



APCTT
Asian and Pacific Centre
for Transfer of Technology

Consolidated Reply

Query 9 -

Technologies for Responding to Urban Heat in Asia-Pacific

**Community of Practice (CoP)
on Climate Technologies**





Community of Practice (CoP) on Climate Technologies

Shared Experiences, Smarter Solutions for Climate Action and Resilience

The Community of Practice (CoP) on Climate Technologies, launched by the Asian and Pacific Centre for Transfer of Technology (APCTT), aims to address climate change challenges in the Asia-Pacific region through technology cooperation and transfer. By leveraging the region's innovation capacities and good practices, the CoP enhances access to critical knowledge on climate technologies, fosters cross-border collaboration, and connects professionals engaged in delivering technological solutions to climate change. The objective of this Community of Practice is to:

- Promote collaborative problem-solving and policy-relevant dialogue
- Support the localization and transfer of innovations aligned with national priorities

Original Query by: Dr. (Ar.) Sujata Kodag, President, Eco-Logic-Foundation, India and Md Selim Reza, Ministry of Finance, Bangladesh

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Urban heat is becoming a major challenge in rapidly growing cities, particularly in developing countries where urban expansion is often unplanned.

We request community members to share perspectives that bring together both technology-driven and policy-oriented solutions. Some key areas that may be useful to explore include:

1. What are the most effective tech solutions (like geospatial data, IoT sensors, AI, etc.) cities are using today to understand and reduce urban heat?
2. How can cities practically scale green solutions (like urban forests, green roofs) and cool materials in dense, fast-growing areas?
3. What kind of planning frameworks, digital tools, and policies — including financing mechanisms — are needed to make these solutions work on the ground, especially in resource-constrained settings?

Your experiences and insights will contribute to regional knowledge sharing and inform inclusive strategies for urban heat management in the Asia-Pacific region and would be greatly appreciated

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1. Summary of Responses

The Query on Technologies for Responding to Urban Heat in Asia Pacific addressed three critical questions: what technologies are working for heat diagnosis and reduction; how green and cool solutions can be scaled beyond pilots to reach the most disadvantaged; and what governance and financing mechanisms need to be in place for interventions to work on the ground.

The most important point of agreement was that no single technology is sufficient — only integrated approaches will work. [Satellite-derived Land Surface Temperature \(LST\)](#) data from Landsat, ECOSTRESS, and Sentinel-3 gives planners a city-scale heat island map. GIS-based spatial analysis allows them to overlay this with population and building density data to identify where thermal exposure and social vulnerability intersect. However, satellite data often misses street-level conditions, and ground sensor networks rarely cover entire cities. [High-resolution climate models](#) such as UrbClim and WRF at 100-metre resolution, combined with machine learning methods predicting the Universal Thermal Climate Index (UTCI) at pedestrian scale, offer information more directly relevant to health outcomes than surface temperature alone — a point supported by [NASA Earthdata satellite training](#) resources and AI-driven [systematic reviews](#) of urban heat forecasting .

Several cities are already moving in this direction. [Heat Action Plans](#) — the most important planning instruments are in use in Delhi and Varanasi, while digital twins in Coimbatore and Bhopal allow scenario testing before implementation, embedding AI, satellite data, and 2050 projections into ward-level, building-level vulnerability planning. Mumbai's Municipal Corporation tracks solar-reflective paint performance on schools in real time via IoT sensors. Pairing predictive modelling with real-time GIS-based early warning systems, as proposed in the [Urban Heat Management Strategy for Asia-Pacific](#) , represents the most comprehensive regional framework currently available. Other approaches include aligning smart city platforms with the UN United for Smart Sustainable Cities ([U4SSC](#)) framework and city-wide hotspot mapping in Dhaka. Where formal sensor networks are sparse, [vehicle-mounted sensors](#) operated by volunteers generate hyperlocal surface

temperature data that neither satellites nor fixed networks capture.

A [colour-coded heat alert](#) system sending zone-specific advisories to residents, paired with public water supply points during extreme heat events is another good technology.

