and improved forecasting for power procurement planning.

Open Discussion

Discussion during this session emphasized infrastructure as the backbone of urban systems and highlighted that extreme heat directly stresses this backbone. Participants noted that with the past decade among the hottest on record, preparedness must be treated as central to safeguarding lives, livelihoods, and development gains.

The deliberations stressed that India's rapid infrastructure expansion presents both a risk and a historic opportunity: cities can either replicate development patterns that intensify urban heat islands or adopt preventive and climate-resilient approaches.

Participants emphasized the importance of adopting a multi-hazard lens because heat intersects with flooding, air quality, water stress, and energy security. This requires systems-based planning rather than fragmented interventions.

Key Takeaways

- Infrastructure plays a critical role in shaping resilient urban futures, and extreme heat considerations must be integrated into planning, design, financing, and operational frameworks rather than addressed through reactive measures.
- There is an urgent need to transition from adaptive responses toward preventive urban design to ensure that India's rapid infrastructure expansion does not lock cities into long-term climate vulnerabilities. Infrastructure decisions made today will determine whether future urban systems amplify heat risk or enhance resilience.
- Passive cooling strategies and nature-based solutions, including reflective materials, urban greening, permeable surfaces, and climate-sensitive building design, were identified as cost-effective approaches to reducing thermal stress and energy demand.
- Strengthening regulatory frameworks and embedding heat mitigation within master plans and development control regulations are essential for mainstreaming resilience. Widespread adoption of such measures has the potential to significantly reduce neighbourhood temperatures and lower cooling demand.
- Heat resilience is closely interconnected with energy security, air quality, water systems, and overall urban liveability, reinforcing the need for multi-sectoral coordination across ministries and institutions.
- Transparent data frameworks and innovative financing tools are critical enablers for scaling resilient infrastructure and attracting investment, while technological solutions including digital modelling platforms, can support evidence-based planning and decision-making.
- Building heat-resilient infrastructure requires integrated policy frameworks, cross-sector collaboration, and forward-looking governance to ensure that resilience becomes embedded within the DNA of urban development.

Conclusion

Technical Session II underscored that infrastructure is both a vulnerability multiplier and a resilience enabler in the context of extreme heat. India's projected urban expansion presents a defining moment; the choices made in building materials, master plans, energy systems, transport networks, and housing design will determine whether future cities amplify heat risk or mitigate it.

The session reinforced that heat-resilient infrastructure requires integrated policy frameworks, preventive planning, cross-sector coordination, climate-aligned financing, and data-driven yet governance-centred implementation. Translating early warning into enforceable operational protocols across sectors will be critical to strengthening resilience.

Ultimately, the deliberations emphasized that heat resilience must become embedded within the DNA of urban development, not treated as an add-on after infrastructure is built.

TECHNICAL SESSION-III

HEAT, HEALTH AND HUMAN SYSTEMS-PROTECTING LIVES AND LIVELIHOODS

Opening Remarks

Ms. Rita Missal, Member, NDMA, and Mr. Gerald Guskowski, Programme Director and Cluster Coordinator, GIZ India, opened the session by highlighting the importance of protecting lives and livelihoods from extreme heat. They emphasized that heat resilience must go beyond seasonal advisories and should be integrated into infrastructure design, health systems, labour policies, and social protection mechanisms to reduce long-term risks.

Chair:

Ms. Rita Missal, Member, National Disaster Management Authority (NDMA)

Co-Chair:

Mr. Gerald Guskowski, Programme Director & Cluster Coordinator, GIZ India

Rapporteurs:

Mr. Shishir Agarwal, Sr. Consultant, NDMA and Ms. Sayantani Ghosh, GIZ

Session Overview

Technical Session III placed human systems at the centre of extreme heat governance, shifting the discourse from meteorological thresholds toward the protection of lives, livelihoods, and institutional capacities. The session examined the intersections of public health preparedness, adaptive social protection, labour systems, mortality surveillance, occupational safety, and climate justice. Discussions emphasized that heatwaves are not merely climatic events but multidimensional development risks that demand cross-sectoral integration across health, labour, and social protection systems to ensure effective preparedness, response, and long-term resilience.

Adaptive Social Protection and Heat Risk

Speaker: Ms. Cristina Stefan, Head of Advisory, Centre for Disaster Protection

Ms. Stefan introduced Adaptive Social Protection (ASP) as a foundational pillar in managing heat-related impacts. She underscored that excess mortality and livelihood disruption during heatwaves often remain under-recognized, particularly among informal workers and near-poor households.

She identified three core roles of social protection in heat contexts:

- Income stabilization during climate shocks
- Shock-responsive delivery systems enabling rapid cash transfers and wage continuity
- Targeted protection of vulnerable groups highly exposed to heat risk

Drawing lessons from pandemic-era interventions, she emphasized integrating employer-supported wage continuity and emergency income mechanisms into heat governance strategies. A key message from her intervention was that social protection must shift from episodic relief to long-term risk reduction, ensuring that development planning itself incorporates heat resilience rather than reverting to "business as usual" after extreme events.

Preparedness, Early Warning and Health System Resilience

Speaker: Mr. John Abo, Asian Disaster Preparedness Center (ADPC)

Mr. John Abo highlighted the importance of strengthening primary healthcare systems, enhancing clinical training, institutionalizing surveillance, and establishing predefined response protocols to improve preparedness for heat-related illnesses. Participants noted persistent challenges such as the absence of standardized clinical protocols, limited awareness among frontline health workers, and weak integration between meteorological alerts and health surveillance systems.

An intervention highlighted major heat-related illnesses, including heat cramps, heat exhaustion, and heat stroke, and introduced the ASPIRE toolkit, a 33-indicator diagnostic framework designed to evaluate the adaptability and shock-responsiveness of social protection systems. The toolkit enables governments to identify systemic gaps and strengthen climate-resilient delivery mechanisms, while speakers underscored that sustainable financing and research-driven targeting are essential for ensuring long-term resilience rather than reactive responses.

Mortality Surveillance and Data Systems

Speaker: Dr. Dileep Mavalankar, Indian Institute of Public Health Gandhinagar

Dr. Mavalankar emphasized that heat-related deaths remain significantly underreported due to weak epidemiological and registration systems. He observed that death data is often collected for administrative purposes rather than public health analysis, highlighting a "lack of administrative and political will to make death data and analysis public."

He proposed several measures, including daily reporting of cremation and burial data during heatwave periods, mandatory publication of excess mortality statistics, strengthened hospital and civil registration systems, and standardized attribution protocols for heat mortality. His intervention underscored that without reliable mortality data, heat governance remains reactive and incomplete.

Occupational Safety and Labour Exposure

Speaker: Dr. Yogindra Samant, International Labour Organization (ILO)

Dr. Samant framed extreme heat as a global occupational safety crisis, citing estimates that approximately 2.4 billion workers worldwide are exposed to excessive heat. He observed that most exposures occur during regular working days rather than declared heatwave periods and highlighted the disproportionate risks faced by informal workers such as street vendors, sanitation staff, and construction labourers.

Key recommendations included enforceable heat exposure standards, mandatory rest, water, and shade provisions under the RE.WA.SH+ strategy, employer accountability, and inclusion of small and medium enterprises in occupational safety planning.

Social Protection Financing and Worker-Centric Heat Resilience

Speaker: Ms. Ritu Bharadwaj, Director – Climate Resilience, Finance and Loss & Damage

Ms. Ritu Bharadwaj, a climate finance and resilience expert with over two decades of experience in policy development, programme management, and research, delivered a comprehensive intervention on protecting workers from extreme heat through integrated social protection systems. She began by highlighting the growing intensity and frequency of disasters across developing countries, Small Island Developing States (SIDS), and Least Developed Countries (LDCs), noting that these trends are placing unprecedented pressure on labour markets and social protection systems.

Ms. Bharadwaj introduced operational frameworks designed to safeguard workers from heat stress, emphasizing the importance of establishing clear trigger mechanisms based on heatwave thresholds and heat index values. She underscored that effective protection requires diagnostic tools capable of assessing existing policies, institutional systems, and programme delivery approaches.

Central to her presentation was the **ASPIRE diagnostic tool**, which evaluates policy effectiveness, identifies systemic gaps, estimates financial and technical resource requirements, and maps stakeholders best positioned to address these challenges. The tool also helps articulate the business case for investment while establishing realistic pathways for implementation. She emphasized that country

diagnostics are critical for enabling **locally led adaptation**, as they support governments in revealing coordination gaps, strengthening institutional frameworks, and improving last-mile delivery mechanisms.

Ms. Bharadwaj further outlined categories of interventions requiring policy and regulatory reform alongside those needing financial and technical assistance. Presenting cost estimates, she noted that addressing existing protection gaps could require investments ranging from **USD 66 million to USD 91 million,** while broader social protection spending already represents substantial national commitments. Importantly, she advocated leveraging existing social protection programmes to simultaneously deliver climate resilience and food security, reminding security, highlighting the opportunity to align welfare spending with adaptation outcomes.

Discussing implementation pathways, she proposed a roadmap focused on mobilizing investment and technical support, strengthening risk analytics within policy systems, and deploying "people plus technology" approaches for last-mile service delivery. Initiatives such as Climate Saathi networks and women-led help desks were cited as examples of community-centered models capable of enhancing crisis preparedness and response.

Ms. Bharadwaj concluded by emphasizing that protecting workers from extreme heat is not solely a welfare imperative but a strategic investment in economic stability. Embedding climate risk considerations within social protection architecture, she observed, is essential for building resilient labour systems and safeguarding productivity in an increasingly warming world.

Advancing Heat Metrics to Protect Labouring Populations

Speaker: Dr. Ashok Gadgil, Professor, University of California, Berkeley

Dr. Ashok Gadgil presented pioneering research on advancing heat metrics to better protect labouring populations, noting that **over 350 million sun-exposed workers face hazardous heat conditions,** necessitating more precise tools for risk assessment and early warning.

He began by observing that widely used heat indices often fail to capture the realities of occupational exposure, as they typically ignore critical variables such as metabolic heat generated during hard physical labour and the additional burden imposed by direct solar radiation. To address these limitations, Dr. Gadgil introduced the **Enhanced Heat Index (EHI-N*),** where "N" represents the Metabolic Equivalent of Task (MET), an internationally recognized measure of labour intensity. The enhanced framework incorporates three key improvements:

- Acknowledgement of higher metabolic heat generation during strenuous work
- Integration of realistic physiological limits, including sweat rate and skin blood flow
- Inclusion of solar load alongside conventional weather data

He explained that labouring in direct sunlight can trigger health damage at significantly lower temperature and humidity levels compared to light work conducted in shaded environments, highlighting the importance of differentiating risk thresholds based on work intensity.

Using the EHI-N* model, physiological conditions can be categorized into six heat-risk zones across temperature ranges of **20–60°C** and relative humidity levels of **0–100 percent,** enabling more nuanced assessment of worker vulnerability. Presenting findings from June 2024, Dr. Gadgil noted that

approximately **37 percent of India reached Zone 6,** the most dangerous category, for outdoor labourers engaged in heavy work under direct sunlight. Further analysis indicated that nearly **92 percent of the country experienced Zone 5 or higher conditions,** underscoring the scale of occupational heat risk.

SHRAM Dashboard: A Real-Time Risk Assessment Tool

Dr. Gadgil also introduced the **System for Heat-Risk Assessment of Manual Labour (SHRAM)-** a live dashboard designed to support decision-making through near real-time alerts for high-risk zones.

Key features include:

- Forecast alerts ranging from one to seven days
- Historical heat-risk trends
- Early warnings for Zones 5 and 6
- Open access through free registration
- API-enabled integration for institutional use

He emphasized that such tools can enable governments, employers, and local authorities to move toward anticipatory action by aligning labour advisories, work schedules, and safety protocols with scientifically calibrated heat thresholds.

Dr. Gadgil concluded by stressing that improving heat-risk metrics is fundamental to safeguarding worker health, strengthening occupational safety standards, and enhancing heat risk governance. Accurate and context-sensitive indices, he noted, can transform early warning systems from temperature-based alerts into actionable risk management tools tailored to human exposure. His intervention reinforced the need to integrate advanced analytics into national heat action strategies, ensuring that protective measures reflect real-world labour conditions rather than generalized meteorological parameters.

Discussant Interventions and Interactive Deliberations

The discussant segment provided critical institutional, technical, and field-level perspectives that deepened the analytical dimension of Technical Session III. Interventions from representatives across science policy, public health, agriculture, and research institutions highlighted the operational realities of implementing heat resilience strategies on the ground and reinforced the session's core premise that protecting lives and livelihoods requires coordinated action across sectors.

Representative from Department of Science and Technology (DST)

Ms. Swati outlined the Department of Science and Technology's ongoing efforts to strengthen India's scientific ecosystem for climate resilience. She highlighted DST's role in implementing national missions under the National Action Plan on Climate Change (NAPCC), particularly those focused on strategic knowledge for climate adaptation.

She emphasized that DST is supporting a national network of research institutions conducting interdisciplinary studies to understand the implications of climate change, including its effects on human health and heat exposure. One such initiative has specifically examined heat-related impacts within broader climate-health research frameworks, generating important evidence to guide policy and adaptation planning.

She further informed participants that DST has undertaken a nationwide vulnerability assessment mapping climate risk across more than 680 districts of India. This work has also included hazard-risk mapping and is now being integrated into the broader national resilience framework currently under development as part of India's forthcoming National Adaptation Plan.

Her intervention underscored that alongside implementation, sustained investment in research, modelling, and scientific evidence generation is essential for designing robust and anticipatory heat governance systems.

Representative from Ministry of Health and Family Welfare

Dr. Srivastav drew attention to challenges faced by health systems in diagnosing, monitoring, and managing heat-related illnesses. He noted that heat stress symptoms often overlap with other medical conditions, leading to underreporting and inconsistencies in surveillance data.

He emphasized the need for:

- Standardized clinical treatment protocols
- Stronger integration between meteorological alerts and hospital preparedness systems
- Enhanced training of frontline healthcare providers
- Strengthened surveillance mechanisms

He stressed that primary healthcare providers serve as the first point of contact for vulnerable populations, particularly informal workers, and therefore must be equipped with both technical guidance and operational preparedness frameworks.

His intervention reinforced the session's broader conclusion that health systems must transition from passive treatment models toward anticipatory preparedness systems aligned with early warning triggers.

Representative from NARAA, Ministry of Agriculture and Farmers' Welfare

Dr. Mishra provided an agricultural systems perspective, emphasizing that crops are as vulnerable to heat stress as human populations. He noted that in large parts of northern India, crop cultivation becomes

difficult during peak summer months following harvest cycles, illustrating the direct linkage between heat exposure and food production systems.

He explained that heat stress affects plant physiology by delaying growth processes, reducing transpiration, and causing rapid drying that can result in near-failure conditions. Modelling studies indicate that even modest temperature increases can significantly reduce yields, with sudden temperature spikes such as those observed during abnormal seasonal events leading to major productivity losses.

Dr. Mishra highlighted adaptive strategies currently being explored, including:

- Climate-controlled greenhouse cultivation
- Traditional indigenous agricultural practices
- Optimized irrigation methods to reduce field temperature
- Subsurface irrigation techniques in water-scarce conditions

He also noted that agricultural labourers have historically adapted work schedules, starting early, pausing during peak heat, and resuming later, a practice that demonstrates how behavioural adaptation can complement technological solutions.

His intervention emphasized that heat resilience must extend beyond urban and public health systems to encompass food security, agricultural productivity, and rural livelihoods.

Representative from Prayas Energy Group, Pune

Dr. Parchure brought a people-centred perspective grounded in field research on informal and outdoor workers. She emphasized that understanding risk perception among vulnerable populations is critical for designing effective early warning communication and response strategies.

Drawing from surveys and qualitative studies among informal workers such as street vendors, she noted that although heat-related illness is widespread, workers' primary concern is not mortality but loss of wages and medical expenses. This insight highlights a fundamental disconnect between official risk messaging and lived realities.

Key findings presented by Dr. Parchure included:

- A high prevalence of chronic conditions such as diabetes and hypertension among outdoor workers
- Continuous heat exposure regardless of official heatwave declarations
- Microclimate temperature differences between city averages and actual worksite conditions
- Significant morbidity burdens that remain unrecorded in official statistics

She illustrated that while city temperatures may register 39°C, worksite temperatures experienced by vendors can reach 44°C, substantially increasing health risks.

Dr. Parchure also emphasized structural barriers to implementing recommended coping strategies. For instance, advice to hydrate regularly is impractical for workers lacking access to safe drinking water or sanitation facilities. She noted that many informal workers remain invisible to formal systems and are not covered by social protection schemes.

Her intervention reinforced that heat resilience strategies must be designed around lived realities, rather than assumptions, and that communication, surveillance, and policy frameworks must align with the needs of vulnerable populations.

Open Discussion

The discussant segment strengthened the session's central message that extreme heat is a systemic development challenge requiring integrated action across science, governance, public health, labour systems, agriculture, and social protection frameworks.

The open discussion focused on operational and systemic challenges in health preparedness and response. Participants raised concerns about diagnosing heat-related illnesses and inconsistent reporting across health facilities. Key issues identified included lack of standardized clinical protocols, limited awareness among frontline health workers, and weak integration between meteorological alerts and health surveillance systems.

Speakers emphasized the need to strengthen primary healthcare capacity, improve clinical training, institutionalize heat-related surveillance, and establish predefined response protocols. A question on hospital preparedness highlighted the need for designated cooling spaces, rapid triage systems, clear treatment guidelines, and referral mechanisms, with strong emphasis on strengthening district-level preparedness. Participants also discussed the integration of meteorological alerts with social protection systems, noting the importance of linking forecast thresholds with predefined cash-transfer or labour protection measures to enable timely and anticipatory responses.

Key Takeaways

- Technical Session III placed human systems at the centre of extreme heat governance, emphasizing the need to move beyond meteorological thresholds toward safeguarding lives, livelihoods, and institutional capacities. Heatwaves were recognized as systemic human development risks requiring integrated action across public health, labour governance, and social protection frameworks.
- Effective heat governance must prioritize people, particularly vulnerable populations such as informal workers, the near-poor, and those with limited access to cooling. Resilience should extend beyond advisories and seasonal alerts to become embedded within infrastructure design, institutional standards, and long-term risk reduction strategies.
- Protecting lives requires a structural shift from short-term disaster response toward systemic preparedness anchored in inclusive development planning.
- Adaptive Social Protection (ASP) emerged as a foundational pillar for managing heat-related risks. Stronger income stabilization measures, shock-responsive delivery systems, and targeted protections are necessary to address excess mortality and livelihood disruptions that often remain under-recognized.
- Integrating employer-supported wage continuity, emergency income mechanisms, and climate-responsive social protection tools into governance frameworks is essential to move from episodic relief toward long-term resilience.

- Strengthening primary healthcare systems is critical to reducing heat-related mortality. This includes improved clinical training, institutionalized surveillance, and predefined response protocols, while addressing gaps such as the absence of standardized clinical guidelines, limited frontline awareness, and weak integration between meteorological alerts and health systems.
- Research-driven diagnostic tools, such as the ASPIRE framework, highlight the importance of targeted interventions and sustainable financing in strengthening social protection systems. Financial preparedness was recognized as equally important as operational readiness.
- Reliable mortality surveillance is a governance imperative. Addressing underreporting through daily cremation and burial data during heatwaves, mandatory publication of excess mortality statistics, strengthened hospital and civil registration systems, and standardized attribution protocols is essential for evidence-based policymaking and accountability.
- Extreme heat was framed as a major occupational safety challenge, with informal workers, including street vendors, sanitation workers, and construction laborers, facing disproportionate exposure. Recommended measures include enforceable exposure standards, mandatory rest-water-shade provisions, stronger employer accountability, and inclusion of small and medium enterprises within safety planning.
- Closing operational gaps requires designated cooling spaces, rapid triage systems, and clearly defined referral pathways to strengthen district-level response capacity. Forecast thresholds should automatically trigger labor protections and cash-transfer mechanisms, enabling anticipatory rather than reactive responses.
- The session reinforced a paradigm shift in heat governance, from viewing heat as an environmental hazard to recognizing it as a multidimensional human risk affecting health outcomes, economic stability, and social equity.
- Protecting lives and livelihoods must remain at the core of extreme heat strategies, ensuring resilience frameworks are inclusive, preventive, and responsive to the needs of the most at-risk populations.

Conclusion

In closing the discussion, the Chair emphasized that the session's deliberations demonstrated tangible progress in strengthening adaptive social protection mechanisms, improving early warning systems, and expanding preparedness frameworks across sectors. She highlighted the importance of tailoring heat advisories to specific population groups, noting that risk levels vary significantly depending on occupation, health status, and exposure conditions.

She also welcomed the growing preparedness efforts within the health sector, including designated treatment spaces and clinical readiness for heat-related illnesses.

The session concluded with acknowledgement that while significant progress has been made, sustained institutional coordination and implementation will determine whether these insights translate into real protection for vulnerable individuals including workers such as domestic and informal labourers whose daily realities remain at the centre of heat risk governance.

TECHNICAL SESSION-IV
DATA TECHNOLOGY AND INNOVATION FOR EXTREME HEAT GOVERNANCE

Opening Remarks

Dr. Dinesh Kumar Aswal, Member, NDMA, emphasized the need to strengthen strategies to manage rising heat risks. He highlighted the importance of research, clean energy transitions, and climate-responsive urban solutions to address increasing heat stress in cities.

Chair:

Dr. Dinesh Kumar Aswal, Member, National Disaster Management Authority (NDMA)

Rapporteurs:

Ms. Raashi, Consultant, NDMA and Ms. Maria Fatima, ADRA

Session Overview

Technical Session IV examined how data systems, digital tools, AI-enabled forecasting, and innovation ecosystems can transform extreme heat governance in India. Bringing together experts from research institutions, state disaster management authorities, global innovation platforms, and international climate science institutions, the session focused on advancing impact-based heat risk governance. Discussions emphasized the role of integrated data platforms, predictive analytics, and collaborative innovation frameworks in strengthening preparedness, improving decision-making, and enabling scalable solutions for heat resilience.

Role of innovations for climate smart and heat resilient infrastructure

Speaker: Mr. Alex, Third Derivative

Mr. Alex explained that Third Derivative works as a startup accelerator under RMI, supporting innovative solutions to reduce extreme heat impacts in cities. A key focus discussed was PDRC (Passive Daytime Radiative Cooling) technology, where special roof coatings reflect solar radiation, helping keep structures cooler. The speaker highlighted companies like QGEN and others such as Panache, which promote cool roof solutions like white roofs. These technologies can reduce the need for air conditioning, thereby lowering fossil fuel emissions, while also serving as an important adaptation strategy for heat resilience.

In addition, the speaker mentioned other promising cooling interventions including bamboo roofing systems, green roofs, shading techniques, and increased vegetation, supported by startups such as Ocean. The discussion emphasized that alongside traditional methods like tree cover and shading, new innovations are emerging that can significantly contribute to keeping buildings and urban environments cooler, making cities more liveable under rising heat stress conditions.

Findings from real time assessment of extended heat index 350

Speaker: Piyush Narang, UC Berkeley

Mr. Piyush Narang explained that heat stress must be measured differently for labor-intensive work. He highlighted the relevance of the Extended Heat Index (EHI 350), which integrates the combined effects of heat, humidity, and metabolic heat generation, showing that outdoor and laboring workers experience much higher heat stress than people at rest indoors. This approach provides a more realistic metric for assessing occupational heat risk and strengthening heat protection strategies.

He further introduced CHETRA, a City Heat Action Intelligence and Risk Atlas designed to help cities plan targeted cooling interventions. CHETRA maps heat hotspots, exposed populations, vulnerable housing zones, 24-hour heat risk areas, and identifies where solutions such as cool roofs, tree plantation, and bundled cooling interventions should be prioritized. The tool also generates ward-level priority lists and cost estimates, enabling better budgeting and implementation. Piloted in Agra, CHETRA was presented as a scalable infrastructure that can support improved heat action plans across 5,000 urban local bodies in India, requiring only basic digitized city boundary data to generate risk layers quickly.

Micro-Level Vulnerability and Building-Level Assessment

Speaker: Chintan Shinde, Mahila Housing Trust

Mr. Chintan Shinde highlighted that Indian cities have wide socio-economic disparities, and these differences often get hidden when heat action planning is done only at a broad ward level. He emphasized that heat action plans are still evolving, and there is a need to make them more inclusive by identifying vulnerable pockets within wards, especially informal settlements that may not appear "high risk" in aggregated ward-level assessments.

He presented a building-level approach to heat vulnerability assessment using a tool developed by SC for ALL and IBM, which was further adapted to generate a Heat Vulnerability Index (HVI) at a much finer scale. Using the example of Churu city, he explained how conventional AR4-based methods (exposure, sensitivity, adaptive capacity) provide only generalized outputs, whereas the new tool zooms into wards to identify clusters of highly vulnerable buildings. This improves targeting of interventions and avoids missing the most at-risk populations. He also noted that such granular, geo-tagged building data can significantly reduce the time required to prepare heat action plans, potentially cutting it to less than three months, supporting faster scaling across cities.

Urban Heat Vulnerability, Geo AI and Capacity Building

Speaker: Mr. Keshav Jha, ICLEI

Mr. Keshav Jha highlighted that while data, innovation, and technology are essential for heat resilience planning, their real value lies in how effectively they can be understood and used by municipal bodies, many of which lack GIS planners and technical expertise. He stressed the need to simplify and "demystify" tools so that they remain practical, open-source, and directly useful for local decision-making, enabling cities to identify priority actions and mobilize financing. He emphasized that heat resilience must follow a multi-layered approach, moving beyond city-level analysis to ward, neighbourhood, and building-level assessments due to microclimatic variations within cities.

He also underlined the importance of inclusion and gender equity, noting that vulnerable groups such as pregnant women, migrants, and marginalized communities face disproportionate impacts and must be involved in planning processes. Sharing field examples, he described Rajkot's Urban Cooling Action Plan, which integrated satellite data with drone-based thermal mapping to assess cool roof potential and material sensitivity, and Coimbatore's participatory urban greening dashboard that maps trees and vegetation for cooling interventions and carbon sequestration. He further promoted a newly launched Geo-AI toolkit for planners and concluded that sustainable heat resilience depends on strong local capacity building, training, and long-term ecosystem support through biodiversity registers, natural asset mapping, and urban greening data repositories.

AI-Enabled Heat Risk Forecasting

Speaker: Mr. Harish Nalawade, Indian Institute of Science

Mr. Harish Nalawade emphasized that strengthening heatwave forecasting systems is a key investment for climate resilience, offering strong returns through better preparedness. He noted that Karnataka has already piloted an AI-based forecasting system and is now moving toward operational deployment, using deep learning to improve lead time and provide hyper-local forecasts at sub-district and potentially village level. He stressed that heat risk assessment must go beyond temperature, considering multiple meteorological and health-related factors.

He described an end-to-end heat risk forecasting platform integrating IMD and health datasets, downscaling methods, bias corrections, and indices such as WBGT, UTCI, Tmax, humidity, Diurnal Temperature Range, Heat Index, and EHF. The system is designed to be epidemiologically meaningful, validated using mortality data from events like Andhra Pradesh 2015, and supports sector-specific decision-making for health, power demand, and labour safety. He concluded by highlighting open-source development, creation of India-specific datasets, institutional collaboration, and future ground-truthing through field validation.

Discussant Interventions and Interactive Deliberations

Representative from India Meteorological Department (IMD)

The IMD representative emphasized the importance of advancing forecasting systems from temperature-based alerts to impact-based early warning systems.

The intervention stressed that meteorological data must be translated into actionable guidance tailored to different user groups, including municipal authorities, health departments, and labour agencies. It was noted that forecast thresholds should trigger predefined administrative responses rather than remaining informational advisories.

This perspective aligned with broader session conclusions that effective governance requires integration between forecasting systems and institutional response protocols.

Representative from Indian Institute of Tropical Meteorology (IITM)

The IITM discussant highlighted the importance of scientific modelling, high-resolution datasets, and localized climate analytics.

The intervention stressed that micro-level heat vulnerability varies significantly across urban landscapes due to factors such as land cover, built density, and humidity interactions. Therefore, decision-makers require granular data rather than aggregated regional averages.

The discussant emphasized that research institutions must work closely with policymakers to translate complex scientific outputs into operational decision tools usable by city administrations.

Key Themes Emerging from Technical Session IV Discussants

The discussion underscored several strategic insights:

- Data alone does not create resilience; usability determines impact.
- Scientific modelling must inform administrative triggers.
- High-resolution localized datasets are essential for urban heat planning.
- Innovation ecosystems must link researchers, startups, and governments.

Participants stressed that the value of technology lies in its ability to convert complex climate data into actionable intelligence for decision-makers.

OPEN DISCUSSION

The overall discussion focused on strengthening heatwave forecasting and heat stress governance in India, highlighting the need to move beyond temperature-only definitions and adopt a more impact-based approach. Experts agreed that India needs a new standardized heat stress parameter/index, built using multiple meteorological variables along with health and vulnerability data, requiring inter-ministerial coordination. Key areas discussed included improving data accuracy and validation, downscaling forecasts for hyper-local decision-making, using AI-based models, integrating satellite and ground station data, addressing uncertainties in weather station readings, and applying geospatial tools for heat hotspot mapping, targeted interventions, monitoring cool roofs/reflectivity, and supporting city-level heat action plans through scalable decision-support systems.

Key Takeaways

- The future of extreme heat governance will depend on the effective integration of data ecosystems, digital tools, and innovation platforms into institutional decision-making processes.
- There is a critical need to move beyond temperature-based forecasting toward impact-based risk intelligence, where data supports real-time preparedness, mitigation, and response.
- High-resolution,localized datasets, combining satellite imagery, thermal sensors, and ground-truthing, are essential for identifying micro-level heat vulnerabilities, particularly in informal and high-risk settlements.
- The session highlighted promising cooling innovations such as passive daytime radiative cooling technologies, advanced cool roofing materials, reflective coatings, and nature-based solutions as effective strategies for heat mitigation.
- Innovation must be complemented by usability; data and technological tools should be presented in accessible formats that enable municipal authorities and planners to make informed decisions.
- Community-centred approaches are critical to strengthening heat governance. Building-level vulnerability assessments and ward-level analytics support targeted interventions, while participatory validation enhances reliability and inclusivity in planning.
- Open-source decision-support platforms were identified as vital for enabling cities to mobilize financing, build institutional capacity, and implement localized Heat Action Plans.
- Technological advancement alone is insufficient; its true value lies in translating complex datasets into actionable, anticipatory governance mechanisms that protect lives, infrastructure, and urban systems.

Conclusion

The session concluded that data systems, digital tools, and innovation platforms will be central to strengthening future heat governance, particularly through integrated, impact-based risk decision systems.

It was emphasized that technological solutions must simultaneously support mitigation and adaptation while presenting data in formats usable for decision-makers. The Chair noted that effective heat management will require both local cooling interventions and long-term emission reduction pathways supported by clean energy transitions and climate-responsive infrastructure.

International Workshop on Heatwaves 2026: Day 2 Event Proceedings

INTERNATIONAL WORKSHOP ON HEATWAVES 2026: DAY 2

FINANCING THE FUTURE OF HEAT RESILIENCE: FROM REACTIVE RELIEF TO PROACTIVE PROTECTION

The second day of the International Workshop on Heatwaves 2026, held on February 12, 2026, at Sushma Swaraj Bhawan in New Delhi, shifted the discourse from the foundational elements of preparedness and resilience explored on Day 1 to the pivotal role of financing in sustaining heat governance. Convened by the National Disaster Management Authority (NDMA) under the Committee on Disaster Risk Reduction (CoDRR-10), the session ns built upon the 2025 workshop's priorities, including early warning systems, Heat Action Plans (HAPs), heat-health adaptation, infrastructure mitigation, and financing mechanisms. Participants, including representatives from international organizations such as the United Nations Office for Disaster Risk Reduction (UNDRR), United Nations Capital Development Fund (UNCDF), Centre for Disaster Protection (CDP), Asian Development Bank (ADB), reinsurers like Munich Re and Swiss Re, philanthropies, and grassroots groups like the Self Employed Women's Association (SEWA) and Mahila Housing Trust (MHT), engaged in deep deliberations. The focus was on reframing extreme heat as a fiscal and development imperative, advocating for layered financing models, public-private partnerships, parametric instruments, and equity-focused delivery to bridge gaps between risk reduction and community-level impact.

INAUGURAL SESSION

Opening Remarks

Stefan Priesner, United Nations Resident Coordinator for India

The session opened with remarks from Stefan Priesner, who extended a warm good morning to all participants and expressed his delight in reconnecting with Dr. Krishna S. Vatsa, his long-time colleague from their UNDP days, . He welcomed the gathering to the second day of the workshop, thanking NDMA for convening this timely event on extreme heat governance. Mr. Priesner restated the obvious yet critical reality: extreme heat is no passing inconvenience but a steady, intensifying threat that harms health, disrupts livelihoods, strains infrastructure, and deepens inequality, particularly among informal workers, women, children, and older persons. Unlike dramatic hazards like floods or cyclones, heat arrives quietly as a slow-onset disaster, yet its consequences are profound and severe.

Reflecting on Day 1's explorations of science, systems, and solutions, he pivoted to Day 2's core question: how to finance resilience and ensure vulnerable communities have the resources, protections, and pathways to adapt. The UN system in India, he affirmed, stands firmly alongside the government and people, offering support across the full spectrum of climate adaptation, disaster risk reduction, and resilience building. Heat resilience cannot be built in isolation, he emphasized; it demands integrated approaches across sectors, scales, and systems. He cited specific UN contributions, including national adaptation plans, strengthening climate finance facilities in states, improved heat action plans at state and district levels, urban heat risk assessments, and enhanced early warning and advisory services—all extended to local communities.

Mr. Priesner called for gender-responsive financing mechanisms to act as lifelines, incorporating risk finance, adaptive social protection, insurance, innovation, and community-led solutions. He posed key challenges: shifting from reactive relief to proactive resilience; moving beyond one-off interventions to systemic change; and ensuring funds reach people, not just infrastructure. To guide the discussions, he proposed three principles: prioritize equity to reach the most exposed, simplify access, and design with communities; innovate through tools like parametric insurance, forecast-based financing, and sustainable cooling materials; and integrate across sectors like health, labour, urban planning, agriculture, and social protection for holistic impact. Praising India's leadership in areas like the national heat action plan, state-level HAPs, renewable energy transitions, and nature-based solutions, he offered the UN's deepened partnership to advance these efforts. His address set an urgent, collaborative tone, framing heat resilience as central to sustainable development.

Special Remarks

Dr. Krishna S. Vatsa, Member & HoD, NDMA

Dr. Krishna S. Vatsa warmly welcomed Stefan Priesner, reminiscing about their shared history in UNDP, particularly their work in Bangladesh, and expressed appreciation for the strong collaboration with multiple UN agencies, including UNEP, UNDP, UNICEF, and UN Women. He extended thanks to the dignitaries, partners, and participants for their engagement. Building on Day 1's comprehensive discussions, Dr. Vatsa noted that the workshop continues to evolve India's approach to heatwaves, translating 2025 recommendations into actionable frameworks. He underscored that extreme heat has emerged as a severe, rapidly intensifying global risk with implications for health, livelihoods, infrastructure, and urban systems no longer an episodic hazard but a systemic one requiring coordinated governance and institutional commitment.

Dr. Vatsa highlighted India's strides, such as the expansion of HAPs and multi-sectoral coordination, and its international leadership through annual workshops. The 2026 event, titled "Strengthening Preparedness, Resilience and Risk Governance," builds on six priority areas from 2025 (early warning services, Indian perspectives on HAPs, city-level adaptations, heat-health strategies, infrastructure mitigation, and financing) and advances key recommendations like institutional strengthening, standardized HAPs, enhanced early warnings, resource mobilization, research innovation, and global collaboration. He framed Day 2's focus on financing as the critical enabler, urging a shift in perception from heat as "seasonal discomfort" to a disaster risk with significant excess mortality, productivity losses, health burdens, and urban heat island effects.

Outlining a continuum of heat risk management preparedness (early warnings, vulnerability mapping), response (cooling centers, adjusted hours), and mitigation (cool roofs, urban greening), Dr. Vatsa called for multi-year programs over ad-hoc allocations, with dedicated budgets and maintenance provisions. He proposed a governance architecture aligning local (ULBs/districts), state, and national levels, and a risk-based allocation model: base funding for all districts, risk-weighted additions for high-vulnerability areas, and performance incentives tied to functional HAPs and vulnerability reductions. Financial instruments should include operational grants for seasonal needs and capital grants for structural changes, with blended co-financing involving central/state/ULB shares and CSR/philanthropy. He emphasized convergence from sources like SDRF/SDMF/NDMF, municipal budgets, Smart Cities/AMRUT, health missions, and CSR, enabled by heat resilience indicators in grants and city-level pools. Monitoring must be evidence-based, tracking metrics like mortality reductions, hospital admissions, cool roofs installed, tree

canopy increases, and surface temperature drops, supported by digital dashboards and IMD integration. In conclusion, Dr. Vatsa stressed that heat financing must be risk-based, equity-focused, multi-year, convergent, locally responsive, and outcome-oriented—not about managing temperature but protecting livelihoods, reducing fiscal risk, and strengthening climate governance to prevent greater future losses.

High-Level Principles for Investing in DRR – A G20 Overview

Shri Abhilash Panda, UNDRR

Shri Abhilash Panda, representing UNDRR, delivered an overview of the G20 High-Level Principles for Investing in Disaster Risk Reduction, emphasizing their relevance to financing heat resilience. He began by noting the principles' development under successive G20 presidencies, starting with India, followed by Brazil and South Africa, and their endorsement in 2025 as a voluntary framework to shift global investments from reactive response to proactive risk reduction. Panda highlighted the economic rationale: every $1 invested in anticipatory action yields up to $7 in avoided losses, with some studies showing returns as high as $14–15. He presented the seven principles in a visual wheel format, explaining each in the context of extreme heat.

Principle 1: Invest in Risk Information, Knowledge, and Innovation	• Treat data as the currency of finance by leveraging AI and earth observation technologies for vulnerability hotspot mapping, and by overlaying census data with heat stress indices to enable informed decision-making.
Principle 2: Develop Comprehensive DRR Financing Strategies, Strong Governance and Implementation Capacity	• Integrate heat risk into national and sub-national budgets, strengthen governance frameworks, and create dedicated funding mechanisms to support effective implementation.
Principle 3: Embed Disaster Risks in Sector Plans and Budget Planning	• Mainstream heat risk considerations into urban planning, agriculture, public health, and other sectoral policies and budgeting processes.
Principle 4: Enable DRR Investment at the Local Level	• Empower municipalities and local governments with appropriate tools, including instruments such as G-RAM/ Gram, to facilitate localized risk management and timely payouts.

Principle 5: Manage Residual Risk by Arranging Finance Ahead of Shocks	• Establish pre-arranged financial mechanisms, including parametric insurance and contingency funds, to ensure timely response to extreme heat events.
Principle 6: Encourage Business Resilience and Stimulate Private Investment in DRR	• Promote private sector adoption of heat-resilient infrastructure, climate-adaptive designs, and risk-informed investment practices.
Principle 7: Advance DRR in International Collaboration and Solidarity	• Strengthen global cooperation through knowledge exchange, technical collaboration, and sharing of best practices in disaster risk reduction.

Dr. Panda applied these to heatwaves, suggesting innovations like disaster clauses in credit lines and resilience bonds. He concluded that these principles provide a roadmap for India to lead in scaling heat resilience investments, ensuring they are inclusive, data-driven, and sustainable.

Discussant : Shri S. Rakesh Kumar, Joint Secretary (Policy & Plan), NDMA

Shri S. Rakesh Kumar provided India's perspective on the G20 principles, aligning them with national frameworks. He traced India's DRR evolution through the Disaster Management Act 2005, which shifted from response to holistic risk reduction, and the National Disaster Management Plan 2019, which incorporates mitigation across sectors. Kumar highlighted Finance Commission allocations creating dedicated windows for response, reconstruction, mitigation, and capacity building, enabling structured financing. He introduced a risk layering approach, categorizing heat risks into frequent/low-impact (handled locally), moderate (state-level), and catastrophic (national/international reinsurance). For residual risks, he cited initiatives like disaster-related death covers, livelihood protections, and infrastructure safeguards.

Sh. Kumar showcased state-level innovations, such as Nagaland's parametric heat insurance pilots and ADB-supported programs in Karnataka, Kerala, and Maharashtra. He affirmed that India would benchmark the G20 principles into policy, enhancing tools like the Heat Action Plans and early warning systems. In closing, he emphasized the principles' potential to amplify India's global leadership in DRR financing.

TECHNICAL SESSION-I

DISASTER RISK REDUCTION FINANCING MECHANISMS TO ADDRESS MULTI-HAZARD RISKS AND HEAT RESILIENCE

Opening Remarks

Dr. Krishna S. Vatsa, Member and Head of Department, NDMA discussed financing approaches for managing multi-hazard risks, including extreme heat. The session highlighted the importance of integrating heat resilience into national planning through pre-arranged financing, budget support, and policy incentives. Speakers emphasized the need to invest in preventive measures and strengthen coordination across sectors to reduce future risks

Chair:

Dr. Krishna S. Vatsa, Member & HoD, NDMA

Rapporteurs:

Ms. Anushka, Consultant, NDMA and Ms. Shivani Das, Consultant, NDMA

Mr. Mathieu Verougstraete, Head of Infrastructure and Finance for Resilience Unit, UNDRR

Mr. Mathieu Verougstraete opened by asserting that no single financing instrument is sufficient for heat resilience, given its predictable, chronic, and escalating nature. He outlined a strategy combining risk reduction (public budgets, concessional finance, policy reforms, fiscal incentives, capital-market instruments) with shock absorption (disaster funds, contingent credits, scalable social protection, insurance pools). Mr. Verougstraete advocated leveraging public budgets by embedding heat action plans in sectoral allocations and medium-term expenditure planning, creating accountability through inter-departmental task forces, Chief Heat Officers, and budget tracking mechanisms. For public investment management, he recommended project screening criteria and stress-testing to incorporate extreme heat considerations.

On concessional resources, he noted that many heat-resilient investments (e.g., urban greening, community cooling) are non-revenue generating, requiring public funding, while others with payback potential (e.g., solar-powered cooling) can use concessional finance like the World Bank's $880 million Cooling Facility supported by the Green Climate Fund (GCF). To incentivize private investment, he suggested fiscal tools like tax credits for cool roofs and norms such as building codes for heat-resilient performance, citing Singapore's Green Mark certification, which promotes passive cooling and reflective materials, future-proofing assets and increasing value. He emphasized that incentives and norms can synergize—e.g., subsidies plus mandatory standards leading to rapid uptake and cost reductions. Finally, Verougstraete highlighted resilience bonds for large upfront capital (e.g., building retrofits, green corridors), as in Paris's €300 million municipal bonds for urban greening, signaling market commitment and attracting climate-focused investors. He concluded that effective heat resilience financing anchors within core public systems, blending tools for comprehensive protection.

Mr. Amar Patel, Risk Finance Adviser, Centre for Disaster Protection (CDP)

Mr. Amar Patel defined pre-arranged financing as funds approved in advance, guaranteed for release to a specific implementer upon an eligible event triggered by predefined conditions. He explained its potential to increase the predictability, speed, and effectiveness of responses, reducing human and financial costs while supporting national disaster risk management leadership. Patel presented a four-pillar framework for disaster risk finance (DRF): context (underlying risks and needs), money-in instruments (pre-arranged sources like insurance or credits), money-out systems (delivery plans to minimize disaster impacts), and project management (implementation, costs, monitoring). For extreme heat, he outlined the role for parametric insurance based on triggers, noting its clarity (no loss calculation) and effectiveness when paired with fast, low-cost delivery mechanisms like mobile payments.

He cited positive examples from MHT and SEWA, acknowledging challenges like KYC and banking access but emphasizing benefits such as rapid disbursement to prevent negative coping strategies, operational readiness linking NDMA, MoF, and agencies, targeted aid for vulnerable groups, and fiscal stability through smoothed budget volatility. Mr. Patel concluded that pre-arranged DRF enables rapid response, accelerates recovery, reduces economic trade-offs, encourages preparedness investments, and minimizes reactive aid dependence.

Ms. Visala Annamalai, Climate Resilience for All (CRA)

Ms. Visala Annamalai focused on the vulnerabilities of approximately 772 million women in the global informal sector, concentrated in heat-exposed areas. She introduced the Women's Climate Shock and Livelihoods Insurance (WCSI), a co-designed model combining risk reduction (e.g., heat adaptation kits) with parametric insurance for payouts during extreme events. Drawing from years of implementation

across countries, Ms. Annamalai shared four hard-won lessons: the "secret" lies in bundled risk reduction and transfer; co-delivery with trusted grassroots partners builds acceptance; affordability requires catalytic capital and subsidies; and testimonials from participants (e.g., women reporting preserved health, income, and dignity) drive scale-up. She emphasized that WCSI protects not just finances but the overall well-being of frontline women, asserting that when women are climate-resilient, societies as a whole become resilient. Ms. Annamalai called for gender-responsive financing to empower informal workers, highlighting WCSI's evolution from pilots to multi-country programs as a scalable blueprint.

Speaker : Sh. Ashish Agrawal, President & CEO, Bajaj General Insurance

Sh. Ashish Agrawal addressed agriculture-linked climate risks, noting heat's role in crop failures and productivity losses. He promoted parametric products tailored for informal sectors, emphasizing public-private partnerships to subsidize premiums, drawing parallels with the Pradhan Mantri Fasal Bima Yojana (PMFBY)'s success in covering millions. Mr. Agarwal discussed affordability challenges, suggesting blended models to make coverage accessible, and highlighted the need for awareness campaigns to build demand.

Speaker : Ms. Akshita Sharma, Country Climate Focal, Asian Development Bank (ADB)

Ms. Akshita Sharma shared ADB's approaches to public policy financing, stressing the integration of environmental considerations. She advocated stress-testing infrastructure for heat and multi-hazard risks and embedding climate resilience in lending frameworks to support long-term adaptations.

Open Discussion

The discussion opened with questions on citizen participation, gender mainstreaming, and elevating resilience in ESG frameworks. Panelists responded by emphasizing grassroots-level mainstreaming, the need for inter-agency coordination, and collaborative efforts to achieve "cult status" for resilience measures. Queries also touched on hazard-specific vs. functional allocations, with speakers agreeing on multi-hazard strategies while prioritizing heat's unique predictability. Participants highlighted the role of data in reducing basis risk and the potential for international solidarity to scale solutions.

Key Takeaways

1. Pre-arranged financing for rapid and precise response

Discussions highlighted the critical role of pre-arranged financing mechanisms in enabling immediate and targeted disaster response, particularly for heat-related emergencies where impacts escalate quickly. Instruments such as contingency funds, forecast-based financing, and parametric insurance allow authorities to release funds automatically once predefined thresholds such as temperature levels or heat index triggers are reached. Establishing transparent and scientifically validated trigger frameworks reduces basis risk in parametric models, ensuring that payouts align more closely with actual on-ground losses. This improves trust among stakeholders, enhances operational efficiency, and minimizes delays typically associated with post-disaster damage assessments and budget reallocations.

2. Mobilising private investment through public policy levers

The consultations underscored that public finance alone is insufficient to meet the growing costs of heat adaptation. Governments can play a catalytic role by using fiscal and regulatory instruments to steer private capital toward heat-resilient infrastructure and services. Policy tools such as targeted tax credits for cooling-efficient buildings, mandatory heat-resilient building codes, concessional loans for green retrofits, and urban planning incentives can shift market behaviour and encourage long-term investments in resilience. By integrating these measures into development and infrastructure policies, authorities can create predictable investment environments that reduce perceived risks and make resilience-focused projects financially viable for private actors.

3. Gender-responsive and community-led financing models

Participants noted the importance of ensuring that heat-risk financing mechanisms address social vulnerability and inequity. Gender-responsive approaches, exemplified by the Women's Climate Shock Insurance (WCSI) model, demonstrate how insurance products can be bundled with local adaptation measures—such as livelihood diversification, climate information services, and community preparedness training—to strengthen resilience at the grassroots level. Such models place communities, especially women-led groups, at the centre of design and implementation, ensuring that financial protection translates into real adaptive capacity. Their scalability lies in combining risk transfer with risk reduction, thereby reducing long-term dependence on emergency assistance.