On what works at scale, an award-winning programme in [Indonesia](#) applies high solar-reflective paint (SRI 106; solar reflectance 0.84), recording indoor temperature reductions of 1 to 3°C in residential buildings and up to 10.7°C in industrial ones, with roof surfaces falling by as much as 13°C. [Evidence](#) across Melbourne, Guangzhou, and Osaka confirms high-albedo coatings consistently deliver 1 to 2°C surface temperature reductions. Regulatory mandates -as seen in Osaka and New York City's Local Laws 92/94 demonstrate that when cool or green roofs are required rather than optional, thermal performance improves across entire building stocks. [Cool roof work](#) in Delhi's informal settlements and NRDC policy factsheet document how this applies in lower-income contexts. Urban forests, green roofs, and blue infrastructure can reduce local temperatures by 2 to 5°C and could be integrated into India's [PMAY-Urban](#) affordable housing programme for cooling to reach the urban poor by design. [Miyawaki](#) forests, as implemented in Kochi, deliver significant canopy cover on small plots through high-density planting. [Earthenware](#)-based passive cooling solutions from rural and border areas of Indonesia offer a low-cost, culturally grounded approach without reliance on formal supply chains. [Cooling corridors](#) combining reflective materials, water features, and clay pot coolers have produced measurable heat island reductions across Southeast Asian cities. Pairing green roofs with vertical [bifacial solar PV](#) panels, with panel output used directly for space cooling, offers another commercially viable model. [Shaded public walkways](#) and accessible water points and [mandatory rest periods](#) during peak heat hours for outdoor workers address the populations with greatest direct heat exposure.

The critical question is why so few approaches have scaled beyond pilots. The gap is not primarily technical. [Heat falls hardest](#) on low-income households, outdoor workers, and older people — those least able to fund, maintain, or navigate complex green infrastructure programmes.

Fragmented data limited technical capacity, and [absent maintenance financing](#) compound this. Cities are losing green cover faster than they replace it, and nighttime cooling is becoming less reliable, meaning the problem worsens even in cities that believe they are responding.

Two [technical caveats](#) are almost entirely absent from mainstream policy guidance. First, in dense urban settings, cool roofs can redirect reflected solar radiation to adjacent buildings through the Sky View Factor effect, potentially intensifying localised heat stress making urban morphology assessments essential before deployment. Second, green infrastructure over compacted or sealed ground underperforms significantly on evaporative cooling; restoring soil permeability and moisture capacity are prerequisites, not optional enhancements. The risk of green gentrification -environmental improvements that raise property values and displace the residents they were meant to protect also demands explicit attention.

The underlying [governance challenge](#) is that too many cities still manage heat as an emergency rather than a long-term condition. What separates cities genuinely adapting from those that are not is whether data, design, policy, and finance have been brought into a [single coordinated system](#), with heat mitigation embedded in zoning laws through minimum tree cover ratios, cool roof requirements, and ventilation corridor standards rather than left to voluntary adoption. Heat Resilience [Toolkits](#) spanning technology, building codes, financial incentives, and community engagement are now available to support this.

On financing, [two instruments](#) merit serious attention but rarely feature in regional discussions. Performance-based contracts pay private partners against verified cooling or energy outcomes rather than upfront capital, aligning incentives to results. Resilience bonds, unlike conventional green bonds, can be structured around heat-health outcomes, giving municipalities a durable funding stream. Blended finance and public-private partnerships are practical near-term enablers in resource-constrained settings. The [equity dimension](#) needs to be explicit. Financing mechanisms must account for the differentiated needs of women, men, and marginalised groups. [District cooling systems](#) offer an efficient alternative to thousands of individual air-

conditioning units in high-density zones and regulating private vehicle use should be treated as a thermal management strategy, not only an air quality measure.

The technologies, frameworks, and financing instruments to manage urban heat across Asia-Pacific already exist. The constraint is not invention but integration - bringing tools together to reach communities carrying the greatest heat burden. Scale requires regulatory mandates, not just incentives. Equity requires deliberate targeting, not the assumption that benefits will reach those who need them most.

2. Relevant Experiences

Country	Key Purpose & Role	Organizations Involved	Link
Brazil	The Urban Heat Solutions Accelerator is designed to: Help cities develop, finance, and implement solutions to reduce the impacts of extreme urban heat.	WRI Brazil	Link
China	China initiated large-scale urban heat mitigation in 2011 through the U.S.-China Clean Energy Research Center (CERC) Cool Roof Infrastructure project, running through 2015, with natural-exposure trials in multiple cities for reflective cool roofs and black/white/garden roof experiments to combat UHI effects.	Guangdong Provincial Academy of Building Research (GPABR) Research Institute of Standards and Norms (RISN) Chongqing University (CU) Chinese Academy of Sciences (CAS)	Link
India	To reduce extreme heat and energy demand, Amravati mandated cool roofs, integrating heat mitigation into urban planning with incentives and digital monitoring.	Amravati Municipal Corporation	Link
Indonesia	Indonesia launched the Urban Heat Island (UHI) Action Plan	BMKG	Link

	around 2020 within the Climate Resilience Policy 2020-2045, featuring short-term actions by 2024 like UHI mapping in 10 metropolitan areas (e.g., Jakarta, Medan, Surabaya), early warning systems via CoCHAP project, integration into sub-national plans, and long-term scaling of best practices with financing unlocks for climate resilience.		
Japan	Japan uses innovative cooling materials and wearables like heat-releasing clothing and UV-blocking parasols to reduce heat stress and improve thermal comfort efficiently.	Toray & Ogawa.Co.Ltd	Link
Malaysia	Malaysia is primarily using green roof technology as a key urban heat mitigation strategy, in which vegetation layers are installed on building rooftops to cool urban environments. This technology works by increasing moisture and surface wetness through plants, which reduces surrounding air and surface temperatures, while also providing thermal insulation that lowers heat transfer into buildings and reduces energy demand for cooling.		Link
Republic of Korea	South Korea uses fog cooling, cool roofs, shading, water features, and IoT sensors to reduce heat and enhance climate-resilient urban environments.	Korean Ministry of Environment	Link

<p>Switzerland</p>	<p>Since the 1970s, Basel has implemented mandatory and incentivized green roof policies, supported by public financing through environmental and energy funds. Over time, the city incorporated thermal mapping and climate modelling tools to identify urban heat islands and guide interventions.</p>	<p>The Department of Environment and Energy & Department of Building and Transport</p>	<p>Link</p>
<p>Taiwan</p>	<p>Taiwan is working on the project “Strategy on mitigation of urban heat island (SOMHI)”. This project aims to popularize the improvement of the urban heat island and implement the improvement strategy for the future.</p>	<p>Architecture and Building Research Institute, Ministry of Interior, Taiwan</p>	<p>Link</p>
<p>Thailand</p>	<p>Bangkok uses heat mapping, climate modelling, and early warning systems to identify hotspots, reduce risks, and support climate-resilient urban planning.</p>	<p>World Bank and Bangkok Metropolitan Administration</p>	<p>Link</p>
<p>USA - City of San Jose, capital of Silicon Valley</p>	<p>San José’s GSI plan uses natural systems to manage stormwater, reducing pollution, flooding, improving water quality, and mitigating urban heat.</p>	<p>City of San Jose</p>	<p>Link</p>

3. Related Resources

Original Research/ Report Title	Authors	Key Summary	Link
AI and Geo-spatial Technologies for Climate Change Mitigation: Opportunities, Challenges, and Pathways to Sustainability	Thavavel Vaiyapuri Golden Julie	AI analyses satellite data to detect heat islands, enabling resilient planning, guiding green infrastructure, and supporting data-driven climate policies and emissions reduction.	Link
Artificial intelligence applications in urban extreme heat management: A systematic review of forecasting, monitoring, mitigation and decision support	Jin Rui, Zahratu Shabrina Wenjing Gong	Explains the application of Artificial Intelligence (AI) across four dimensions of urban heat governance: prediction/early warning, monitoring/assessment, mitigation/adaptation, and scenario simulation/decision support.	Link
Attributing and Projecting Heatwaves Is Hard: We Can	Van Oldenborgh, G. J., Wehner, M. F., Vautard, R.,	Global warming intensifies heatwaves, but local factors and model limitations	Link

Do Better	Otto, F. E. L., Senviratne, S. I., Stott, P. A., et al. (2022).	complicate trends, making regional heat predictions and attribution uncertain and challenging.	
Climate change and cities: Second assessment report of the urban climate change research network	C Rosenzweig, WD Solecki, P Romero-Lankao	Analyzes urban climate risks and infrastructure impacts, proposing mitigation and adaptation solutions across sectors; highlights rising temperatures driven by climate change and urban heat island effects (0.12–0.45°C per decade).	Link
Climate change made the deadly heatwaves that hit millions of highly vulnerable people across large parts of Asia more frequent and extreme	Mariam Zachariah, Ben Clarke, Maja Vahlberg, Carolina Pereira Marghidan, Roop Singh, Sayanti Sengupta, Friederike E. L vOtto	Urban heat is a growing urban health and economic risk worsened by climate change. Effective response combines immediate measures (alerts, cooling, healthcare) with long-term planning (green infrastructure, resilient design), targeting vulnerable populations through inclusive, data-driven policies.	Link