4. Integrating heat risk into public financial management systems

A key institutional takeaway was the need to embed heat-risk considerations into core public financial management (PFM) systems rather than treating them as stand-alone disaster expenditures. This includes incorporating heat resilience into annual budgeting processes, medium-term expenditure frameworks, climate budget tagging, and departmental performance indicators. Doing so strengthens fiscal accountability, clarifies roles across ministries — such as health, urban development, labour, and energy, and promotes shared responsibility for managing heat risks. Institutionalising these measures ensures that preparedness and adaptation investments are sustained over time and linked directly to sectoral development priorities.

5. Leveraging concessional finance and resilience bonds for systemic interventions

The discussions also emphasised the financing gap for large-scale resilience projects that generate strong social and environmental benefits but limited direct revenue streams, such as urban heat shelters, early warning systems, or nature-based cooling infrastructure. Concessional finance from multilateral and development partners can help de-risk such projects and crowd in additional funding. Similarly, resilience bonds and blended finance structures can pool public and private resources while signalling long-term policy commitment to climate resilience. These instruments help mobilise capital at scale, support infrastructure upgrades, and demonstrate market confidence in adaptation investments, thereby enabling systemic and sustained heat-risk reduction efforts.

Strategic Insight

Financing must evolve from siloed hazard responses to integrated, multi-hazard strategies, embedding heat resilience in public financial systems to prevent fiscal shocks, promote equity, and ensure long-term adaptive capacity.

TECHNICAL SESSION-II
FINANCING FOR RISK REDUCTION THROUGH HEAT RESILIENT INFRASTRUCTURE

Opening Remarks

Lt Gen Syed Ata Hasnain, Member, NDMA, highlighted the importance of building heat-resilient infrastructure to address growing climate risks. The discussion focused on the need to invest in climate-resilient infrastructure, particularly in rapidly growing cities, by integrating heat considerations into the design, construction, and maintenance of infrastructure.

Chair:

Lt Gen Syed Ata Hasnain, Member, NDMA

Rapporteurs:

Ms. Avani Gupta, Consultant, NDMA and Ms. Prerna Ojha, CEEW

Speaker : Ms. Shubhra Singh, SUN Group, Khemka Foundation

Ms. Shubhra Singh discussed philanthropy's catalytic role in re-characterizing fiscal flows using a "heat lens" for public and private investments, emphasizing the need to reprioritize amid limited new funding for emerging risks like heat, which disproportionately affect low-income communities. Ms. Shubhra Singh introduced the National Heat Hub, a collaborative initiative with NDMA and CDRI to create a multi-dimensional taxonomy mapping heat impacts across government levels, populations, and research fields for broader dissemination, policy influence, and evidence-based decision-making. This hub aims to integrate data from diverse sources, including satellite imagery and community surveys, to identify hotspots and inform targeted interventions. Ms. Shubhra Singh also detailed the HAP+ (Heat Action Plus) pilot launched in Patiala in August 2025, addressing gaps in traditional HAPs like top-down approaches, lack of convergence, and insufficient community engagement by incorporating real-time feedback and participatory mapping. As a philanthropy-led effort, HAP+ brings together thought leaders from MHT, NRDC, and others to demonstrate bottom-up planning at the district level, centering community voices—particularly of women and informal workers—and ensuring government stakeholders (e.g., commissioners and health officers) lead from the outset for scalability, replication across states, and integration with national programs like AMRUT. Ms. Shubhra Singh cited the Notre Dame Global Adaptation Initiative (ND-GAIN) framework, which has re-characterized $10 billion globally by assessing vulnerability and preparedness for data-driven decisions, offering lessons for India in blending funds and measuring outcomes like reduced heat-related hospitalizations. Ms. Shubhra Singh emphasized that with no massive new funds for heat, reprioritizing existing flows is key, and philanthropies like Khemka's Global Heat and Health Funders Coalition (a $300 million network including Wellcome and Gates) are shifting from impact-focused to risk-reduction financing to de-risk innovations like cool roofs, community cooling centers, and green infrastructure pilots.

Speaker : Brij Mohan, Senior Climate Change Officer, ADB

Mr. Brij Mohan warned of emerging heat amplifiers like data centers, where 90-95% of energy is converted to heat, exacerbating urban heat islands, increasing energy demands in rapidly growing cities, and straining power grids during peak summer. Mr. Brij Mohan advocated integrating the latest climate science into public investment, with heat-specific KPIs in budgets to measure impacts and ensure accountability, such as tracking surface temperature reductions in urban areas. Mr. Brij Mohan recommended policy-based lending and multi-tranche facilities for long-term heat planning, promoting technologies like passive cooling (e.g., reflective materials), green-blue infrastructure (e.g., permeable pavements and wetlands), and regulatory reforms in master plans to prevent amplification in expanding cities, drawing from ADB's projects in Southeast Asia and India (e.g., Rajasthan and Odisha diagnostics showing 20-30% energy savings from retrofits). Mr. Brij Mohan stressed that public finance systems must track heat-specific indicators, and standalone interventions should give way to programmatic approaches for sustained impact, including capacity building for local bodies to implement and monitor.

Speaker: Dr. Ramesh Subramaniam, Global Director, CDRI

Dr. Ramesh Subramaniam positioned infrastructure as both a vulnerability multiplier and resilience enabler, noting annual global disaster losses of $800 billion plus 2–7 times indirect costs (e.g., service disruptions, health costs), with resilience needs at $400 billion per year yet only 4% of climate finance targets it, highlighting a funding gap in low-income countries exacerbated by heat's compounding effects. Dr. Ramesh Subramaniam urged lifecycle integration of heat mitigation, citing evidence that cooling codes could reduce temperatures by 1-2.5°C and AC demand by 15-25%, based on studies from urban hotspots like Metro Manila's Quezon City (first city with a Chief Heat Officer, achieving measurable canopy

increases). Dr. Ramesh Subramaniam called for medium-term budget frameworks, enforcement of codes through audits, nature-based solutions like green corridors and blue infrastructure (e.g., restored water bodies for evaporative cooling), and mainstreaming resilience in ESG to attract investment, warning that without it, cities will face amplified risks, economic downturns, and migration pressures, with examples from Kenya and Ghana showing localized success in community-led retrofits. Dr. Ramesh Subramaniam also discussed digital tools like urban climate twins for simulating heat scenarios and optimizing investments.

Speaker: Bhaskar Padigala, Climate Advisor (UK Representative)

Mr. Bhaskar Padigala focused on performance incentives and risk-weighted allocations, promoting convergence from sources like SDRF/NDMF and CSR to mobilize diverse funds for heat-resilient projects, emphasizing the role of green finance in bridging gaps. Mr. Bhaskar Padigala highlighted resilience bonds and green bonds as tools for upfront capital, with examples showing their potential to signal market commitment and enable scaling in developing economies, while integrating with UK-India climate partnerships for technology transfer. Mr. Bhaskar Padigala stressed linking incentives to outcomes like vulnerability reductions, and advocated for international collaborations to de-risk investments in emerging markets.

Speaker: Mandakini Balodhi, Director, Dept. of Financial Services

Ms. Mandakini Balodhi emphasized financial layering, including operational grants for seasonal needs (e.g., cooling centers) and capital grants for structural changes like urban greening, aligned with multi-level governance roles to ensure coordination across central, state, and local levels. Ms. Mandakini Balodhi advocated citizen-centric approaches, affordability through subsidies and microfinance, and blended models involving central, state, and local contributions for inclusive access, stressing the role of insurance-linked securities in freeing capital for infrastructure and integrating with schemes like PMAY for heat-resilient housing.

Open Discussion

Queries addressed data center heat emissions (90-95% conversion), regulatory gaps in building codes, and scaling pilots like HAP+, with panelists like Ms. Shubhra Singh and Dr. Ramesh Subramaniam stressing ESG integration, collaborative "dot-connecting" across sectors, and the need for enforcement to transform infrastructure from heat amplifiers to adaptive systems. Discussions also touched on global examples like Neom's abandonment due to unsustainable cooling demands, underscoring lessons for India on avoiding maladaptive designs in glass-heavy urban projects. Participants raised concerns about funding for rural infrastructure and informal settlements, leading to responses on blending CSR with government schemes like PMAY for cool roofs and community-led initiatives. The session explored challenges in enforcing codes, with suggestions for community-led monitoring, nature-based solutions like permeable pavements, and digital twins for predictive modeling. Additional questions on viability gap funding for startups elicited views on subsidies with sunset clauses for maturity, and the role of international donors in capacity building.

Key Takeaways

1. Preventive urban design to avoid long-term risk lock-in

The deliberations emphasised that urban design decisions made today will determine cities' heat vulnerability for decades. Preventive planning such as orienting streets for ventilation, reducing heat-absorbing materials, preserving open spaces, and regulating building density helps avoid long-term lock-in of heat risks that become costly or technically difficult to reverse later. Passive cooling strategies, including shaded streets, reflective roofing, natural ventilation, and thermally efficient building envelopes, provide low-cost and energy-efficient solutions suitable for both new developments and retrofits. Complementing these measures, green-blue infrastructure such as urban forests, wetlands, water bodies, and permeable landscapes delivers multiple co-benefits: lowering ambient temperatures, improving stormwater management, enhancing biodiversity, and strengthening public health outcomes. Integrating these approaches into master plans and building regulations ensures that heat resilience becomes a structural feature of urban growth rather than a corrective afterthought.

2. Blended finance and institutional convergence to bridge funding gaps

Participants recognised that many heat-resilience interventions such as cooling shelters, shaded public transport corridors, and urban greening generate high social returns but limited direct revenue, making them difficult to finance through traditional market instruments. Blended finance models, combining public funds, development assistance, private investment, and corporate social responsibility (CSR) contributions, can help close this viability gap. Institutional convergence is equally important: aligning disaster response funds (such as State Disaster Response Funds), municipal development budgets, climate missions, and CSR programmes enables pooled financing and coordinated implementation. Such integrated financing frameworks reduce duplication, enhance efficiency, and allow cities to prioritise resilience projects that might otherwise remain unfunded due to fragmented budget structures.

3. **Evidence-based metrics for accountability and investment confidence**

   The discussions highlighted the necessity of establishing measurable and outcome-oriented indicators to track the effectiveness of heat-resilience investments. Metrics such as reductions in heat-related mortality and morbidity, increases in urban tree canopy coverage, and measurable declines in land surface or ambient temperatures provide concrete evidence of impact. These indicators support transparent monitoring and evaluation, strengthen public accountability, and help policymakers justify continued or expanded funding. From a financing perspective, reliable data also builds investor confidence by demonstrating that interventions produce quantifiable risk reduction and social benefits, thereby improving the case for concessional finance, resilience bonds, and climate-focused investment portfolios.

4. **Catalytic role of philanthropy in scaling community-driven models**

   Philanthropic organisations were recognised as important early-stage enablers of innovation in urban heat resilience. By providing flexible funding, technical assistance, and convening power, philanthropy can support bottom-up initiatives such as Heat Action Plan Plus (HAP+) approaches that integrate community engagement, local risk assessments, and interdepartmental coordination. These pilots often serve as demonstration models that validate solutions in real-world conditions, amplify community voices in planning processes, and generate lessons for policy adoption at city or state levels. Once proven effective, such models can be scaled through government programmes or blended finance mechanisms, making philanthropy a catalyst rather than a long-term substitute for public investment.

5. **Lifecycle integration of resilience in urban systems**

   A central takeaway was that the effectiveness of heat-risk management depends on embedding resilience across the entire lifecycle of urban infrastructure and services from planning and design to construction, operation, maintenance, and eventual redevelopment. Cities that incorporate heat considerations only at the response stage tend to amplify vulnerabilities through energy-intensive cooling demand, poorly designed public spaces, and infrastructure stress. In contrast, lifecycle integration ensures that investments in housing, transport, utilities, and public services systematically reduce exposure and sensitivity to extreme heat. This approach not only lowers long-term adaptation costs but also aligns resilience objectives with sustainable urban development, determining whether future urban growth exacerbates or mitigates heat risks.

Strategic Insight

Embedding resilience within infrastructure lifecycles from planning to operations will define future urban adaptive capacity, requiring sustained, outcome-oriented financing to protect against escalating climate extremes.

TECHNICAL SESSION-III

ADDRESSING RESIDUAL RISK FOR EXTREME HEAT THROUGH MONEY-IN MECHANISMS

Opening Remarks

Krishnan Narasimhan, Lead Specialist and Program Manager for Climate Disaster Risk Financing and Insurance at UNCDF with Cristina Stefan, Head of Advisory at the Centre for Disaster Protection discussed financial tools such as insurance, risk pooling, and parametric financing to address residual risks from extreme heat and other hazards. Speakers highlighted the importance of layered financing, data-driven approaches, and international partnerships to protect lives, livelihoods, and economic systems from climate-related risks.

Chair:

Krishnan Narasimhan, Lead Specialist and Program Manager for Climate Disaster Risk Financing and Insurance, UNCDF

Co-Chair:

Cristina Stefan, Head of Advisory, Centre for Disaster Protection

Rapporteurs:

Ms. Niyati, Intern, NDMA and Mr. Mrinal Srivastava, RMI

Speaker : Kamna R. Sharma, Additional Commissioner, Pradhan Mantri Fasal Bima Yojana (PMFBY), Ministry of Agriculture and Farmers Welfare

Ms. Kamna R. Sharma detailed PMFBY's success as a structured risk-financing tool, covering the entire crop lifecycle and maximum perils, including heat and cold waves, to stabilize rural economies amid climate variability and ensure food security. Ms. Kamna R. Sharma noted its pre-emptive nature and payout certainty, with 10-year learnings showing technology upgrades (e.g., satellite data for damage assessment, drones for verification), farmer inclusion via voice mechanisms and mobile apps, and income stability for 400 million farmers through public-private partnerships that have reduced claim disputes by 50% and expanded to parametric add-ons. Ms. Kamna R. Sharma proposed similar layered models for heat disasters, emphasizing that when risks are layered (e.g., heat with drought or humidity), financing must be too to handle compounded effects like productivity losses in manual labor sectors, and highlighted expansions to non-crop risks like livestock and horticulture for comprehensive coverage.

Speaker : Dipankar Munshi, IBISA Network

Mr. Dipankar Munshi presented parametric solutions for informal sectors, including gig workers and dairy farmers, focusing on system stability during massive events rather than individual compensation to maintain economic continuity in supply chains. Mr. Dipankar Munshi shared a Kerala-origin dairy heat index product with low premiums (Rs. 100–200) and payouts on 5–7 days exceeding 45°C, evidencing demand (from 15,000 to 350,000 farmers) and viability even in 2024's record heat, with optimism for national scale via concessional capital and global reinsurance partnerships. Mr. Dipankar Munshi noted extensions to poultry and human heat indices, stressing co-creation with beneficiaries, integration with early warning systems for anticipatory action, and blockchain for transparent payouts.

Speaker : Mangesh Patankar, Munich Re India

Mr. Mangesh Patankar differentiated heat stress from heat waves, citing strong evidence for impacts on crops (saffron, apple, sugarcane) and livestock (milk yield) from international studies by agronomists and veterinarians, showing losses up to 30% in yields and requiring customized indices. Mr. Mangesh Patankar advocated derivatives for non-visible damages but cautioned on human heat indices due to moral hazard risks, suggesting payout without loss verification could function like financial instruments in volatile markets, requiring policy mechanisms for validation (e.g., proof of non-work or medical records to prevent abuse). Mr. Mangesh Patankar highlighted scaling in Kerala (Milma dairy) and Rajasthan, with markets reaching $250 million for weather-based products, and discussed reinsurance's role in absorbing catastrophic layers, with examples from Munich Re's global portfolio covering heat in Australia and Europe.

Speaker : Chandan Verma, Head of Agriculture, Swiss Re India

Mr. Chandan Verma addressed lengthening heat durations and early onset (February becoming hottest), urging India-specific indices validated epidemiologically to account for regional variations like humidity in coastal areas and night-time cooling failures. Mr. Chandan Verma emphasized agriculture reinsurance's role in managing linked risks, with examples from global portfolios showing potential for sugar cane heat stress products, hybrid indices combining temperature with humidity, and partnerships with governments for subsidized premiums.

Speaker: Aavrit Singhal, Partner, InRisk

Mr. Aavrit Singhal focused on crop insurance innovation, stressing product design starting with community-specific "why" rather than generic indices to minimize basis risk and ensure relevance, with

examples from gig workers and value chain providers like food delivery platforms facing heat-related delays. Mr. Aavrit Singhal highlighted actuarial modeling for heat, incorporating metabolic rates, exposure times, and economic impact assessments for tailored coverage.

Speaker : Anuj Kumbhat, Founder and CEO, Weather Risk Management Services (WRMS)

Mr. Anuj Kumbhat shared experiences covering dairy milk yields, loans for rural/urban beneficiaries, gig workers, and even humans in Iraq, using 10,000+ weather stations in India (with partners like Tamil Nadu DRRA) for accurate data and hyper-local triggers to reduce basis risk by 40%. Mr. Anuj Kumbhat reiterated parametric insurance's purpose as ensuring system stability amid layered risks, not panacea compensation, and highlighted payment capacity challenges in developing contexts, advocating for national-level frameworks, integration with fintech for instant payouts, and expansions to coral reefs and poultry for biodiversity-linked risks.

Open Discussion

Participants discussed affordability, stakeholder convergence, and global scaling of PMFBY-like models, with speakers like Ms. Kamna R. Sharma and Mr. Dipankar Munshi addressing basis risk mitigation through dense data networks and co-design with farmers for customized products. Consensus emerged on integrating weather measurement for reliability, with questions on moral hazard leading to responses from Mr. Mangesh Patankar on balanced verification and policy requirements like self-reporting apps or employer certifications. Additional queries explored reinsurance for non-agricultural sectors like tourism and hospitality, with Mr. Chandan Verma sharing international examples from Europe (e.g., heat

wave coverage for events), and the session covered challenges in gig worker coverage, emphasizing subsidies, multi-peril extensions, and partnerships with platforms like Uber for data sharing. Questions on livestock indices elicited details from Mr. Anuj Kumbhat on station networks and AI for predictions, concluding with calls for standardized human heat metrics and international standards alignment.

Key Takeaways

1. Parametric insurance as a stabilisation tool during extreme heat events

The discussions underscored that parametric insurance can play a critical role in stabilising economic and social systems during severe and prolonged heat events. Unlike traditional indemnity-based insurance, parametric models provide rapid payouts once predefined heat thresholds are exceeded, enabling governments, utilities, health systems, and employers to activate contingency measures immediately. This approach is particularly relevant for heat risks, which often produce "silent" and cumulative impacts such as productivity losses, health deterioration, supply-chain disruptions, and increased energy demand rather than visibly catastrophic damage. By providing liquidity at the onset of extreme conditions, parametric instruments help maintain continuity of essential services and reduce cascading systemic stress across sectors.

2. Layered financing with trigger-based automation for predictable response

Participants highlighted the value of structuring heat-risk financing in layers combining budgetary reserves, contingency funds, social protection top-ups, and insurance mechanisms each linked to clearly defined triggers. Such trigger-based systems allow authorities to move beyond advisory-based responses toward automatic operational actions, such as opening cooling centres, extending worker protections, activating emergency health services, or releasing livelihood support. Automation enhances predictability, reduces administrative delays, and improves coordination across departments. Over time, this structured approach strengthens institutional readiness by embedding response protocols directly into financial and governance systems.

3. Importance of dense climate and health data networks

Accurate parametric models depend heavily on high-resolution and reliable data. The consultations emphasised that expanding dense meteorological observation networks potentially comprising thousands of monitoring stations greatly improves spatial precision in temperature and humidity measurements. When combined with epidemiological validation, such as correlating heat thresholds with hospital admissions, mortality trends, or labour productivity losses, these datasets allow policymakers to define more realistic and locally calibrated triggers. This reduces basis risk, strengthens confidence in payouts, and ensures that financing mechanisms are aligned with actual human and economic impacts rather than purely meteorological extremes.

4. Public–private partnership models for scaling protection

Public–private partnerships were recognised as essential for scaling climate risk protection to large and diverse populations. Agricultural insurance programmes, such as large-scale crop insurance schemes, demonstrate how government-backed subsidies, risk pooling, and private-sector underwriting can jointly expand coverage while keeping premiums affordable. A similar approach could be adapted for heat-risk protection targeting vulnerable urban and informal-sector workers.

Early-stage public subsidies are particularly important to establish participation, build actuarial datasets, and create viable insurance markets, especially for populations that lack formal income records or established credit profiles.

5. **Prioritising system stability over full loss compensation**

   A key conceptual shift identified in the discussions was the need to focus on stabilising livelihoods and essential systems rather than attempting to fully compensate every loss caused by extreme heat. Heat impacts are diffuse and continuous, making comprehensive compensation impractical and fiscally unsustainable. Instead, targeted payouts or support measures aimed at maintaining income continuity, access to healthcare, safe working conditions, and essential services can significantly reduce long-term vulnerability. This approach is particularly relevant for hard-to-reach groups such as gig and platform workers, informal labourers, and migrant populations whose risks are often underrepresented in formal insurance systems but whose economic stability is critical to urban functioning.

Strategic Insight

Residual risk financing demands innovative, trigger-based instruments to protect diverse sectors equitably, leveraging data and partnerships for resilience in an era of escalating heat extremes.

TECHNICAL SESSION-IV
FINANCING MECHANISMS TO REACH COMMUNITIES MOST AT RISK

Opening Remarks

Ms. Anna DeGrauw, Senior Policy Advisor at the Centre for Disaster Protection (CDP) focused on financing solutions to support vulnerable communities affected by extreme heat. The discussion highlighted the need for adaptive social protection, gender-responsive approaches, and stronger integration with existing welfare systems to support informal workers and low-income groups. Speakers emphasized community participation, digital tools for delivery, and partnerships to ensure financial support reaches those most at risk.

Chair:

Ms. Anna DeGrauw, Senior Policy Advisor, Centre for Disaster Protection (CDP)

Rapporteurs:

Ms. Rashi Mukund, Consultant, NDMA and Ms. Tamanna Dalal, SFC

Speaker : Bhawana Ahuja, Programme Lead, WRI India

Ms. Bhawana Ahuja presented on MSME heat vulnerabilities, with over 80% reporting operational and workforce disruptions in surveys from Asia (e.g., machinery overheating, absenteeism leading to 20-30% productivity drops, and supply chain delays in textile and construction sectors). Ms. Bhawana Ahuja identified low risk perception among owners, data gaps on indirect losses like lost contracts or increased energy bills, and financing barriers like high interest rates for retrofits, recommending adaptive social protection for income stabilization using existing networks for vertical (additional payouts during shocks) or horizontal (expanded beneficiaries like gig workers) scaling to cover global informal economies. Ms. Bhawana Ahuja called for granular studies on losses, policy triggers linked to IMD forecasts, and partnerships with banks for low-cost loans, highlighting WRI's research showing heat's $120 billion annual impact on Indian MSMEs. Ms. Bhawana Ahuja emphasized integrating with schemes like PMJJBY for bundled protections.

Speaker : Amar Patel, Lead Risk Advisor, Centre for Disaster Protection

Mr. Amar Patel reiterated money-out mechanisms' importance for speed, operational readiness, targeting, ownership, predictability, and fiscal stability in international settings, explaining how they prevent negative coping like debt traps or child labor in heat-affected households. Mr. Amar Patel cited MHT and SEWA as positive examples of parametric insurance paired with fast delivery like mobile payments, addressing challenges like KYC through AI and linking to adaptive social protection for broader reach, with evidence from pilots showing 40% reduction in vulnerability and improved household savings. Mr. Amar Patel discussed horizontal expansion for heat-induced unemployment benefits, vertical top-ups for existing beneficiaries, and the need for pre-defined rules to ensure discipline.

Discussant : Dr. Sahil Hebbar, Sr. Coordinator, Self Employed Women's Association (SEWA)

Dr. Sahil Hebbar shared SEWA's parametric program, piloted in 2023 for 21,000 members across five districts after 2022's massive heatwaves forced income-health trade-offs globally, with women facing 50% higher risks due to outdoor work and care responsibilities. In 2023, no payouts occurred, but adaptation equipment (protecting against heat, rain, cyclones) was valued for multi-hazard resilience and reduced medical costs by 25% in participant households. Scaled to 50,000 in 2024 with CRA (three states, 22 districts), yielding payouts exceeding premiums by 200% and enabling food security, and to 225,000 in 2025 (35 districts, multi-shocks including floods). Dr. Sahil Hebbar emphasized bundling insurance with tools like reflective vests and hydration kits, mobile apps for KYC (reducing errors from 20% to single digits through biometric verification), and grassroots trust for sustainability across borders, noting limited climate literacy as a barrier addressed through workshops, peer education, and vernacular materials. Dr. Sahil Hebbar called for multi-peril coverage including floods and initial subsidies to build momentum.

Bhavna Maheriya, Programme Manager, Mahila Housing Trust (MHT)

Ms. Bhavna Maheriya discussed housing retrofits and community cooling for urban poor women, noting willingness to pay 300–500 if results are visible in pilot studies from Gujarat, where temperatures dropped 5°C indoors and improved sleep quality, reducing fatigue-related accidents. Ms. Bhavna Maheriya suggested special heat allowances integrated into construction welfare boards for international labor standards, with focus on affordable cool roofs (using reflective paints), loans for grassroots access, and community funds for maintenance and training programs to empower women as installers. Ms. Bhavna Maheriya highlighted MHT's work in slums, showing 15% productivity gains post-retrofit.

Bharti Birla, ILO Enterprise Specialist

Ms. Bharti Birla framed extreme heat as a global occupational safety challenge, requiring enforceable standards, rest-water-shade provisions, and employer responsibility extending to supply chains (per MNE Declaration and Convention 155), with estimates of 2.4 billion workers exposed and 18,970 annual deaths from heat, rising in Asia. Ms. Bharti Birla called for time-motion adjustments (e.g., shorter shifts), forecast triggers for protections in multinational contexts, highlighting impacts on piece-rate and casual workers who lose earnings during breaks, and advocating for ILO guidelines integration with training programs, audits, and collective bargaining. Ms. Bharti Birla shared examples from garment factories in Bangladesh where heat protocols reduced absenteeism by 20%.

Ritu Bhardwaj, Director of Climate Resilience, Finance, Loss and Damage, IIED

Ms. Ritu Bhardwaj urged gender-responsive loss and damage funds, focusing on unpaid care work burdens during heat in global south contexts, where women lose 30% more work hours and face increased domestic loads like child care during school closures. Ms. Ritu Bhardwaj advocated integrating community voices for equitable pathways internationally, emphasizing financial inclusion for women through micro-grants, loss funds, and policy reforms to recognize care as economic value, with IIED studies showing $1 trillion global unpaid care gap widened by heat.

Open Discussion

Panelists addressed trust-building, basis risk mitigation, and bundling insurance with adaptation, with questions on global scalability leading to responses from Ms. Bhawana Ahuja on MSME surveys and Ms. Bhavna Maheriya on subsidies for retrofits in slums. Discussions emphasized initial subsidies, multi-peril coverage, and employer accountability for uptake, with Ms. Bharti Birla sharing ILO case studies from supply chains in Bangladesh and Vietnam. Additional queries explored integration with UN frameworks and welfare boards, with Ms. Ritu Bhardwaj discussing loss funds for care work and gender audits, concluding with consensus on cross-border learning, citizen-centric delivery, pilot expansions, and literacy campaigns.

Key Takeaways

1. Adaptive social protection for heat-induced livelihood shocks

The consultations emphasised the growing need to expand adaptive social protection systems to address employment disruptions and income losses caused by extreme heat. Prolonged heatwaves can reduce working hours, halt outdoor labour, and affect productivity in sectors such as construction, agriculture, transport, and informal services. Leveraging existing delivery platforms such as social registries, public distribution systems, employment guarantee programmes, and direct benefit transfer mechanisms—allows governments to channel temporary income support, food assistance, or health benefits rapidly and efficiently. Integrating heat triggers into these systems ensures that support is anticipatory rather than reactive, reducing administrative burden while protecting vulnerable households from slipping into deeper poverty.

2. Bundled protection models linking insurance with practical adaptation support

Participants highlighted the effectiveness of bundled approaches that combine financial protection with tangible adaptation resources. Models such as Women's Climate Shock Insurance (WCSI)-type initiatives demonstrate how integrating insurance coverage with heat-safety kits, access to cooling resources, health awareness, and early warning information can simultaneously safeguard health, income stability, and personal dignity. Such approaches strengthen real resilience because payouts alone may not prevent exposure to heat risks. Scaling these models requires multi-stakeholder partnerships among insurers, local governments, community organisations, and development partners, along with sustained investment in financial and climate literacy so that beneficiaries understand and effectively utilise both insurance and adaptation tools.

3. Role of grassroots demand in ensuring programme sustainability

A key lesson from field experience is that long-term sustainability depends both on the source of financing (i.e. premium support for parametric insurance or social assistance able to cover more beneficiaries) and on demand-driven design.

When beneficiaries directly perceive the usefulness of interventions—such as access to cool-roof materials, shaded workspaces, hydration infrastructure, or protective gear—they are more likely to participate, maintain assets, and advocate for programme continuation. Combining financial payouts with visible, practical tools strengthens trust and reinforces behavioural change toward heat-safe practices. This bottom-up validation also helps policymakers refine programme design and prioritise investments that generate measurable improvements in daily living and working conditions.

4. Employer standards and supply-chain accountability for occupational heat safety

The discussions underscored that managing occupational heat risk cannot rely solely on public interventions; it must also be embedded in employer practices and supply-chain governance. Establishing enforceable workplace standards—such as regulated work-rest cycles, access to shaded rest areas, hydration provisions, heat illness monitoring, and flexible scheduling during extreme conditions—is essential to protect worker health and productivity. Large firms and contractors can further promote compliance by incorporating heat-safety requirements into procurement policies and supplier codes of conduct. Such supply-chain accountability mechanisms extend protection to subcontracted and informal workers who often face the highest exposure while having the least bargaining power.

5. Gender-responsive financing to address structural inequities

Extreme heat affects both indoor and outdoor sectors, including construction, agriculture, garment and textile industries, as well as manufacturing. While women do not disproportionately represent all these sectors, participants stressed the gendered impacts of health vulnerabilities, lack of access to financing mechanisms and income support, and caregiving responsibilities which impact climate resilience.

Strategic Insight

Financing must prioritize last-mile mechanisms, empowering communities through equitable, adaptive tools to transform vulnerability into resilience, grounded in trust and cross-sector integration.

WRAP-UP SESSION

Key Takeaways

Ms. Mrinalini Srivastava, Director, NDMA

Ms. Mrinalini Srivastava synthesized the day's insights: layered financing for multi-hazard risks to handle compounded threats like heat and drought; blended models for infrastructure to bridge public-private gaps and de-risk investments; parametric tools for residuals to ensure rapid, predictable payouts; and community mechanisms for equity to address gender, informal sector, and rural vulnerabilities. Ms. Mrinalini Srivastava highlighted shifts to proactive mitigation, standardized indicators for tracking progress (e.g., health and economic metrics), and convergence across sectors, drawing from international examples like G20 principles, UN-supported pilots, and ADB diagnostics. Ms. Mrinalini Srivastava noted the workshop's role in building a community of practice for ongoing collaboration, emphasizing the need for knowledge sharing platforms, follow-up webinars, and joint research initiatives.

Chair:

Dr. Krishna S. Vatsa,
Member & HoD, NDMA

Rapporteurs:

Shishir Agarwal,
Sr. Consultant, NDMA

Way Forward

Dr. Krishna S. Vatsa, Member & HoD, NDMA

Dr. Krishna S. Vatsa outlined priorities: recognize heat as a notifiable disaster for dedicated funding and policy prioritization; develop national parametric frameworks with state-customizable triggers for localized risks; expand urban pilots like cool roofs, cooling stations, and green infrastructure to rural areas; integrate humidity and night-time conditions into warnings and HAPs for comprehensive alerts; and foster collaborations on policy with global partners, including reinsurance pools and UN agencies for technology transfer. Dr. Krishna S. Vatsa extended NDMA's support for partners internationally, committing to annual workshops, interim meetings for knowledge exchange, joint research on metrics like economic loss avoidance, and capacity building programs for local authorities. Dr. Krishna S. Vatsa stressed monitoring frameworks with digital tools and evaluation of pilots for evidence-based scaling.

Closing Remarks

Mr. Ben Webster, Associate Director of Advisory, Training and Engagement, CDP

Mr. Ben Webster thanked NDMA for the platform and excellent organization, reaffirming global commitment to integrated financing for sustainable development in a warming world. Mr. Ben Webster called for continued international dialogue, emphasizing urgency in scaling solutions to protect vulnerable communities, and highlighted CDP's role in technical assistance for pre-arranged mechanisms, risk modeling, and capacity building. He further highlighted the workshop's contributions to global knowledge and encouraged India's public policy and financial instrument innovations be shared with other governments in multilateral forums such as the G20 and BRICS+.

Concluding Synthesis

Day 2 advanced the national and global discourse on extreme heat from conceptual frameworks to financial implementation, emphasizing layered, equitable mechanisms to protect vulnerable populations worldwide. By integrating public budgets, innovative instruments like parametric insurance, and community-led solutions, the workshop charted a path toward resilient systems capable of withstanding climate extremes. The deliberations reinforced India's leadership in heat governance, fostering collaborations for scalable, inclusive impact across sectors and scales on an international stage.

Consolidated Key Takeaways:

Overarching Strategic Messages

1. **Systemic Reframing of Extreme Heat:** Heatwaves are governance, development, and fiscal imperative, not just seasonal events. Their silent, cumulative impacts disproportionately affect vulnerable groups (informal workers, women, urban poor), demanding integrated risk management across health, livelihoods, infrastructure, and equity.
2. **Shift to Proactive Resilience:** Move from reactive relief to anticipatory, data-driven strategies, incorporating multi-parameter forecasting (temperature, humidity, duration) and layered financing for long-term mitigation.

3. **Equity and Inclusion at the Core:** Prioritize gender-responsive approaches, community co-design, and protections for frontline populations, ensuring financing reaches the last mile through adaptive social protection and occupational safeguards.
4. **Innovation and Scalability:** Leverage technologies (AI, satellites, parametric tools) and global frameworks (e.g., G20 High-Level Principles for DRR) for measurable outcomes, with economic incentives like $7–15 ROI per $1 invested driving adoption.
5. **Institutional and Financing Commitments:** Recognize heat as a notifiable disaster for dedicated budgets; foster convergence (public-private, CSR) and international solidarity for scalable, evidence-based resilience.

Day 1: Foundations for Preparedness and Resilience

Technical Session I: Heat Action Plans – From Local Tools to Global Practices

- HAPs as core instruments for systemic risk reduction, evolving from reactive to anticipatory planning with localized vulnerability mapping and hotspot identification.
- Institutionalize accountability through nodal officers, task forces, and dedicated financing via blended models for implementation beyond planning.
- Standardize indicators (e.g., Heat Impact Assessment framework) for measurable outcomes, integrating global best practices for multi-sectoral adaptation.

Technical Session II: Heat-Resilient Infrastructure – Climate-Smart Urban Development

- Infrastructure's dual role: Preventive designs (passive cooling, green-blue solutions) avoid lock-in; inaction amplifies urban heat islands.
- Use digital twins for scenario planning; enforce codes reducing temperatures 1-2.5°C and AC demand 15-25%; converge funds (SDRF/CSR) for scaling.
- Urban expansion as an opportunity for nature-based resilience, with lifecycle integration ensuring adaptive capacity.

Technical Session III: Heat, Health, and Human Systems – Protecting Lives and Livelihoods

- Center human impacts: Integrate health surveillance, labor standards (rest-water-shade), and adaptive social protection to address inequities.
- Forecast triggers for anticipatory responses; strengthen primary care and mortality attribution for evidence-based policy.
- Frame heat as occupational hazard, grounded in climate justice for informal workers.

Technical Session IV: Data, Technology, and Innovation for Extreme Heat Governance

- Intelligent data integration (satellites, sensors, AI) for micro-vulnerabilities and impact-based forecasting.
- Emerging tech (passive radiative cooling, reflective coatings) supports dual mitigation-adaptation; open-source platforms enable municipal financing.
- Community validation enhances inclusivity; technological tools translate to actionable governance.

Concluding Synthesis – Day 1

Evolution from seasonal hazard to structural challenge; integrated governance across domains for proactive, data-driven systems safeguarding lives and livelihoods.

Day 2: Financing Mechanisms for Implementation and Equity

Inaugural and G20 Overview: Setting the DRF Agenda

- Heat as fiscal risk: Pre-arranged DRF (triggers, contingency) for predictability; G20 Principles (7 pillars: risk info to solidarity) guide ex-ante investments with high ROI.
- India's risk layering (frequent/moderate/catastrophic) aligns with global best practices; state innovations (e.g., Nagaland parametric) as models.

Technical Session I: DRR Financing for Multi-Hazard Risks and Heat Resilience

- Blend tools: Public budgets/task forces; concessional (World Bank $880M Cooling); incentives (tax credits/Singapore Green Mark); bonds (Paris €300M).
- Parametric for heat triggers (MHT/SEWA examples); WCSI bundles for 772M informal women (co-design/affordability/trust).
- Pre-arranged DRF reduces basis risk; gender-responsive scaling via literacy and subsidies.

Technical Session II: Financing for Heat-Resilient Infrastructure

- Blended/convergent models (SDRF/CSR) for preventive designs; lifecycle integration avoids lock-in (data centers 90-95% heat).
- Tech/KPIs (passive cooling/green-blue; 20-30% savings in ADB pilots); National Heat Hub/ HAP+ for data-driven/community-led convergence.
- ESG mainstreaming attracts bonds; nature-based (1-2.5°C reduction); digital twins for optimization.

Technical Session III: Addressing Residual Risk through Money-In Mechanisms

- Parametric stabilizes layered risks (system over compensation); PMFBY scales to 400M with tech (50% dispute reduction).
- Indices for dairy/crops/livestock (30% losses); moral hazard mitigation; 10K+ stations reduce basis risk 40%.
- Reinsurance for catastrophes; co-creation/multi-peril for gig/non-agri sectors.

Technical Session IV: Financing to Reach Communities Most at Risk

- Adaptive protection (vertical/horizontal) for MSMEs ($120B impact); money-out for speed (40% vulnerability drop).
- SEWA scales 225K (bundles reduce costs 25%; apps/literacy); retrofits (5°C drop/15% productivity); heat allowances.
- ILO standards (2.4B exposed/18K deaths; 20% less absenteeism); gender funds for care burdens (30% women hours/$1T gap).

Wrap-Up Synthesis – Day 2

DRF enables proactive; layered/parametric for equity; global G20 alignment with India's innovations.

Consolidated Workshop Synthesis

- **Holistic Roadmap:** Institutionalize HAPs/data-driven governance; finance via ex-ante DRF (parametric/bonds); prioritize equity/gender (WCSI); converge sectors for resilience.
- **Challenges & Solutions:** Basis risk/affordability via data/subsidies; moral hazard through validation; scaling through PPPs/global ties.
- **India's Leadership:** Notifiable status/national frameworks/pilots; annual workshops for sustained impact in a warming world.

ACRONYMS AND FULL FORMS

ADB	Asian Development Bank
CDP	Centre for Disaster Protection
CDRI	Coalition for Disaster Resilient Infrastructure
CRA	Climate Resilience for All
CSR	Corporate Social Responsibility
DRR	Disaster Risk Reduction
ESG	Environmental, Social, and Governance
GCF	Green Climate Fund
HAP	Heat Action Plan
IIED	International Institute for Environment and Development
ILO	International Labour Organization
IMD	India Meteorological Department
MHT	Mahila Housing Trust
MNE	Multinational Enterprise
MoF	Ministry of Finance
MSME	Micro, Small, and Medium Enterprises
ND-GAIN	Notre Dame Global Adaptation Initiative
NDMA	National Disaster Management Authority
NDMF	National Disaster Mitigation Fund
NRDC	Natural Resources Defense Council
PMFBY	Pradhan Mantri Fasal Bima Yojana
PPP	Public-Private Partnership
SDRF	State Disaster Response Fund
SDMF	State Disaster Mitigation Fund

SEWA	Self-Employed Women's Association
ULB	Urban Local Body
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environment Programme
WCSI	Women's Climate Shock and Livelihoods Insurance
WRI	World Resources Institute
WRMS	Weather Risk Management Services

ANNEXURE-I
POSTER GALLERY

SHOWCASING INNOVATIONS AND ACTION PATHWAYS FOR HEAT RESILIENCE

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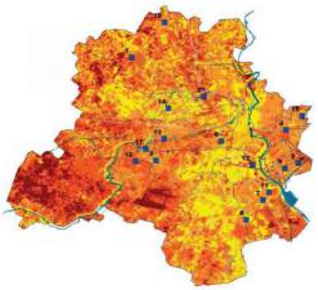
WORKER-CENTRED STRATEGIES FOR EXTREME HEAT PREPAREDNESS

HEAT-RESILIENCE FOR STREET VENDORS

GEOGRAPHY AND CONTEXT OF HEAT CHALLENGE ADDRESSED



More than **500 vendors across 17 markets** in Delhi reported:

0%	79%	90%	90%	96%
WATER POINTS	NO TOILETS	REDUCED WORK HOURS	HEAT-RELATED ILLNESS	CUSTOMER DECLINE

Street vendors work in **extreme outdoor heat** with **little shade, water or rest**. Yet they remain excluded from Heat Action Plans and protections.

KEY OUTCOMES AND EARLY RESULTS

- Identified critical heat-protection needs
- Severe **heat impacts** on vendors documented
- **Vendor collectives** enabled heat preparedness
- Supported **inclusion of workers** in heat response planning

KEY LEARNINGS AND SCALABILITY PROSPECTS

- **Heat resilience** must be built at the workplace
- Infrastructure = adaptation for informal workers
- **Early warning systems** improve preparedness
- **Gender-responsive design** strengthen outcomes
- **Low-cost solutions** allow citywide scaling

WIEGO · SEWA DELHI · JANPAHAL

WOMEN IN INFORMAL EMPLOYMENT: GLOBALIZING AND ORGANIZING
www.wiego.org

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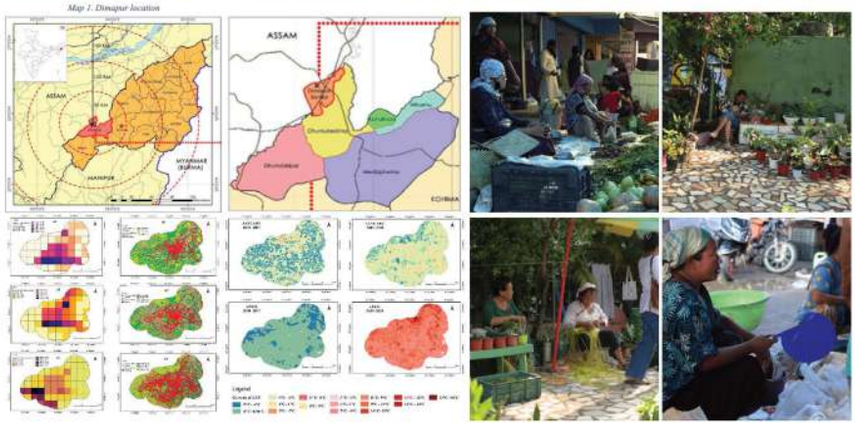
FROM HEAT TO ACTION: URBAN HEAT RISK GOVERNANCE PILOT IN DIMAPUR

Dimapur, Nagaland: A rapidly urbanising Foothill city in Northeast India



- **Heat challenge:** Rising urban heat stress driven by rapid Land-Use Change, surface hardening, and loss of green vegetation
- **High-risk groups:** Informal workers, indigenous women vendors, school children and elderly exposed to heat stress.
- **Governance gap:** Urban heat historically under-recognised within Disaster management and urban planning frameworks

KEY OUTCOMES AND EARLY RESULTS

KEY LEARNINGS AND SCALABILITY PROSPECTS

- Evidence ≠ Action - Institutional anchoring | Community co-production
- Secondary cities - Process-based heat governance (not event-led HAPs)
- Heat as risk multiplier - Cross-sector convergence
- Low-cost, governance-led - Scalable
- Policy-aligned - DRR framework

DIMAPUR MUNIPAL COUNCIL (DMC)

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Anticipatory Action on Heatwaves

GEOGRAPHY AND CONTEXT OF HEAT CHALLENGE ADDRESSED

Heatwave days in India have jumped from 413 to 600 in recent decades, hitting urban poor and informal workers the hardest. ADRA India piloted anticipatory heat-risk actions in three high-risk urban areas: South-East Delhi, Gwalior, and Ahmedabad, selected using IMD forecasts, recent heat severity, and local vulnerability. These dense, low-income areas lack green cover, cooling options, and access to early warnings.

Stakeholder Consultation at NDMA

Capacity Building of Frontline Workers

KEY OUTCOMES AND EARLY RESULTS

- Installed **39 air coolers**, **5 water coolers**, and **public hydration points** across shelters, markets, and labour hubs.
- Set up **4 green shade sheds** and planted **640+ trees** to boost long-term cooling.
- Tested **PCM cooling vests** for traffic police.
- Ran community outreach: **hydration kits**, **street plays**, **school sessions**, and **local-language campaigns**.
- Trained **150+ frontline workers** (ASHAs, ANMs, AWWs, Aapda Mitras) on heat illness prevention and response.

Result: Better thermal comfort, safe water access, awareness, and frontline readiness before peak heat.

Tree Plantation Drive

Cool Vest Initiative

Cooling Centre Inauguration

Street Play

KEY LEARNINGS AND SCALABILITY PROSPECTS

- Low-cost, early actions work when grounded in real local assessments.
- Sustainability improves when municipal bodies, shelters, and community institutions take ownership.
- Street theatre, school activities, and hydration points are highly replicable.
- Strongest scale potential where efforts align with Heat Action Plans and existing public infrastructure.

Next steps: Stronger Local Early Warnings, Regular Frontline Training, and Integrating Heat Action into Urban Planning, Disaster Management, and CSR Partnerships.

ADRA

Adventist Development and Relief Agency India

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Reduce Home & City temp by High SRI Paints

Rapid urbanization creates "heat islands" where dark rooftops and driveways reach lethal temperatures above 60°C. This thermal absorption intensifies indoor heat stress and spikes emergency energy demand. This technology helps **Vulnerable Communities Across India, especially.**

Easily Self Applied - Heat Reflective High SRI, Coatings to reduce heat stress in vulnerable communicites and Reduce UHI Directly

KEY OUTCOMES AND EARLY RESULTS

People **used to** Sleep- outside their homes due to heat trap, and Urban Heat Island - with metal roofs aggravating pain. **Now** a kid tells how he is able to sleep and eat in his home after coating. Reduced surface temperature of Infra, results in **around 2 degrees reduced city temp, at scale.**

KEY LEARNINGS AND SCALABILITY PROSPECTS

Reduced surface temperatures by 30°C and indoor air by up to 5°C. Upto 2 °C reduced city temp.

GCGC foundation

Global Cool Green City Foundation

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HEAT RELIEF FOR HOMELESS PERSONS

GEOGRAPHY AND CONTEXT OF HEAT CHALLENGE ADDRESSED

In the absence of adequate housing, homeless persons are exposed to extreme heat for prolonged periods, often without reliable access to free and potable drinking water. This heightens their risk of dehydration and heat stress during summer. In response, Housing and Land Rights Network (HLRN) and the Social Design Collaborative, together with shelter residents, facilitated the installation of a **low-cost cooling-cum-resting point** at the homeless shelter at Mori Gate Terminal, Delhi.

KEY OUTCOMES AND EARLY RESULTS

During peak summer, the pilot provided shade, cool drinking water, and a safe place to rest to over 16,000 people (June to August), including daily wage workers, rickshaw pullers, and truck and bus drivers—many of whom returned multiple times.

KEY LEARNINGS AND SCALABILITY PROSPECTS

The compact, low-cost structure is highly scalable. Its modular design allows flexibility in size and roofing materials depending on the site, and it can be assembled or dismantled in under a day. Daily operations require minimal manpower, limited to routine cleaning and refilling of earthen water pots.

HOUSING AND LAND RIGHTS NETWORK

HOUSING AND LAND RIGHTS NETWORK (HLRN)

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COOL ROADS AND PERMEABLE PAVING

Dark asphalt roads and concrete pavements act as massive thermal sponges, absorbing solar energy and elevating city temperatures. These surfaces contribute to the Urban Heat Island effect, making outdoor spaces like **cycle tracks and walkways** unusable during heatwaves. Also all urban roads when made permeable have increased water retention/ absorption thus, better heat transmitivity.

Implementation of high-albedo road coatings and permeable pavers transforms urban transit corridors.

KEY OUTCOMES AND EARLY RESULTS

Easy and Fast Application Across Various Use Cases:

- Cool Cycle Tracks
- Permeable Driveways
- Permeable Walkways - increase catchment etc
- Cool Roads

Implementation of high-albedo road coatings and permeable pavers has transformed urban transit corridors:

- **Surface Temperature Reduction:** Lowered road and track temperatures by 7-10°C.
- **Pedestrian Comfort:** Enhanced thermal comfort for cyclists and pedestrians, reducing heat-exhaustion risks.
- **Water Management:** Permeable pavers reduced runoff while providing natural evaporative cooling to the surface.
- **Durability:** Applied heavy-duty, heat-reflective materials designed for high-traffic durability.

Scalable across Cities and Townships.

Reduced surface temperatures by 7–10°C and and ambient surrounding temp by 1-2°C.

Panache

Panache Greentech Solutions Pvt. Ltd.

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Cool Roofs: Passive Cooling for Informal Settlements

GEOGRAPHY AND CONTEXT OF HEAT CHALLENGE ADDRESSED

- Context: Differential impact of heat for low income informal laborers living in dense, low-ventilated homes.
- The settlement in general of low-income informal workers are either unplanned or poorly planned resulting in higher energy consumption to beat the heat. Walls are thin, windowless with hardly any ventilation, building materials trapping heat and making indoor temperature unbearable.
- Indoor temperatures exceeding outdoor levels at night

KEY OUTCOMES AND EARLY RESULTS

XLPE (Cross linked Polyethylene) Foam Sheets fixed to the ceilings

- Indoor temperature reduction of 3°C - 5°C
- Enhanced work-output for home-based workers
- Saving on energy consumption and water usage
- Rise in comfort level especially for women with higher exposure to heat due to cooking & care work.

KEY LEARNINGS AND SCALABILITY PROSPECTS

- Being a low cost measure for reducing the room temperature, ceiling modification through using the sheet is scalable.
- High community acceptance due to immediate relief.
- Additional measures for reducing the room temperature can be done with rooftop horticulture and roof-top painting with reflective paints where possible.

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Early Heat Warnings: Weather Alert Boards for Outdoor Workers

GEOGRAPHY AND CONTEXT OF HEAT CHALLENGE ADDRESSED

- Context: Outdoor workers are at the front of climate crisis - losing income and health in absence of timely knowledge about weather.
- High-density street markets in Delhi where vendors have limited access to real-time digital alerts.
- Sudden heat spikes impacting vendor health and perishables (vegetables/flowers).

KEY OUTCOMES AND EARLY RESULTS

- Weather-alert disseminated among 1000+ vendors in various markets across Delhi using color-coded display boards.
- Information sharing in simple language enabled large number of viewers to take up precautionary measures for keeping cool during extreme heat.
- Increased productivity as a result of heat impact mitigation on health.
- Better management of perishable inventory, saving food from spoilage.
- Vending time adjustment as per changing weather.

KEY LEARNINGS AND SCALABILITY PROSPECTS

- Learning: Advance information of weather leads to vending efficiency and well-being of workers.
- Scalability: Easily replicable in any public spaces like Mandi/committee/office/markets
- Grassroot organizations can scale this up and beyond
- Better spatial and infrastructural planning can be used to make street markets climate-resilient
- With additional measures for cooling the city through eradicating the heat island impacts, heat information displays and precautionary measures can remain a sustained intervention for combating extreme heat.

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Cooling Without Air-Conditioning

Designing Resilient Cooling Shelters for India's Heat Crisis

Yashima Jain[1,2], Yi Wu[2,3], Jeetika Malik[2], Tianzhen Hong[2], Elif Kiliç[1], Prasad Vaidya[4], Da Yan[3], Ashok Gadgil[1,5]

[1]India Energy and Climate Center, University of California, Berkeley, USA , [2]Building and Industrial Energy Systems Division, Lawrence Berkeley National Laboratory, Berkeley, USA, [3]School of Architecture, Tsinghua University, Beijing, China, [4]Indian Institute for Human Settlements, Bengaluru, India, [5]Department of Civil and Environmental Engineering, University of California Berkeley, Berkeley, USA,

Context of heat challenge addressed

Cooling shelters are structures offering a cooler environment to rest, cool down, and commonly offer cold drinking water. For workers exposed to high heat-stress, intermittent rest in cooling shelters is known to reduce serious injury, illness, and death from heat. Thus, Heat Action Plans (HAPs) should urgently pay attention to the design and feasibility of low-cost cooling shelters. However, currently, little clear guidance exists on how these shelters should be designed or operated.

Key outcomes and results

We report on physics-based building performance simulations of peak-summer indoor thermal conditions in low-cost cooling shelters designed in line with current Indian standards and practices. We select a heat wave in Jodhpur TMY as representative of peak hot dry climate in India. Heat resilience is evaluated using indoor wet-bulb globe temperature (WBGT) and extended heat index (EHI). WBGT results are not shown for lack of space. (Ref. Wu et al, 2025, Building Simulation).

EnergyPlus simulations show that select simple inexpensive measures – such as natural ventilation, insulation, thermal mass, and fans – achieve the highest reductions during hazardous heat hours. Moreover, packages of combined measures can reduce the indoor WBGT by 8 to 10° C, eliminating overheating hazard hours.

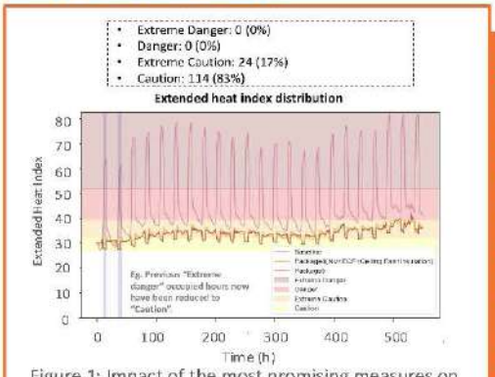

Figure 1: Impact of the most promising measures on indoor thermal conditions - based on EHI.

Simulation result: During the occupied time for Package 5 *(Natural ventilation + Ceiling Fan + Enhanced Cool Roof + External Insulation + Thermal Mass (with stacked Water Bottles)*, 58.9% of the occupied-time have reduced indoor WBGT relative to that outdoor by up to 10 C, and 98.6% of time have it reduced up to 8 C.

Implementation of a cooling shelter in Churu, Rajasthan

Ongoing work with Mahila Housing Trust (MHT) is translating simulation findings into practice through a pilot cooling shelter in Churu, Rajasthan.

Site details: Near Bus Stand, Public area with high pedestrian activity, limited tree cover, high solar exposure

Strategies proposed	
Secondary Shading	Segmented canopy roof system acting as an external shading layer above the main roof.
Structural Insulated Panels (SIPs)	Prefabricated panels providing thermal insulation, faster erection, and improved envelope performance.
Natural Ventilation (Cross-Flow)	Minimum 10% window-to-wall ratio (WWR) across façades. All windows to remain operable.
Mechanical Air Movement	3 - 4 ceiling fans (~50 W each) to deliver approx. 0.8 m/s air velocity during occupancy. One exhaust fan installed on the east façade to expel hot air and moisture
Thermal Mass (Stacked water bottles)	Thermal mass of an internal wall of water bottles in a trellis, absorbs internal heat during hot occupied hours.

Size: 6m x 4m (24 m²) accommodating 20-25 workers at a time.

Figure 2: Conceptual sketch of the cooling shelter

India Energy and Climate Centre
University of California, Berkeley, USA
Email: iecc@berkeley.edu

INTERNATIONAL WORKSHOP ON HEATWAVES 2026
STRENGTHENING PREPAREDNESS, RESILIENCE, AND RISK GOVERNANCE

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TECHNICAL PARTNER

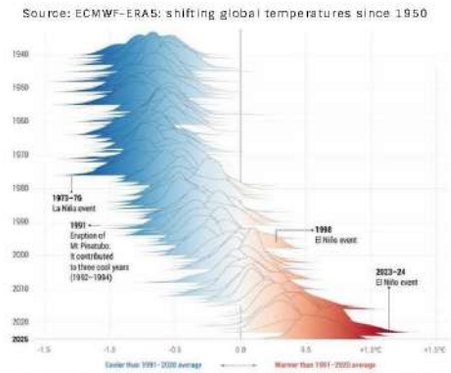
Building Resilience in Future Heat

Open-Access future weather files (till 2085) allow architects, engineers and cities to design heat-resilient buildings

Rohini Tamarana[1,*], Leland Li[2], Nicole Lee[2], Dr. Ashok Gadgil[1,2]

[1]India Energy & Climate Center, Goldman School of Public Policy, and [2]Department of Civil & Environmental Engineering, College of Engineering, UC Berkeley

The Challenge of Urban Heat Resilience

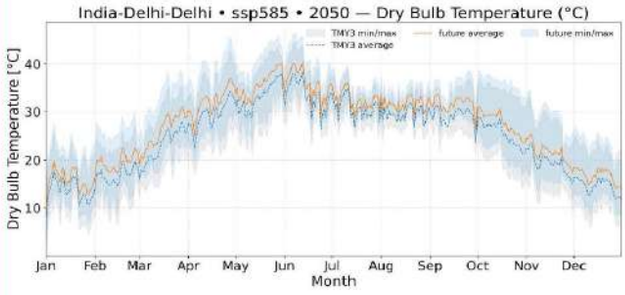


Daily global temperature anomalies from 1940 to 2025

Under all realistic GHG emission-scenarios the world gets hotter throughout this century and beyond. Significantly, about 75% of India's urban infrastructure in 2050, has not yet been built.

India's new urban infrastructure must be heat resilient in design and construction (usually that is much cheaper than retrofits). However, assessing future thermal performance of buildings at their design stage requires relevant software and future local-weather data. An excellent Open Access software for assessing of thermal performance of building designs is EnergyPlus. It needs weather information in a file-format called EPW.

Key Outputs & Outcomes



Delhi daily temperatures in baseline (1975-2005) and in 2050 for the SSP-585 Scenario

Delhi's daily air temperature (left) is displayed from EPW file of 2050, for emission-scenario SSP 585, and also Delhi's baseline Typical Meteorological Year3 (TMY3) temperature from sampling years 1976-2005. EPW files, for every 5th year up to 2085, for every IPCC emissions scenario, for 21 out of the largest 75 Indian cities will be placed on the IECC website before the end 2026 for free downloads. We closely follow the peer-reviewed methodology of Rodriguez et al, (2023, *Building and Environment*) for generating the future EPW files.

Key Learnings

Many locations have available EPW files based on typical historical local weather, but these are of limited use for the future in a changing climate. We are working to create Open Access EPW files for 21 large Indian cities, for years up to 2085, for every IPCC emissions scenario. In conversations, we have received expressions of interest for accessing these files for evaluating future thermal performance of buildings at their design stage.

IECC INDIA ENERGY & CLIMATE CENTER

India Energy and Climate Centre
University of California, Berkeley, USA
Email: iecc@berkeley.edu

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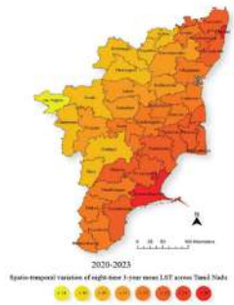
Tamil Nadu Green Schools Programme: Cooling Classrooms through Passive Solutions

Tamil Nadu's government schools face increasing heat stress, affecting learning conditions and student well-being, particularly in urban heat-prone areas.



- Pilot at Perunthalaivar Kamarajar Girls Higher Secondary School in Ambattur recorded 3–4°C lower indoor temperatures
- Ceiling surface temperatures reduced by 4–5°C
- Surveys confirmed thermal comfort was maintained in classrooms during school hours

- Combining cool roofs with nature-based solutions effectively reduces indoor heat
- Coupling cool roofs with solar rooftop photovoltaics improves project financial feasibility
- Programme now scaling to 297 schools, benefiting over 148,000 students, demonstrating strong state-wide replication potential
- Other states like Delhi and Maharashtra are now considering similar pilots led by public departments and through corporate social responsibility initiatives.

UN environment programme

Cool Coalition

United Nations Environment Programme

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Scaling Cool Roofs in Public Infrastructure

Delhi faces rising extreme heat risks, affecting large public facilities with heavy daily footfall. Transport hubs like Kashmere Gate ISBT experience high indoor heat stress, impacting commuter comfort, and increasing cooling demand.



- 150,000 sq. ft. roof retrofitted with reflective cool roof coating
- Improved indoor thermal comfort for ~200,000 daily commuters
- Demonstrated feasibility of cooling large public infrastructure through passive solutions


- Technically and financially scalable in public transport infrastructure (bus terminals, bus
- shelters, railway stations, government offices and similar public buildings)
- Training of public/ government engineers in cool roof products is important for smooth project
- implementation
- Comprehensive national performance and testing standards are required for quality control of cool roof products
- Cool roofs are a low-risk entry measure for integrating passive measures in urban infrastructure and public buildings
- Procurement guidelines and integration of standard specifications in schedule of rates may
- significantly accelerate adoption across public departments

UN environment programme
Cool Coalition
Embassy of Switzerland in India and Bhutan

United Nations Environment Programme

INTERNATIONAL WORKSHOP ON HEATWAVES 2026
STRENGTHENING PREPAREDNESS, RESILIENCE, AND RISK GOVERNANCE

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TECHNICAL PARTNER

USE OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR HYPER LOCAL HEAT RISK ASSESSMENT

GEOGRAPHY AND CONTEXT OF HEAT CHALLENGE ADDRESSED

The impact of heat waves varies significantly across different types of structures, with the greatest risk faced by homes of the most vulnerable families. Studies in New Delhi have shown that temperatures inside informal settlements can be 5–6°C higher than outdoor temperatures. Factors contributing to higher indoor heat include limited ventilation, use of fire for cooking, and people remaining indoors during extreme heat.

Resilience360™ is an Indian developed Artificial Intelligence and Machine Learning–based Disaster Technology Platform that integrates human assistance. It enables assessment of temperature variations across individual human-made structures, allowing for targeted, differential interventions based on real-time data. This was deployed in a small area of New Delhi for the NDMA lead heat action plan 2025.

KEY OUTCOMES AND EARLY RESULTS

Resilience360(TM) was deployed in Sultanpur to assess structure level impact of heat wave as a part of the NDMA lead Heat Action Plan. (Resilience AI) utilized Artificial Intelligence (AI) and Machine Learning (ML) driven analytics to enhance early warning systems and impact assessments. Human assisted Artificial Intelligence and Machine Learning based heat and vulnerability assessment was conducted and differential heat impact was assessed. Severity at structural level for various types of buildings (residential, industrial and commercial), houses, roads, streets and area level (ward/block, district) into dashboard for localised heat thresholds and impacts

KEY LEARNINGS AND SCALABILITY PROSPECTS

1. Digitisation of Data Management
   Resilience360's tools and reporting platform expand to integrate advanced analytics, enabling seamless monitoring and decision-making across sectors.
2. Heat Risk Assessment Framework
   A comprehensive framework evolves to map sectoral impacts of heat stress, strengthening preparedness and guiding targeted interventions.
3. Ward-Level Digital Heat-Risk Maps
   Digital maps at the ward level grow to incorporate more than twenty unique urban design and planning parameters, enhancing precision in identifying vulnerable zones.
4. Simulation-Based SOPs and Playbooks
   Standard operating procedures and playbooks develop through advanced simulations, supporting at-risk neighbourhoods and critical buildings in responding effectively to heat emergencies.

Resilience AI

RESILIENCE AI SOLUTION PVT. LTD.

INTERNATIONAL WORKSHOP ON HEATWAVES 2026
STRENGTHENING PREPAREDNESS, RESILIENCE, AND RISK GOVERNANCE

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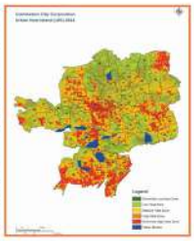
COIMBATORE URBAN GREENING DASHBOARD:

GEOTAGGING, TREE COVER MAPPING, AND STRATEGIC MANAGEMENT OF URBAN PARKS & OPEN SPACE RESERVATION (OSR) PLOTS



GEOGRAPHY AND CONTEXT OF HEAT CHALLENGE ADDRESSED

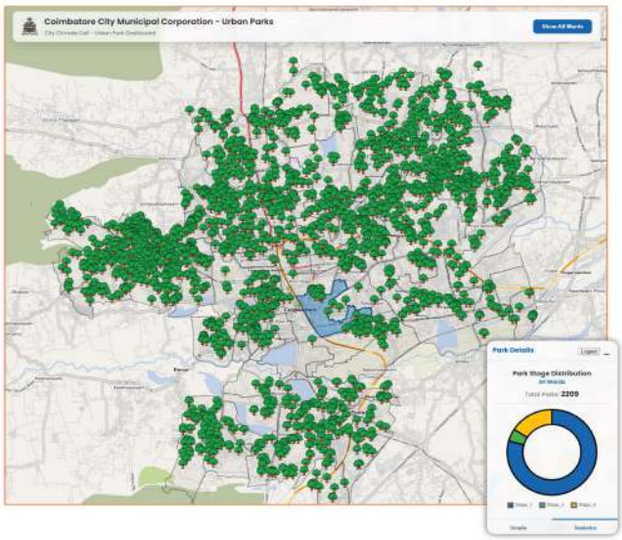
Location: Coimbatore City Municipal Corporation (CCMC), Tamil Nadu, India.

Heat Challenge:

- Urban expansion significantly reduced green cover
- Intensified Urban Heat Island effects
- Increased heat stress during summers
- Heightened climate vulnerability
- 14 wards (14% of total wards) classified as 'very high heat risk index'
- These high-risk wards cover 5% of city area but house 17.5% of total population

Contributing Factors:

- Rapid urbanization and encroachment of open spaces
- Loss of shade from tree cover
- Decline in carbon sequestration capacity



KEY OUTCOMES AND EARLY RESULTS

OSR Plot Mapping:
2,234 Open Space Reservation plots mapped and geotagged within CCMC limits. Ownership and encroachment verification completed using legal overlays, FMB, Layout, and Patta maps.

Carbon Sequestration:
Average CO_2 sequestration: 251.2 tons per hectare
Total sequestered: 1.17 million tonnes in Coimbatore (This value represents the overall carbon sequestration by the urban tree cover in the surveyed plots).

Tree Cover Mapping:
Ward-level mapping integrated into city and state level citizen centric tree plantation apps (Green Kovai and TNGCC mobile apps).
Enables prioritization of plantation wards, identification of vacant lands, and shade

Strategic Dashboard:
Tool for identifying park location, maintenance and encroachment status, finance estimates, and shade optimization (under finalization)

Ground Validation:
Field surveys with tree measurements and biodiversity checks support data-driven urban greening and heat mitigation

KEY LEARNINGS AND SCALABILITY PROSPECTS

Scalability:

- Methodology replicable across Tamil Nadu cities (Tiruchirappalli, Tirunelveli) and nationally
- Supports Tamil Nadu's Green Mission goals
- Adaptable for heatwave preparedness in Indian cities

Key Learnings:

- Geotagging and legal verification effectively prevent encroachments
- Field-based assessments provide accurate carbon and shade data for policy
- Mobile app integration enables citizen participation in urban greening
- Urban parks/OSR are vital for passive cooling and carbon sinks in hot cities
- Data dashboards empower municipal monitoring and climate budgeting

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Use of PDRC Coating- Ganzkuhl®

Site at Hyderabad, Pharma Company. Context is to reduce the heat stress on the roof

KEY OUTCOMES AND EARLY RESULTS

Before Coating: 61°C to 64°C

After Coating: 44°C to 45°C

Total Temperature Reduction: 17-20°C

KEY LEARNINGS AND SCALABILITY PROSPECTS

Ganzkuhl® PDRC Technology – Cooling Roofs Passively

- Drops roof surface temperature by 20°C+ through elite reflection & radiation. It operates via a dual mechanism: high solar reflectivity (98.6%) to minimize heat absorption and strong thermal emissivity in the 8-13 µm atmospheric window to radiate heat to outer space.
- Delivers real indoor cooling of 6–10°C – proven in hot real-world tests
- Durable + long-lasting performance

Easy to scale & Affordable → Apply like regular paint (brush, roller or spray) → No special tools or training needed → Works on concrete, metal, polycarbonate, sheds, containers, even vehicles.

Huge addressed need in hot climates (e.g., India): projected massive energy/CO_2/labor/heat-death savings if widely adopted.

GANZKUHL

Q GEN-NEXT SUSTAINABLE TECHNOLOGY PVT LTD
21, Shah Industrial Estate Deonar, Mumbai – 400088
Phone: +91 83697 44305
Email: sales@ganzkuhl.com

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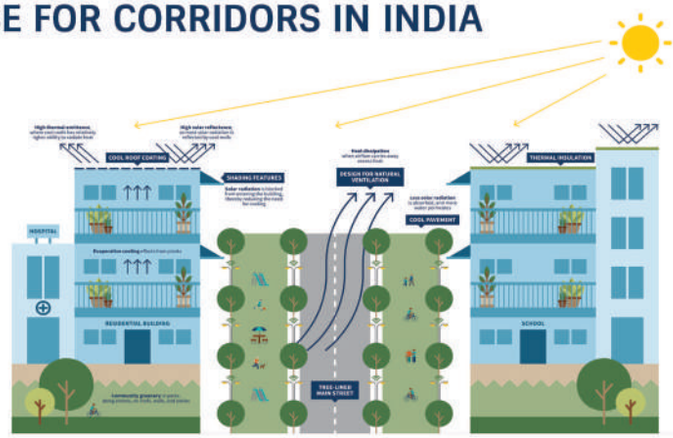
BUILDING COOLER NEIGHBOURHOODS
THE CASE FOR CORRIDORS IN INDIA

PRIMARY BENEFITS
Cooler urban environment, more comfortable climates indoors, and reduced cooling loads.

ADDITIONAL BENEFITS
Cleaner air, more attractive and vibrant public spaces, improved mental health, enhanced biodiversity, better walkability and more.

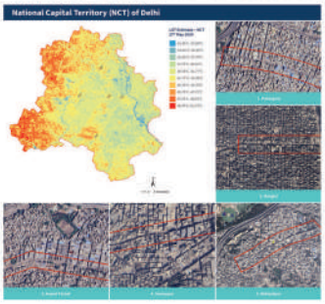


VISUALISING AN EARLY SUCCESS STORY IN PALAVA CITY

Palava city has deployed:
- Light-coloured pavements and roads to reduce heat absorption
- Man-made shading devices that provide respite during extreme heat
- Dedicated green spaces and water bodies to enhance cooling

LST mapping shows Palava reduces land surface temperatures by ~2°C overall and up to 7–11°C in shaded, vegetated areas.

THE PATH FORWARD: DEPLOYING COOL CORRIDORS AT SCALE



Assessing future opportunities across Delhi

THINK: Research, raise awareness, and align stakeholders across sectors around a shared vision for heat-resilient cool corridors.

DO: Translate thought leadership into pilot projects that test and demonstrate cool corridors, reducing adoption risk and enabling scale.

SCALE: Integrate cool corridors into policy for long-term heat mitigation, leveraging existing planning and funding to scale implementation.

Scan the QR to learn more

LODHA FOUNDATION

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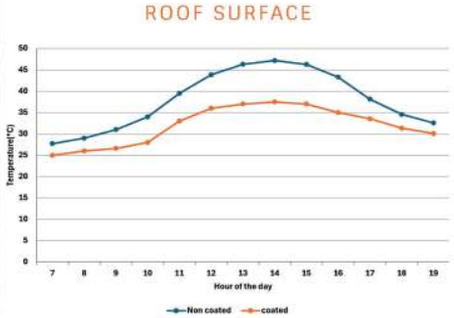
TURNING DOWN THE HEAT

COOL ROOFS PILOT—CHENNAI, TAMIL NADU

KEY OUTCOMES AND EARLY RESULTS



KEY LEARNINGS AND SCALABILITY PROSPECTS

REDUCED HEAT GAINS
Cool-coated roofs reduced outdoor surface temperatures by 9°C–12°C and indoor temperatures by 0.5°C–1.5°C, improving thermal comfort by 20% for residents.

AFFORDABLE AND SCALABLE
Energy savings of up to 12% make cool roofs a cost-effective passive cooling strategy, with citywide adoption requiring a modest share of municipal budgets.

Scan the QR to watch the cool roofs pilot in action

RMI INDIA FOUNDATION
https://rmi-indiafoundation.org/

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DELHI URBAN HEAT ISLAND (UHI) MAPPING

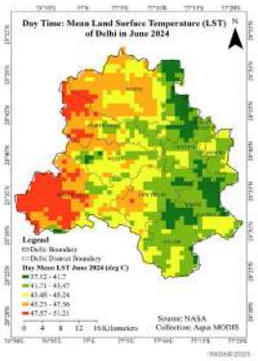
GEOGRAPHY AND CONTEXT OF HEAT CHALLENGE ADDRESSED

- Delhi is highly impacted by the Urban Heat Island phenomenon.
- UHI mapping is important for the Government of Delhi's targeted response and interventions for safeguarding vulnerable populations.
- UHI mapping provides a nuanced and granular approach for the implementation of effective Heat Action Plans.

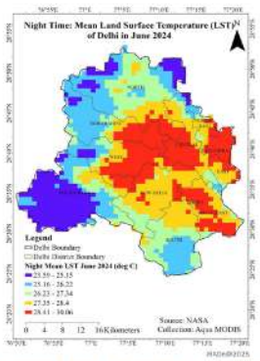
- Mapping of UHI was done by IRADe between 2019 - 2024.
- IRADe has mapped UHI at two administrative scales - ward level (for the Delhi Heat Action Plan) and district level (South Delhi Heat Action Plan), being developed by IRADe.

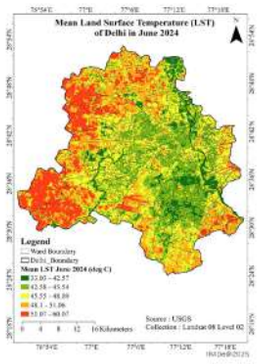
District Level | **Ward Level**

Day-time



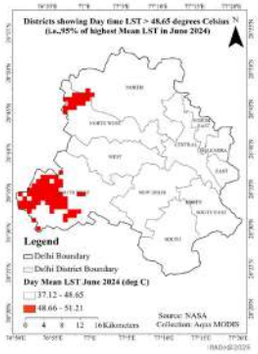
Night-time





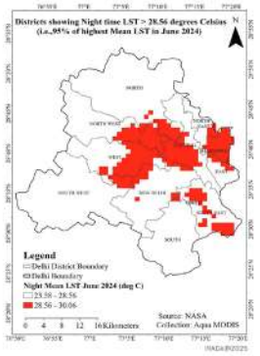
KEY OUTCOMES AND EARLY RESULTS

Day-time

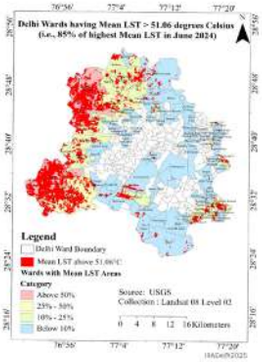


Identified daytime UHI districts:
North West, South West

Night-time



Identified nighttime UHI districts:
West, North West, Central, Shahdara, South East



Identified UHI wards:
- **>50% ward area:** Nangal Thakran, Karala, Isapur
- **25-50% ward area:** Sangam Vihar-C, Badarpur, Madanpur Khadar East, Pooth Khurd, Nangloi, Dichaon Kalan, Chhawala, Kalyanpuri

KEY LEARNINGS AND SCALABILITY PROSPECTS

- Intervention designs which are localised, granular and help prioritise action for short term, medium and long term planning.
- Day and night time UHIs supports strategic monitoring and early warning during heatwaves at District level in Delhi (NCT).
- Ward-level UHIs and its aerial extent enable location-specific intervention design for Delhi (NCT).
- Cost effective, scalable and Replicable methodology which can be scaled for identification of UHIs at state, district and city level.

Prepared by : Rohit Magotra, Sai Rama Kamalamrutha Mokkarala, Ajoy Ghosh
Contact: kmokkarala@irade.org

20 YEARS Integrated Research and IRADe Action for Development

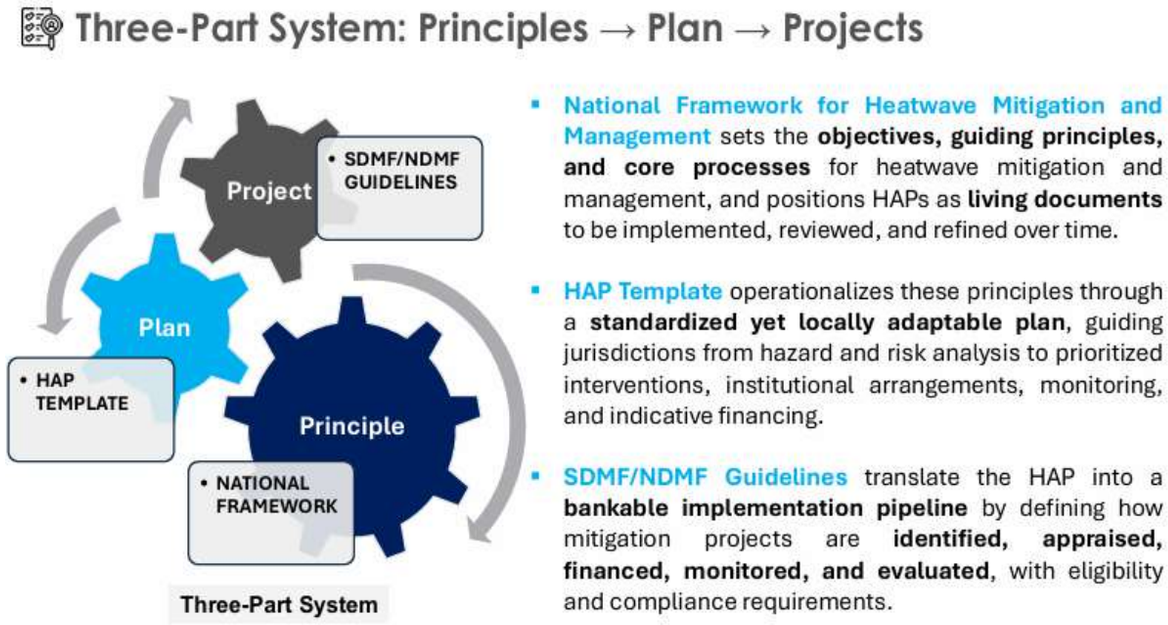
Integrated Research and Action for Development (IRADe)

ANNEXURE-II
PRESENTATIONS

THE FOLLOWING PRESENTATIONS WERE REFERENCED IN THE PROCEEDINGS:

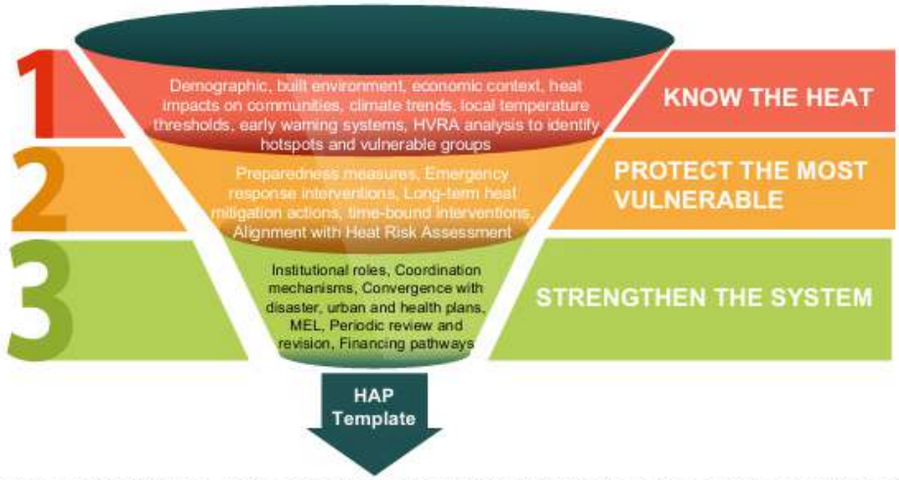
DAY 1: TECHNICAL SESSION - I
EVOLUTION OF HEAT ACTION PLANS: LESSONS FROM PRACTICE

Speaker: Mr. Abhiyant Tiwari, NRDC



HAP Template: From Evidence to Action

- The HAP Template operationalizes heat governance by embedding risk evidence into decision-making, guiding where to act, who to priorities, how to implement, and how to track results over time.



- The HAP functions as a living plan - implemented annually, reviewed post-season, and strengthened through monitoring, learning, and revision.

1. KNOW THE HEAT

- Build a **place-specific, evidence-based understanding** of heat risk and who is most affected.

Chapter 1: Understanding the Localized Heat Hazard

- Local context of the jurisdiction and **type of heat experienced** (dry, humid, mixed, recurrent)
- **Demographic profile**: age, gender, disability, informal settlements, migration, vulnerable groups
- **Land use and built environment**: built-up areas, vegetation, water bodies, open spaces
- **Economic structure**: heat-exposed occupations, livelihood patterns, poverty
- **Climatological analysis** using official data:
  - Temperature and humidity trends
  - Night-time temperatures
  - Number of heatwave days
  - Seasonal focus on March–June (with Feb/Jul/Aug for emerging patterns)

Chapter 2: Understanding Impacts and Differential Risk

- **Local temperature thresholds** to determine heatwave declaration
- **Early Warning Systems** and last-mile dissemination, especially to vulnerable groups
- **Heat Risk Assessment (HRA)** combining:
  - Socio-economic and demographic indicators
  - Access to services (health, housing, water, transport, emergency)
  - Built environment characteristics
  - Environmental indicators
  - Urban Heat Island (UHI) assessment (basic level recommended)
- Identification of **heat hotspots and priority vulnerable populations** at ward/block/village level

Risk evidence and hotspot identification form the foundation for all subsequent actions.

2. PROTECT THE MOST VULNERABLE

- Turning analysis into **on-ground preparedness, response, and long-term resilience**

Chapter 3: Preparedness, Response, and Mitigation Interventions

The HAP Template organizes actions through **three complementary intervention streams**:

- **Preparedness Interventions:** *Building awareness, readiness, and preventive capacity before heat events*
- **Response Interventions:** *Emergency actions during heatwave periods to reduce exposure and harm*
- **Mitigation Interventions:** *Long-term measures to reduce underlying heat vulnerability*

What the intervention tables ensures:

- **Action** – Proposed solution and description
- **Ownership** – Implementing authority
- **Delivery window** – Short / medium / long term
- **Investment required** – Budget with costing logic and coverage
- **Spatial targeting** – Location informed by the Heat Risk Assessment
- **Risk rationale** – Justification based on HRA findings
- **Financing pathway** – Potential funding sources and indicative split

Actions are spatially targeted, demographically focused, time-bound, and costed- ensuring resources are directed where risk is highest.

3. STRENGTHEN THE SYSTEM

- Ensure the HAP is **implemented, monitored, financed,** and **continuously strengthened.**

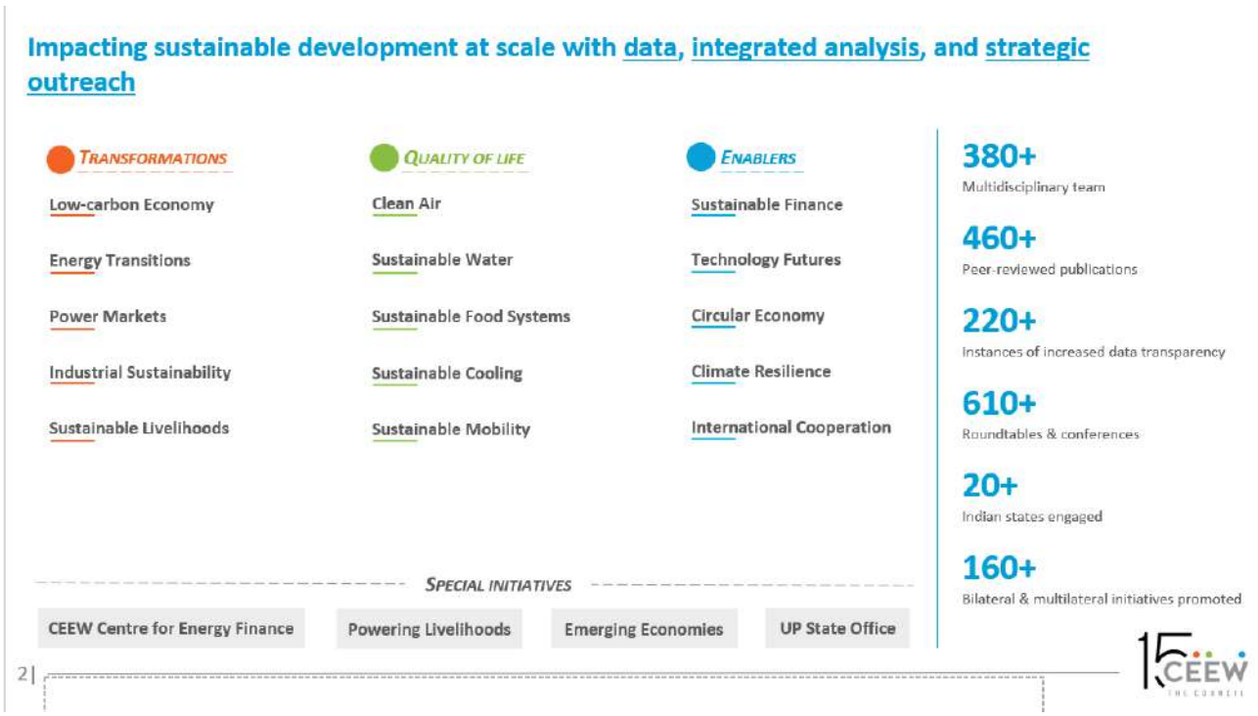
Chapter 4: Institutional, Operational, and Monitoring Framework

- **Institutional arrangements**
  - Designated **Nodal Officer** with defined roles and responsibilities and **Multi-agency coordination mechanism.**
- **Integration with existing plans:** Linkages with **DM Plans, Climate Action Plans, Development Plans.**
- **Monitoring, Evaluation & Learning (MEL)**
  - **Annual tracking** of HAP implementation progress
  - Monitoring of: **Process indicators** (e.g. actions implemented) and **Outcome indicators** (e.g. heat-related health impacts, lost workdays)
  - **Post-season review** of actions and effectiveness
- **Plan review & revision**
  - **Periodic revision of the HAP** to incorporate updated data and emerging evidence and lessons
  - **Consultation with affected communities and vulnerable groups**
- **Financing pathways**
  - Identification of **local, state, and national funding sources**
  - Alignment with **SDMF/NDMF** and other relevant funding streams

The HAP is a living, evidence-based plan - implemented annually, reviewed post-season, and strengthened over time.

INSTITUTIONAL ACCOUNTABILITY AND GOVERNANCE STRUCTURES

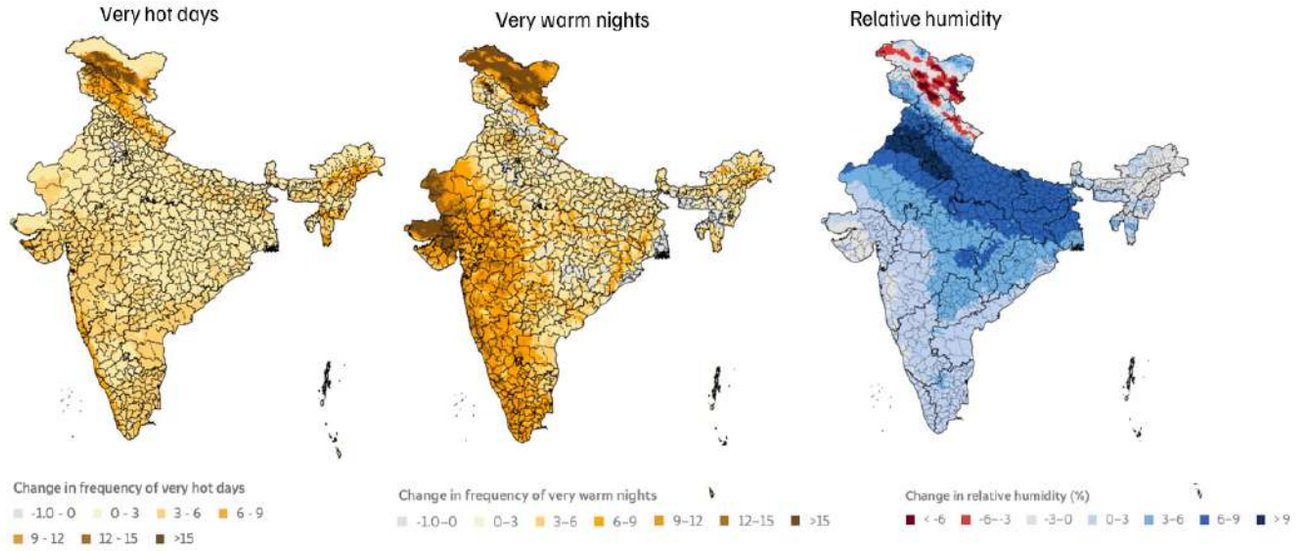
Speaker: Dr. Vishwas Chitale, Council on Energy, Environment and Water (CEEW)



The conundrum of extreme heat in India: Current situation

More 'very hot days', but even more 'very warm nights' — raising serious health concerns

North India is experiencing significant increase in summer relative humidity



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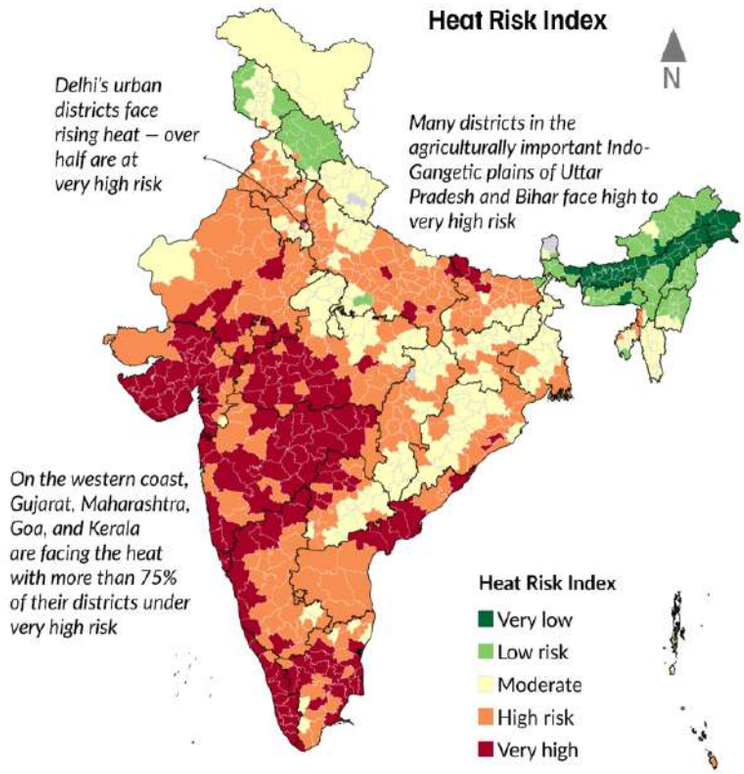
Note: *very hot days and warm nights calculated as days exceeding the weekly 95th percentile threshold of baseline Tmax and Tmin.
IMD = India Meteorological Department and NCMRF = National Centre for Medium Range Forecasting



~ 57% of Indian districts, home to 76% of total Indian population are in high to very high heat risk category

Category	Number of districts
Very High	151
High	266
Moderate	201
Low	78
Very low	36

Top ten states and UTs: Delhi, Maharashtra, Goa, Kerala, Gujarat, Rajasthan, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, and Uttar Pradesh

From research to action: CEEW's urban heat resilience program aims to support 300 cities on heat action

Gaps in HAPs design of India (as of 2023)

~67%
HAPs lack localised heat hazard mapping, info on humidity, warm nights

~95%
HAPs lack heat vulnerability and risk assessments

~INR 720 crore
estimated cost to develop robust HAPs for all states and cities

~10-12 years
estimated time to develop all 4,500+ city-level HAPs individually

Proposed solution | Automating HAP development and heat management process through technology and AI

Output

Heat-risk informed HAP, **ward-level risks calculated**

CEEW's open-access tool, real-time heat management

Outcome

- HAPs for **300 cities from 23 heatwave-prone states**
- **Integrate HAPs into national policy-making**; collaboration with NDMA, NCDC and IMD
- **Enhanced heat action capacity of administrators;** collaboration with state and municipal governments

Impact

Zero heat-related mortalities and reduced illnesses by 30% in cities and districts across India

5 |

Source: Natural Resources Defence Council (2022), Pillai and Dalal (2023) | CEEW estimates based on approx. costing of INR 15 Lakh for developing one HAP

CEEW THE COUNCIL

CEEW's urban heat resilience programme: target supporting 300 cities & districts on developing and implementing heat action plans by 2027

1. **Himachal Pradesh** | State HAP
1. **Uttarakhand** | State HAP
1. **Delhi** | State HAP
1. **Gujarat** | 10 cities
1. **Maharashtra** | Thane city & State heat risk adaptation plan
1. **Goa** | 2 cities
1. **Odisha** | 41 cities & 5 districts
1. **Andhra Pradesh** | 20 cities
1. **Tamil Nadu** | 25 cities & 38 districts

6 |

CEEW THE COUNCIL

Approach for jointly developing a city or district heat action plan | based on NDMA guidelines

Inception workshop | Presentation of methods, and data requirements

On ground data collection | Virtual discussions; field visits; data validation

Designing a hyperlocal heat action plan | As per NDMA guidelines

Validation workshop | detailed validation of results; field validation

Launch of HAP and implementation capacity building workshop

Technical support | Identification and implementation of sustainable cooling solutions

Monitoring and impact evaluation | Implementation of HAPs and solutions

When to take action | Localised heat thresholds for early warning systems

Where to take action | Ward-level heat risk and vulnerability assessment

What action to take | Technological, cooling, public health and traditional solutions

Who will take action and how| Stakeholder-wise responsibility matrix of solutions; HW task force committee

7|

WHEN | An administrator's dilemma: How hot is *too hot* in my city?

"A heatwave is a period of abnormally high temperatures"

In India: 40°C for plains, 37°C for coastal regions, and 30°C for hilly areas; along with deviations from the long-term average

"Heat stress is a situation where too much heat is absorbed by a human body"

Heat cramps, heat exhaustion, and, if not treated, often a heatstroke

Setting the heat threshold too low → Economic losses from closures, disrupted work, reduced productivity

Setting the heat threshold too high → Increased risk of heat-related illnesses, fatality

Thane's city-specific heat thresholds based on bio-meteorological thermal indices

Dry heat thresholds (in °C)			
Month	Yellow alert	Orange alert	Red alert
March	38	39	40
April	39	40	41
May	38	39	41
June	36	37	40

Felt heat thresholds (in °C)			
Month	Yellow alert	Orange alert	Red alert
March	38	39	41
April	41	42	45
May	42	43	46
June	39	40	43

8|

Source: European Journal of Public Health (2006); CEEW analysis based on IMD criteria and percentiles chosen from a NDMA study titled "A Preliminary Study to Estimate Temperature Threshold for Heat Wave Warning in India"; IMD by using 90th, 95th and 99th percentiles

How do we map heat risks at ward level? A collaborative approach with ULBs

1. Increase in frequency of very hot days
2. Increase in frequency of very warm nights
3. Increase in heat index
4. Decrease in rainy days
5. Hotspots of higher Land Surface temperatures (LST)

Risk* = Hazard x Exposure x Vulnerability

1. Population density
2. % of Built-up area to total geographical area
3. Building density

Local data that is acquired from the cities

Data computed by CEEW from open-access climate and satellite source

1. Total slum population
2. Illiteracy Rate
3. Young population (age < 6 years) and old population (age > 60 years)
4. Population with chronic health conditions (cardiovascular diseases, mental health diseases, obesity)
5. Green spaces (NDVI)
6. Access to water sources (MNDWI)
7. Health centres per thousand people
8. Access to road network
9. Sex ratio
10. Number of weather monitoring stations per sq. km
11. Number of Parks per sq. km

A ward-level heat risk index can help take targeted actions – Cuttack, Odisha

Mapping the risks → **Identification of what is leading to risk in each ward**

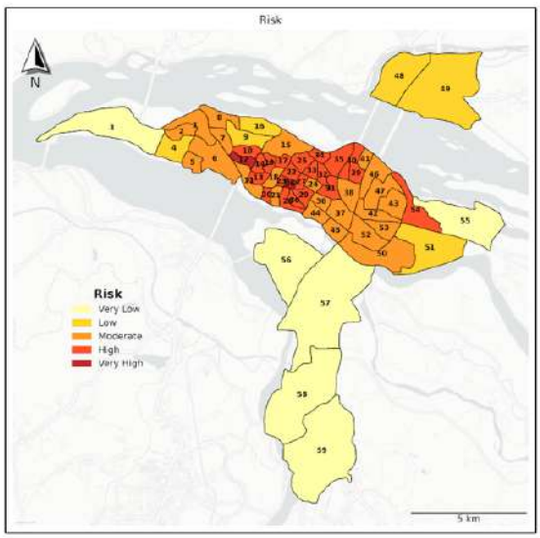


Table 5: Factors contributing to heat risk in the very high risk category wards.