<p>Combating urban heat: Systematic review of urban resilience and adaptation strategies</p>	<p>Qingchen Fu, Zhouhua Zheng, <u>Md Nazirul Islam Sarker</u>, Yang Lv</p>	<p>Identifies urban greening strategies, heatwave early warning systems, and community involvement projects as specific measures to enhance urban resilience and mitigate vulnerability to urban heat.</p>	<p>Link</p>
<p>Could/should improving the urban climate in informal areas of fast-growing cities be an integral part of upgrading processes? Cairo case</p>	<p>Heba Allah Essam E. Khalil , AbdelKhalek Ibrahim , Noheir Elgendy , Nahla Makhoulouf</p>	<p>Explains the application of technology-driven solutions, such as GIS and satellite imagery, to develop an Urban Climate Map for Cairo, which is essential for understanding and mitigating the urban heat island effect.</p>	<p>Link</p>
<p>Decoding the Urban Heat Stress among Indian cities</p>	<p>Avikal Somvanshi and Sharanjeet Kaur</p>	<p>This report provides a detailed and nuanced analysis of how heat in Delhi is evolving, showing that the city's heat crisis is no longer driven solely by rising temperatures but by a complex</p>	<p>Link</p>

		interaction of temperature, humidity, land surface conditions, and urbanization.	
Global projections of heat exposure of older adults	Giacomo Falchetta Enrica De Cian Ian Sue Wing Deborah Carr	Study projects doubled heat exposure by 2050, risking 23% of older adults, especially in Asia and Africa, urging urgent policy action.	Link
Global urban heat island mitigation	A khan, H Akbari, F Fiorito, S Mithun, D Ni-yogi	Explores urban heat mitigation via cool materials, photonic technologies, and urban greenery; compares Global North–South vulnerabilities and highlights planning policies and strategies from China and Latin America to address UHI impacts.	Link
Linking digital twin paradigm for urban heat monitoring and policy integration to building smart city climate resilience	Mohammad Ismail Hossain, Md Refath Hosan, Md Nahid Ferdous	Introduces the Digital Twin paradigm as a transformative approach that integrates real-time sensor data, detailed geospatial information, and meteorological forecasts to comprehensively monitor and reduce	Link

		urban heat, addressing the need for effective tech solutions.	
Mitigating Urban Heat Islands in the Global South: Data-driven Approach for Effective Cooling Strategies	Rabin Chakraborty, Malay Pramanik, Mohamed Zhran	Uses an urban cooling model to quantify heat mitigation via albedo, evapotranspiration, and green cover; supports scaling green infrastructure and recommends policies like reflective surfaces, incentives, and advanced cooling investments.	Link
Multimodal Urban Heat Island Mitigation via Knowledge Reasoning and Geospatial Optimization	M. Nithyashree, Krupa P. Nadgir, Prithiviraj N., Manasvini G. Pamasali, Deeksha Hegde Jyoti Shetty	Dual-mode framework combines passive knowledge recommendations with active LULC optimization. Uses computer vision, GNNs, and genetic algorithms for ~3°C cooling, plus RAG-based policy insights for evidence-driven urban heat mitigation strategies.	Link
Planning for urban heat resilience	L Keith, S Meerow	Explains the importance of proactive planning in	Link

		<p>managing and mitigating urban heat across various systems and sectors to achieve greater heat resilience.</p>	
<p>Prioritizing Nature-Based Solutions and Technological Innovations to Accelerate Urban Heat Mitigation Pathways</p>	<p>Yongling Zhao, Jan Carmeliet, Rafiq Hamdi, Chao Yuan, Xiaotian Ding, Dominique Derome, Yifan Fan, Song Jiang and Jian Peng</p>	<p>Proposes strategies that integrate nature-based solutions (like urban greenery) with emerging technological innovations to mitigate urban warming and accelerate capacity building efforts.</p>	<p>Link</p>
<p>Resilient Tashkent</p> <p>Inputs into an Urban Resilience Strategy and Investment Program</p>	<p>World Bank Group</p>	<p>The document examines how urban heat islands (UHI) where cities are hotter than surrounding rural areas interact with climate change to intensify heat risks. Rapid urbanization, dense infrastructure, and reduced green cover trap heat, making cities significantly warmer and more vulnerable to extreme temperatures. This creates a growing</p>	<p>Link</p>