Component	Indicator leading to risk	WARD 12	WARD 26	Correlation to risk
Exposure	Building density			Direct
	Population density			Direct
	Percentage of built-up area			Direct
Vulnerability	Health centers per thousand population			Inverse
	Number of parks per square kilometer			Direct
	Water Cover Index			Direct
	Population below 5 years			Direct

How do we advance resilience to heat? | solutions based on best practices, feasibility and localised suitability

Prepare and respond timely

- Cooling centers
- Heat-health early warning systems based response mechanism
- Emergency Cooling mechanisms in health centres
- Information, Education & communication

Redesign cities and systems

- Sustainable community cooling solutions
- Heat resilient infrastructure
- Nature-based Solutions (NbS)
- Guidelines and building codes

Insurance against it

Parametric heat insurance

Cross cutting → Data + Finance + Capacity building + Strategic outreach

Who does what? A department and stakeholder wise responsibility matrix

A snapshot of the responsibility matrix

Sr No.	Key strategy	Planned action	Responsible authority
Preparation and updation of plans and policies			
1	Preparation and implementation of annual heat action plan	Coordinate with relevant stakeholders and experts to develop and implement the Heat Action Plan effectively, ensuring a collaborative and comprehensive approach.	Heatwave Task Force Committee
2	Standard Operation Procedures (SOPs)	Develop a comprehensive Standard Operating Procedure (SOP) for heatwave response, clearly defining the roles and responsibilities of various departments within the Municipal Corporation (MC), along with specific timelines for implementation. Issue necessary orders and notices to ensure clarity and accountability, while coordinating effectively among all stakeholders for seamless execution.	Heatwave Task Force Committee
Early warning and alert mechanisms			
3	Early warning and Coordination	Establish coordination with weather forecasting and warning institutions prior to the summer season to ensure timely access to critical weather updates and forecasts for proactive planning and response.	Heatwave Task Force Committee
		Analyze weather updates received from the India Meteorological Department (IMD), district and state authorities, and other research institutions, and disseminate the information promptly to all ward members to ensure informed decision-making and proactive heatwave management.	

Focus areas | Preparedness and response

1. Preparation and updation of plans and policies
2. Early warning and alert mechanisms
3. Interagency and department coordination
4. Capacity Building – Training, public awareness, community outreach

Focus areas | Long term heat risk mitigation

1. Understanding of heat risks and vulnerabilities
2. Structural heat risk mitigation measures
3. Non-structural heat risk mitigation measures

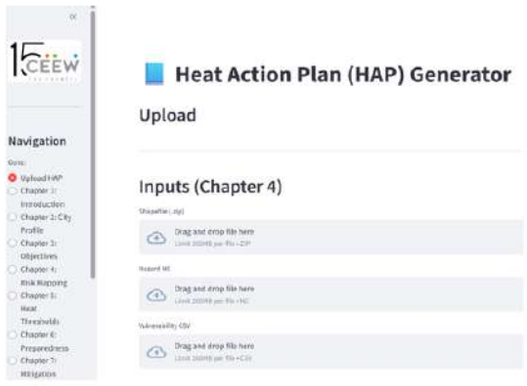
Chennai city formed a heatwave task force committee for monitoring the implementation of HAP

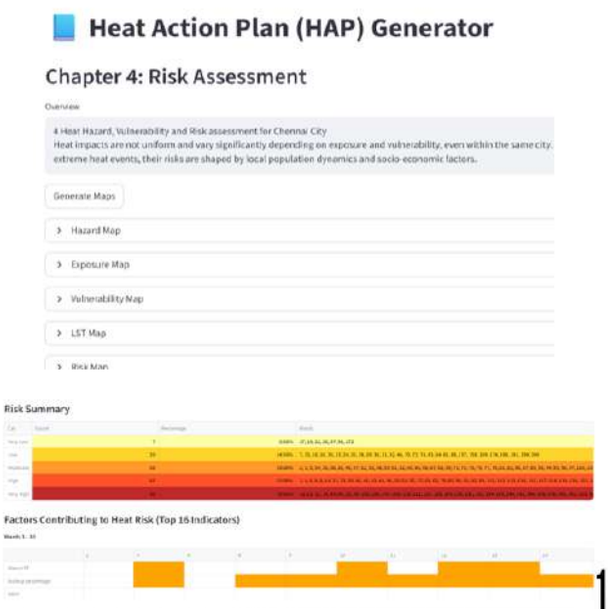
Designation	Role
Commissioner	Chairperson
Additional Commissioner (Health)	Member Secretary
Joint Commissioner (Education)	Member
Deputy Commissioner (Works)	Member
Chief Engineer (General)	Member
Chief Engineer (SWM)	Member
Chief Engineer (Parks)	Member
City Health Officer	As needed
Senior Divisional Engineer (Storm Water Drain)	Member
Senior Divisional Engineer (Coordination)	Member Secretary

To ensure inter-departmental and inter-agency coordination for successfully implementing the strategies outlined in the plan, a heatwave task force committee has been established in all cities and districts. Example from Chennai city.

13

How do we reach 4800+ ULBs? An automation tool that can generate a HAP as per NDMA guidelines with only 30% inputs from cities





- Upload data as CSV/GIS
- Automated risk assessment → risk maps, tables
- Edit text for each chapter on tool
- Preview and edit chapter on the tool
- Download as DOCX/PDF

FINANCING HEATWAVE MITIGATION THROUGH STRUCTURED FRAMEWORKS

Speaker: Shri Aditya Valiathan Pillai

National Framework for Heatwave Mitigation & Guidelines for Utilisation of SDMF/NDMF for Heatwave Mitigation Projects

Presented at the National Disaster Management Authority on 11 Feb, 2026

Objective: create foundation for mitigation actions

- MHA notification 47-24/2022-DM-III (25 Sep 2024) allows use of mitigation funds for heatwaves, following 15th Fin Comm recommendations
- NDMA has been developing a framework for heatwave mitigation projects (to lay out scope, principles and instruments)
- Guidelines describe how nature of project proposals, monitoring systems, relative role of SDMF, NDMF
- Began at NDMA heatwave workshop Feb 2024
- Technical assistance by SFC, NRDC, CEEW, UNDP, IRADe and others
    - Consultations with Harvard University, IIPH-G , IITM-Pune, IMD, NCDC, UC Berkley, state officials (DM, Municipal Commissioners, Addl. Chief Secretary)

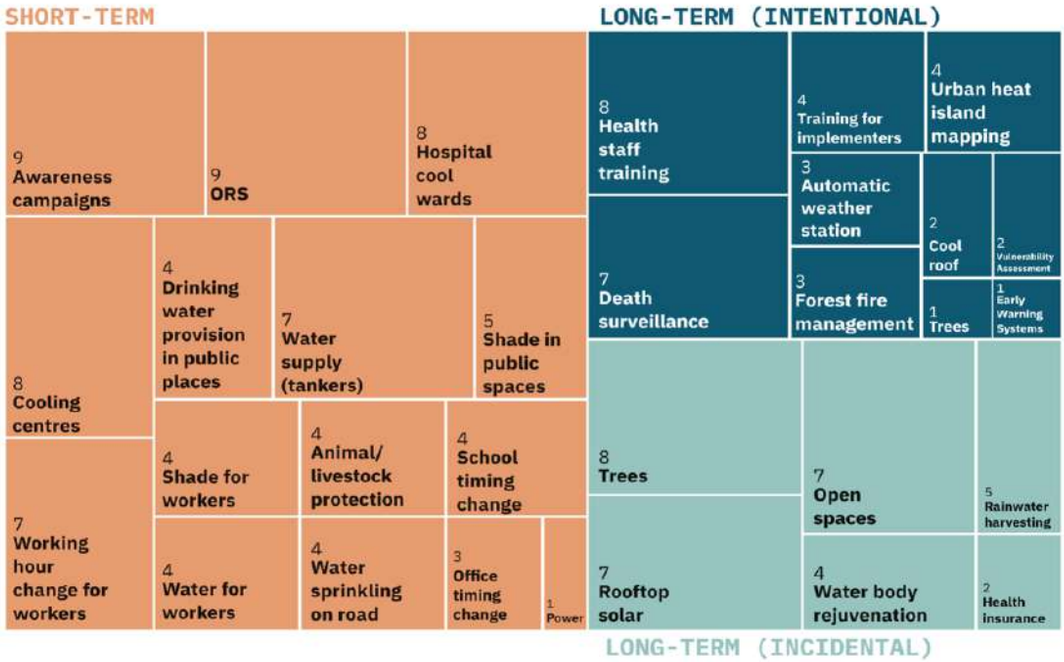
Current state of affairs: focus on short-term responses

- States implementing short-term emergency response measures
    - Dos and Don'ts dissemination; Water & ORS distribution; cooling centres & cool wards; school and work timings; awareness campaigns; tanker supply
- Patchwork implementation of some long-term actions
    - Heat-health trainings; heat death surveillance; AWS; conducting urban heat island mapping
- Next stage: Cooling programmes, electricity grid resilience programme

(9 cities, 150 solutions)

- Short-term actions dominate

- LT 'incidental' category large (do not target areas or populations at highest risk)



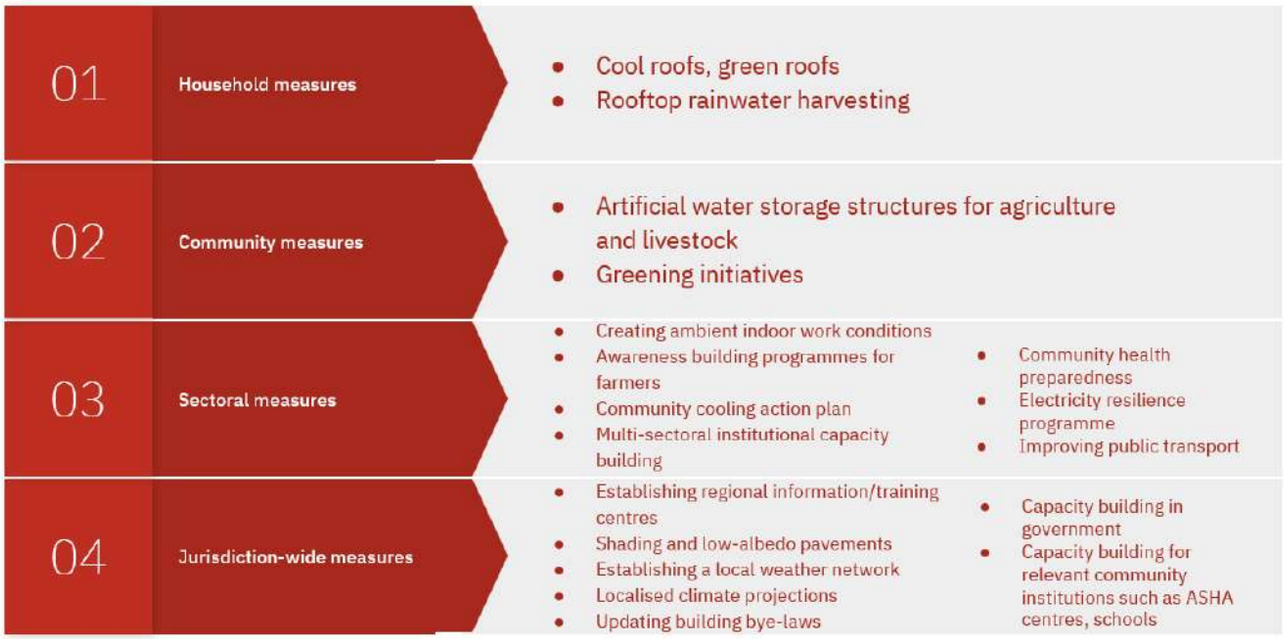
Source: Pillai et al. 2025. "Is India Ready for a Warming World? How Heat Resilience Measures Are Being Implemented for 11% of India's Urban Population in Some of Its Most At-Risk Cities." SFC Report, New Delhi.

National Framework for Heatwave Mitigation and Management

- Build adaptive capacity of states, districts and cities
- Key principles
  - Decentralization and localisation;
  - community participation;
  - flexibility in solutions;
  - collaborative implementation;
  - multi-sectoral focus;
  - preparing for future heat
- **Not a prescriptive framework but rather offers a menu of options for implementers**
- Lays out HAP building blocks:
  - Localising the heat hazard for a city, district or state (Situation analysis, historical climatological analysis, Early warning systems)
  - Understanding how heat affects the community (Localised temperature thresholds, Vulnerability assessments)
  - Identifying locally-appropriate mitigation and preparedness solutions (indicative list provided)
  - Institutional structure (legal groun ism, incentives, data, M&E, enabling environment)

https://www.sustainablefutures.org/publication/is-india-ready-for-a-warming-world-how-heat-resilience-measures-are-being-implemented-for-11-of-indias-urban-population-in-some-of-its-most-at-risk-cities/
Ctrl+Click to follow link

Mitigation measures (examples)



Guidelines for the utilization of NDMF, SDMF for heatwave mitigation

- Projects must be embedded in local HAP
- Anchored in risk assessments to be eligible for funding (methodology of assessment is flexible, to be locally determined)
- Balance of structural and non-structural measures
  - Structural measures (cool roofs, shade structures, tree canopy, building retrofit, passive cooling)
  - Non-structural measures (awareness programs, trainings, developing or revising policies, public awareness, heat insurance)
- Community engagement in design & monitoring
- **Not for short-term response and preparedness** (heat alerts, water kiosk etc.) – see SDRF/NDRF

Key elements of guidelines - 1

- SDMA is the nodal coordinating and approving authority for SDMF
- Proposals by ULBs, district administrations, and line departments or specialised agencies through SDMAs
- Special cases – housing boards, development authorities, authorised by SDMA
- Projects must be appraised
    - At the state level by SDMA
    - States to constitute a Technical Appraisal Committee (TAC) to appraise project:
        - Technical and financial feasibility
        - Alignment with HAP
        - Targeting of vulnerable populations etc.
- States can tap into NDMF where they face limitation of funds
- NDMF for national heatwave mitigation projects

Key elements of guidelines -2

- For NDMF, submitted through SDMA (after TAC appraisal)
- NDMF funds released in tranches based on milestones and UCs (<50cr, in single instalment)
- Implementation and nodal responsibilities
    - Approved projects are implemented by the designated executing agency (ULB/DDMA/line department)
    - Each *project* must have a designated nodal officer responsible for implementation & coordination
    - SDMA – state-level coordination, fund flow, monitoring, NDMA reporting
- M&E: Dedicated monitoring cell at state level, monitoring plan, NDMA database and review, end-of-project evaluation

Financing architecture for heatwave mitigation

- Routed through SDMF, NDMF as supplementary channel
- Blended financing model:
  - SDMF and NDMF
  - State and city budgets
  - Convergence with central schemes
  - Private sector, CSR, and donor funding
- Constraints for S/NDMF:
  - No more than 50% of annual SDMF/NDMF allocations on a single hazard (including heat)
  - 10% minimum for non-structural measures (planning, training, capacity-building)
  - Up to 5% may be allocated for pilots, experimental models
  - Ineligible: Routine O&M, general beautification, activities covered by other schemes, routine admin costs (can use for technical experts, consultants)
- Annual allocation by population size (categories from URDPFI guidelines – Vol 1).

Template for Proposals for Heatwave Mitigation Projects

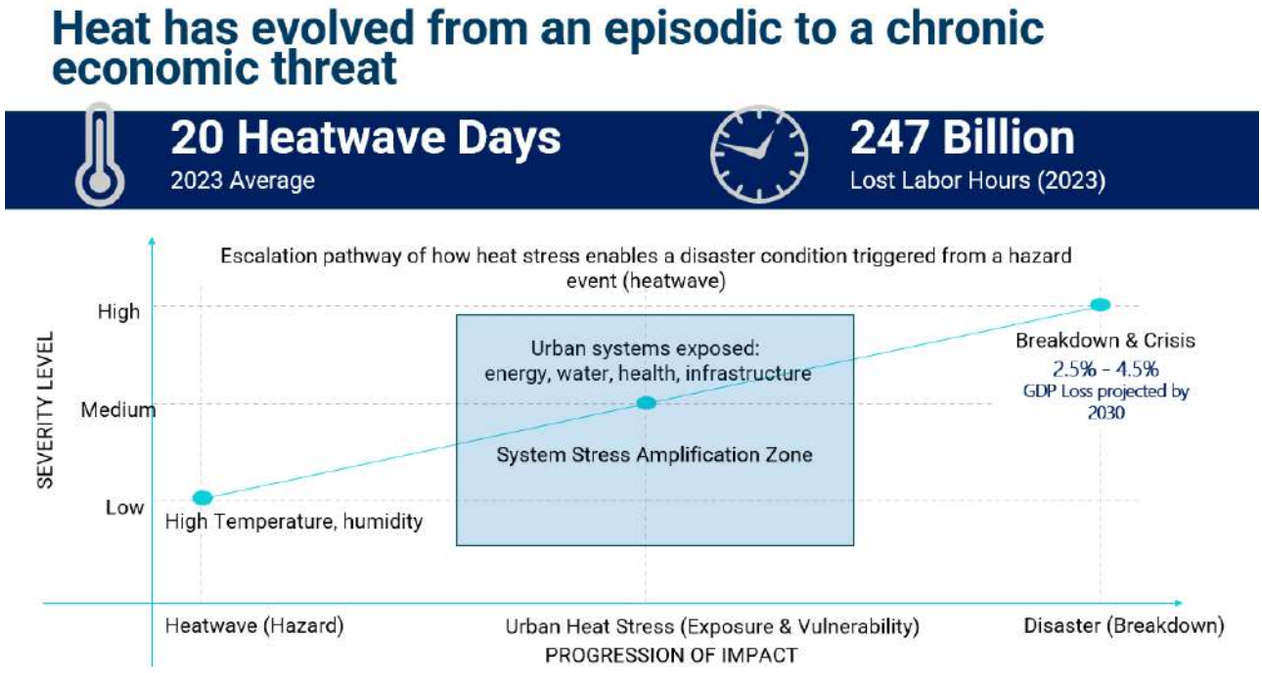
- Abstract

Sr.no.	Project Name	Project location (block, taluka, ward, zone)	Nodal implementing authority	Total cost (line-item budget to be attached separately)	Requested from SDMF	Co-financing from other sources
1.						
2.						
Total amount requested from SDMF (for all projects)						

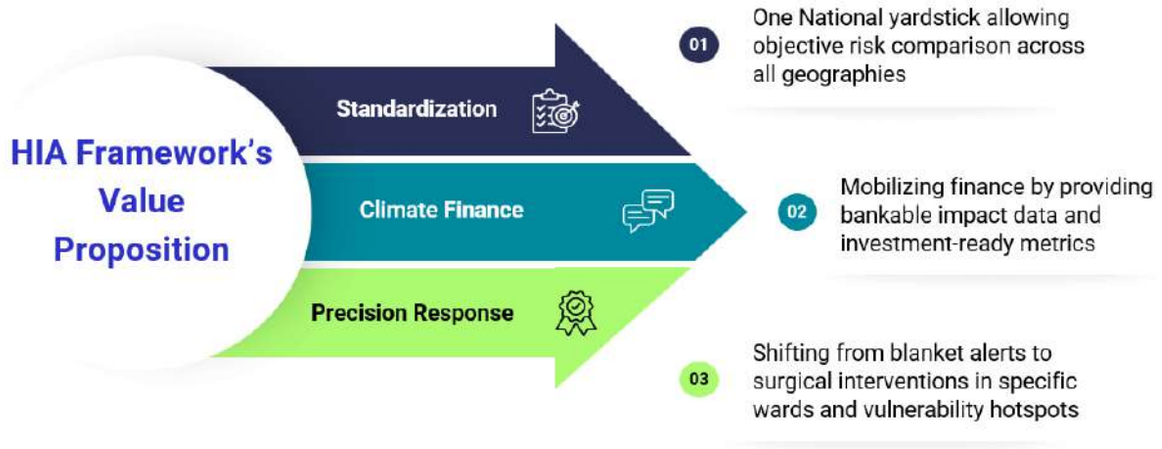
- Risk assessment and rationale (need, based on HAPs & risk assessment)
- Implementation arrangements
- Monitoring and evaluation (Outputs, timelines, indicators and reporting arrangements)
- Supporting documents (Line-item budget, HAP, risk evidence, and co-financing commitments (if any)

MEASURING AND GOVERNING HEAT RISK

Speaker: Shri Tarun Garg, RMI India Foundation



Strategic Value Proposition



Institutionalizing Accountability

HIA Compliance becomes a requirement for fund mobilization

NDMA
- Set Standards
- Set Indicators
- Set data mandates

ULBs
Operational Action: Managing dashboards and deploying resources

SDMA
Institutionalized MoUs
Generates State Heat Risk Reports

Phased Roadmap

SHORT TERM

- Notify Disaster
  - •Establish a National Task force
  - •Pilot Cities (1-2)

MEDIUM TERM

- Standardized Reporting Templates
- Digital Dashboard Live Integration into State Plans

LONG TERM

- Automated API integration
- National HIA Platform
- Linkage to Global Climate Finance

Source: if none delete this text box.

DAY 1 : TECHNICAL SESSION - I I

MAINSTREAMING HEAT INTO URBAN INFRASTRUCTURE

Mr. Benjamin Hickman, Programme Management Officer, UNEP

UN environment programme

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

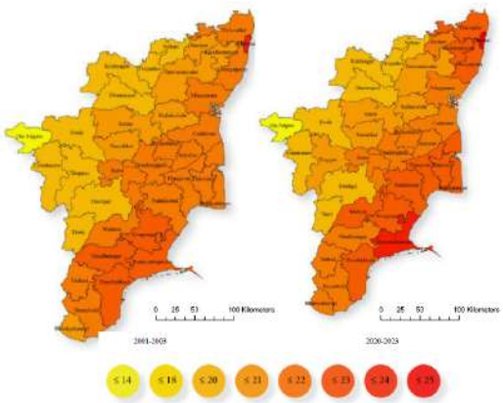
Embassy of Switzerland in India and Bhutan

BeCool to BeatTheHeat: Urban Heat Assessments-to-Delivery Model for Heat-Resilient Urban Development:
Pilots in Tamil Nadu, Maharashtra and Delhi

11 Feb 2026

NDMA International Workshop on Heatwaves 2026

State Policies and Regulations



Step 1 – Urban Heat Island Assessments

Step 2 - Demonstrations with Environment Dept., Housing, Shelter fund, Public Works, SPC

Step 3 – Embedding provisions for passive, nature & resilient cooling in

- Tamil Nadu Combined Building and Development Rules
- Chennai Masterplan
- PWD SoR
- Pradhan Mantri Awas Yojana: public housing authorities (TNUHDB and TNSF)
- Environment Department: PCS Guidelines
- City projects and Local Areas Plans

Step 4 - Multimillion USD project pipelines

Approach and Methodology for Urban Heat Island Effect study

LOD characterization: Data Collection

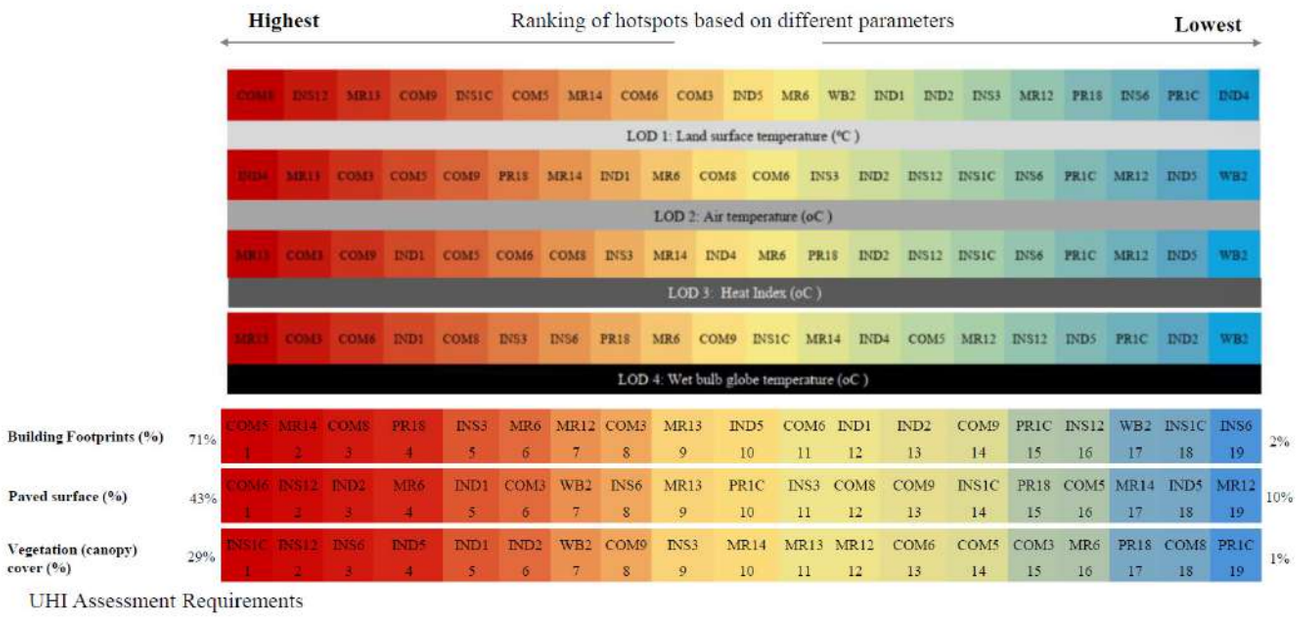
Level of Detail	Study Parameters						
	Meteorology	Urban Infrastructure	Semantic	Operational profile	Energy consumption	Spatial resolution	Temporal resolution
LoD 1	Surface Temperature	LULC	Surface Characteristics	Deterministic-Single	Connected loads	1000 m.	Decadal
LoD 2	**LoD1** + Air temperature	**LoD 1** + Plot boundaries	**LoD 1** + Building use	**LoD 1** + Deterministic-Multiple	**LoD 1** + Load profiles	100 m	Annual
LoD 3	**LoD 2** + Relative humidity + Solar radiation	**LoD 2** + Building footprint	**LoD 2** + Age of property	**LoD 2** + Stochastic-Space based	**LoD 2** + Metered data	30 m	Monthly
LoD 4	**LoD 3** + Cloud cover + Wet bulb globe temperature	**LoD 3** + Building height + Tree properties	**LoD 3** + Building archetype	**LoD 3** + Agent-based	**LoD 3** + Submeter end-use data	10 m	Daily/hourly

Note: Each parameter is assigned a colour palate to differentiate from the table, and the hues of the colour become darker as the LoD increases for the datasets concluded in each parameter to map and assess the UHIE.

UHI Assessment Requirements

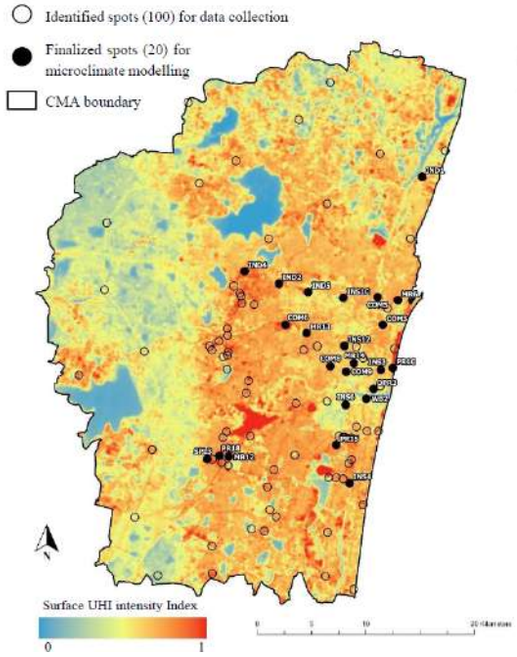
Mapping and Assessment of canopy UHIE in CMA

Data analysis of 20 spots: Intra-urban heat stress variability



UHI Assessment Requirements

UHI- HEAT RESILIENT CITY PLANNING - Chennai



Update of masterplan to integrate heat-resilience, nature, passive cooling and district cooling

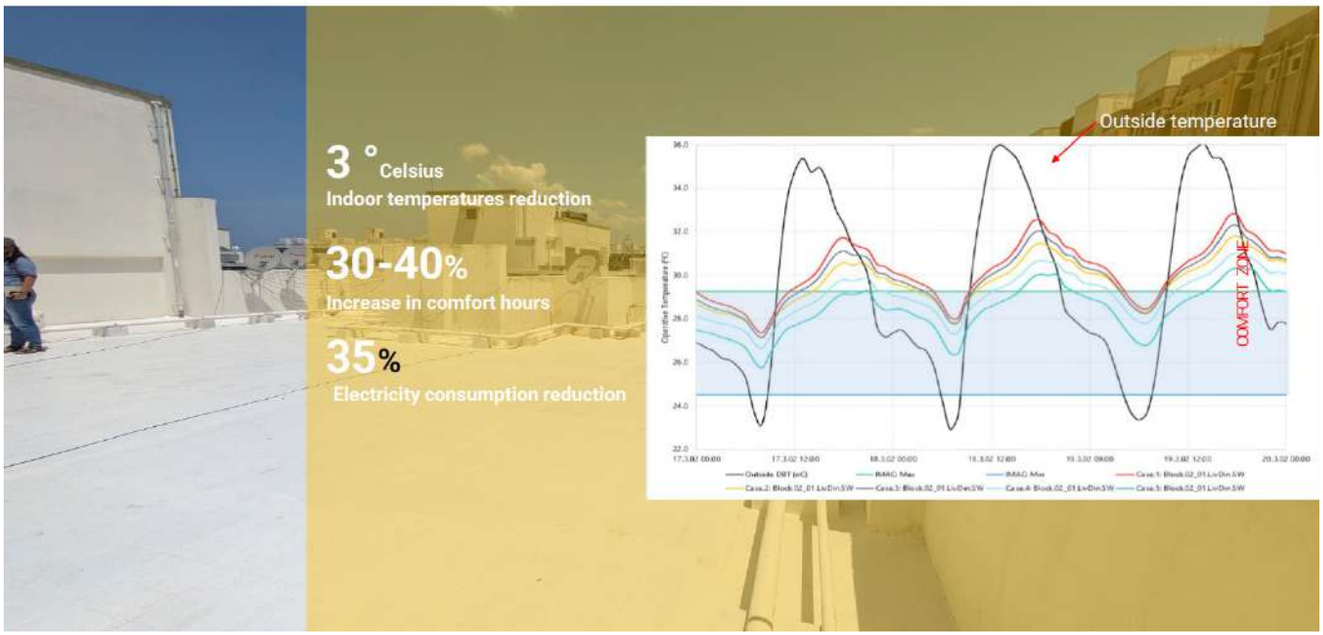
- 75% of buildings adopt codes - neighbourhood-scale temperature reductions of **1 to 2.5°C**
- Moving outdoor mechanical cooling units to roof could reduce street-level air temperatures by **1 to 1.5°C.**
- Strategic placement of open spaces near residential and commercial hubs can decrease AC demand by **15-25%**

State-level and national-level scaling

Link urban heat analysis with:

- Targeted greening, public green spaces, protection of nature
- Cool surfaces, minimize hard concrete surfaces, permeability
- Urban morphology
- Water sensitive urban design, water body rejuvenation
- Building regulations update – passive cooling and ECSBC
- Public buildings and retrofits (PMAY, schools, Anganwadis...)
- Integration with Heat Action Planning, Disaster & Climate Finance

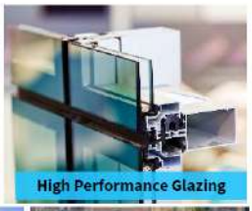
Basic passive cooling measures and building materials reduce indoor temperatures by at least 3°C and cut electricity use by 35%



1 Passive Cooling Methods


Thermal Insulation


Heat Resistant Material


High Performance Glazing


Natural Ventilation


External Shading


Cool Roof

TAMIL NADU
PASSIVE COOLING GUIDELINES
FOR BUILDINGS

2 Demonstration and Capacity Building

Green Schools Scheme– Pasumai Palli

Advise Retrofit of 100 Governemnt Schools for PCS

- launched in 2023, Department of Environment, Forest and Climate Change
- eco-friendly governemnt school campuses promoting **sustainability** and **climate awareness**

COOL ROOFS
to reflect solar radiation

EXTERNAL SHAIDNG
for windows to block solar radiation – based on size and orientation.

NATURAL VENTILATION
(with windows and openings)
+ **BLDC Fans**
to dissipate heat

HEAT-RESILIENT MATERIALS
reduce heat gain in walls and windows

NbS
Trees and green cover in the outdoors to reduce local temperatures and provide shade

IMMEDIATE INITIATIVE IMPACT

297 Schools **1,48,320** Students

Thermal Comfort through PCS in Affordable Housing: Public and Rental

Low Income Families
Working Women

- Highest number of working women in country ~ 43%
- 15% above national average
- 1/3 of adult women employed
- State government provided hostel facilities

Blue Collar Worker Hostels

- Stack Ventilation with forced Industrial Fan Turbine for staircase and corridor shaft
- External Shading Devices for Full Façade Orientation
- Targeted Façade Insulation for walls and Alternate materials.
- Enhanced Room and Corridor Ventilation (with Turbo Ventilators & Night-Purge)
- Fully Openable Windows for Night Purge Ventilation
- louvers on top of the doors as ventilator for cross ventilation.

POLICY AND URBAN MISSIONS: MINISTRY-LEVEL INTERVENTIONS

Ms. Grace L. Pachuau, Deputy Secretary, Ministry of Housing and Urban Affairs (MoHUA)

Ministry of Housing and Urban Affairs
Government of India

Climate-Smart Urban Development through Heat-Resilient Infrastructure

11th February 2026

MoHUA's Interventions

Schematic Interventions focused on Heat Resilient Infrastructure

- **AMRUT & AMRUT 2.0**
- **Swachh Bharat Mission (Urban) 2.0**
- **Smart Cities Mission (SCM)**
- **Pradhan Mantri Awas Yojana (PMAY-U)**
- **National Urban Livelihoods Mission (NULM)**
- **PM-eBus Sewa**
- **Metro Rail Projects**
- **Scheme for Special Assistance to States for Capital Investment (SSASCI 2022-24)**

2

Different scales of actions

Urban planning Frameworks

Policy Level Interventions

City Level Interventions

Building Level Interventions

NMT, Thrissur Sky Walk

Green Roof, Kolkata, WB

Sponge Park, Chennai

India Habitat Centre, New Delhi

3

Urban Planning Frameworks

Advisories & Guidelines

- **Urban & Regional Development Plans Formulation and Implementation (URDPFI) Guidelines, 2015:**
  - **Advocates promotion of Compact & Green city approach.**
  - Embed **sustainability, resilience**, & **inclusivity** in development practice.
- **Model Building Bye-laws, 2016:**
  - **30+ States/UTs** integrated core sustainability provisions (rainwater harvesting, rooftop solar & green buildings into their building bye-laws.
  - MBBL Incorporates **India Cooling Action Plan-2019** promoting **cooling-oriented building designs**

GIS Based Master Plans

- Geo database creation of area **Covering ~1,87,000 sq. km.**

Cooling Action Plans

- **Exists in 23 states** to provide early warning & emergency measures

Cool in Singapore: city's hottest and coolest places showing up to 6.5C difference - Vulcan Post

REDUCING HEAT ABSORPTION AND CURTAILING HEAT EMISSION

Cooling spaces by channelizing the wind flow

CREATING WIND CORRIDORS

Cooling the open spaces using mobile shading devices, & street trees

OPTIMIZING SHADE

Policy Level Interventions

Cool Roof Policy

- **Telangana** adopted **India's first Cool Roof Policy (2023),** mandating reflective roofs in government buildings, affordable housing, and large private projects, **with targets up to 100 sq. km coverage by 2030**.
- **Cool Roof Pilot initiated by Mahila Housing Trust (MHT)**
  - **Higher Solar Reflective Paints on roofs** lowers temperature
  - **Over 30,000 houses** and other buildings in **Maharashtra, UP, MP, Gujarat, Rajasthan and Delhi**

Cool Roof Pilot

India's First Cool Bus stop in Ahmedabad (2024)

- **Bus stops retrofitted** with **high-pressure misting systems**
- **Khus curtains lowered temperatures by 5–7°C** compared to nearby stops.

Cool Bus Stop, Ahmedabad

Inclusion of Green Building Initiatives in Building Byelaws

- **29 States/UTs adopted** green building provisions in Building Byelaws

Waste Processing & Circularity

- **Remediation: 2,424 dumpsites** (~ **23.5 Cr. MT)** taken up

Policy Level Interventions

Public Transport & Non-Motorized Transport

- **2,170 Km** pedestrian walkways & **755 Km** dedicated cycle tracks
- **PM eBus Sewa**: **7,293** buses sanctioned of **10,000** buses
- **1,011 km** of metro rail network operational
- **Namo Rail - 82.15 Kms** planned & **55 Kms** operational

Benefits of Metro Rail In NCR (2024, TERI assessment)

Descriptors	2024
No. of vehicles off the road daily	7,47,937
Annual reduction in Passenger road trips (Crore km)	467.4
Annual reduction in fuel consumption (tons)	3,61,052
Annual reduction in pollutants (tons)	11,04,973

Ghaziabad RRTS Station

Guwahati, Riverfront Development

City Level Interventions

- **Waterbody Rejuvenation:**
  - ~ **4,000** waterbodies in **1,950** cities **with >1 lakh Acres**
- **Green Spaces:**
  - **6,870 acres** green spaces added in **1,322 cities**
- **Aquifer management –**
  - **1 Million+** water recharge structures
- **5 Lakh + trees planted** under Amrut Mitra Initiative involving 30,000+ SHG members.
- **Creation of Urban Forests** - 62 Projects in 13 States
- **22 Streets Pedestrianization** of 63.73 Kms in 10 States

- Study shows that peak summer temperatures reduced in the vicinity of water bodies by **2-3 degree**

Source: *IIT Roorkee study &Delhi University*

Pedda Cheruvu WB, Andhra Pradesh

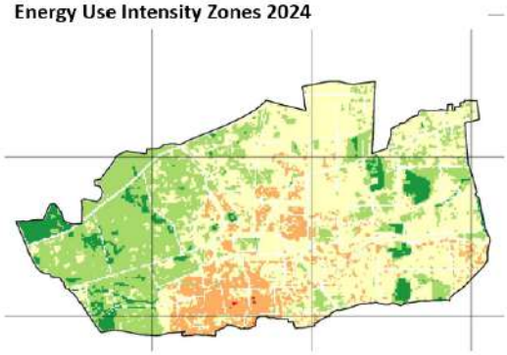
Sponge City Interventions, Chennai

Building Level Interventions

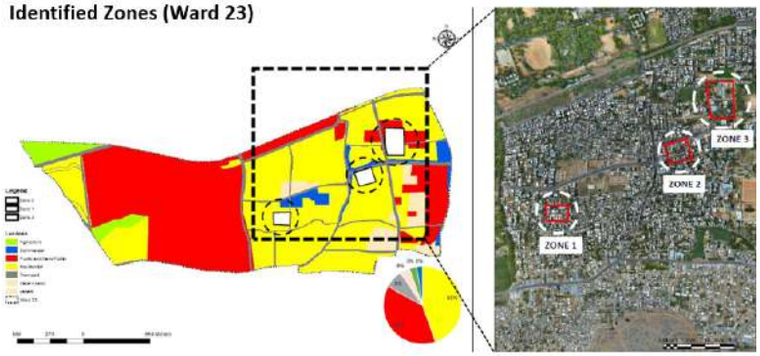
Energy Efficiency in Zoning Regulations – Tirupati

- **Current zoning lacks energy integration**; rising electricity demand, shrinking green cover (0.304 → 0.183 sq. km), and intensifying Urban Heat Island effects.
- Findings showed **Wards 17, 19, and 23 as high-intensity zones,** with dense residential, commercial, & institutional land use.
- Recommendations to **update zoning with energy-efficient building codes, integrate green cover, & passive cooling**

Energy Use Intensity Zones 2024



Identified Zones (Ward 23)



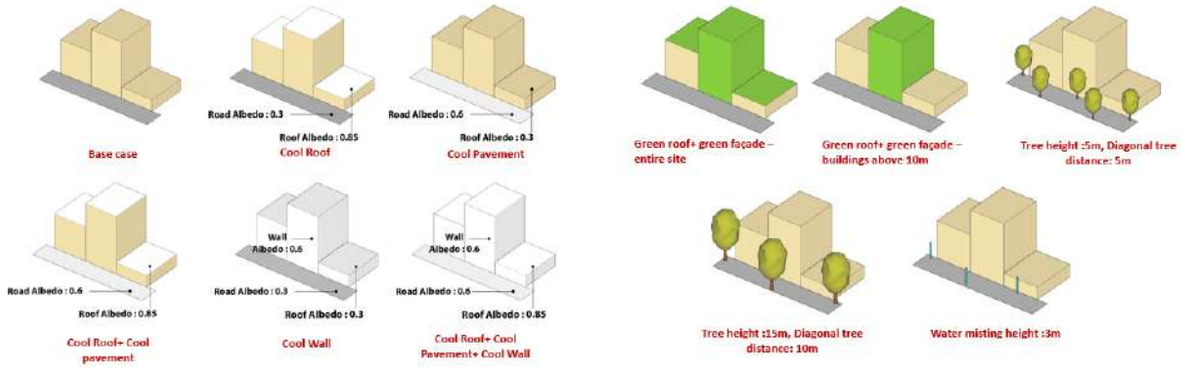
Building Level Interventions

Hyderabad Case Study by SPA Vijayawada

- Demonstration of **11 cooling strategies** with average temperature **reduction of ~2.4°C.**

o **Building Cooling Strategies**

- Cool Roof, Cool Pavements, Cool Wall, Green Roof, Green Wall, Green Pavements, Landscaping, Water Mists, etc



Way Forward

- **Mainstream resilience into planning**
- **Risk Informed Master Plans**
- **Carrying out Urban Heat Island studies in cities**
- **Preparation of Climate Action Plans**
- **Capacity building of frontline responders**
- **Incentivizing cities to adopt adaptive measures**
- **Improved coordination between government agencies**

DIGITAL TOOLS, AI AND URBAN CLIMATE MODELLING

Mr. Ander Zozaya, ETH Zurich – Cooling Singapore Initiative

ETH zürich (SEC) SINGAPORE-ETH CENTRE

International Workshop on Heatwaves 2026
Cooling Singapore 2.0
Digital Urban Climate Twin

COOLING SINGAPORE

Ander Zozaya
Project Manager

CREATE (SEC) SINGAPORE-ETH CENTRE CAMBRIDGE CARES NUS SMU SMART TUMCREATE

ETH zürich (SEC) SINGAPORE-ETH CENTRE

The Cooling Singapore journey

Cooling Singapore is a research project dedicated to **developing solutions** to address the **urban heat challenge** in Singapore.

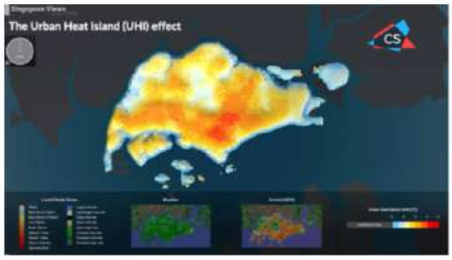
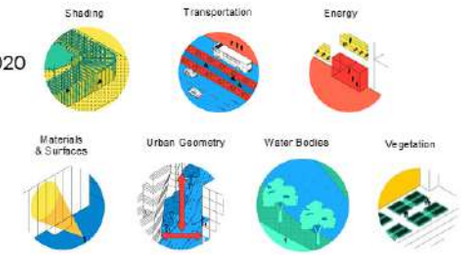


Image: Simulation results, Urban Heat Island (UHI) effect in Singapore during a extreme hot day CS1.0

CS 1.0
Jan 2017 – Dec 2018
(24 months)

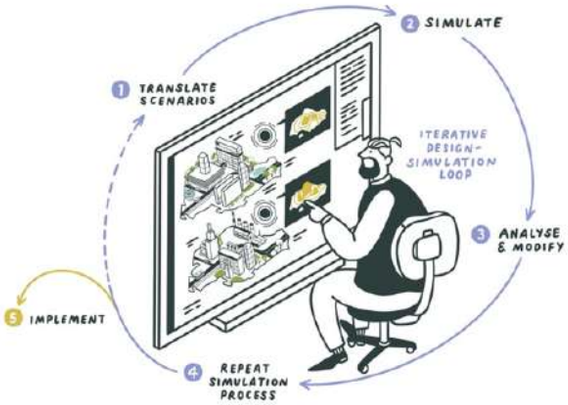
CS 1.5
Apr 2019 – Sept 2020
(18 months)



Cooling Singapore 2.0 (2020-2025), from science to policy

How can we help planners to better understand the impact of new policies and plans on the urban climate?

By using a digital twin of the city that allows us to simulate what-if scenarios...



Cooling Singapore 2.0, mitigating Singapore UHI effect

Mitigating Singapore's Urban Heat Island (UHI) Effect:

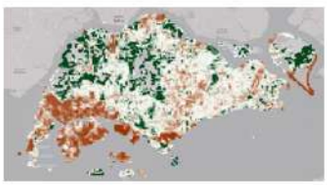
DUCT as a decision support tool combining multiple measures of interest

Urban Heat Island is a complex phenomenon

- Multiple interdependent measures
- Big datasets with multiple parameters
- Multiple transdisciplinary stakeholders

Developing a Digital Urban Climate Twin (DUCT)

- Understand how components contribute to UHI effect
- Manipulate defined parameters in "what-if" scenarios to simulate mitigation strategies, individually and in combination



Island-wide "mesoscale"

District level "microscale"

32 COOLING SINGAPORE

ETH zürich (SEC) SINGAPORE-ETH CENTRE

Beyond CS2.0 the use-case for climate and city planning

Madrid and Vienna testing urban climate effects on city scale policies

What-is the effect on Temperature and Urban Heat Island Effect if we replace all the combustion engine with electric vehicles in the city?

Step 1) Prepare scenario inputs

Anthropogenic heat from traffic is injected into the model as a grided sensible heat flux at hourly resolution.

An EV scenario **reduces the amount of sensible heat flux** into the atmosphere compared to a Baseline scenario which considers all vehicles with internal combustion engines.

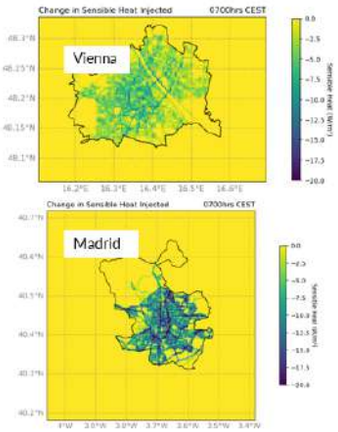


Figure 1. Difference in the sensible heat flux injected into the model at 7am CEST, shown as EV – Baseline for (top) Vienna and (bottom) Madrid city.

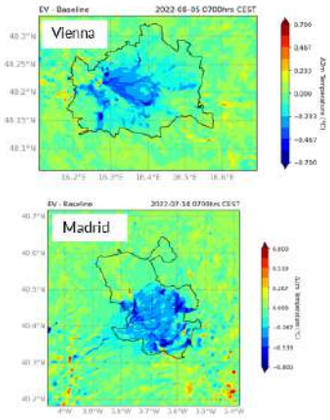
Step 2) Run simulations

Simulation results show that a full conversion to EV can **reduce 2m air temperatures,** particularly during nighttime and during peak traffic hours.