		challenge for public health, economic stability, and social equity.	
Strengthening Heat Resilience in Cities: A Comprehensive Policy Document		Cities must combine emergency responses (warnings, cooling centres, healthcare) with long-term strategies (green infrastructure, cool roofs, resilient design) to reduce heat risks, protect vulnerable groups, and improve public health.	link
Systematizing and upscaling urban climate change mitigation	Felix Creutzig, Xuemei Bai, Radhika Khosla, Vincent Viguie and Yoshiki Yamagata	Identifies four key areas to scale urban climate mitigation, emphasizing big data, ML analysis, governance frameworks, and 41 tech-policy solutions with measurable emission reduction potential.	Link
Towards cool cities and communities: Preparing for an increasingly hot future by the development of	Yi Cui , Mingqiang Yin , Xiang Cheng , Junqing Tang , Bao-Jie He	Frames a heat-resilient infrastructure system and an Urban Heat Management Plan (UHMP) to promote the implementation of heat solutions in	Link

<p>heat-resilient infrastructure and urban heat management plan</p>		<p>highly urbanized and urbanizing cities, which directly addresses the need for planning frameworks and policies.</p>	
<p>Urban Heat & Equity Experiences from C40's Cool Cities Network September 2021</p>		<p>Urban heat affects communities unevenly; C40 cities apply environmental justice to reduce inequities and protect vulnerable populations from extreme heat risks.</p>	<p>Link</p>
<p>Urban heat island adaptation and mitigation in practice: lessons from policy implementation in five cities</p>	<p>Kevin Lau, Chao Yuan, Edward Ng</p>	<p>Integrates scientific insights into planning and regulations; uses GIS and advanced modelling for urban heat analysis; promotes scalable solutions like urban greening, high-albedo materials, and ventilation-focused design standards.</p>	<p>Link</p>
<p>Urban Heat Island mitigation strategies: a comprehensive review of recent advances</p>	<p>Author links open overlay panel Jihui Yuan, Patryk Antoszewski, Adam Choryński, Yafeng Gao, Jiale</p>	<p>Synthesizes recent advancements in Urban Heat Island (UHI) mitigation, critically evaluating</p>	<p>Link</p>

	Chai, Xiangfei Kong	a spectrum of strategies including green infrastructure, high-albedo and reflective materials, urban design modifications, and emerging technological interventions.	
Urban Heat in South Asia	Ella Kim, Grace Henry, and Monica Jain	Extreme heat worsens in South Asia due to urbanization and climate change, harming vulnerable groups; solutions require data, planning, and heat-resilient infrastructure.	Link
Urban Heat Stress Tracker	Avikal Somvanshi and Sharanjeet Kaur	The report shows that heat in Delhi is not just increasing it is changing in nature. Instead of only higher temperatures, humidity, urbanization, and night-time heat are making heat stress far more dangerous.	Link
Urban Heat Technologies		Cities combat the Urban Heat Island Effect using green infrastructure, reflective materials,	Link

		<p>passive design, renewable energy cooling, and smart technologies, combining immediate responses with long-term strategies to improve sustainability, efficiency, and public health.</p>	
<p>What the urban heat island effect means for East Asia's cities</p>	<p>World Bank Group</p>	<p>Urban heat islands intensify climate change impacts, increasing health risks, inequality, and economic losses, requiring urgent urban planning, policy action, and resilience strategies.</p>	<p>Link</p>

4. Relevant Organizations/Initiative

Organization / Initiative	Key Role & Activities	Link
American Planning Association (APA)	Offers planning frameworks, policy toolkits, zoning strategies, and guidance on integrating green infrastructure and equity into urban heat mitigation.	Link
California heat Island Mitigation Program	Provides community-based solutions like thermal imaging, cool roof grants, and public education to reduce urban heat impacts.	Link
Esri (ArcGIS)	Provides GIS-based tools for mapping, analysing, and modelling urban heat islands using geospatial data and remote sensing.	Link
Google	Uses satellite data and AI to map urban heat vulnerability and support city-level decision-making for heat mitigation strategies.	Link
Lawrence Berkeley National Laboratory Heat Island Group	Conducts scientific research on cool materials, urban surfaces, and mitigation technologies for reducing heat islands	Link
NASA ARSET	Provides training on satellite data, heat vulnerability mapping, and geospatial	Link

Organization / Initiative	Key Role & Activities	Link
	analysis for urban climate applications.	
PreventionWeb (UNDRR Platform)	Shares global case studies, policy frameworks, and resilience strategies for climate adaptation, including urban heat mitigation in developing cities.	Link
U.S. Environmental Protection Agency (EPA)	Provides research, tools, and guidelines for urban heat island mitigation including cool pavements, green infrastructure, and policy support.	Link
World Resources Institute (WRI)	Provides data-driven tools, heat mapping platforms (e.g., Cool Cities Lab), policy guidance, and urban cooling strategies for cities globally.	Link

5. Responses in Full

1. **Engr. Md Selim Reza, System Analyst, Ministry of Finance, Bangladesh; [Response 1](#); [Response 2](#)**
2. **[Sohail Akhtar, Senior Scientist, Pakistan Council of Scientific & Industrial Research \(PCSIR\) Lab Complex, Karachi, Pakistan](#)**
3. **[Sharjil Khanna](#)**
4. **[Ugyen Penjor, Bhutan](#)**
5. **Enriko Siahaan, Nbs Expert, Sintang Regency Border Infrastructure, Indonesia [Response 1](#); [Response 2](#)**
6. **[Dan Millison, Manager, Planet Sea, LLC, United States](#)**
7. **[Irum Tariq, Member Standing Committee \(SC\) for Smog and Climate Lahore Chamber of Commerce and Industry \(LCCI\), CEO at Exodus Green Pvt. Ltd., Pakistan](#)**
8. **[Beta Paramita Project Manager of BeCool Indonesia, Chair of the University Centre of Excellence for Low-Emission Building Materials and Energy, Universitas Pendidikan, Indonesia](#)**
9. **[Jinha Kim, Expert in International Development Cooperation, ADB, Philippines](#)**
10. **[Dr. Vinit Kumar Mishra Environment, Sustainability, ESG expert, EIA, Air & Water Pollution and remediation](#)**
11. **[Tianyi Wang, PhD Researcher, Urban Heat Island Modeling, Remote Sensing & Climate Adaptation, University of Liège, Belgium](#)**
12. **[Jyoti Singh, Senior Program Associate at WRI, India](#)**
13. **[Zubia Raza, IRMS Risk Manager, Pakistan](#)**
14. **[Nancy Tuammen](#)**
15. **[APCTT INPUT 1](#)**

16. [APCTT INPUT 2](#)

17. [APCTT INPUT 3](#)

18. [APCTT INPUT 4](#)

Responses:

1. **Engr. Md Selim Reza, System Analyst, Ministry of Finance, Bangladesh**

Urban heat is not only an environmental challenge but also a **human dignity, health, and justice issue**, particularly affecting vulnerable populations in rapidly urbanizing regions across Asia-Pacific.

Drawing from **human values, global best practices, and emerging technologies**, I would like to share a holistic response:

1. **Ethical Foundation:**

The teachings of all religions encourage environmental care, tree planting, water conservation, and protection of all living beings.

Therefore, mitigating urban heat is a **moral responsibility**, ensuring protection for current and future generations.

2. **Nature-Based & Low-Cost Solutions (High Impact):**

Proven global and OIC-relevant practices include:

- **Urban afforestation & green corridors** (tree canopy expansion reduces surface temperature significantly)
- **Blue infrastructure** (ponds, lakes, rainwater harvesting)

- **Cool roofs & reflective materials** (low-cost solution for dense cities like Dhaka)
- **Green roofs & vertical gardens** in urban buildings

Countries can scale these through community-based endowment models and public-private partnerships.

3. Smart Technologies (AI, IoT, ICT Integration):

Emerging technologies can significantly enhance urban heat response:

- **IoT-based heat monitoring systems:** Real-time temperature, humidity, and air quality sensors
- **AI-driven urban heat mapping & prediction:** Identifies heat hotspots for targeted intervention
- **Satellite data & GIS platforms:** Supports planning and early warning systems
- **Smart citizen apps:** Alerts for heatwaves, hydration reminders, and safe zones

These solutions align with Smart Sustainable Cities initiatives like [United for Smart Sustainable Cities \(U4SSC\)](#).