Magnitude and spatial patterns of the cooling effects are **highly dependent on road network density and prevailing wind direction.**

Figure 2. Difference in the simulated temperatures 7am CEST, shown as EV – Baseline for (top) Vienna and (bottom) Madrid city.

Step 3) Compare results



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Beyond CS2.0 the use-case for climate and vulnerable populations

Belo Horizonte identifying heat vulnerable areas to tackle the heat challenge

How can we set priority areas to address the urban heat challenge and the implement heat mitigation strategies?

GLOBAL COVENANT of MAYORS for CLIMATE & ENERGY

Step 1) City-scale UHI analysis

Mesoscale climate model simulated output is used to **calculate heat exposure** per district.

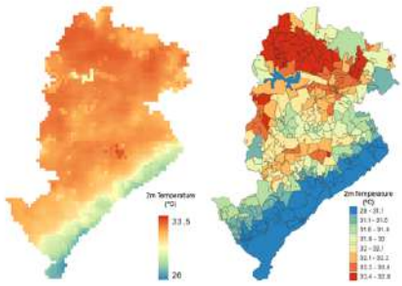

Figure 1: Belo Horizonte 12:00pm noon average heat exposure map in average temperature day in 2023 (left). BH exposure map normalized by districts.

Step 2) Identifying vulnerable populations

The heat exposure map is **combined with socio-economic datasets** to determine district-level **heat vulnerability.**

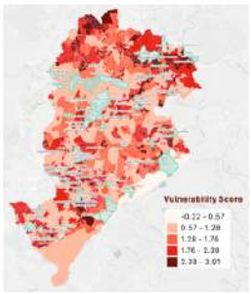

Figure 2: Heat Risk vulnerability map Belo Horizonte (Brazil).

Step 3) Test district scale heat mitigation strategies

Simulate the effects of:

- Additional **greenery and vegetation.**
- Enhancing **wind corridors.**
- **Reflective materials** "cooling paints".

Figure 3: Testing pocket-parks and green corridors in Padre Eustaquio Favela area.

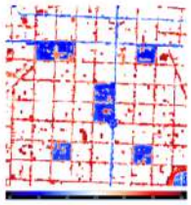

Figure 4: Physiological Equivalent Temperature (PET) map, representative summertime mean temperature day scenario.

Presentation link

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For more information please contact:
ander.zozaya@sec.ethz.ch

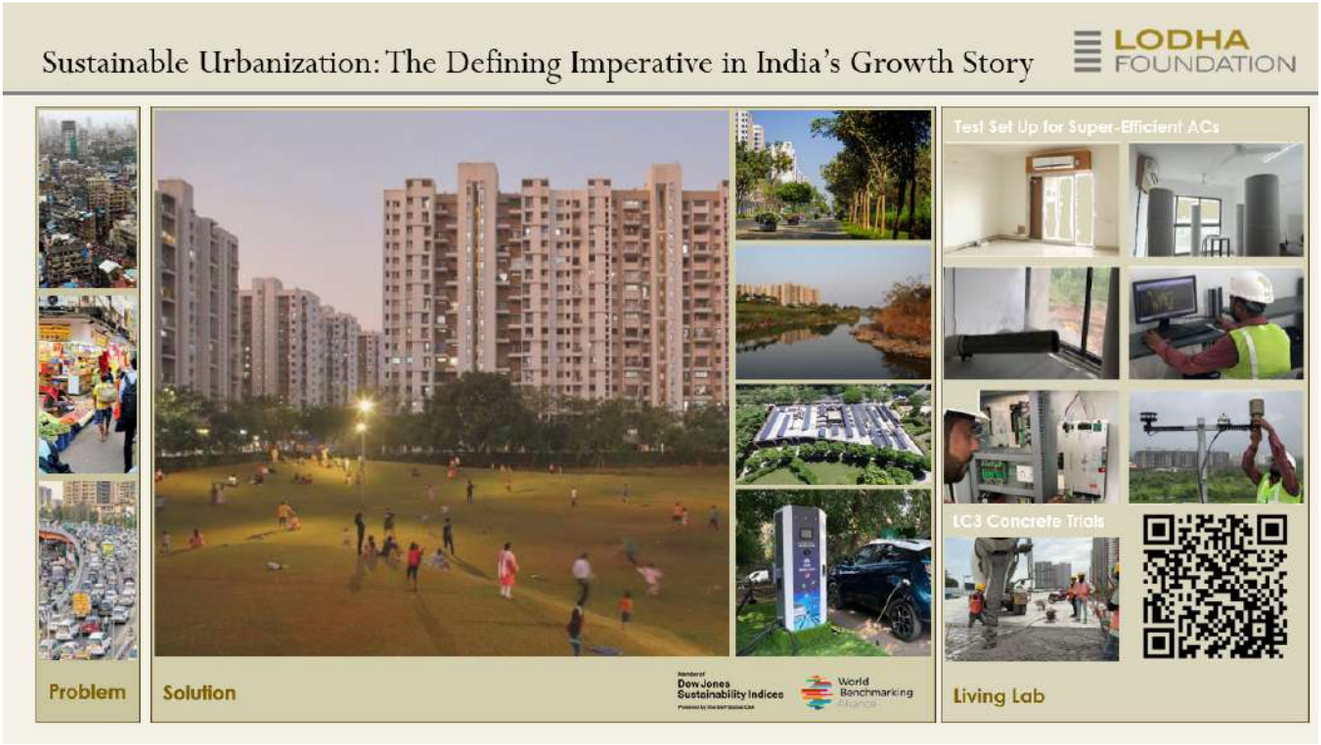
Or visit
https://sec.ethz.ch/research/cs.html

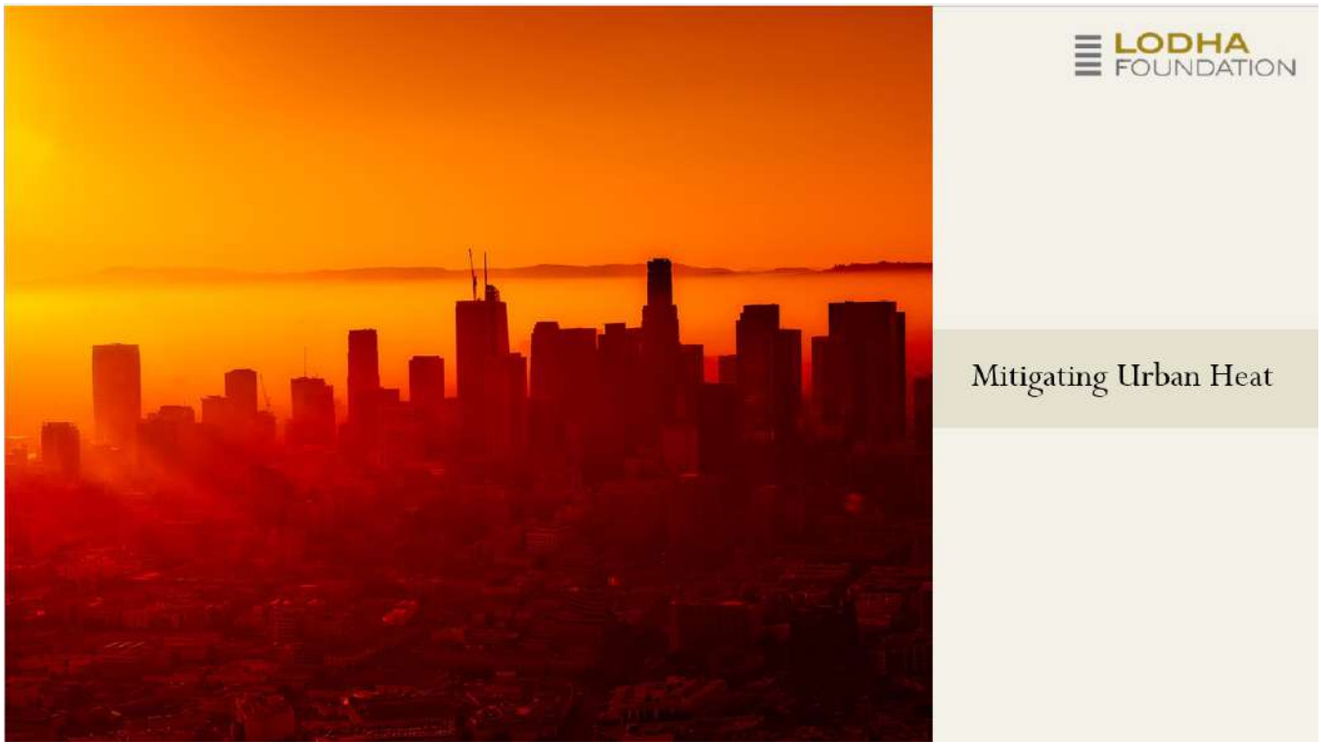
STICS: Science to Impact Critical Stories

IN	*Singapore*
ON	*Singapore's GLOCAL challenges*
USING	*Swiss-SG R&D capabilities*
WITH	*Stakeholders*
FOR	*Society: Singapore, Switzerland, and* ***the world***

BUILDING HEAT RESILIENT CITIES

Shri Aun Abdullah, Lodha Foundation


Sustainable Urbanization: The Defining Imperative in India's Growth Story
LODHA FOUNDATION
Test Set Up for Super-Efficient ACs
LC3 Concrete Trials
Problem
Solution
Dow Jones Sustainability Indices
World Benchmarking Alliance
Living Lab


LODHA FOUNDATION
Mitigating Urban Heat

Urban Heat Contributors & Mitigation Solutions

LODHA FOUNDATION

- **Designing thermally comfortable neighbourhoods using multiple strategies & solutions that tackle key drivers of urban heat**

Key contributors to UHI Effect in a typical residential neighbourhood

	Urban Characteristics	UHI Contribution
SOURCES	Man-made Surfaces (key trait of urban areas)	Solar Gain & Slow Release
SOURCES	Vehicles, Buildings	Waste Heat Generation
CATALYSTS	Urban Geometry	Heat Entrapment
CATALYSTS	Less Green & Blue Spaces	Reduced Cooling

Solutions deployed at scale


Limiting expansive heat-gaining surfaces using **intermittent unpaved areas** and **reflective materials**

Indirect strategies like reduced **vehicular traffic** & **efficient appliances** that lower waste heat generation from anthropogenic sources

Designing layouts that allow **high sky view factor** and **wind flow** that prevents heat entrapment

Integrating **large vegetated & wetland zones** that help regulate temperatures by enhanced evapotranspiration & dissipation

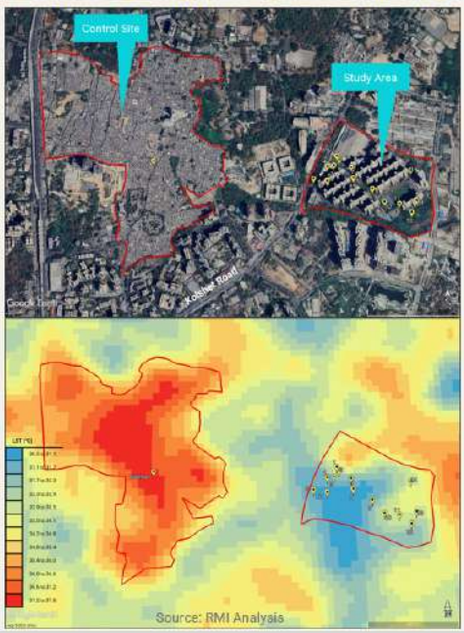
Source: RMI Analysis based on US-EPA (2025), UNEP (2021), Druckenmiller (2023), Shahmohamadi et al. (2011) and WSROC (2021)

Results & Co-Benefits

LODHA FOUNDATION

- **Reduction in Urban heat in-turn helps in reducing energy consumption and improving indoor thermal comfort**

Example of localised benefit of solution strategies

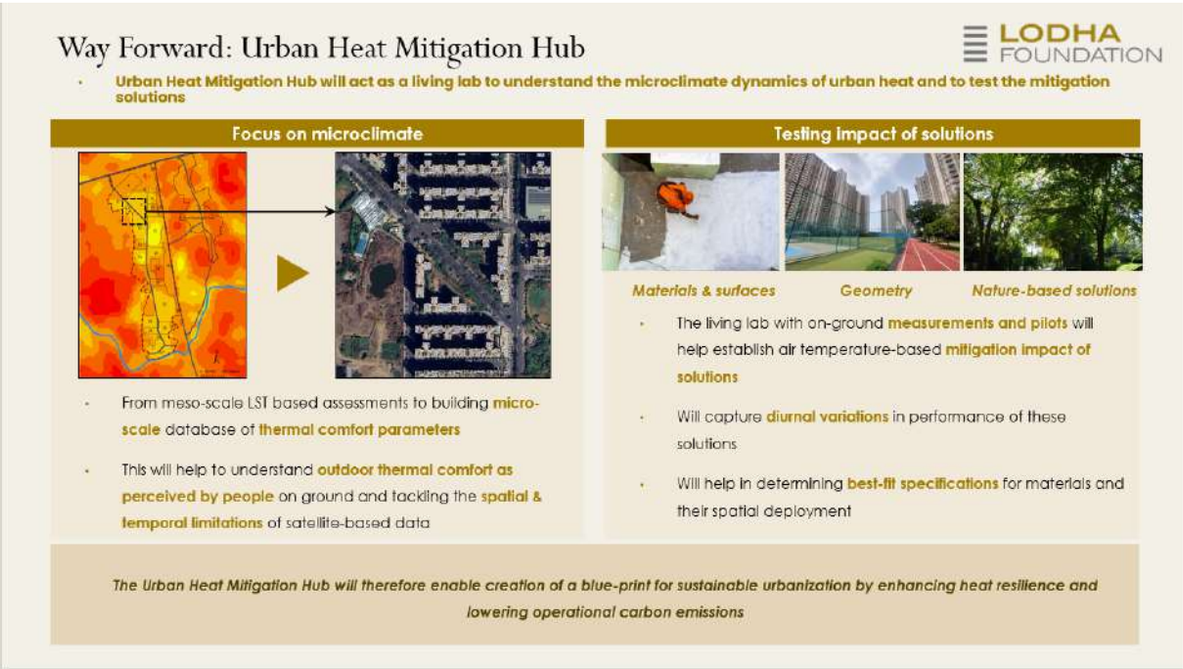


Consistent results at larger scales & envisaged co-benefits

Preliminary results show that Lodha's townships - when **compared with adjacent organic settlements** - show:

- **3-5°C** *lower daytime LST of effective surfaces based on SUHI assessments*
- **2-3°C** *lower daytime ambient temperatures at near ground level*

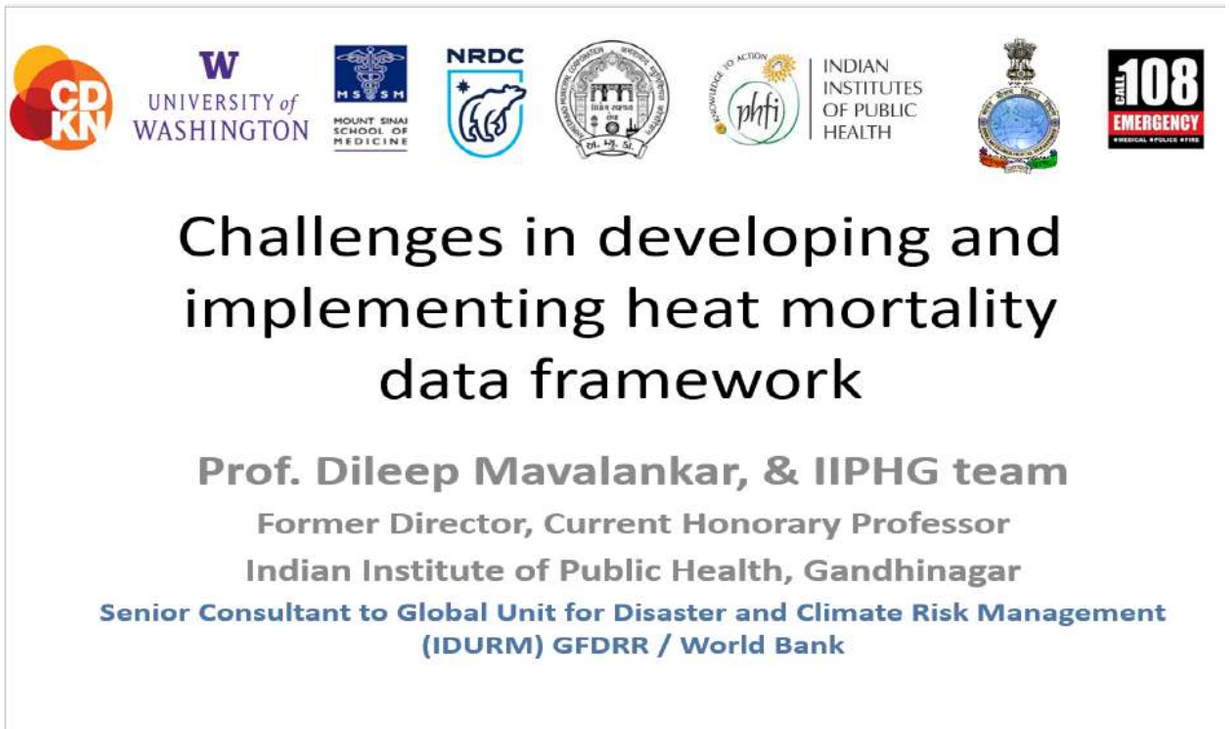
These results are promising enough to infer that the townships will score better in terms of **indoor thermal comfort**, **reducing heat stress in households** and thereby **reducing energy consumption.**



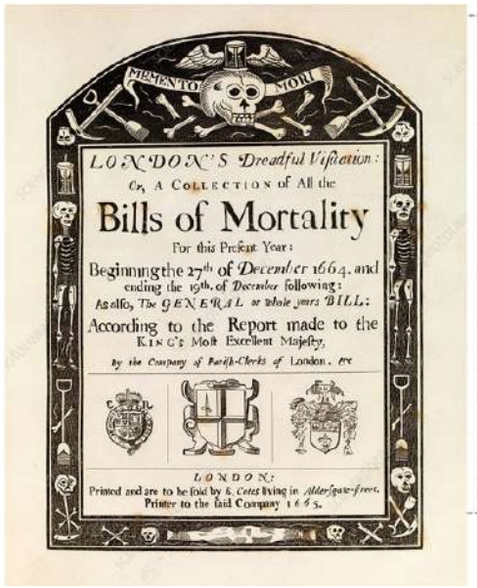
DAY 1: TECHNICAL SESSION - III

MORTALITY SURVEILLANCE AND DATA SYSTEMS

Speaker: Dr. Dileep Mavalankar, Indian Institute of Public Health Gandhinagar

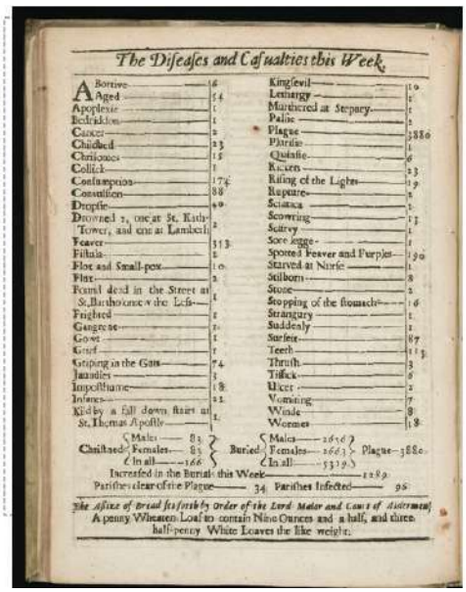


Mortality data analysis is not new: Bills of mortality of London 1664-5


MEMENTO MORI

LONDON'S Dreadful Visitation:
Or, A COLLECTION of All the
Bills of Mortality
For this Present Year:
Beginning the 27th of December 1664. and ending the 19th. of December following:
Alſo, The GENERAL or Whole years BILL:
According to the Report made to the KING'S Moſt Excellent Majeſty,
by the Company of Parish-Clerks of London, &c

LONDON:
Printed and are to be ſold by S. Cotes living in Aldersgate-ſtreet.
Printer to the ſaid Company 1665.


The Diſeaſes and Caſualties this Week.

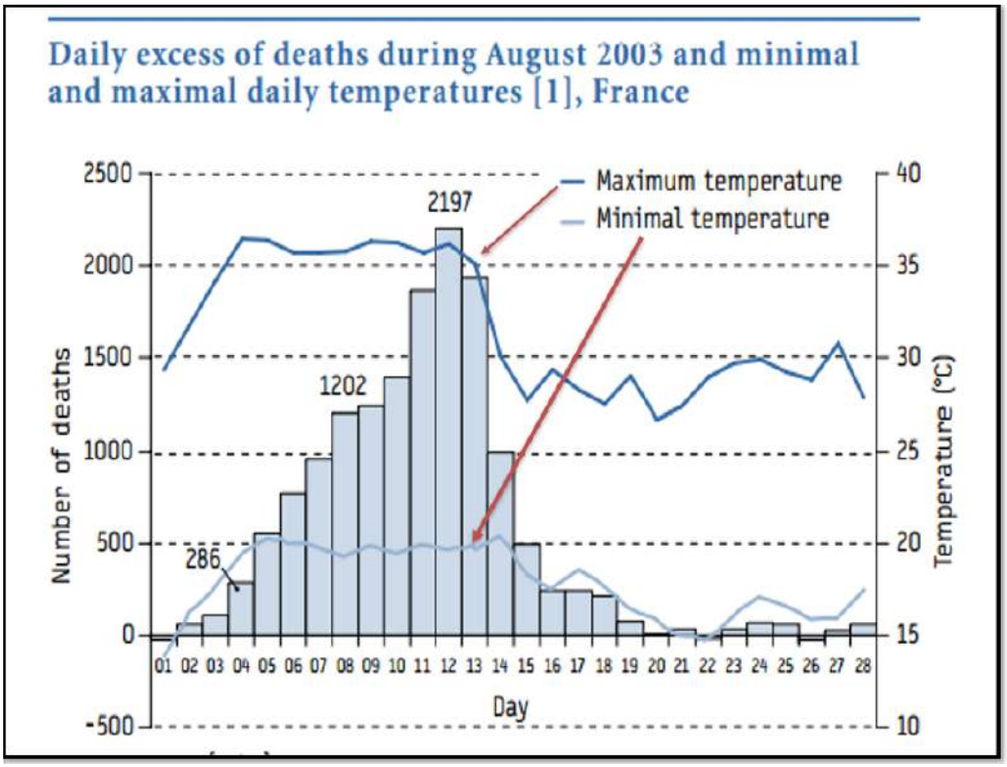
Abortive	16	Kingsevil	10
Aged	54	Lethargy	1
Apoplexie	1	Murthered at Stepney	1
Bedridden	1	Palsie	1
Cancer	2	Plague	3880
Chrisomes	23	Plurisie	1
Chrisomes	15	Quinsie	6
Collick	1	Rickets	23
Consumption	174	Riſing of the Lights	19
Convulſion	88	Rupture	2
Dropſie	49	Sciatica	1
Drowned 2, one at St. Kath. Tower, and one at Lambeth	2	Scowring	13
		Scurvy	1
Feaver	513	Sore legge	1
Fiſtula	2	Spotted Feaver and Purples	190
Flox and Small-pox	10	Starved at Nurſe	1
Flux	2	Stillborn	8
Found dead in the Street at St. Bartholomew the Leſs	1	Stone	2
		Stopping of the ſtomach	16
Frighted	2	Strangury	1
Gangrene	2	Suddenly	2
Gout	2	Surfeit	67
Grief	2	Teeth	113
Griping in the Guts	74	Thruſh	3
Jaundies	3	Tiſick	9
Impoſthume	18	Ulcer	2
Infants	22	Vomiting	7
Killed by a fall down ſtairs at St. Thomas Apoſtle	1	Winde	8
		Worms	18

Chriſtned: Males 85, Females 81, In all 166
Buried: Males 2616, Females 2663, In all 5279. Plague 3880.
Increaſed in the Burials this Week 1289.
Pariſhes clear of the Plague 34. Parishes Infected 90.

The aſſize of bread ſet forth by order of the Lord Maior and Court of Aldermen:
A penny Wheaten Loaf to contain Nine Ounces and a half, and three half-penny White Loaves the like weight.

Key challenges in recording and analysis of mortality

- **Lack of understanding of value of mortality registration and analysis as powerful tool for public health**
- **Weak system of mortality registration**
  - **Cities and states do not have qualified epidemiologists and demographers**
- **Non-availability and nonuse of mortality data in India**
- **Lack of administrative and political will to make death data and analysis public**
- **NCDC has developed good online data surveillance system for heat related deaths – extend it to all hospitals including private and also for home deaths.**



Challenges of recording heat as cause of death

- Heat is generally one of the contributing factors/ cause of mortality in old and comorbid
- Core body temperature via rectal thermometer needs to be measured – not often done.
- Circumstances of death, other causes and city / location temperature / heat exposure / work history need to be obtained carefully. Which is not generally done.
- There are no unique pathological tests or changes that can identify heat stroke even on detailed autopsy. Exclusion of other causes is important.

5

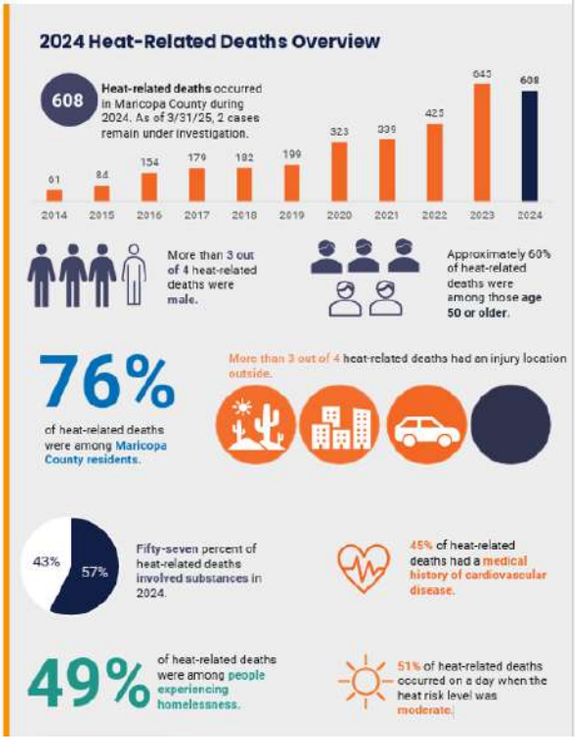
What can be done to improve mortality recording and analysis

- **Short-term** : Count **all deaths** from each crematoriums and burial grounds on daily basis.
- Compare this with expected mortality and 95% confidence limits
- Correlate the daily mortality with daily max and min temperature.
- **Public announcement of daily deaths in media like the weather bulletin.**
- Long-term: Improve cause of death registration in hospitals and home deaths. **Develop "bills of mortality" type system**
- Computerization of all death records with cause and weekly analysis and feedback.

6

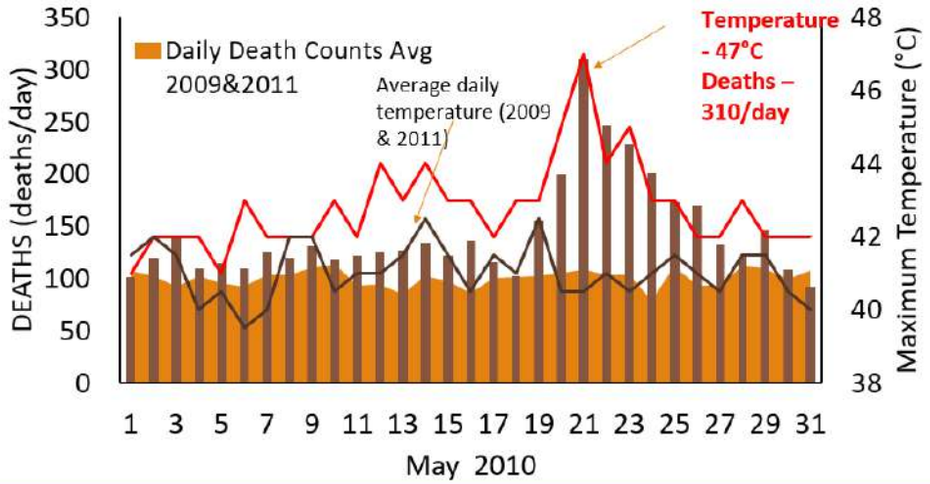
Best practice

- Maricopa County, Arizona USA
- Heat-related death report 2024



2010 Ahmedabad heat wave :

May 20-27th – excess deaths 800 in one week and 1344 excess deaths in May 2010.



8

INDIAN INSTITUTE of PUBLIC HEALTH GANDHINAGAR

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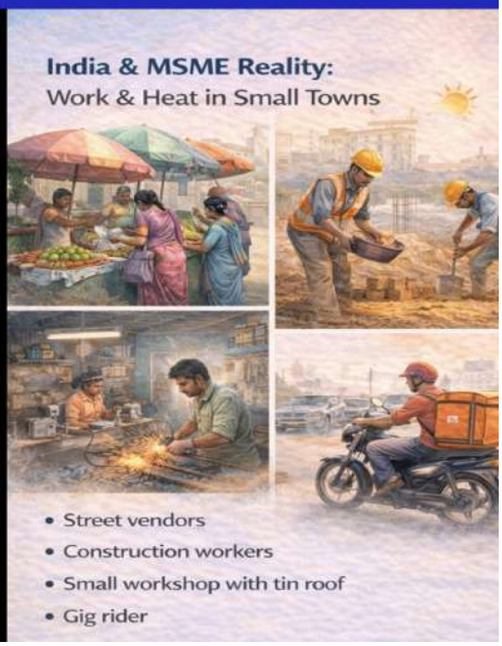
Thanks

9

Speaker: Dr. Yogindra Samant, International Labour Organization (ILO)

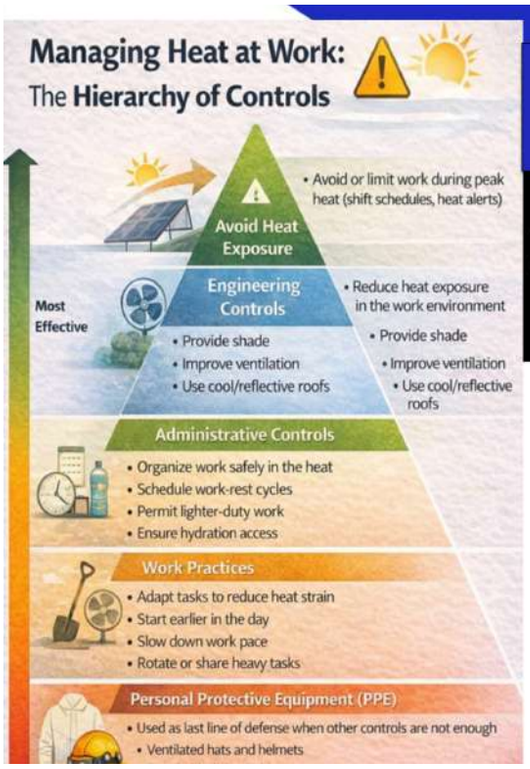
Heat is Already Disrupting Work and Livelihoods

- Work often happens for many groups of workers in outdoor or semi-outdoor settings
- Many small businesses have little access to cooling or protection
- Heat reduces work capacity and increases fatigue and illness
- For daily-income workers and small businesses, less work means less pay



Early Warning systems

Heat early warning systems save lives only if they translate into action at workplaces.



Hierarchy of Controls

- **OSH is a fundamental right**
- **C155 Occupational Safety and Health Convention (ILO)**

- Elimination = Remove the heat hazard completely
- Engineering controls = change the environment
- Administrative controls = change how work is organised

Three Clear Messages (RE.WA.SH +)

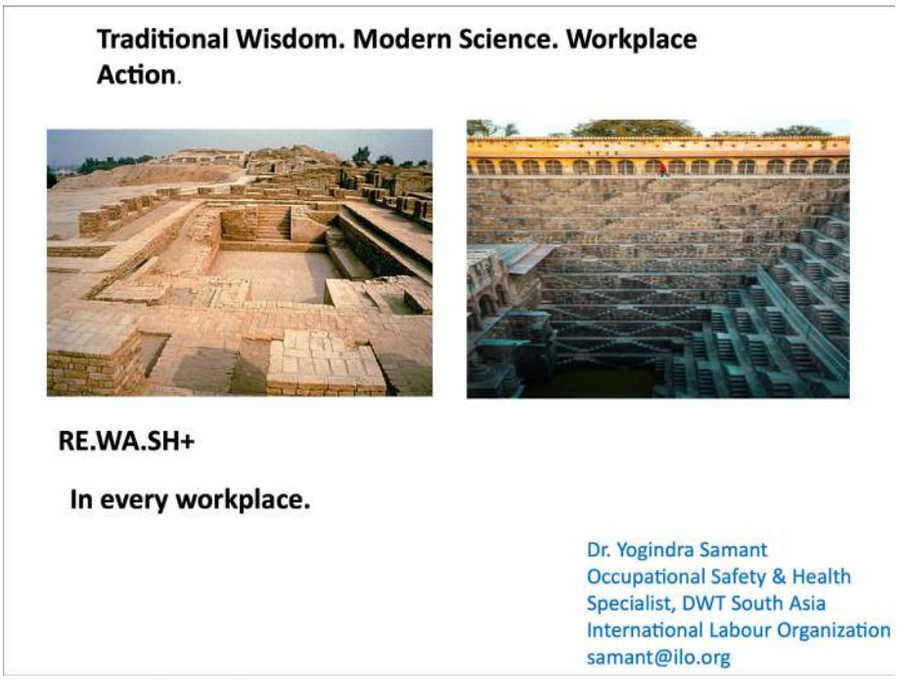
International Labour Organization

REst

WAter

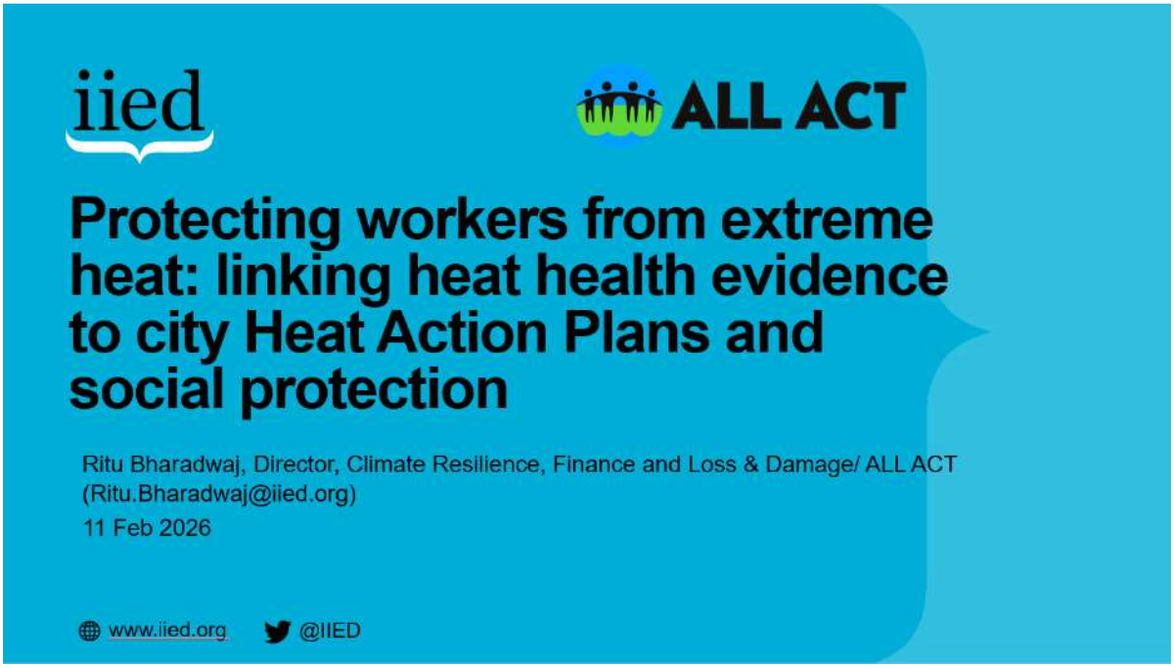
Shade

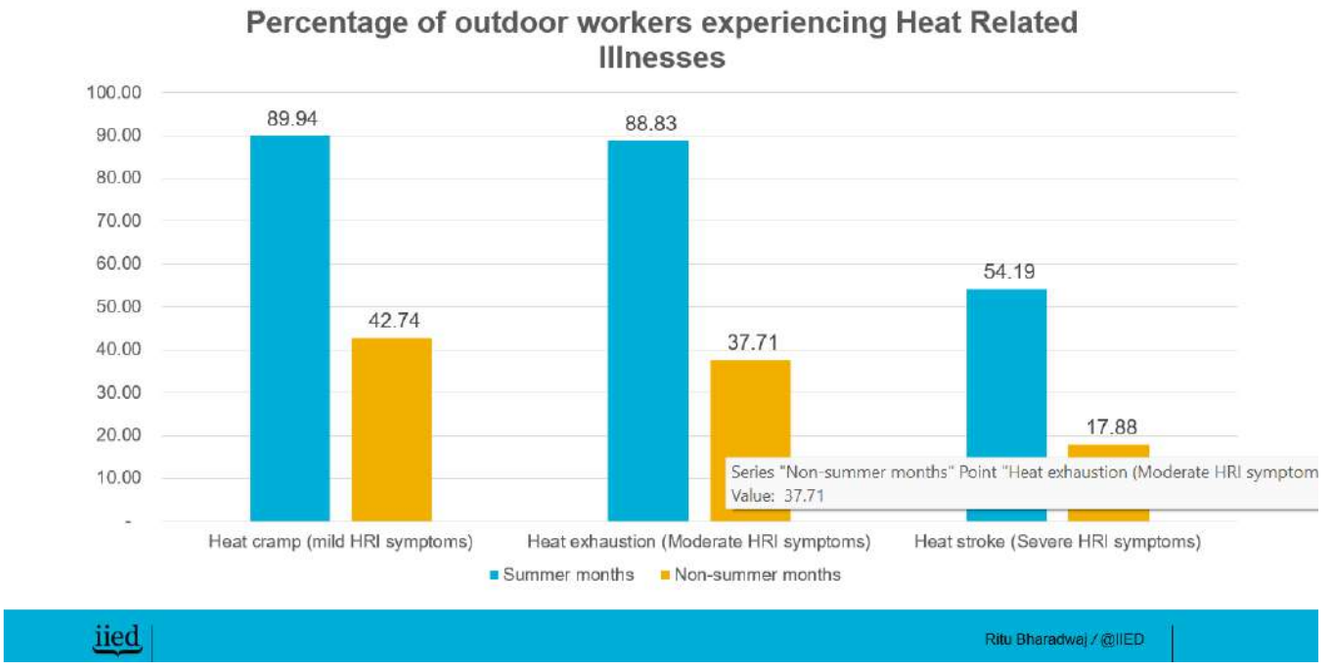
+ Safer Work Hours & Climate-appropriate PPE



SOCIAL PROTECTION FINANCING AND WORKER-CENTRIC HEAT RESILIENCE

Speaker: Ms. Ritu Bharadwaj, Director – Climate Resilience, Finance and Loss & Damage




Percentage of outdoor workers experiencing Heat Related Illnesses
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
-
89.94
42.74
88.83
37.71
54.19
17.88
Series "Non-summer months" Point "Heat exhaustion (Moderate HRI symptom
Value: 37.71
Heat cramp (mild HRI symptoms)
Heat exhaustion (Moderate HRI symptoms)
Heat stroke (Severe HRI symptoms)
Summer months
Non-summer months
iied
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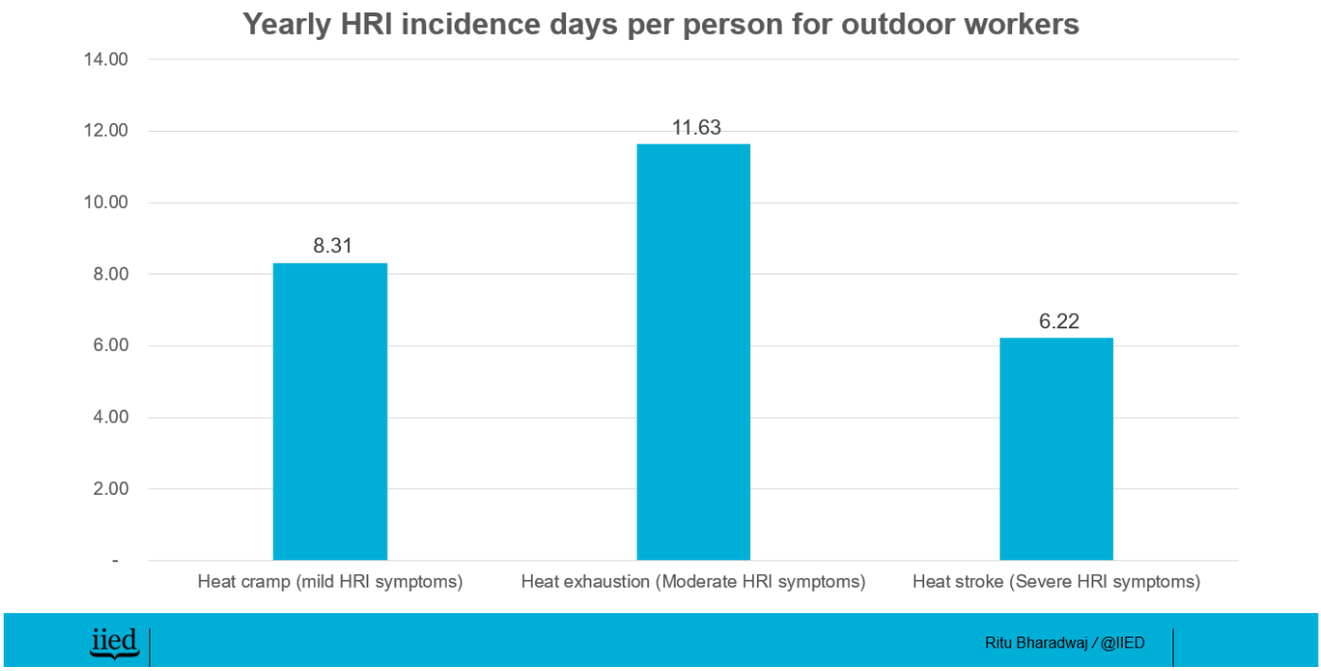
Yearly HRI incidence days per person for outdoor workers
14.00
12.00
10.00
8.00
6.00
4.00
2.00
-
8.31
11.63
6.22
Heat cramp (mild HRI symptoms)
Heat exhaustion (Moderate HRI symptoms)
Heat stroke (Severe HRI symptoms)
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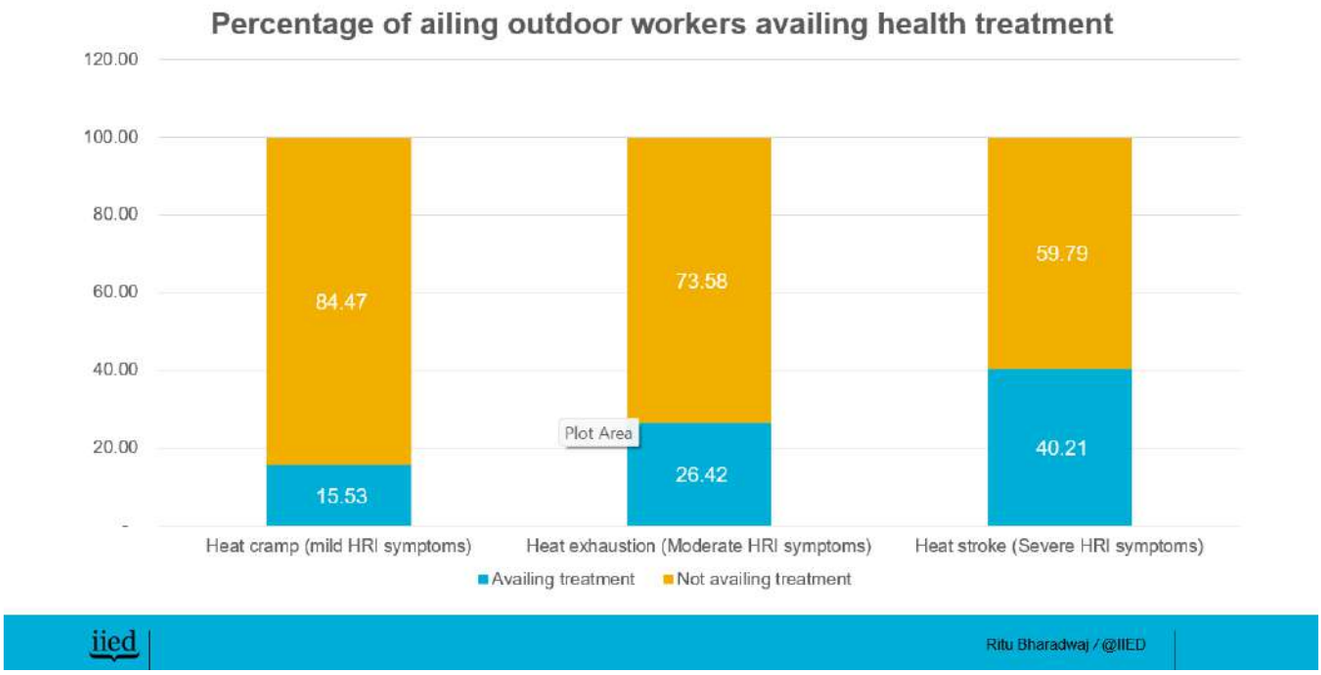
Percentage of ailing outdoor workers availing health treatment
120.00
100.00
80.00
60.00
40.00
20.00
-
84.47
15.53
73.58
26.42
59.79
40.21
Plot Area
Heat cramp (mild HRI symptoms)
Heat exhaustion (Moderate HRI symptoms)
Heat stroke (Severe HRI symptoms)
Availing treatment
Not availing treatment
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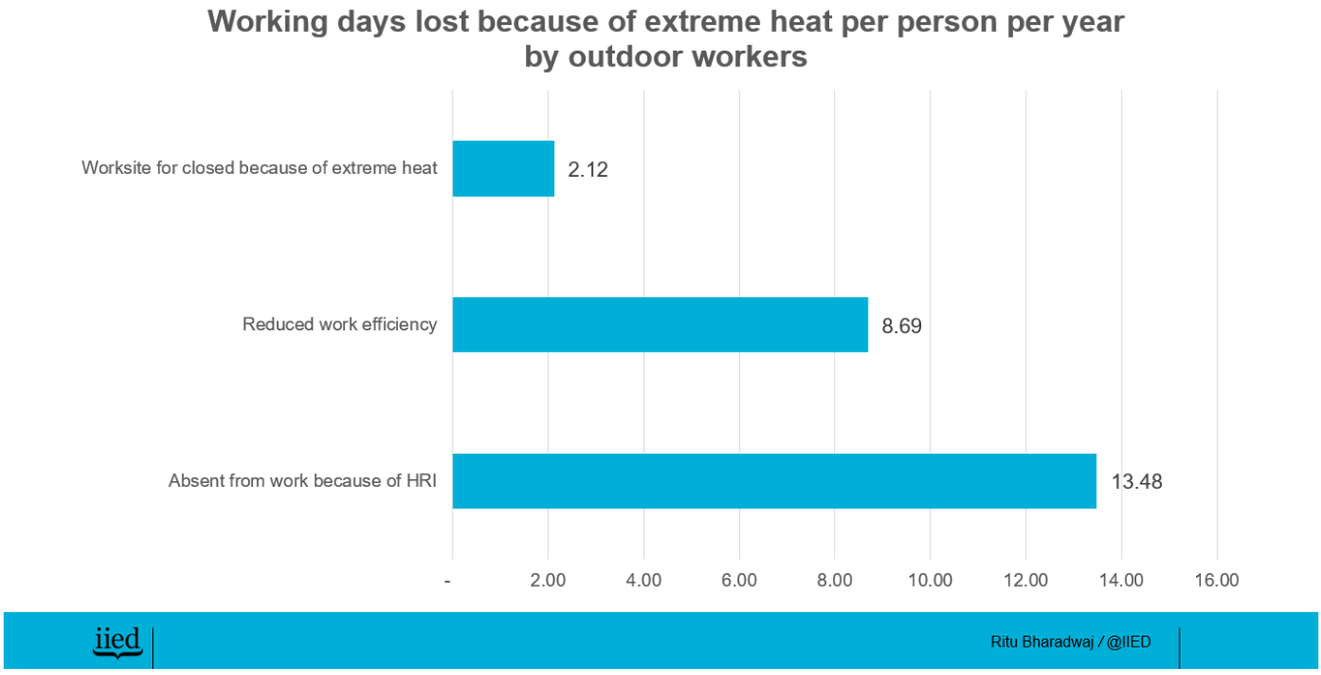
Working days lost because of extreme heat per person per year by outdoor workers
Worksite for closed because of extreme heat
2.12
Reduced work efficiency
8.69
Absent from work because of HRI
13.48
-
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
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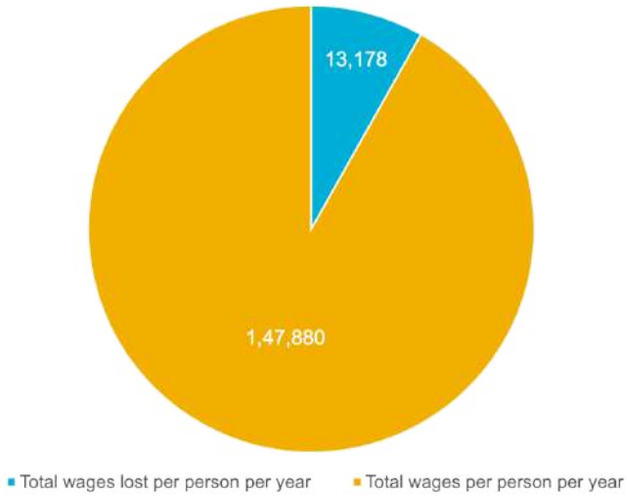
Wage loss because of extreme heat (INR) by outdoor workers



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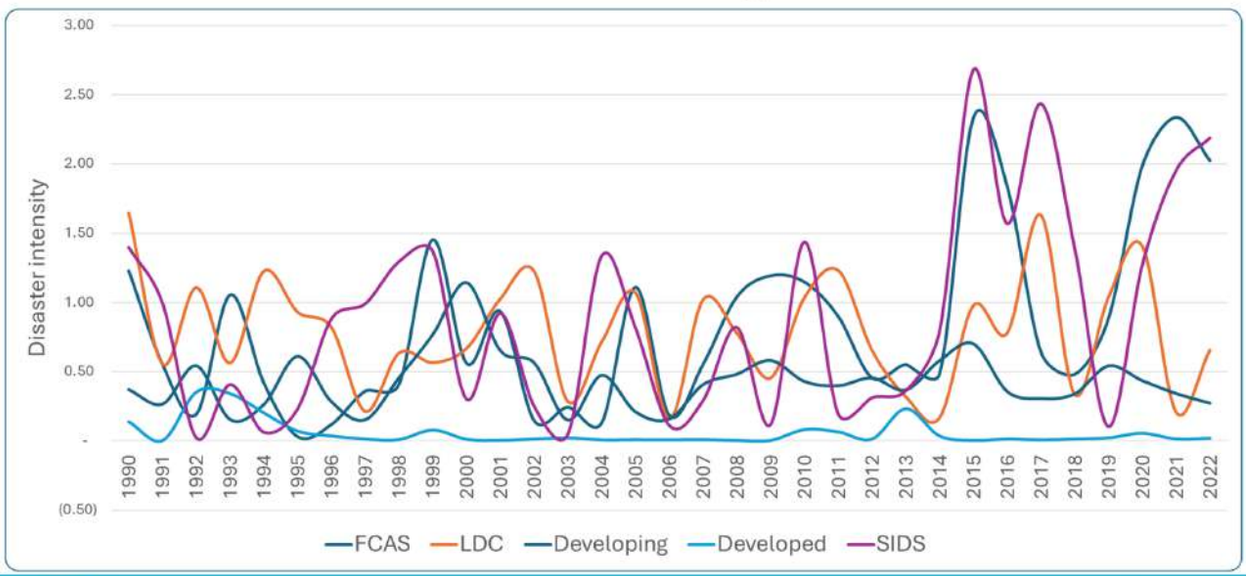
Disaster intensity and frequency in Developing countries, SIDS, LDCs been increasing



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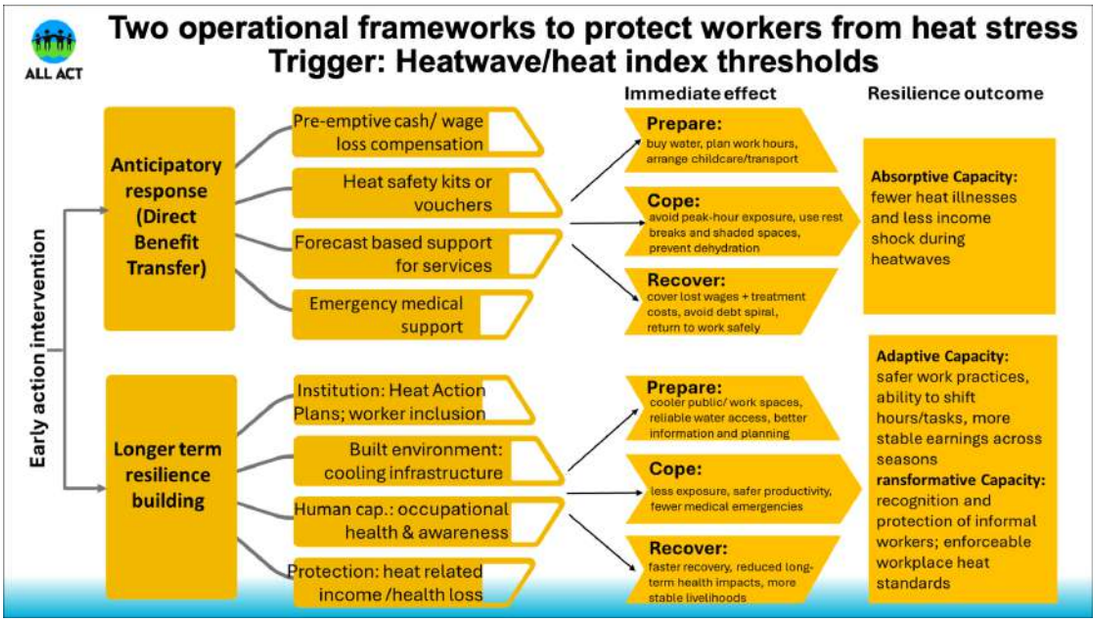
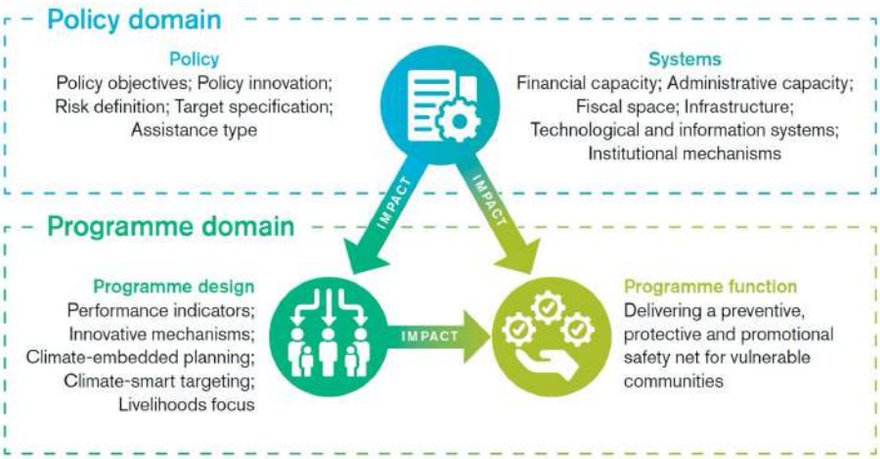
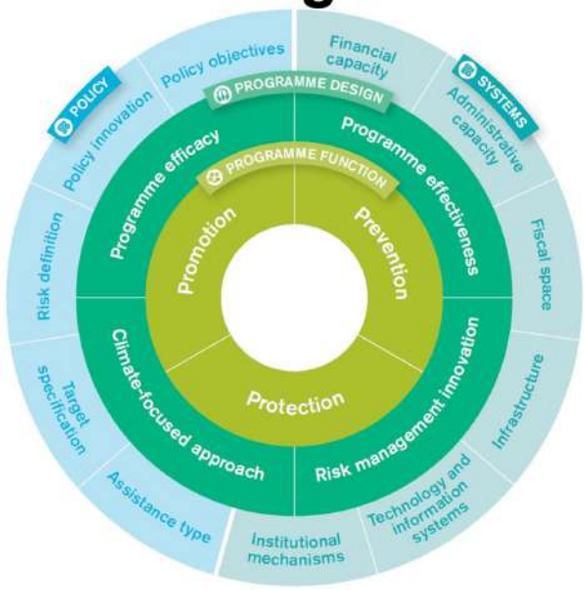


ASPIRE diagnostic tool : Assess policy, system and programme delivery effecti



Using analysis for action on the ground

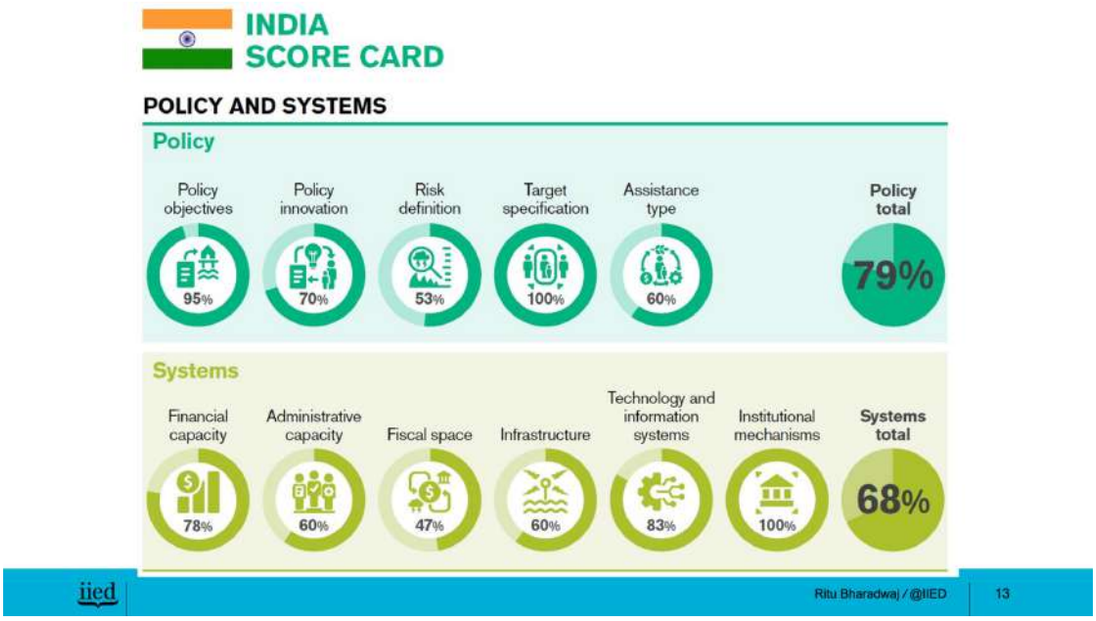
- Understanding current gaps and opportunities
- Estimate the financial and technical resources necessary to address these gaps
- Determining which stakeholders can best contribute to filling these gaps
- Helping partners understand the business case for investment
- Establish a realistic timeline for addressing identified gaps



8

Country diagnostic

to identify and address gaps in policy, systems, institutional coordination and delivery approaches to support development of Locally Led approaches


INDIA
SCORE CARD
POLICY AND SYSTEMS
Policy
Policy objectives
95%
Policy innovation
70%
Risk definition
53%
Target specification
100%
Assistance type
60%
Policy total
79%
Systems
Financial capacity
78%
Administrative capacity
60%
Fiscal space
47%
Infrastructure
60%
Technology and information systems
83%
Institutional mechanisms
100%
Systems total
68%
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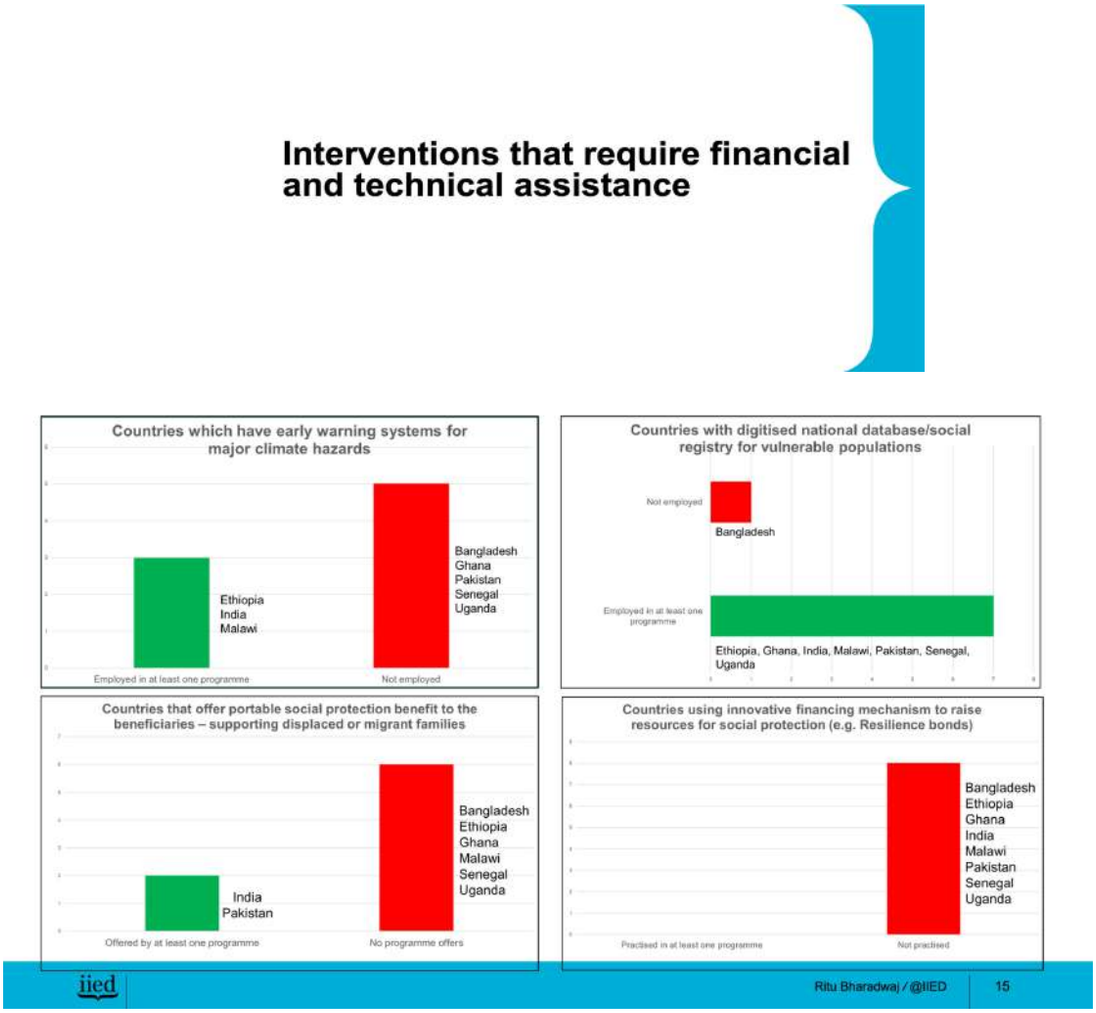
Interventions that require financial and technical assistance
Countries which have early warning systems for major climate hazards
Ethiopia
India
Malawi
Bangladesh
Ghana
Pakistan
Senegal
Uganda
Employed in at least one programme
Not employed
Countries with digitised national database/social registry for vulnerable populations
Not employed
Bangladesh
Employed in at least one programme
Ethiopia, Ghana, India, Malawi, Pakistan, Senegal, Uganda
Countries that offer portable social protection benefit to the beneficiaries – supporting displaced or migrant families
India
Pakistan
Bangladesh
Ethiopia
Ghana
Malawi
Senegal
Uganda
Offered by at least one programme
No programme offers
Countries using innovative financing mechanism to raise resources for social protection (e.g. Resilience bonds)
Bangladesh
Ethiopia
Ghana
India
Malawi
Pakistan
Senegal
Uganda
Practised in at least one programme
Not practised
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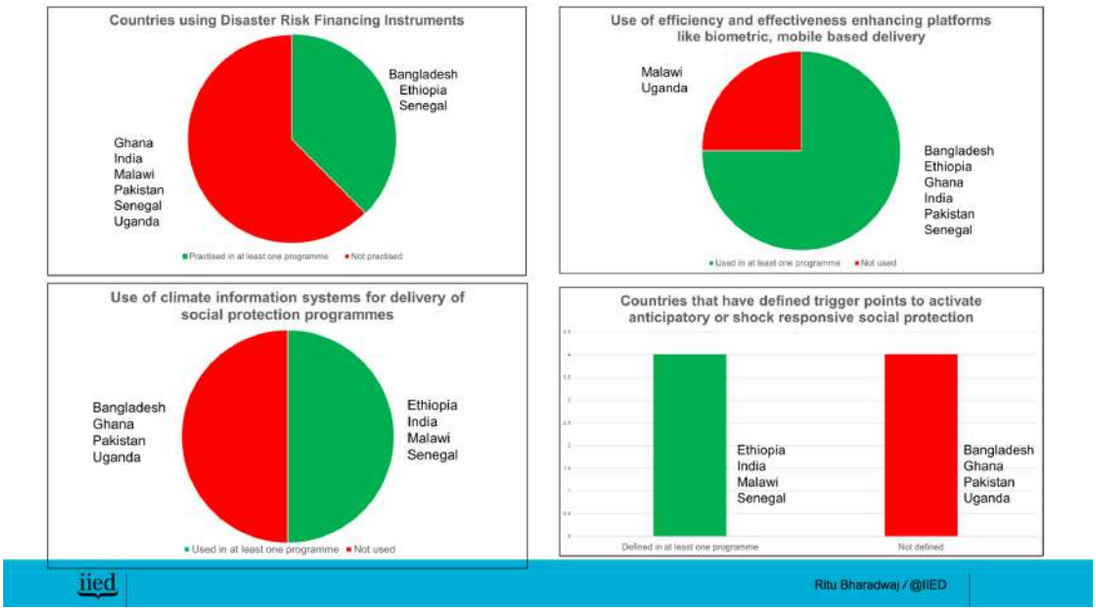
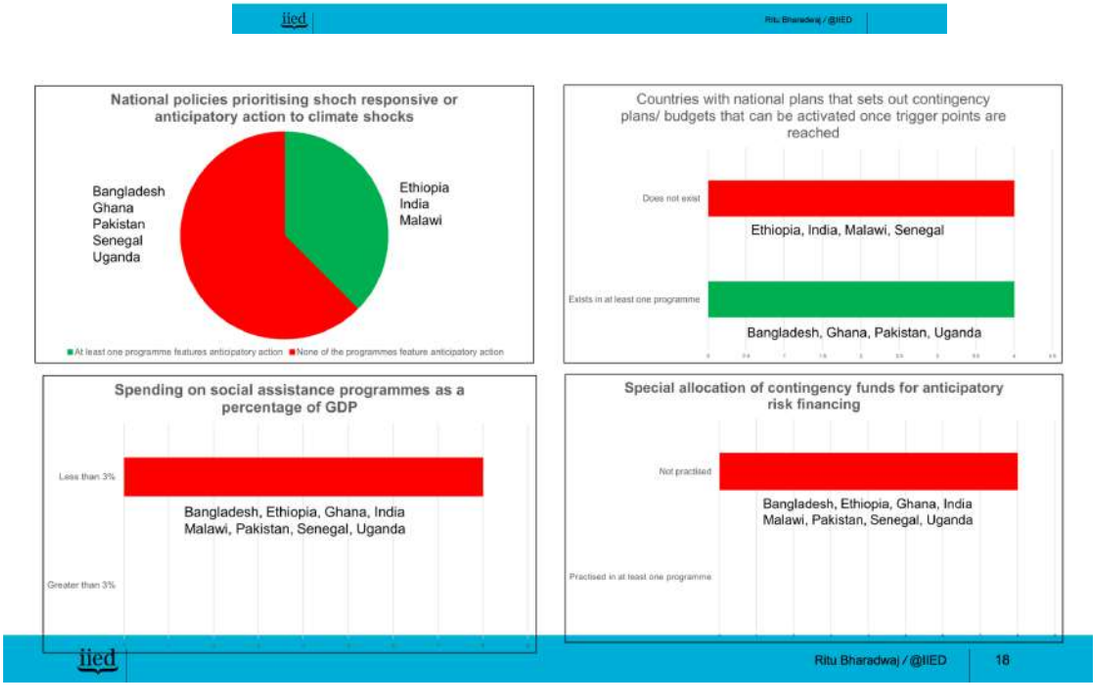
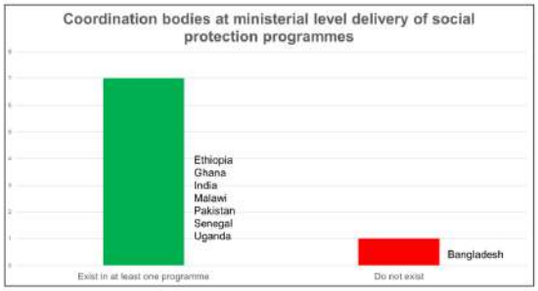
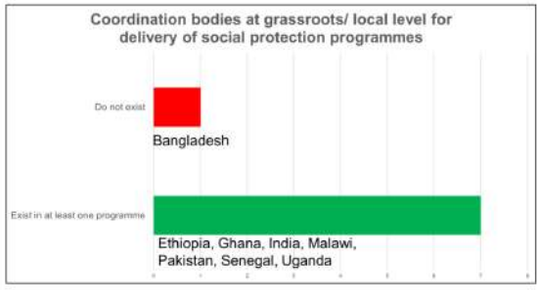


Interventions that require policy and regulatory changes at country level







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Interventions that require financial and technical assistance

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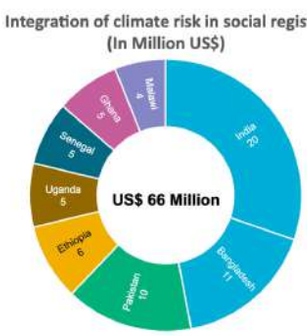
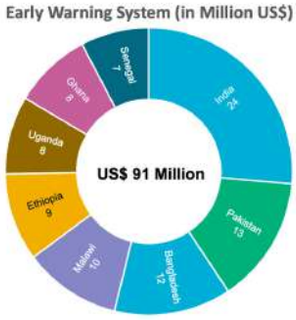
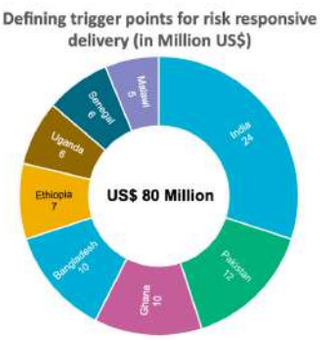
Estimation of the cost of cover some of the existing gaps







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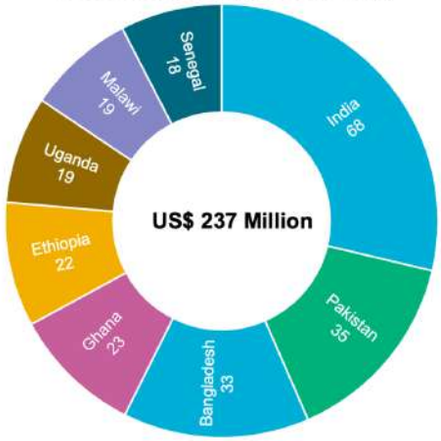
What it can help deliver

ALL ACT

Total Investment for filling gaps for delivering anticipatory and shock responsive social protection delivery (Million US$)



US$ 62,574 Million

Using existing social protection spending to also deliver climate resilience and food security

Existing investment in social protection by countries (Million US$)

Country	Social spending (Million USD)
Bangladesh	4,330
Ethiopia	1,670
Ghana	344
India	53,249
Malawi	210
Pakistan	2,166
Senegal	276
Uganda	330

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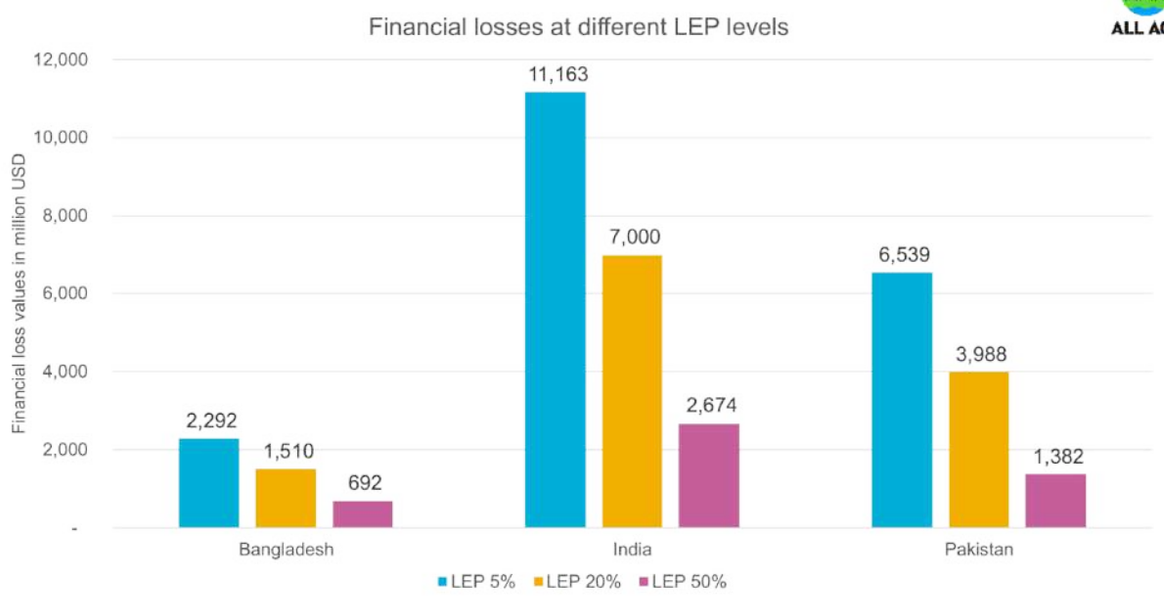
ALL ACT



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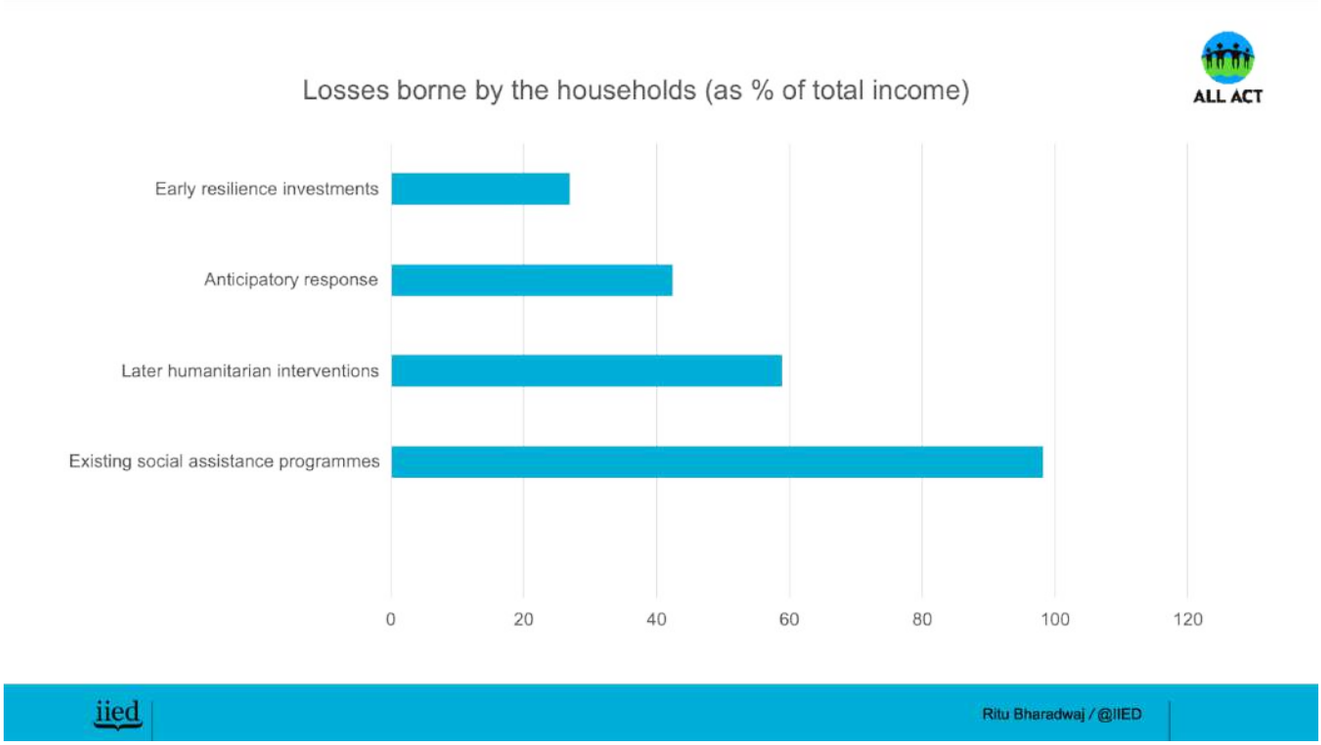
Losses borne by the households (as % of total income)
ALL ACT
Early resilience investments
Anticipatory response
Later humanitarian interventions
Existing social assistance programmes
0
20
40
60
80
100
120
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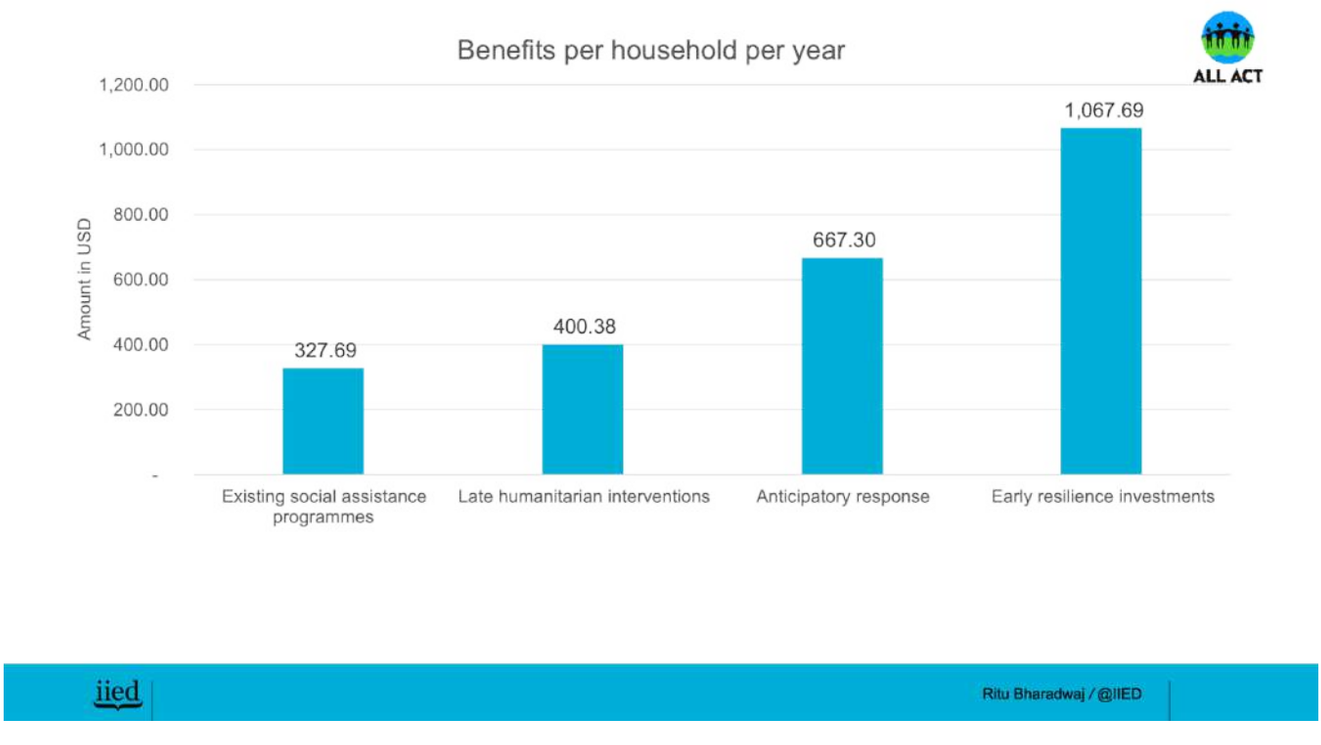
Benefits per household per year
ALL ACT
1,200.00
1,000.00
800.00
600.00
400.00
200.00
-
Amount in USD
327.69
400.38
667.30
1,067.69
Existing social assistance programmes
Late humanitarian interventions
Anticipatory response
Early resilience investments
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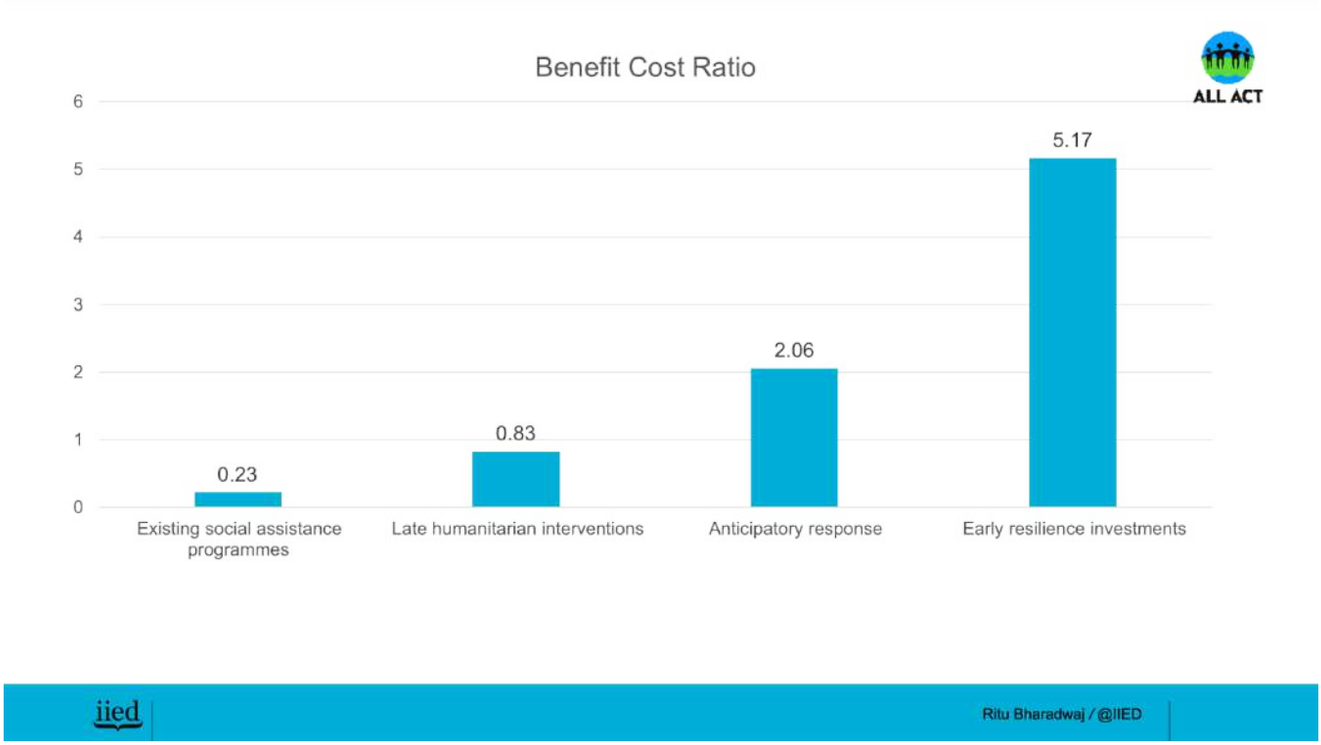
Benefit Cost Ratio
ALL ACT
6
5
4
3
2
1
0
0.23
0.83
2.06
5.17
Existing social assistance programmes
Late humanitarian interventions
Anticipatory response
Early resilience investments
iied
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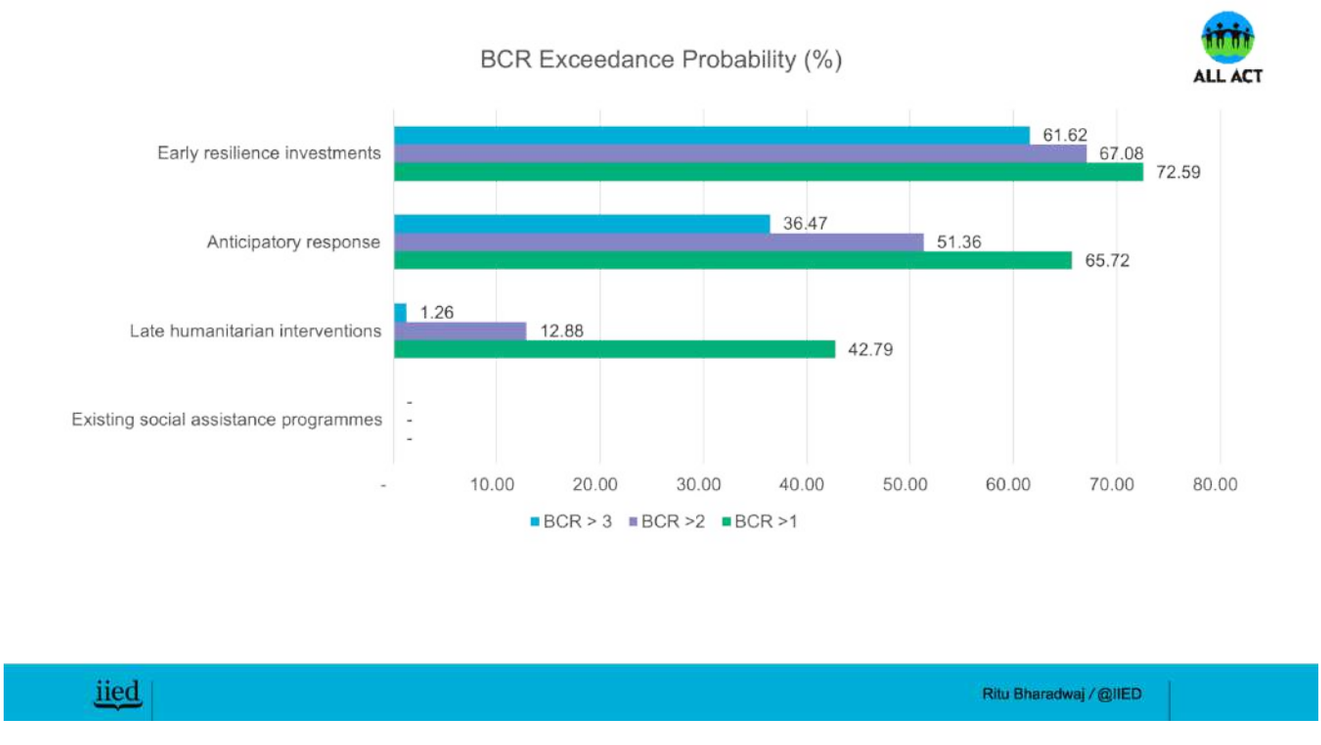
BCR Exceedance Probability (%)
ALL ACT
Early resilience investments
61.62
67.08
72.59
Anticipatory response
36.47
51.36
65.72
Late humanitarian interventions
1.26
12.88
42.79
Existing social assistance programmes
-
-
-
-
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
BCR > 3
BCR >2
BCR >1
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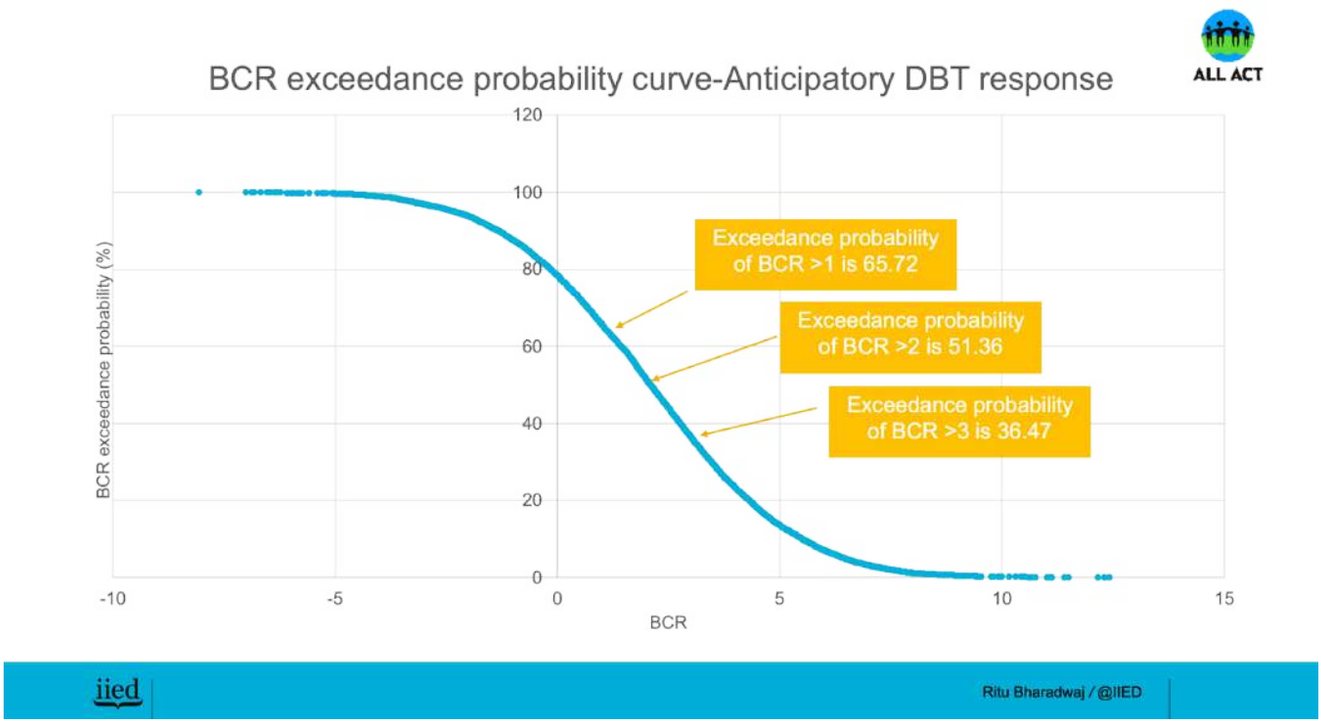
BCR exceedance probability curve-Anticipatory DBT response
ALL ACT
BCR exceedance probability (%)
120
100
80
60
40
20
0
-10
-5
0
5
10
15
BCR
Exceedance probability of BCR >1 is 65.72
Exceedance probability of BCR >2 is 51.36
Exceedance probability of BCR >3 is 36.47
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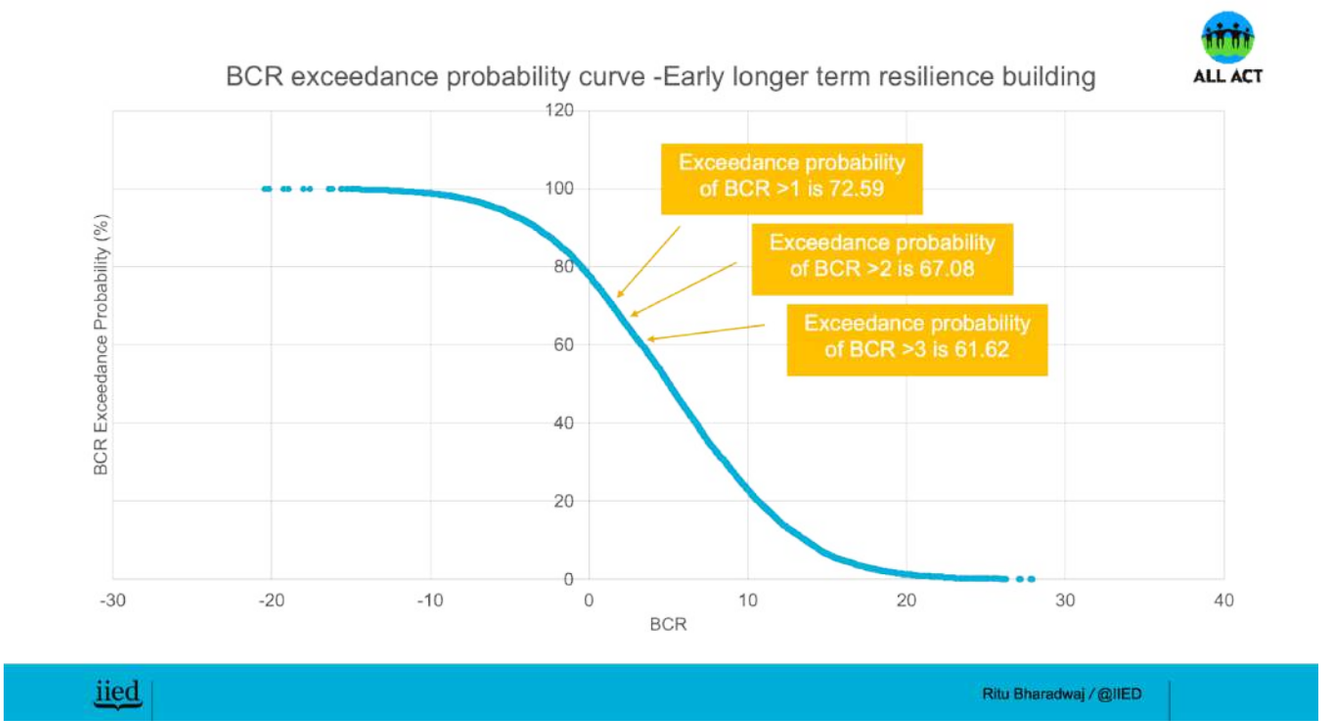
BCR exceedance probability curve -Early longer term resilience building
ALL ACT
BCR Exceedance Probability (%)
120
100
80
60
40
20
0
-30
-20
-10
0
10
20
30
40
BCR
Exceedance probability of BCR >1 is 72.59
Exceedance probability of BCR >2 is 67.08
Exceedance probability of BCR >3 is 61.62
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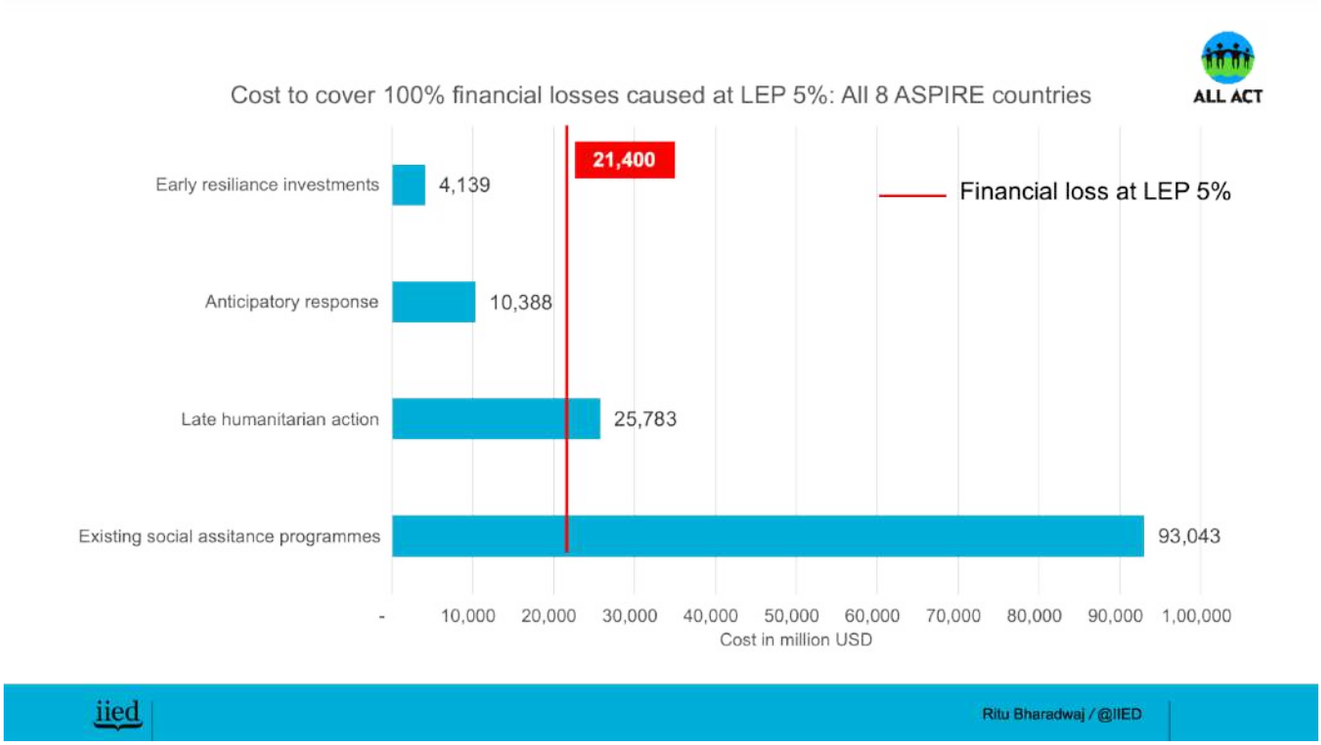
Cost to cover 100% financial losses caused at LEP 5%: All 8 ASPIRE countries
ALL ACT
Early resiliance investments
4,139
21,400
Financial loss at LEP 5%
Anticipatory response
10,388
Late humanitarian action
25,783
Existing social assitance programmes
93,043
-
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
1,00,000
Cost in million USD
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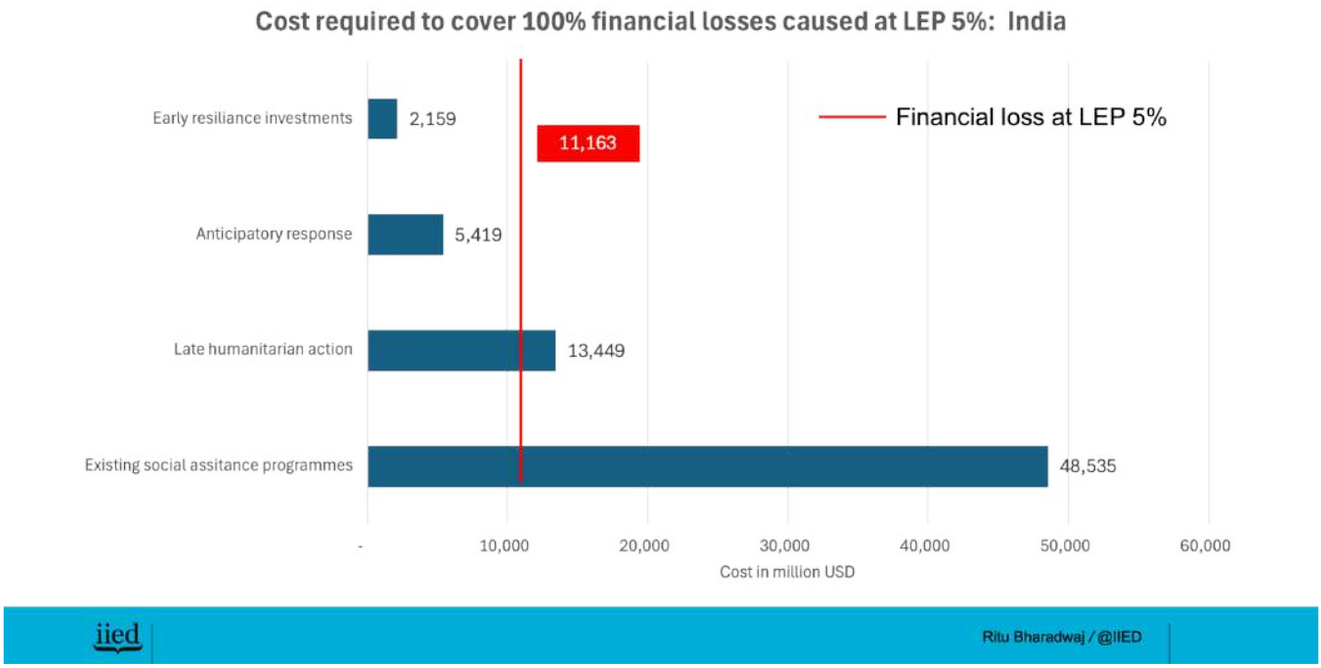
Cost required to cover 100% financial losses caused at LEP 5%: India
Early resiliance investments
2,159
11,163
Financial loss at LEP 5%
Anticipatory response
5,419
Late humanitarian action
13,449
Existing social assitance programmes
48,535
-
10,000
20,000
30,000
40,000
50,000
60,000
Cost in million USD
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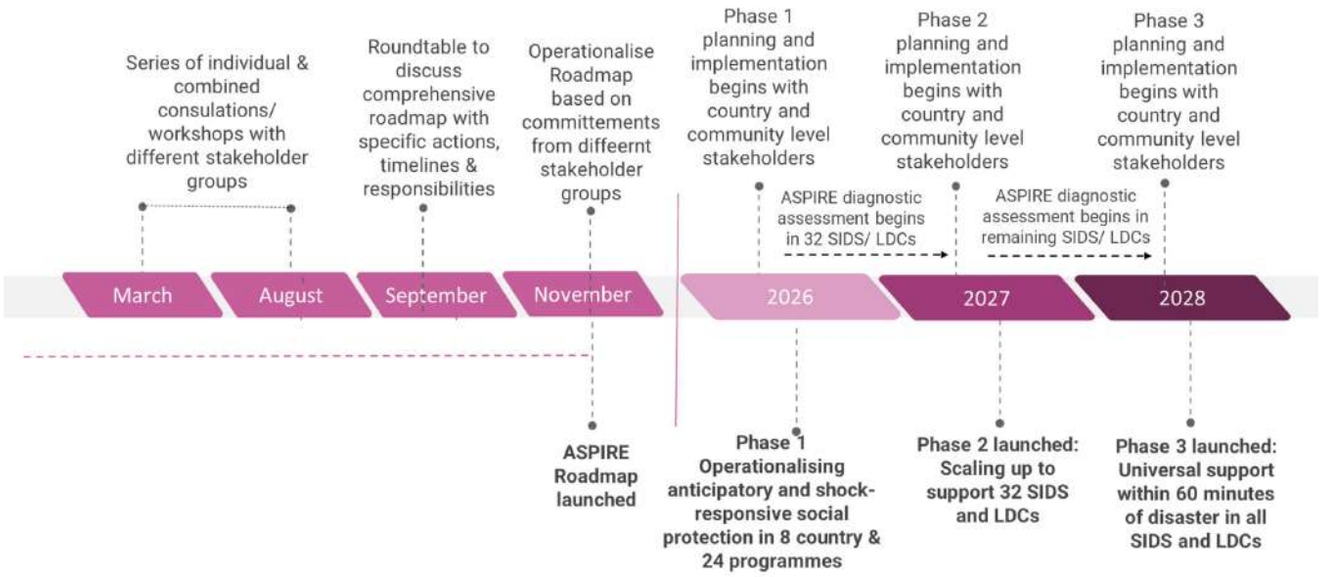
Roadmap to bring in investment and technical suppo