4. Policy & Urban Planning Innovations:

- Integrate **heat-resilient urban design** in city master plans
- Promote **intergenerational procurement** (long-term climate resilience)
- Enforce **building codes** for ventilation, insulation, and green coverage

- Establish **cooling centres** for vulnerable populations

5. Social Justice, Peace & Inclusion:

Urban heat disproportionately impacts:

- Low-income communities
- Elderly, children, and outdoor workers

Thus, responses must ensure:

- **Equitable access to cooling solutions:**
 - Community awareness and behavioural change
 - Gender-sensitive and inclusive climate policies

Climate resilience contributes directly to **peace, stability, and human security**.

6. Bangladesh & Asia-Pacific Context:

In countries like Bangladesh:

Dense urbanization and limited green space increase vulnerability

Practical actions include:

- Scaling **cool roof programs**
- Expanding **urban green belts**
- Deploying **low-cost IoT sensors in pilot smart city zones**
- Integrating climate tech into national ICT and SDG strategies

Conclusion:

Addressing urban heat requires a **holistic, ethical, and technology-enabled approach** that combines:

- Faith-based responsibility
- Nature-based solutions
- Smart technologies (AI, IoT, ICT)
- Inclusive governance

By aligning **basic human principles, global best practices, and innovation**, we can build **cooler, safer, and more just cities for all generations**.

Final Message:

Protecting the Earth is protecting humanity.
Let us act collectively to ensure a sustainable, peaceful, and resilient future for all people.

2. Sohail Akhtar, Senior Scientist, Pakistan Council of Scientific & Industrial Research (PCSIR) Lab Complex, Karachi, Pakistan

The [Urban Heat Management Strategy in Asia-Pacific](#) outlines a comprehensive, versatile approach and interconnected strategies for reducing urban heat island effects around a city space and its surroundings. For effective working and planning for mitigating urban heat island stress in

the Asia-Pacific region, two fields need to be combined; firstly, materialistic deployment like cool roofs, green spaces, and climate resilient infrastructure/construction materials, and secondly the applications based on

predictive ML/AI Learning. These tools can be used for futuristic monitoring, early warning and heat mapping as per GIS systems. Urban heat management strategies combine sustainable design (green infrastructure, reflective materials, shading) with advanced meteorological monitoring (remote sensing, GIS, and AI forecasting). The nearest coordinates for a central cityscape are used for monitoring the heat and temperature caused by intense sunlight. These are observed and seen through satellite imagery and real time sensors, Urban Heat effects. The obtained information from the data (for UHI) is used in developing policy integration and sustainable urban planning.

The key enablers and visually linking all elements can promote heat resilience infrastructure for densely populated regions.

AI & Urban Intelligence (including predictive mapping, monitoring, and early warning systems), Nature-Based Solutions (such as natural cooling, green spaces, trees, green roofs, and walls), Resilient Infrastructure (featuring cool roofs and pavements, cooling centres and shelters, energy resilient systems), and Community Engagement (focused on equitable access) need to be the topmost actionable tasks. These key enablers ensure that planning, mapping and analysing relationships between entities in a network and a circular flow can promote heat resilience in densely populated Asia-Pacific regions.

3. Sharjil Khna

Yes, there is very much heat here

4. Ugyen Penjor, Bhutan

Urban heat management has shifted from emergency response to **long-term resilience planning, and** we must take prompt action.

5. Engr. Md Selim Reza, System Analyst, Ministry of Finance, Bangladesh

Dear COP Moderating Team,

Thank you for your kind invitation and for highlighting this important query on urban heat in the Asia-Pacific region. I am pleased to contribute my perspectives based on ongoing work and experience in Bangladesh and related global initiatives.

Urban heat is indeed a critical challenge for rapidly urbanizing regions. Addressing it effectively requires an integrated approach combining advanced technologies, nature-based solutions, and policy frameworks.

1. Technology-driven solutions:

Cities should adopt geospatial technologies, remote sensing, and AI-based analytics to monitor urban heat islands in real time. IoT-based environmental sensors can support localized temperature and air quality monitoring. Digital twin technologies and smart city platforms can further help simulate and optimize urban planning decisions.