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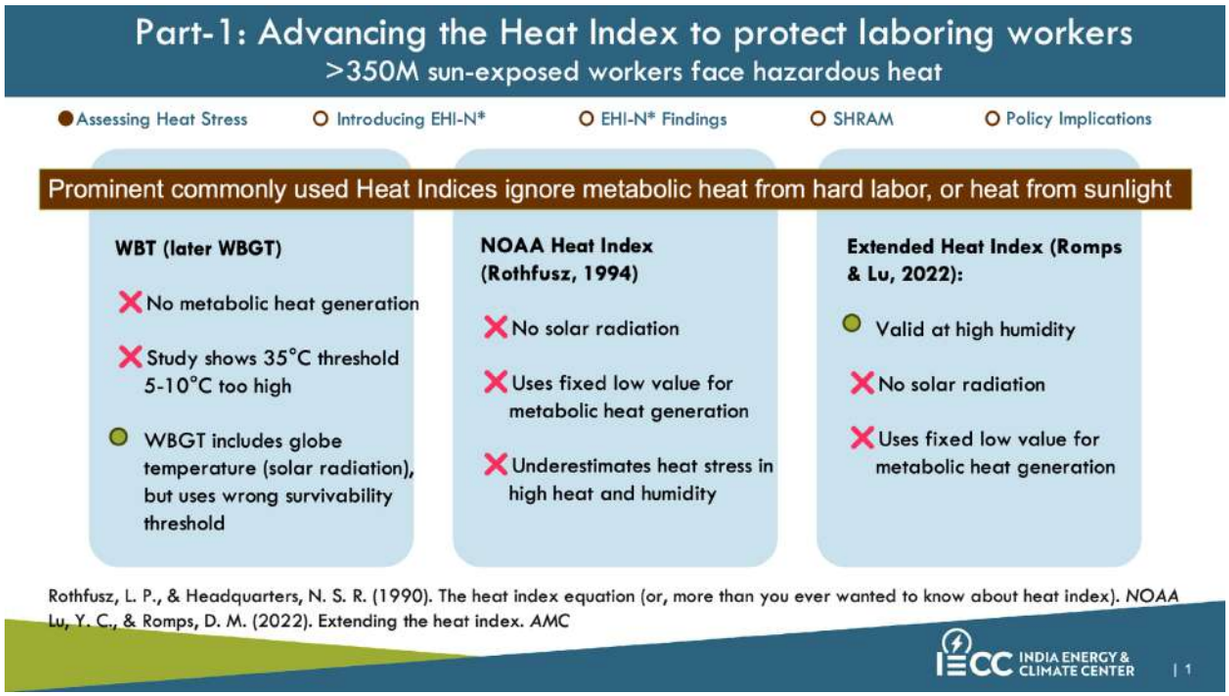
Last mile delivery during crisis with 'people plus tech' approach, Climate *Saathi* (friends) and women help desks

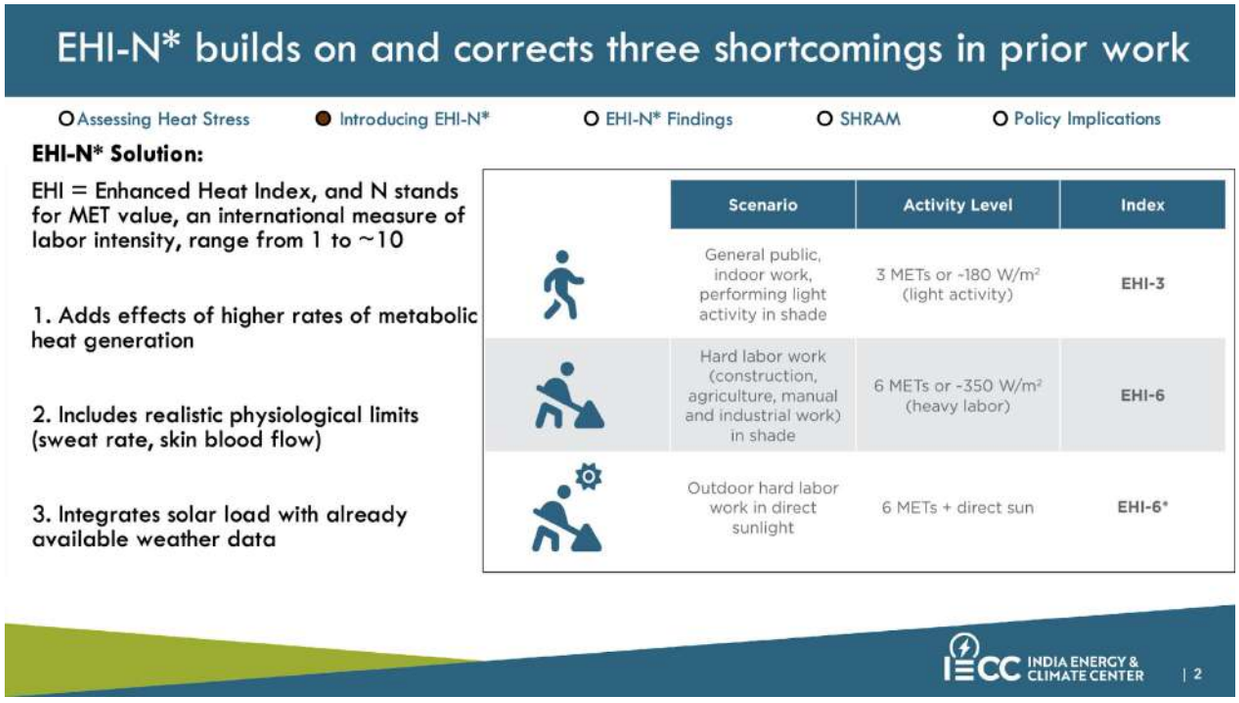
Tools for planning and decision making at local level

Integrating risk analytics in policy and systems to ensure stronger preparedness to crisis

ADVANCING HEAT METRICS TO PROTECT LABOURING POPULATIONS

Speaker: Dr. Ashok Gadgil, Professor, University of California, Berkeley

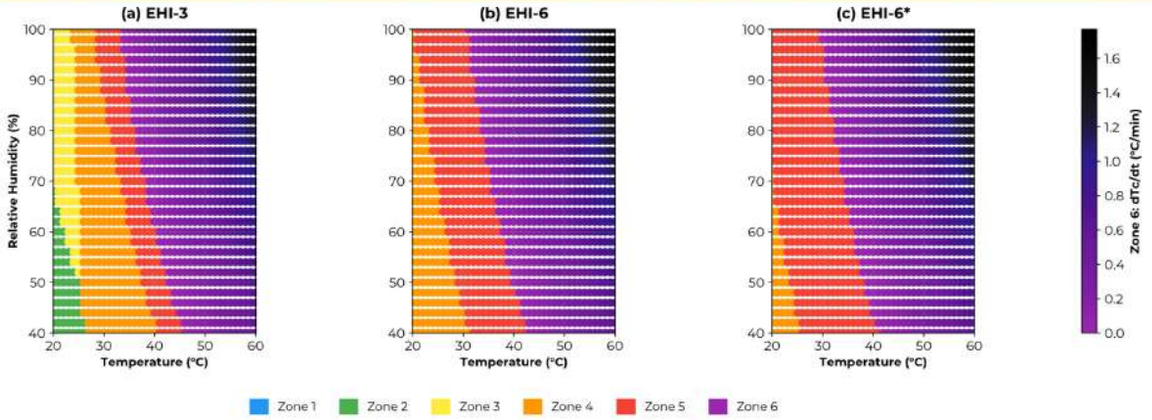




Laboring in sun (EHI-6*) triggers health damage at lower temperatures and humidity-levels, compared to easy work in the shade (EHI-3)

O Assessing Heat Stress O Introducing EHI-N* ● EHI-N* Findings O SHRAM O Policy Implications

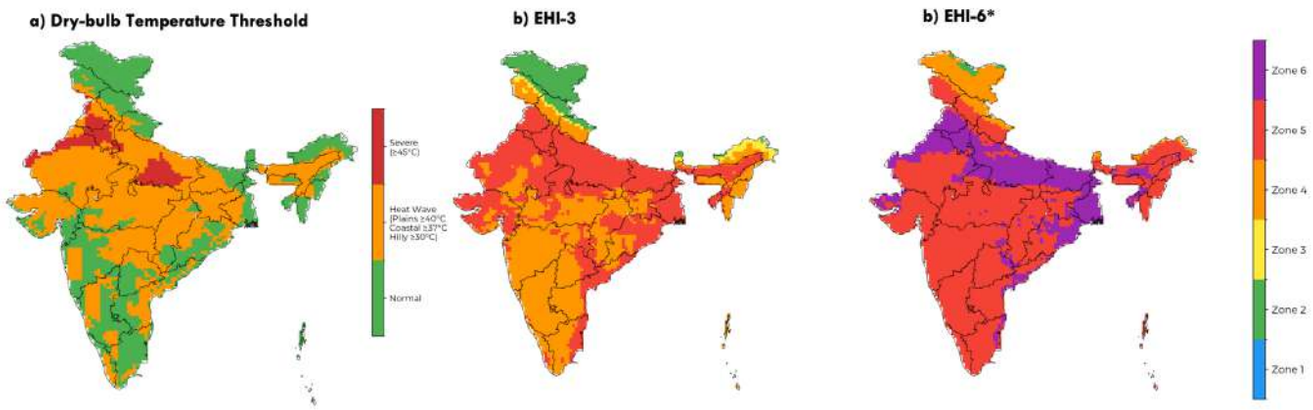
Physiological state of a standard person, at any value of EHI-N, at any air temperature and humidity, can be divided into 6 Zones



EHI-N* zones (20–60°C, 0–100% RH) for three scenarios: (a) light work in shade (MET 3), (b) heavy work in shade (MET 6), and (c) heavy work in full sun (MET 6*).

June 2024, 37% of India reached Zone 6 for outdoor laborers (EHI-6*)

O Assessing Heat Stress O Introducing EHI-N* ● EHI-N* Findings O SHRAM O Policy Implications



June 2024 analysis. (a) Maximum heat wave classifications through terrain/coastal -adjusted dry-bulb temperature thresholds, and maximum EHI-N* zones reached for: (b) EHI-3: light activity in shade, and (c) EHI-6*: heavy labor in direct sunlight. (For EHI-6*, 36.8% area reached Zone 6, and 92.1% area reached Zone 5+).

Part 2: Live Dashboard: System for Heat -Risk Assessment of Manual labor (SHRAM)

Assessing Heat Stress | Introducing EHI-N* | EHI-N* Findings | **SHRAM** | Policy Implications

http://shram.info

Supporting documents available at the website below

SHRAM Dashboard Features

- Near-real time alerts for Zones 5 and 6
- Historical trend
- Forecasts 1-, 3- and 7 -days
- Forecast alerts for Zone 6
- FREE sign-up for alerts

Reach out to use our API for your needs: iecc@berkeley.edu

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DAY 1 : TECHNICAL SESSION - I V

FINDINGS FROM REAL TIME ASSESSMENT OF EXTENDED HEAT INDEX 350

Speaker: Piyush Narang, UC Berkeley

CHAITRA quantifies risk layers using IPCC AR6 framework Hazard–Exposure–Vulnerability

Layer	What It Shows	What It Informs
Heat Hotspots	Areas hotter or cooler than city average	Where heat concentrates - diagnostic baseline
Population Heat Risk	People exposed to high heat + low shade	Number of cooling centres, medical teams, water stations
Cool Roof Priority	Wards with high heat + dark roofs + dense built-up	Number of buildings that require roof coating and its budget
Tree Planting Priority	Wards with tree cover below 25% target (WHO/TERI)	Number of saplings, planting locations and its budget
24-Hour Heat Zones	Areas hot during both day and night	Number of rest shelters, after hours health centres, market shades and its budget
Vulnerable Housing	Dense informal settlements with heat amplification	Priority areas for housing interventions
Composite Heat Risk Index	Combines all factors into a single ward score	Identifies where bundled interventions are needed

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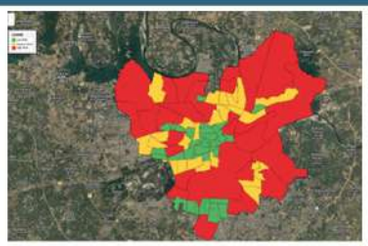
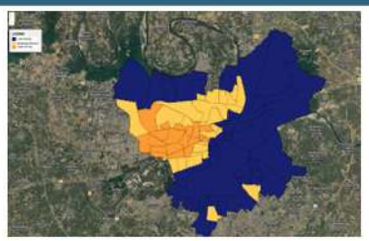
CHAITRA applied to Agra



1. Population Heat Risk Wards (in Red)

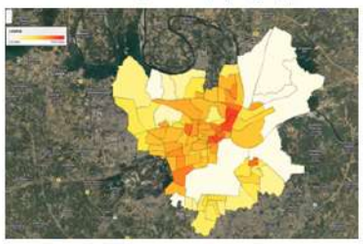


2. 24-hour heat zone (in dark yellow)

3. Tree Planting Priority (in grey)

4. Dense/Vulnerable Housing Areas (in darker brown)

5. Cool Roofing Priority (in Brown)



6. Composite Heat Risk Index

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CHAITRA enables decision makers to strengthen heat action planning

- For cities developing new HAPs: Enables any Indian city with ward boundaries to rapidly generate risk maps and develop Heat Action Plans
- For cities with existing HAPs: Translates generic recommendations into spatially targeted, ward-level actions linked to specific risks.
- For the State Disaster Management Authorities (SDMAs): Supports allocation of resources to highest-need areas and enables year-on-year monitoring of key heat risk indicators.
- For the National Disaster Management Authority (NDMA): Provides a standardized risk assessment framework and strengthens evidence-based support to states and cities developing Heat Action Plans.

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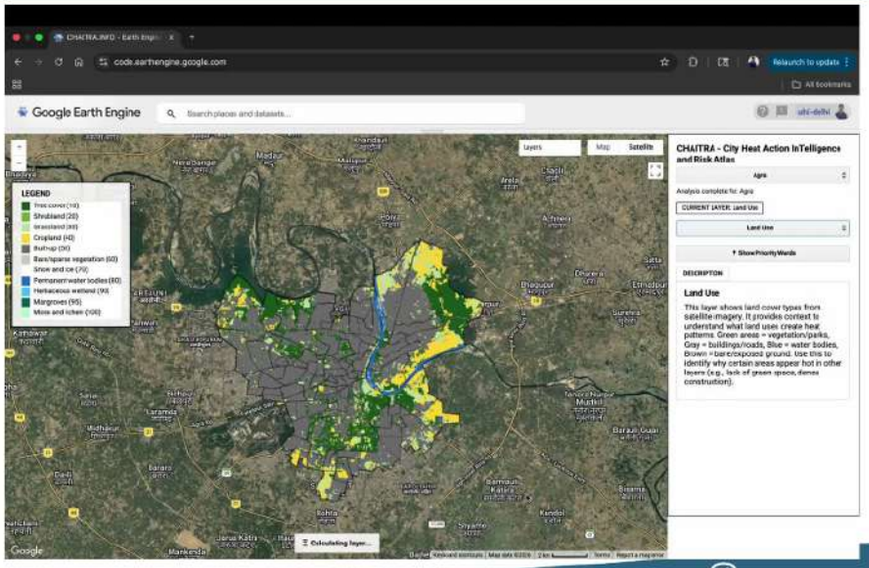
CHAITRA at glimpse

chaitra.info



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MICRO-LEVEL VULNERABILITY AND BUILDING-LEVEL ASSESSMENT

Speaker: Chintan Shinde, Mahila Housing Trust

Co-Development of Building-level Heat Vulnerability Assessments using Open Building Insights(OBI) tool

MAHILA HOUSING TRUST
Towards Responsible Urban Development
MHT

IBM

SUSTAINABLE ENERGY FOR ALL

Project Overview

- Co-develop OBI – Heat Vulnerability Index (HVI) along with IBM& SEforALL
- Train community Women for Ground truthing Exercise
- Validate model output through Ground-Truthing
- Conduct Heat Vulnerability Assessment at the building-level for selected cities - Churu (Rajasthan) &Patan(Gujarat)

Outputs Validated:

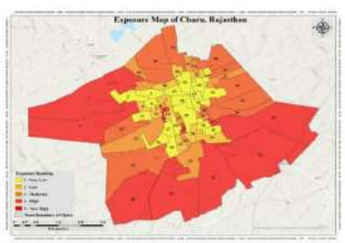
- **420 buildings were validated by women leaders for the following attributes**
- **Building type** – Residential, Non- Residential, Industrial (Classification task)
- **Inhabitants** – Number of people/inhabitants in the building **if residential**
- **No of Floors** – Number of floors in the building

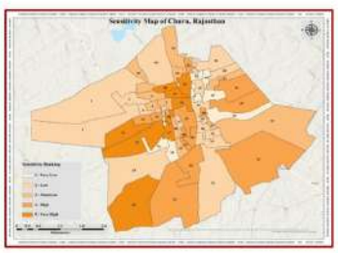
HVI Parameters Derived from OBI

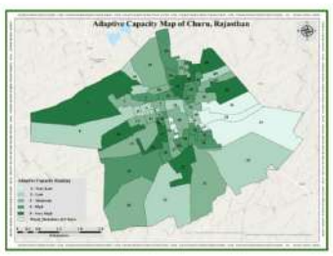
No.	Parameter Category	Parameter
1	Exposure	Heat Exposure
2	Exposure	Land Surface Temperature
3	Sensitivity	Builtup Area, Volume of Fabric Density Ratio
4	Adaptive Capacity	Access to Urban Health Centers
5	Adaptive Capacity	Proximity to Parks
6	Adaptive Capacity	Road Density
7	Adaptive Capacity	Proximity to water bodies
8	Adaptive Capacity	Surface Area of the water body
9	Adaptive Capacity	Vegetation Cover

Heat Vulnerability Components

MAHILA HOUSING TRUST
MHT Towards Responsible Urban Development





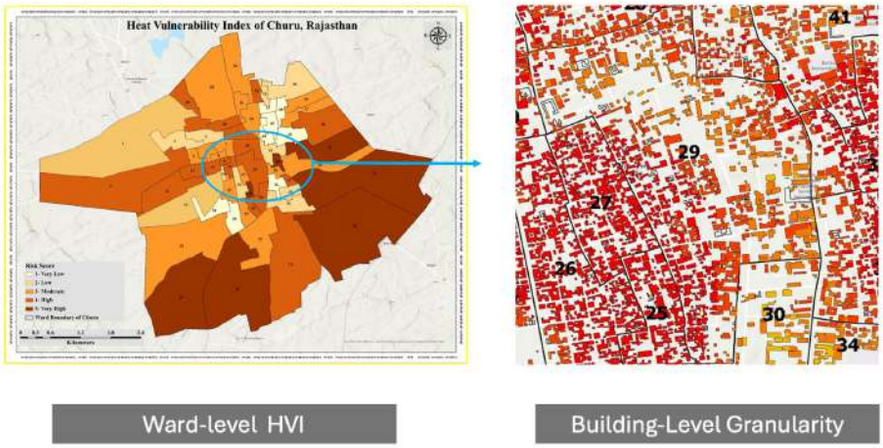


Exposure | Sensitivity | Adaptive Capacity

How can OBI improve HAP

MAHILA HOUSING TRUST
Towards Responsible Urban Development

1. Smooth data gathering procedure
2. Targeted Interventions



Ward-level HVI

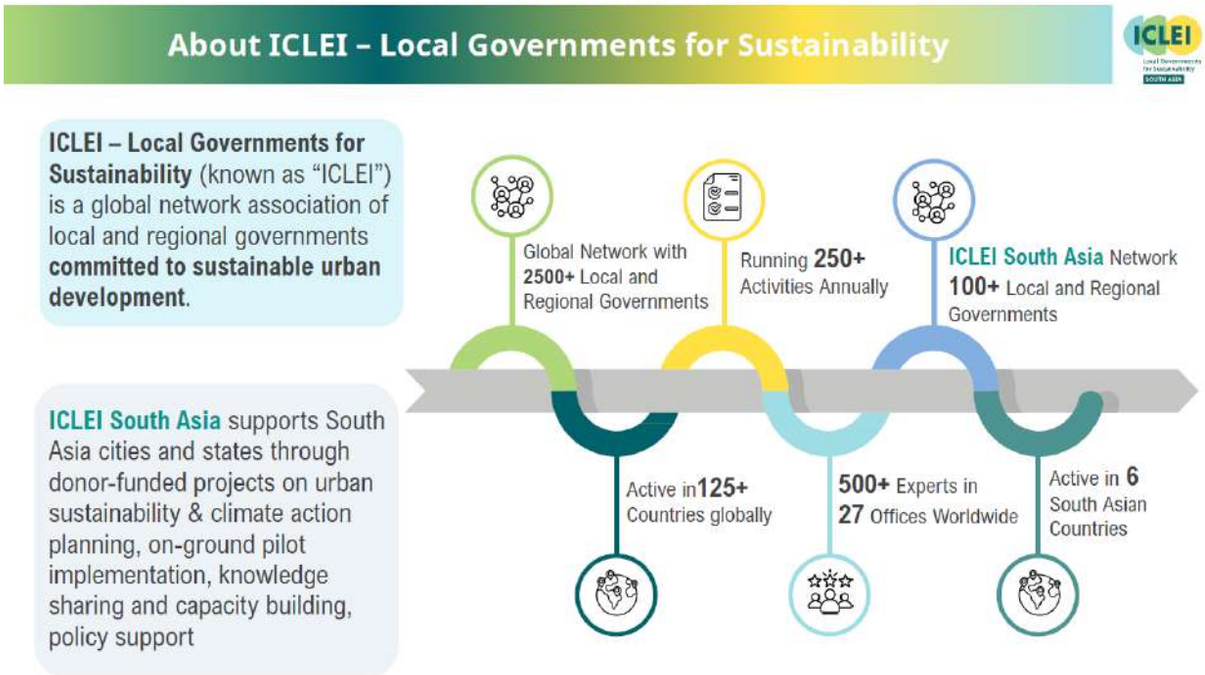
Building-Level Granularity

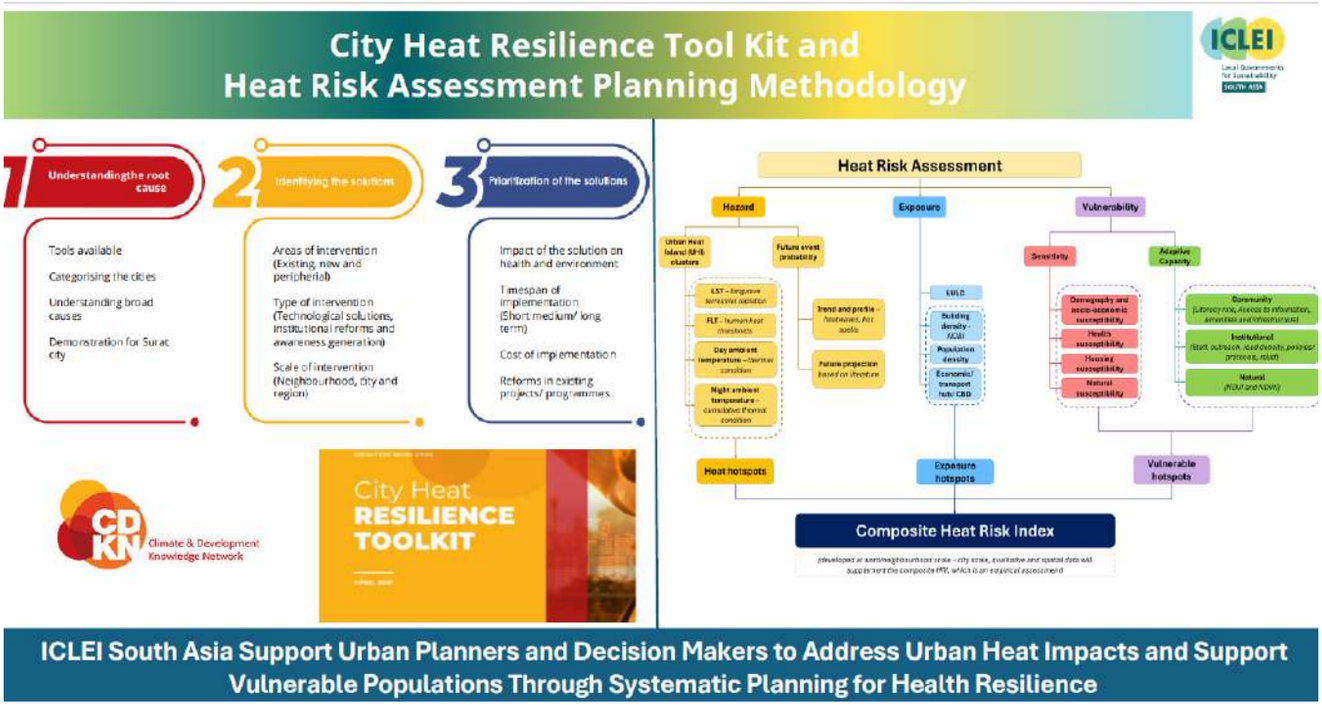
How does OBI improve Heat Action Plans

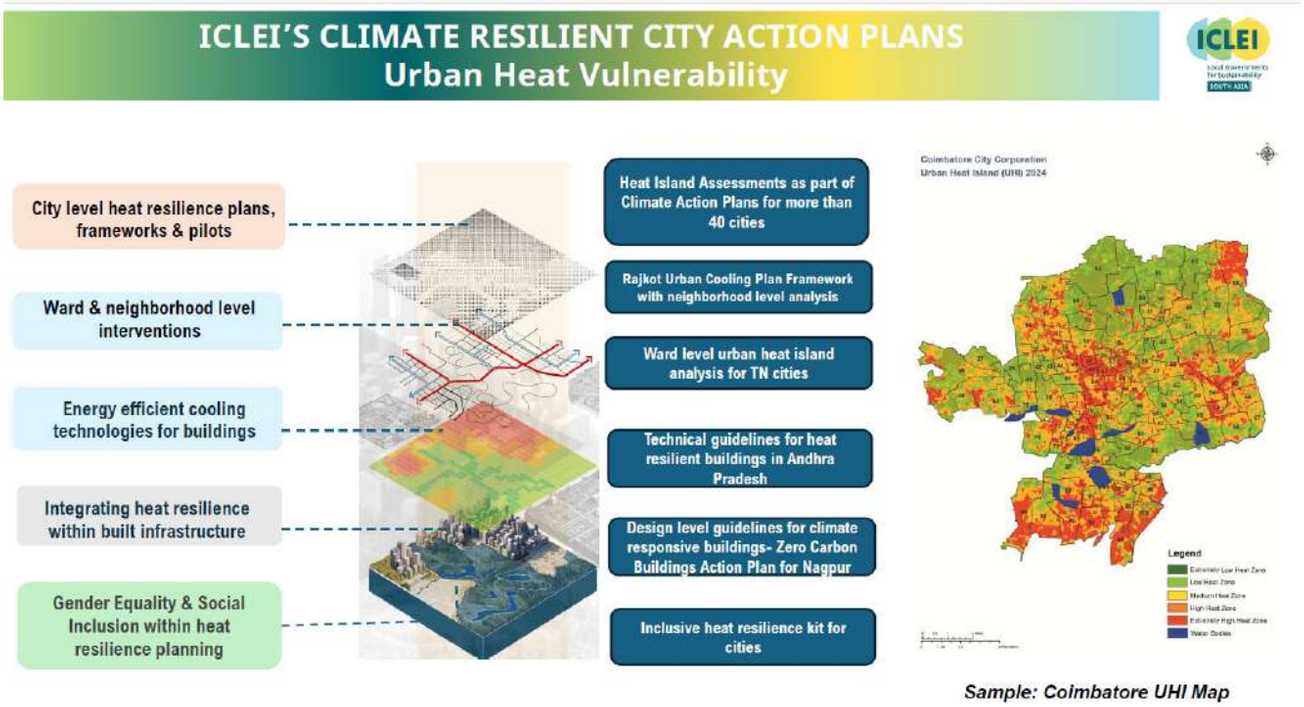
- Brings the analysis to building level
- Instead of the entire ward, clusters of buildings can be evaluated for various parameters or overall vulnerability
- OBI saves significant amount of time.

URBAN HEAT VULNERABILITY, GEO AI AND CAPACITY BUILDING

Speaker: Mr. Keshav Jha, ICLEI



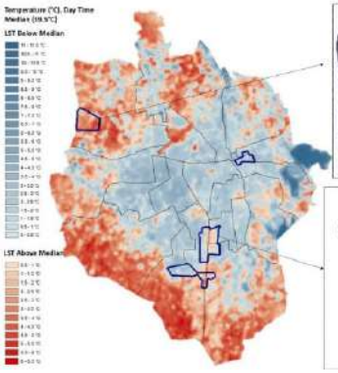

City Heat Resilience Tool Kit and
Heat Risk Assessment Planning Methodology
ICLEI
1 Understanding the root cause
Tools available
Categorising the cities
Understanding broad causes
Demonstration for Surat city
2 Identifying the solutions
Areas of intervention (Existing, new and peripheriel)
Type of intervention (Technological solutions, Institutional reforms and awareness generation)
Scale of intervention (Neighbourhood, city and region)
3 Prioritization of the solutions
Impact of the solution on health and environment
Timespan of implementation (Short medium/ long term)
Cost of implementation
Reforms in existing projects/ programmes
CDKN
Climate & Development Knowledge Network
City Heat
RESILIENCE
TOOLKIT
Heat Risk Assessment
Hazard
Exposure
Vulnerability
Heat hotspots
Exposure hotspots
Vulnerable hotspots
Composite Heat Risk Index
ICLEI South Asia Support Urban Planners and Decision Makers to Address Urban Heat Impacts and Support Vulnerable Populations Through Systematic Planning for Health Resilience


ICLEI'S CLIMATE RESILIENT CITY ACTION PLANS
Urban Heat Vulnerability
ICLEI
City level heat resilience plans, frameworks & pilots
Ward & neighborhood level interventions
Energy efficient cooling technologies for buildings
Integrating heat resilience within built infrastructure
Gender Equality & Social Inclusion within heat resilience planning
Heat Island Assessments as part of Climate Action Plans for more than 40 cities
Rajkot Urban Cooling Plan Framework with neighborhood level analysis
Ward level urban heat island analysis for TN cities
Technical guidelines for heat resilient buildings in Andhra Pradesh
Design level guidelines for climate responsive buildings- Zero Carbon Buildings Action Plan for Nagpur
Inclusive heat resilience kit for cities
Coimbatore City Corporation
Urban Heat Island (UHI) 2024
Legend
Sample: Coimbatore UHI Map

Neighborhood Level Micro-scale Thermal Analysis

(Using Drone mounted with RGB and Thermal Sensor)

Micro level information related to land use, built up form, surface area type, various material used and related emissivity, blue and green infrastructure etc.



Smart City – Green Field

Type of Built Form: Barren land, Water Body, Vegetation

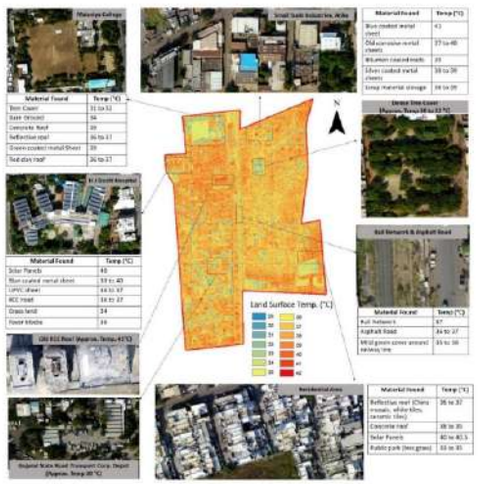
Surface Temperature: Water Body - ~35°C Barren Land - ~43°C to 45°C

Malaviya & Atika

Type of Built Form: Residential, University, Hospital, ST workshop, Government buildings, Gardens, Railway track and Industries

Surface Temperature: ~38°C to 42°C

Malaviya and Atika



Urban Greening/ Development of Urban Parks Dashboard

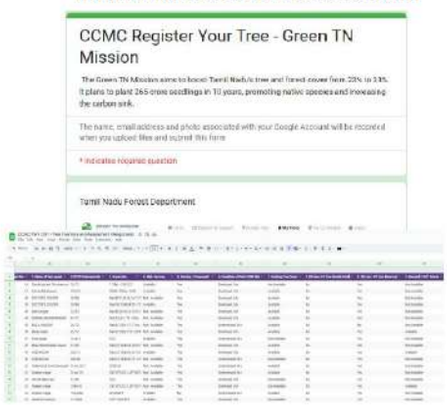
CCMC aims to enhance urban green cover by developing parks in 2,000+ OSR sites

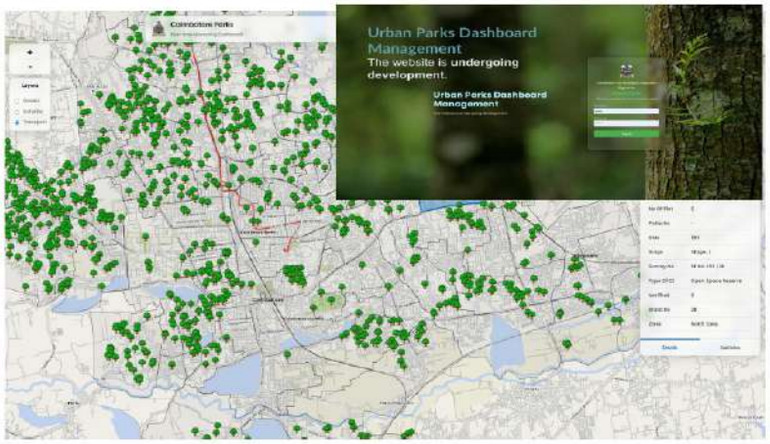
1	2	3	4	5
Baseline Assessment	Ward level tree cover mapping	Development of urban parks dashboard	Proposal to develop 100 OSR sites into parks and urban green spaces	Prioritization of remaining OSR sites for park development

Quantifying Coimbatore's "Urban Green" For Climate Action

Managed Geotagging, Legal Verification, And GIS Dashboard Development for 2,234 OSR Plots to Streamline Urban Land Monitoring And Development

Urban Parks and Tree Assessment





GeoAI Toolkit for Urban Planners

AI for Spatial Mapping, Analysis and Key Applications in Urban Planning

Land-use, Housing and Infrastructure

Land use classification
Identification of building/housing areas, and change (building footprints)
Detection of informal settlements and illegal housing
Generation of spatial plans and urban renderings
Urban green space and infrastructure management

Urban Basic Services

Intelligent traffic light control
Traffic flow monitoring and forecasting
Forecasting citywide energy demand and supply
Optimised waste collection routes
Mapping and detection of water bodies and utilities
Water quality and demand forecasting

Administration, Policy and Governance

Automated routine administrative tasks such as permit approvals, billing, service requests and citizen engagement
Modernising land cadastres, enhancing property tax collection
Digitising participatory budgeting processes

Disaster Management and Climate Resilience

Predictive modelling of hazard and vulnerability assessment (flooding, heat islands, sea-level rise, stormwater drainage, earthquakes, landslides)
Environmental monitoring of air and water quality, biodiversity
Early warning systems and disaster preparedness
Damage detection and situational awareness for response and planning

Public Health & Safety

Crime prediction and hotspot analysis
Prediction of disease incidence based on spatial factors
Mapping of health resources and accessibility
Modelling/monitoring air pollution and exposure risks, and real time updates for residents

Download Toolkit: https://unhabitat.org/ai-for-spatial-mapping-and-analysis-geoai-toolkit-for-urban-planners

Technical Training and Capacity Building on Heat Resilience Innovation

Training to Technical staff (Assistant Engineers, Technical Assistants, Tap Inspectors) equipped to map Coimbatore's water distribution network using Google My Maps - enabling accurate asset tracking and laying the foundation for GIS-based utility management

Municipal teams through GIS training to tackle localised climate impacts like UHI via real-time spatial data and targeted interventions

Enable the public, volunteers, and NGOs to directly engage in identifying and prioritising actions on temperature-related risks, with a strong focus on both mitigation and adaptation

Next phase will address industrial-level Heat Action Planning, and Heat Action Planning and strategies across the Local Planning Authority sub-region

Urban Biodiversity Assessments, Plans, Investments & Actions

53 Urban Greening Data Depository

ICLEI

1 Biodiversity Surveys

Detailed assessments of the diversity of Flora (herbs, shrubs, trees), Fauna (Grasshoppers, Butterflies, Moths, Odonata, Spiders, Birds, Mammals) and Ecosystems.

2 City Biodiversity Index (CBIs)

Developed for 18 cities

Kochi, Siliguri, Gangtok, Jammu, Srinagar, Hyderabad, Bangalore, Chennai, Visakhapatnam, Vijayawada, Tirupati, Kadapa, Itanagar, Dehradun, Indore, Bhopal, Noida, Rajkot

3 People's Biodiversity Registers (PBRs)

Developed for 17 cities amd 56 villages in India

Goa, Chandigarh, Delhi, Thane, Gangtok, Ichalkaranji, Nagpur

4 Local Biodiversity Strategy and Action Plan

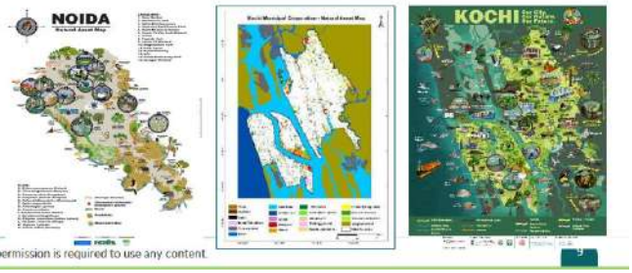
Developed for 10 cities in India

Kochi, Gangtok, Rajkot, Jammu, Srinagar, Nagpur, Indore, Bhopal, Udaipur, Hyderabad

5 Illustrated Natural Assets Map

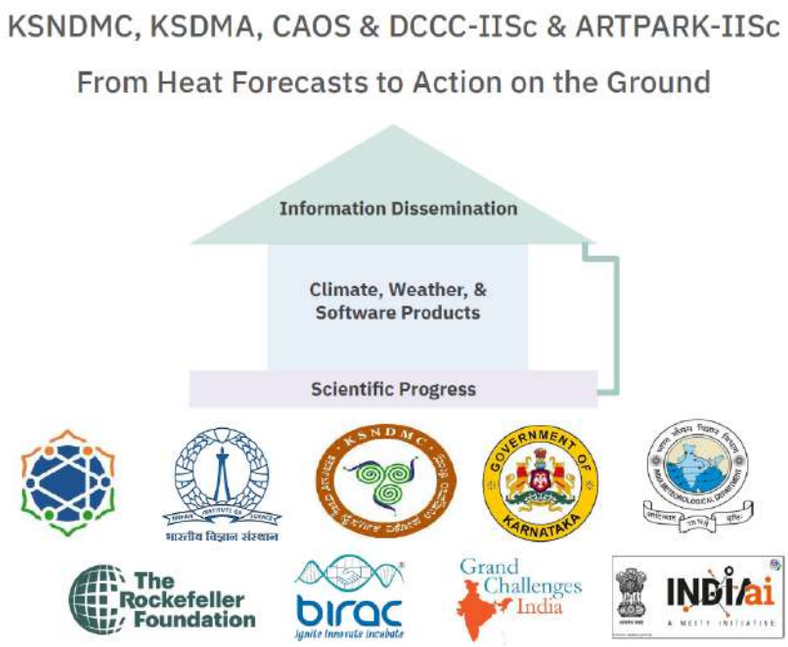
Developed for 8 cities

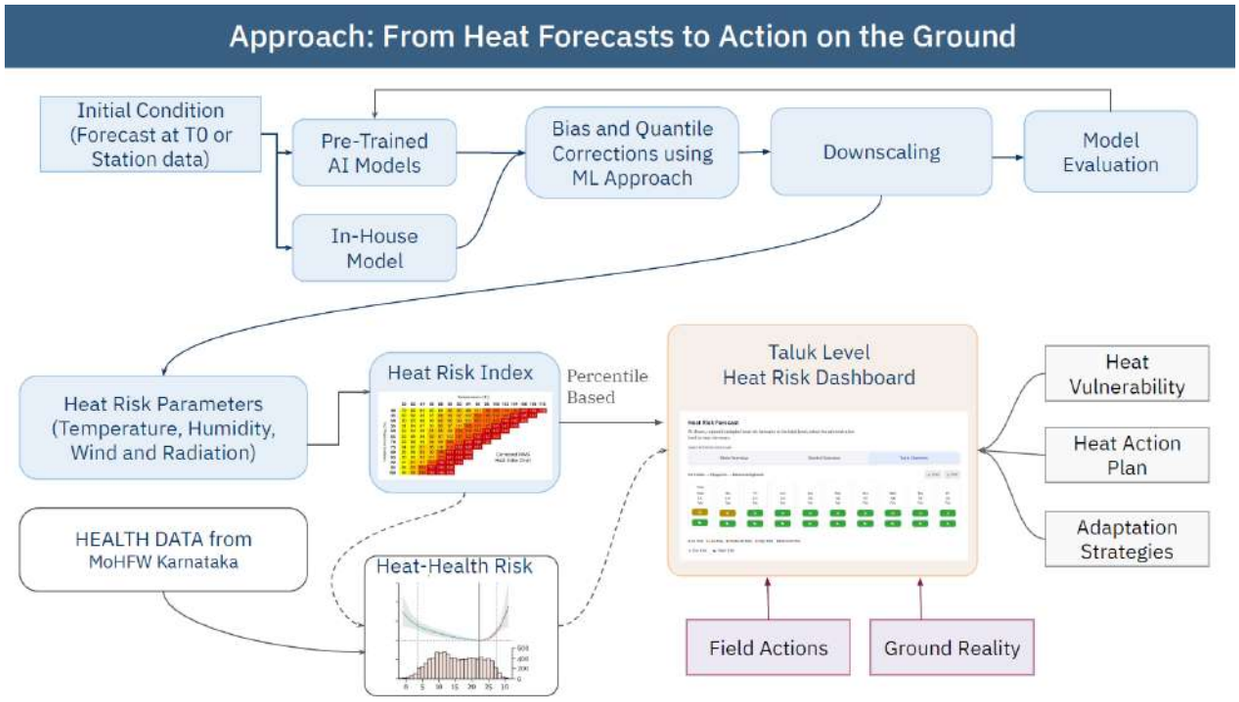
Kochi, Gangtok, Jammu, Srinagar, Nagpur, Indore, Noida, Hyder



AI-ENABLED HEAT RISK FORECASTING

Speaker: Mr. Harish Nawari, Indian Institute of Science





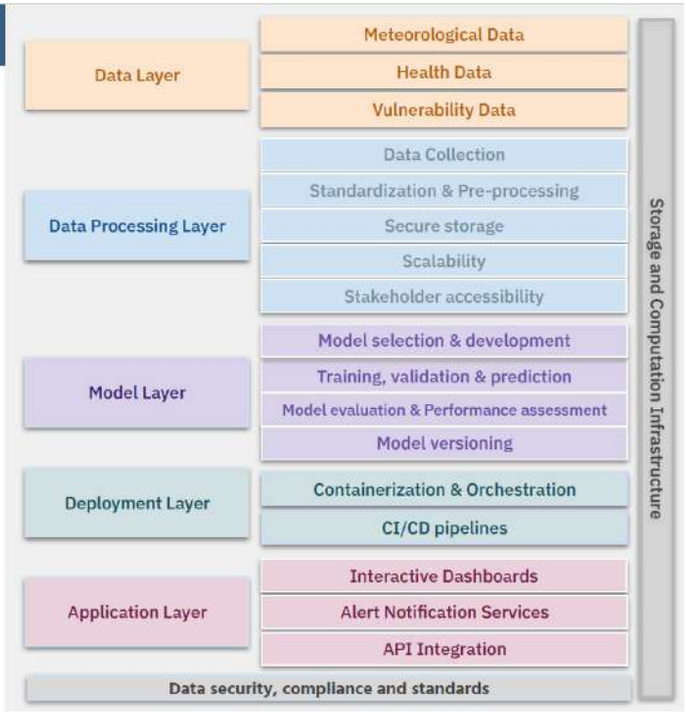
Technology Stack

IMD | IMDAA | KSNDMC

ERA | NCEP | NPCCHH & IHIP

Products:

- Code: Open-Source -Github Repo
- Data: AI-Models Hindcast Data + Forecast Data
- Dashboard
- MeghaBase: It provides curated India-specific datasets of historical and forecast heat-stress metrics derived from multiple indices.



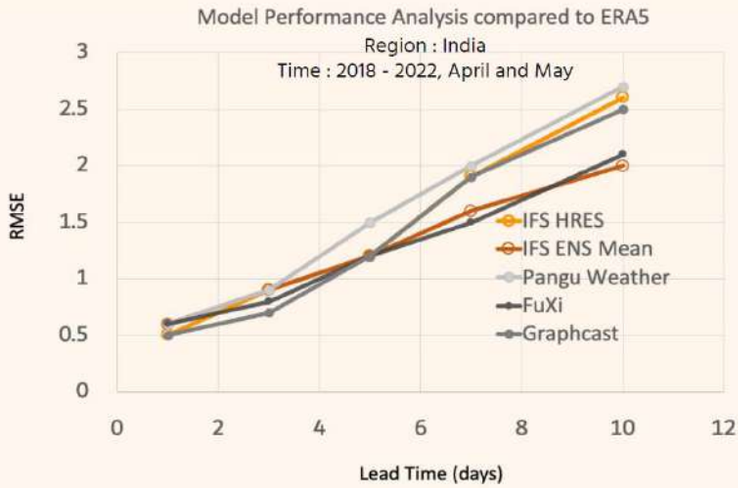
Forecast modelling - AI-WP models

Different types of AI models employed for the inferencing. Please note the last row corresponds to physical model

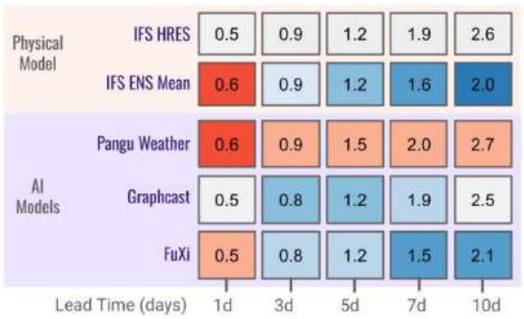
AI - Model	Model Architecture	Output Lead time Output Frequency	Output Variables Required for Heat Stress
Fourcast net V2	Fourier Neural Operator	10 days , 6 hourly	Temperature , Humidity, Horizontal wind,
Pangu	Vision Transformer	10 days, 3 hourly 6 Hourly	Temperature , Humidity, Horizontal wind
Graphcast	Graph neural networks	10 days 6 hourly	Temperature, Humidity, horizontal wind
AIFS	Graph neural networks	10 days 6 hourly	Temperature, dew point temperature, horizontal wind
Fuxi	Vision Transformer	15 days 6 hourly	Temperature, Humidity, horizontal wind
IFS HRES ECMWF (NWP-model)	State of the art conventional numerical (physical model) weather forecasting	10 days 3 hourly - 6 hourly	Temperature, dew point temperature, horizontal wind,

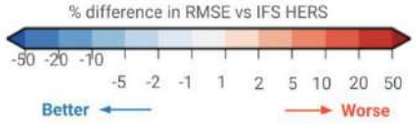
Forecast modelling - AI-WP Performance - RMSE

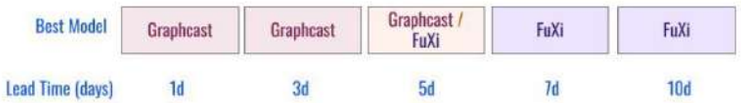
- AI models perform as good – or even better than – deterministic physical models
- Therefore AI models can be effectively utilised for forecast
- **Ability to generate forecasts within minutes on a GPU powered workstation/laptop**
- **Democratisation of forecasts**



Forecast modelling - AI-NWP Performance - Scorecard

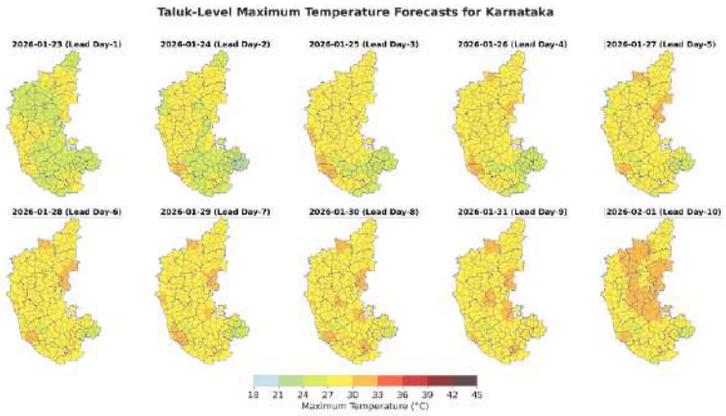






- Showing RMSE for surface variables, with absolute values compared against ERA5.
- Colors represent percentage differences relative to the IFS HRES baseline, with blue indicating improved performance and red indicating worse performance.
- Deterministic AI models have scores comparable to ensemble model at longer leads

AI-Enabled Heat Stress Forecasting for Early Warning



"The focus is not exact temperature accuracy, but on the early identification of high heat-risk periods."

- IMD forecasts remain the official and primary reference.
- The AI-based forecasts is an additional layer to detect early signals of extreme and multi-day heat events.

Bias-Quantile Correction with Station data	Spatio-temporal downscaling	Multi-models to improve confidence	Custom heat stress indicators

How Heat Stress Becomes Heat Risk

"Risk reflects how abnormal and sustained the heat stress is for a given location."

- Combinations of temperature, humidity, wind, and sun exposure
- Interpreted relative to local climate, not fixed numbers
- Accounts for local acclimatisation
- Flags unusual and persistent heat stress
- Accounts for daytime and night time stress
- Looks beyond single-day spikes

WBGT | UTCI | Tmax | Tmin | EHF | EHF_HI

We use extended heat-index (Yu & Romps, 2022)

No Risk	EHF_HI ≤ 0
Low Risk	0 < EHF_HI ≤ P50
Moderate Risk	P50 < EHF_HI ≤ P75
High Risk	P75 < EHF_HI ≤ P90
Extreme Risk	EHF_HI > P90

Heat Risk Dashboard: A Common Operational Picture

This is not just a forecast or a dashboard – it is an operational system that links predictions with field checks and real actions on the ground.

Link to Dashboard
https://karnatakaheatriskforecast.vercel.app/forecast

From Information to Action: Closing the Feedback Loop

Daily 15-minute stand-up meetings with state departments (disaster management, health, labour, and others) to review heat risk.

Departments brief planned actions and field-level suggestions to guide on-ground response.

Ground observations and health-facility assessments help interpret forecasts and identify high-risk locations.

Taluk-level action updates on the dashboard create a feedback loop, linking heat-risk information with preparedness and on-ground response to heat-related issues.

Filling Ground Reality Gaps

Outdoor Heat Stress Observational Measurements

- Heat stress varies widely within cities, with local hot-spots not seen in city- or district-level data
- Neighbourhood-scale ground measurements are limited, affecting forecast interpretation
- Student-led pilot initiated by KSDMA & KSNDMC with ARTPark, IISc, and local colleges

Health Facility Readiness for Heat Illness

- Preparedness varies across health facilities, influenced by infrastructure, staffing, and power availability
- Ground assessments reveal gaps not visible in routine administrative data
- Pilot completed by CPH–NIMHANS & NPCCHH, Karnataka, leveraging Master's in Public Health students

DAY 2: INAUGURAL SESSION

Dr. Krishna S. Vatsa, Member & HoD, NDMA, Financing Heatwave Management

Financing Heat Wave Management: Framing Issues

National Disaster Management Authority
12 February 2026

Financing Heat Wave Management

From Seasonal Relief to Climate Risk Investment

Heat waves are slow-onset climate disasters requiring structured, multi-year financing.

Context:

- Increasing frequency, intensity, and spatial spread
- High mortality and morbidity
- Productivity loss and urban system stress
- Disproportionate impact on vulnerable populations

Framing:
Heat resilience is not welfare expenditure — it is fiscal risk management.

Why Heat Waves Remain Underfinanced

Challenges in Risk Perception

- No visible destruction (unlike floods/cyclones)
- Impacts are dispersed and cumulative
- Often seen as “seasonal discomfort”

But Evidence Shows:

- Significant excess mortality
- Labour productivity losses (construction, agriculture, informal sector)
- Increased health system burden
- Urban heat island intensification

Policy Imperative:
Shift perception from discomfort to disaster risk.

The Continuum of Heat Risk Management

Heat resilience lies across a structured continuum:

1. Preparedness (Seasonal)

- Early warning systems
- Public advisories
- Health system readiness
- Vulnerability mapping

2. Response (Alert-Based)

- Cooling centres
- Hydration points
- Adjusted working hours
- Temporary shaded areas

3. Mitigation (Structural, Multi-Year)

- Cool roofs
- Urban greening
- Water body restoration
- Passive cooling in housing

Financing must support the full continuum — not just relief

From Annual Spending to Multi-Year Programmes

Current Pattern

- Ad hoc seasonal allocations
- Fragmented efforts
- Pilot-based interventions

Required Shift

- Bundled, multi-year heat resilience programmes
- Clear differentiation between operational and capital support
- Maintenance provisions built into funding

Heat financing must be predictable and sustained.

Governance Architecture for Heat Financing

Heat risk is hyper-local — but coordination is multi-level.

Local Level (ULBs, Districts)

- Cooling centres
- Shaded markets
- Cool roof implementation
- Water access points

State Level

- Technical standards
- Capacity building
- Vulnerability assessments
- Inter-departmental convergence

National Level

- Financial incentives
- Guidelines and frameworks
- Digital monitoring systems
- Integration with IMD early warning

Finance must align with governance roles.

Financial Instruments for Heat Resilience

Different needs require different instruments:

Seasonal Operational Grants
- Preparedness & response
- Annual recurring

Capital Investment Grants
- Cool roofs
- Urban greening
- Water restoration
- Multi-year window

Blended / Co-financing Models
- Central + State + ULB cost-sharing
- CSR / philanthropy participation

Design must prioritize simplicity and scalability.

Allocation Framework- A Risk-based Model

A structured financing model may include:

1. Base Allocation

Minimum seasonal preparedness support to all districts.

2. Risk-Weighted Allocation

Additional funding to high heat-vulnerability districts.

3. Performance Incentives

Linked to:
- Functional Heat Action Plans
- Reporting compliance
- Vulnerability reduction indicators

Objective: Equity + Objectivity + Accountability.

Pooling and Convergence of Resources

Disaster funds alone are insufficient.

Potential Convergence Sources:

- SDRF / SDMF / NDMF
- Municipal budgets
- Smart Cities / AMRUT
- G-RAM G
- Health Missions
- CSR & philanthropy

Policy Enablers:

- Heat resilience indicators in performance-linked grants
- City-level climate resilience pools
- Template co-financing agreements

Move from isolated funding to financial layering.

Monitoring & Demonstrating Impact

Financing must be evidence-based.

Key Metrics:

- Reduction in heat-related mortality
- Hospital admissions during heat alerts
- Number of cool roofs installed
- Tree canopy increase
- Surface temperature reduction in hotspots
- Usage rates of cooling centres

Institutional Support:

- Lightweight digital dashboards
- Integration with IMD alerts
- Alignment with Heat Action Plans

Accountability sustains financing.

Conclusion– Building a Heat Resilience Financing Ecosystem

Heat financing must be:

- Risk-based
- Equity-focused
- Multi-year
- Convergent
- Locally responsive
- Outcome-oriented

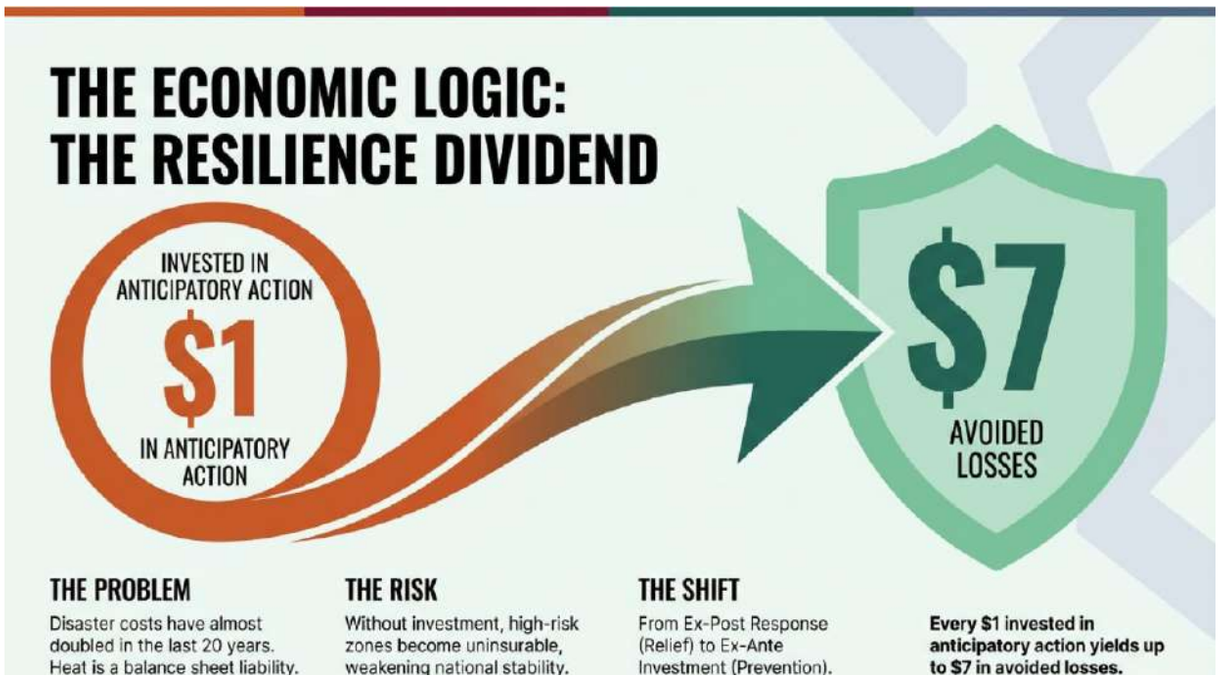
Core Message:
This is not about managing temperature.
It is about protecting livelihoods, reducing fiscal risk, and strengthening climate governance in a warming India.

Structured financing today prevents far greater economic losses tomorrow.

DAY 2: INAUGURAL SESSION

HIGH-LEVEL PRINCIPLES FOR INVESTING IN DRR – A G20 OVERVIEW

Shri Abhilash Panda, UNDRR

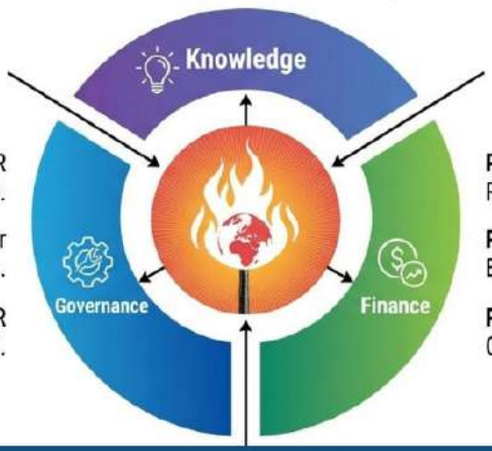


Newly Endorsed ! G20 Voluntary High-Level Principles for Investing in DRR

Developed by the G20 Disaster Risk Reduction Working Group
Indian Presidency (2023) • Brazilian Presidency (2024) • South African Presidency (2025)

7 Principles at a glance

Knowledge
Principle 1: Invest in Risk Information, Knowledge, and Innovation.



Principle 2: Develop DRR Financing Strategies.

Principle 3: Embed Disaster Risks in Sector Plans.

Principle 4: Enable DRR Investment at the Local Level.

Principle 5: Manage Residual Risk (Finance ahead of shocks).

Principle 6: Encourage Business Resilience.

Principle 7: International Collaboration.

Principle 1: Data is the Currency of Finance

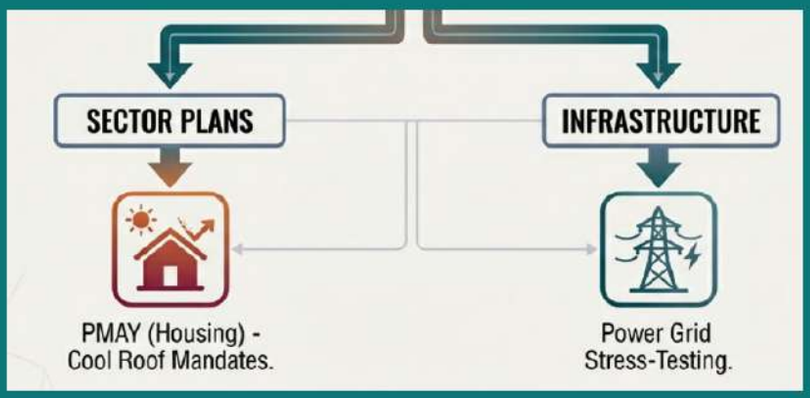
- MANDATE: Governments must maintain risk registers and adopt clear risk metrics
- ACTION: Overlay census data with heat stress metrics to prioritize vulnerable population.
- TECH: Leverage AI and earth observations to scale up and fast track.

Principles 2 & 3: Financing strategies and mainstreaming resilience

OPPURTUNITY:

Integration nature-based colling and design standards into the Pradhan Mantri Awas Yojana (PMAY)

If we build millions of homes, they must be habitable in future climate scenarios.



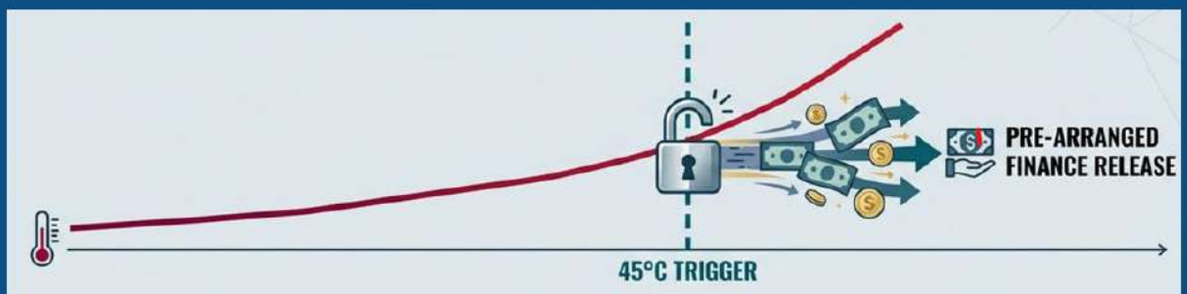
Principle 4: Empowering Local Action

The Challenge: A significant share of investments occurs sub-nationally, yet local governments often lack resources

The Mechanism: Include 'disaster risk' as a variable in the formula for distributing national resources.

Focus: Ensure locally-led appropriate solutions and ownership.

Principle 5: Manage Residual Risk and Finance ahead of Shock



Conditional Grants
Fiscal transfers based on meeting heat-resilience benchmarks.

Parametric Insurance
Automatic payouts based on weather triggers

Adaptive Social Protection
MGNREGA climate wages for laborers during extreme heat days.

Principle 6: Unlocking Private Capital & Resilience of Private Sector

34 MILLION

FULL-TIME JOBS PROJECTED LOST BY 2030

Due to heat-induced productivity declines, specifically targeting Agriculture and Construction sectors.

- High-heat days cause mandatory work stoppages and reduced shifts.
- Result: Delayed manufacturing timelines and soaring project costs.

Workforce Safety Standards

Innovation: Develop instruments like Resilience Bonds to finance DRR.

Transparency: Encourage businesses to assess and disclose their risk dependencies.

Principle 7: International Solidarity

India could support the Global South in sharing Heat Action Plans (HAPs) and cool roof technologies.

Promote Shock Resilient Loans, incorporating " Disaster Clauses" during declared heat event, freeing liquidity.

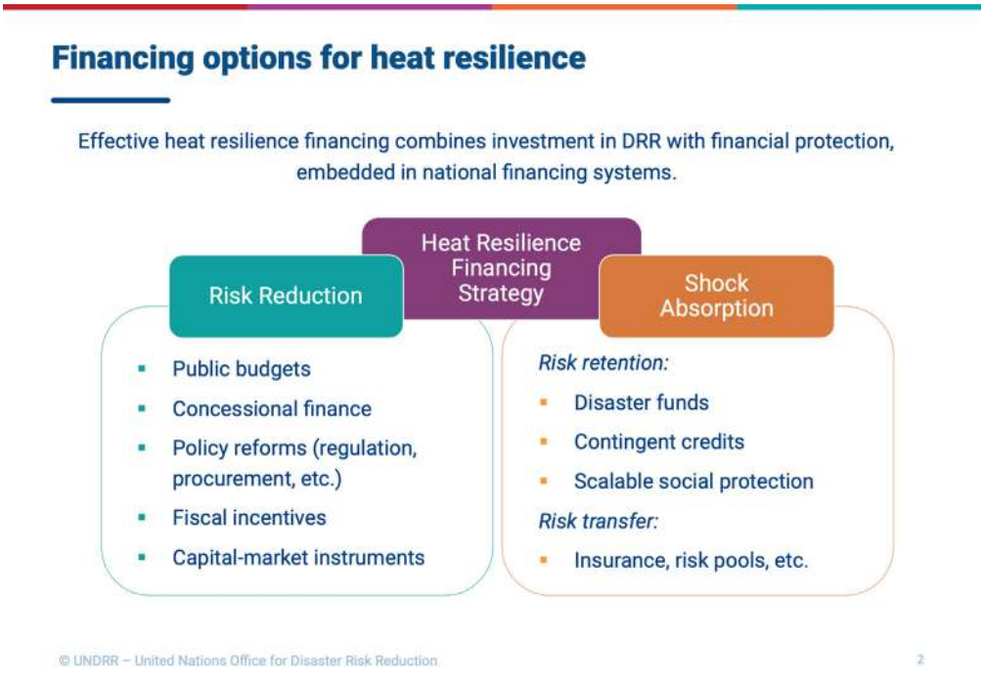
Operationalizing the Principles

THE HEAT FINANCING ECOSYSTEM

- ☐ **AUDIT:** Review National/State HAPs for financing gaps (Principle 2).
- ☐ **PILOT:** Launch parametric insurance pilot for construction workers (Principle 5).
- ☐ **POLICY:** Update National Disaster Mitigation Fund to include "Anticipatory Heat Measures" (Principle 3).

DAY 2: TECHNICAL SESSION- I

Mr. Mathieu Verougstraete, Head of Infrastructure and Finance for Resilience Unit, UNDRR



Leverage public budget

Anchors heat resilience within core public financial management systems

- How to link heat action plan to **budgetary processes** (e.g., embedding in sector budget allocation, medium-term expenditure planning)
- How to create **accountability** and shared responsibility

  (e.g., inter-department task force, Chief Heat Officers, budget tracking mechanisms/special budget line)
- How to embed extreme heat considerations in **public investment management**

  (e.g., project screening criteria, stress-testing, etc.)

Strategic use of concessional resources

Many heat-resilience building investments do not create or have limited cash flows, making them difficult to self-finance

Non-revenue / public good

- Urban greening in public spaces
- Community cooling programs

Payback potential *(cost savings / user fees)*

- Solar + storage powering cooling infrastructure
- Commercial real estate retrofits

→ Non-revenue / public good may need to be financed by public resources

→ Concessional finance provides a solution for projects generating some revenues but not enough for commercial financial viability

Example: $880 million Cooling Facility implemented by the World Bank/ Energy Sector Management Assistance Program (ESMAP) with support from GCF

Incentivize private sector investment

Fiscal incentives and norms **shift investment decisions** toward heat-resilient solutions by changing the financial calculus and the rules of the game

Fiscal Incentives

- **Tax credits, rebates, and subsidies** for heat-resilient buildings, efficient cooling, cool roofs, etc.

Norms

- **Building codes** (heat-resilience performance) and certification
- **Disclosure** and **certification** norms.

Example - Singapore's Green Mark

- Support passive colling, reflective materials
- Future-proof asset against future regulation
- Increase value and brand recognition

Tap innovative instruments such as resilience bonds

Resilience bonds open an avenue for large upfront capital investment

(e.g., building retrofits, green corridors, cool roofs in schools, grid upgrades)

Benefits of resilience bonds

- **Signal** to the market (and population) a strong **commitment** to this priority
- Attract institutional and **climate-focused investors** (e.g., labelled bonds)
- Encourages heat-resilience planning and performance **tracking** (to report to investors)
- Potentially **self-sustaining** if the lower future public costs (in terms of health emergencies, infrastructure degradation, energy demand spikes, etc.) exceed the associated financial costs

Example: Paris (France) - €300M municipal Bonds financing urban greening (tree planting – park)

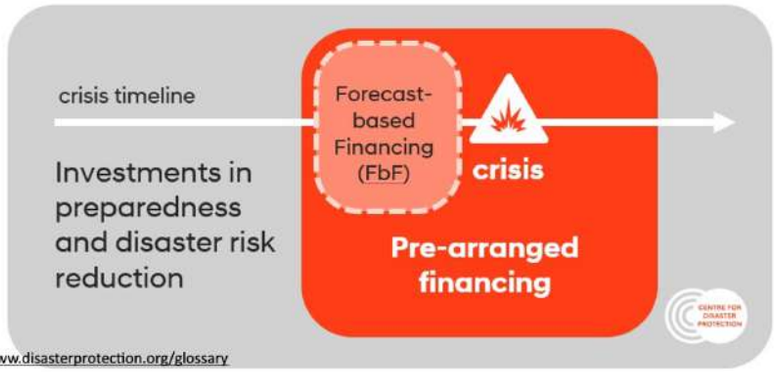
Speaker

Mr. Amar Patel, Risk Finance Adviser, Centre for Disaster Protection (CDP)

What is pre-arranged financing?

Financing that has been:

- approved **in advance** of a crisis and
- that is guaranteed to be **released to a specific implementer**
- when an eligible event occurs as defined by **pre-identified trigger conditions.**



Source: https://www.disasterprotection.org/glossary

WHY DOES PRE-ARRANGED FINANCING MATTER

Pre-arranged financing has the potential to significantly increase the predictability, speed and effectiveness of responses to shocks, reducing the human and financial costs.

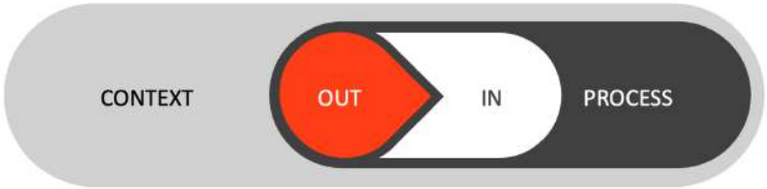
Pre-arranged financing also supports, rather than undermines, national leadership on disaster risk management.

SCOPE OF FINANCING INSTRUMENTS

A FRAMEWORK FOR DISASTER RISK FINANCE

1. **Context** – the underlying risk, need, and wider factors to consider when developing Disaster Risk financing (DRF)-based approaches.

3. **Money-in instruments** – the pre-arranged finance instruments in place to supply the right amount of money at the right time.

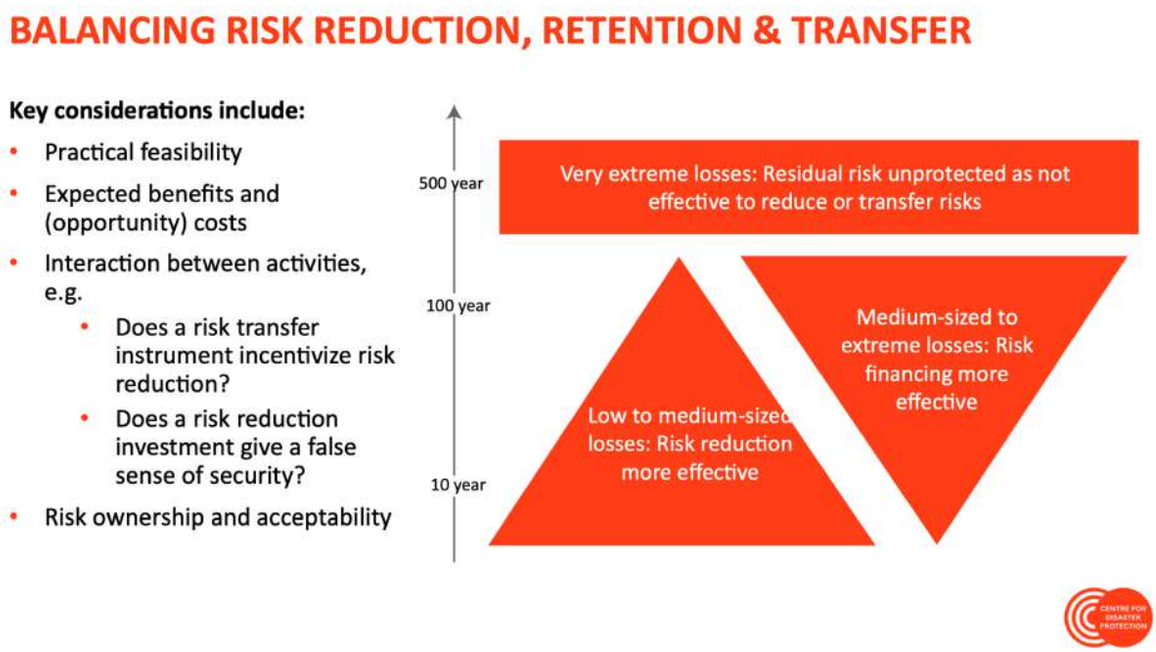


2. **Money-out systems** – the delivery systems and plans in place that use money to reduce the impact of disasters on people.

4. **Project management processes** – practical considerations, including project implementation processes, costs, contingencies, and monitoring and evaluation.

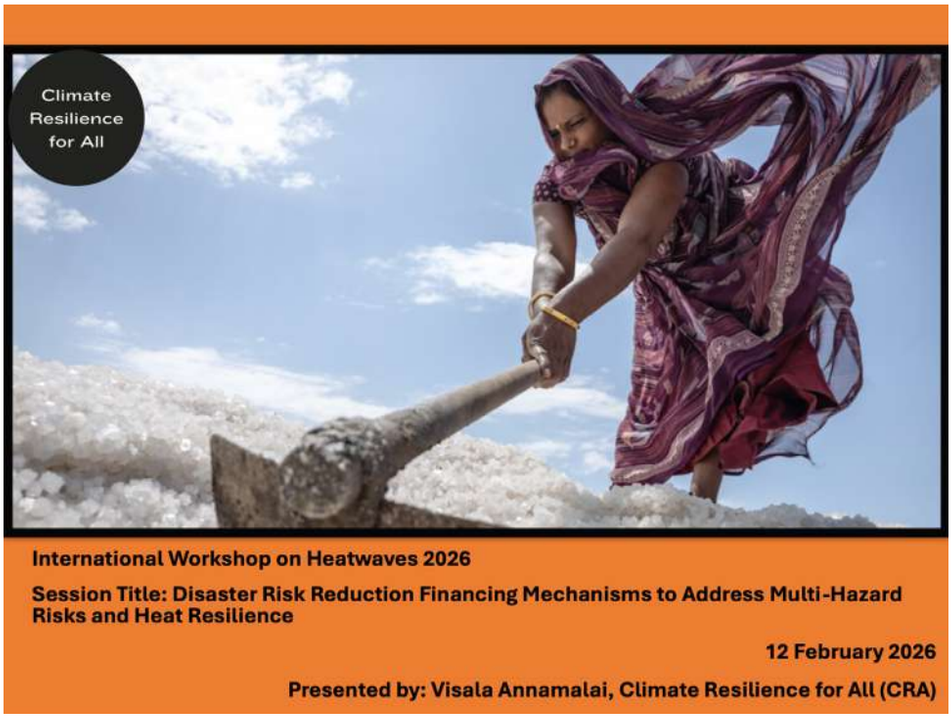
THE CASE FOR PRE-ARRANGING DRF

- Enables **rapid and reliable disaster response** through automatic release of funds
- **Accelerates recovery**, lowering infrastructure damage and protecting livelihoods
- **Reduces economic trade-offs** and budget disruptions post disaster
- **Encourages investment** in preparedness and early-warning systems
- **Minimises dependence** on reactive and unpredictable aid

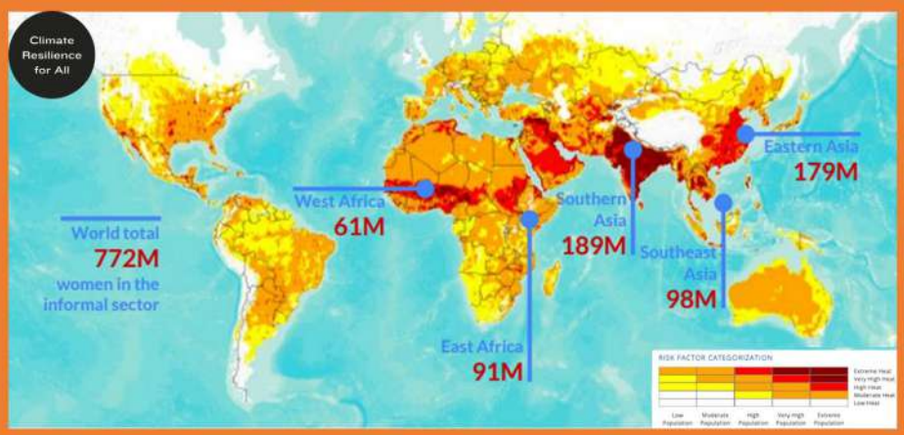


Speaker

Ms. Visala Annamalai, Climate Resilience for All (CRA)

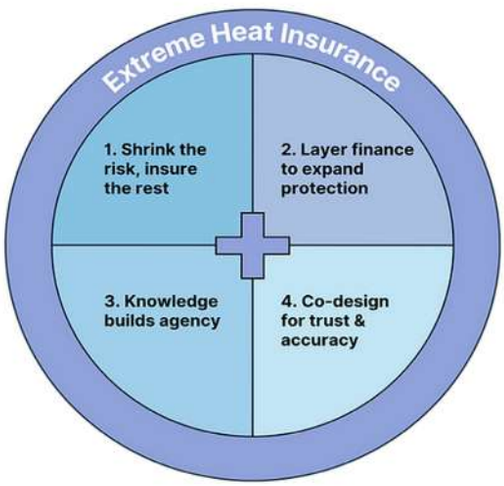


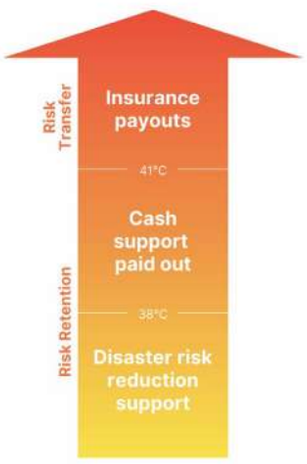
Gitaben **is not alone—roughly 772 million women in the informal sector globally—are concentrated in areas most exposed to extreme heat**



WE CO-DESIGN AND CO-DELIVER WOMEN-CENTERED SOLUTIONS: THE WOMEN'S CLIMATE SHOCK AND LIVELIHOODS INSURANCE (WCSI)

Over the years of work, and rolling of WCSI in multiple countries, we have identified four hard-won lessons on what works. The secret isn't just "insurance"—it's a combination of risk reduction and transfer which is essentially the WCSI model.





Testimonials from WCSI participants...

"Nobody was willing to enroll. They said I was fooling them. Then they got umbrellas... Then 120 vendors enrolled. **Some of them got jugs and umbrellas**... **Some got 400 rupees, some 800 rupees.** Then they said I was not fooling them."

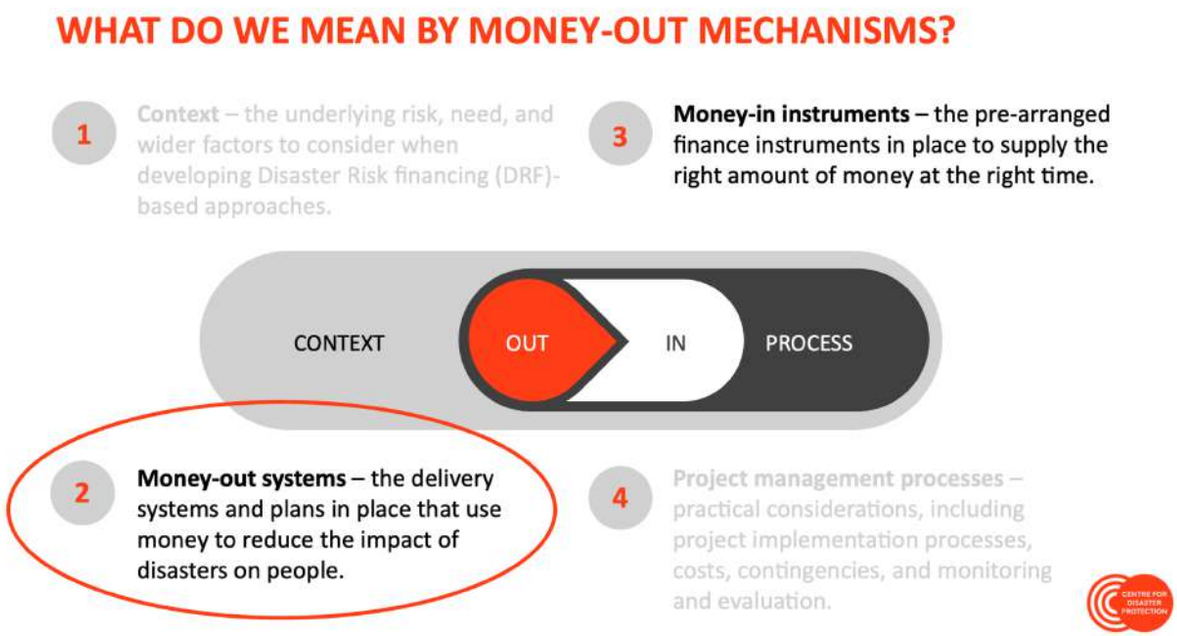
- Shiva Ben, community leader

"I enrolled 350 members. When they got ₹400 [just under $5], they said **it was like ₹4000, as it came at a critical time of life**..."

- Jigyasa, SEWA grassroots leader

DAY 2: TECHNICAL SESSION- IV

Amar Patel, Lead Risk Advisor, Centre for Disaster Protection

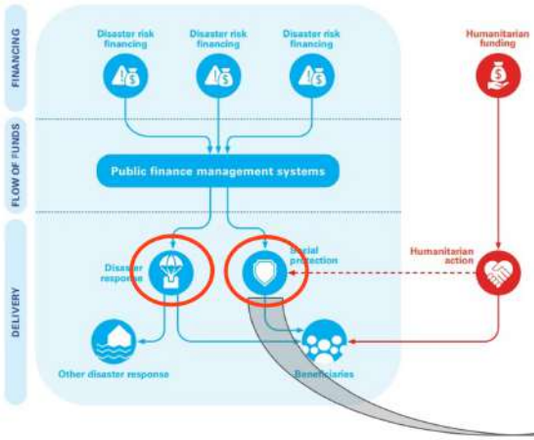


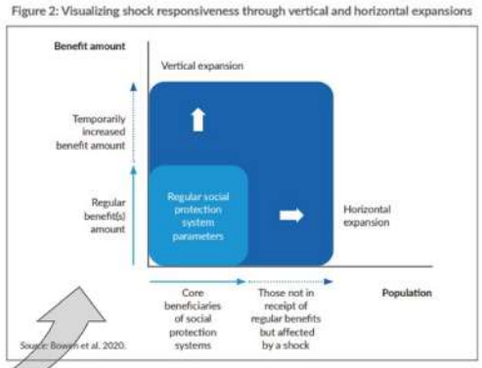
WHY ARE MONEY-OUT MECHANISMS SO IMPORTANT?

PAIRING MONEY IN WITH MONEY OUT – PARAMETRIC INSURANCE FOR EXTREME HEAT

- **Money In** – Parametric Insurance based on an Extreme Heat related trigger
- Effective because there is clear articulation of when the payout will occur (unlike indemnity, does not require loss to be calculated)
- Benefit of parametric policy is dependent on effect **Money Out** mechanisms
- Automatic trigger with pre-determined payout can be very effective when paired with a fast low-cost delivery (such as automatic mobile/banking payment)
- Complications can arise (KYC, access to funds, establishment of banking practices in community)
- Positive examples include MHT and SEWA.

MONEY-OUT: DEDICATED SYSTEMS IN PLACE



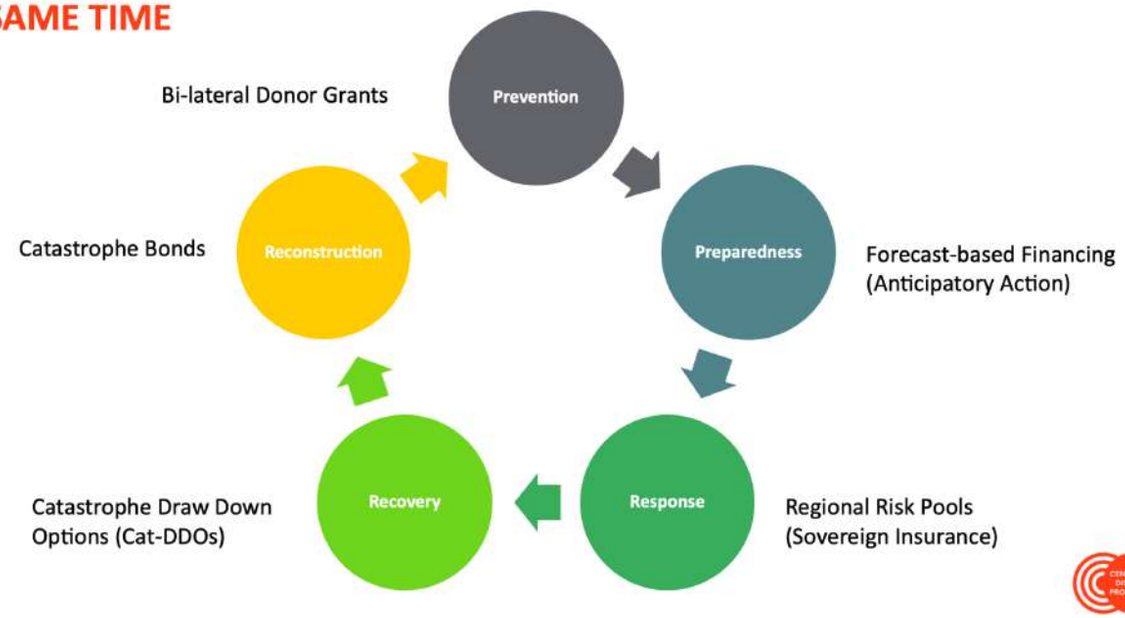


DEDICATED EMERGENCY RESPONSE SYSTEMS like Shock Responsive Social Protection

Source: UNICEF: Disaster Risk Financing and Social Protection-East Asia and Pacific, 2023

Source: World Bank Adaptive Social Protection ,2020

NOT EVERY DRF INSTRUMENT SHOULD RELEASE FINANCING AT THE SAME TIME



Speaker

Bhawana Ahuja, Programme Lead, WRI India

..but MSMEs and Workers are **extremely vulnerable to climate impacts**

- India ranks **9th** in Climate Risk Index (2026)
- In 2023, extreme heat cost India an estimated **181 billion potential labour hours**, translating into income losses of about **Rs 13 lakh crore** (about $141 billion)
- India could **lose over 34 million** full-time jobs annually by **2030** due to heat-induced productivity loss
- 2023 Chennai Floods: 4,800 MSME units across 24 industrial estates, leading to losses worth at least **₹3,000 crore**
- 2015 Chennai Floods: Automobile industry lost **USD 2.1 billion**; **50,000** MSME jobs lost
- 2006 Surat Floods : Textile business lost **USD 36 million**

Sources: Lancet 2023; ILO 2019, Media Sources

WRI INDIA

WRI India aims to Build the Resilience of MSMEs

Stakeholder Engagement & Ecosystem Alignment

- Structured consultations to identify priority clusters and sectors
- State Level Launch in GJ and TN
- Formation of Cluster Level Advisories
- Sustained Engagement with MSMEs, industry bodies and local institutions

Data-driven Prioritization and Targeting

- Cluster Level Multi-hazard Mapping to Heat and Flood Risks
- Climate Trend Analysis

Risk Assessment

- **300+** MSMEs units surveyed across:
  Surat (Textiles sector), Chennai & Coimbatore (Automotive sector)
- FGDs with **100+** workers
- Expert Consultations

Capacity Building & Action Enablement

- Multi-stakeholder platforms for Heat and flood risk preparedness
- Development and dissemination of heat-risk communication tools

WRI INDIA

Challenges to Risk Financing

- Low risk perception; heat seen as short-term and seasonal → limits preparedness and demand.
- Limited access to finance, insurance, and cooling solutions → constrains adaptive investment.
- MSMEs in a policy blind spot; misaligned public assistance → reduces external support.
- Lack of granular heat-impact data and awareness → weakens targeted action for developing risk financing products
- Lack of Business case for investment.
- Lack of business continuity plans by MSMEs and emergency funds.
- Heat-trapping buildings, poor ventilation, space constraints and regulations → restrict physical coping capacity.

WRI INDIA

National Disaster Management Authority (NDMA)
Government of India
NDMA Bhawan, A-1, Safdarjung Enclave,
New Delhi-110029