2. Scalable green and cool solutions:

Nature-based solutions such as urban forests, green roofs, vertical gardens, and water-sensitive urban design are highly effective. In addition, cool roofs, reflective pavements, and heat-resilient construction materials should be promoted through incentives and regulatory standards. Public-private partnerships can accelerate scaling in dense urban environments.

3. Planning, policy and financing frameworks:

Urban heat mitigation must be embedded in national and city-level development plans. This includes integrating climate-responsive urban planning, strengthening building codes, and adopting data-driven decision-making tools. Financing mechanisms such as green bonds, climate funds, and blended finance models can support implementation, especially in resource-constrained settings.

From Bangladesh's perspective, integrating ICT-based solutions with sustainable urban planning and community engagement can significantly enhance resilience to urban heat challenges.

I look forward to further knowledge exchange and collaboration within this Community of Practice.

6. Enriko Siahaan, Nbs Expert, Sintang Regency Border Infrastructure, Indonesia

Hello, this is Our Response for your Query consisting of a Pitch Deck with 10 Slides. We hope this enhances the discussion ([Click Here](#)).

7. Dan Millison, Manager, Planet Sea, LLC, United States

A relatively new technical solution is green roofs with vertical solar PV (bifacial panels). The solar output can be utilized directly for space cooling in the host building. The business model can be the same as traditional rooftop solar options.

<https://vertical.solar/frequently-asked-questions-vertical-bifacial-solar-panels/green-roofs>

Also, as others have noted, urban forests or urban greenery is a great solution. A logical complement is to use permeable pavement for storm water control or flood prevention. The business model is flood prevention

insurance. The insurance and re-insurance industry is supposedly interested in climate adaptation, so these companies should be willing to support delivery of these solutions.

These technical solutions are available and may be used.

8. Irum Tariq, Member Standing Committee (SC) for Smog and Climate Lahore Chamber of Commerce and Industry (LCCI), CEO at Exodus Green Pvt. Ltd., Pakistan

Urban heat isn't just a climate issue, it is a planning, governance, and equity problem. The cities making real progress are the ones blending **data + design + policy + finance** into one coordinated system rather than treating heat as a standalone concern. Here's how the three focus areas come together in practice:

1) Tech solutions cities are using today

a) Geospatial & satellite intelligence

Cities are using platforms like Google Earth Engine and NASA thermal datasets to map urban heat islands (UHI) at neighbourhood level.

This allows identification of “hotspots” (often low-income, low-tree-cover areas) and prioritization of interventions.

b) IoT-based hyperlocal sensing. Low-cost temperature and humidity sensors mounted on streetlights or buildings give real-time microclimate data. These are especially useful in dense cities where satellite data alone misses street-level variation.

2) Scaling green and cool solutions in dense cities

a) Urban forests (strategic, not cosmetic)

Focus on heat-vulnerable zones, not just beautification corridors.

Use native, drought-resistant species to reduce water stress.

b) Cool roofs & reflective materials

One of the fastest, lowest-cost solutions—especially for informal settlements.

Programs like Ahmedabad’s cool roof initiative show measurable temperature drops indoors.

3) Planning frameworks, policies & financing mechanisms

a) Heat-resilient urban planning frameworks

Embed heat mitigation into master plans, zoning laws, and building codes.

Mandate:

Minimum tree cover ratios

Cool/green roof requirements

Ventilation corridors (wind pathways)

b) Digital planning tools

GIS-based planning platforms + urban digital twins for scenario testing.

Integration of land use, transport, and climate data into one decision system.

**9. Beta Paramita Project Manager of BeCool Indonesia,
Chair of the University Centre of Excellence for Low-
Emission Building Materials and Energy, Universitas Pendidikan, In-
donesia**

I wish to share details of our project in Indonesia - we have cool roof and cool house project.

[Kompilasi Cool House - Presentation
18 VEOLIA FACTS 27 2025 GB WEB B Paramita.pdf](#)

10. Jinha Kim, Expert in International Development Cooperation, ADB, Philippines

Integrated solutions combine technology, early warning systems (EWS), planning, and financing. Leveraging tools may be used such as geospatial data for mapping, IoT & AI enabled cooling with EWS. Scale up practical measures - green roofs, reflective paint, improved ventilation, urban greening, and cooling shelters (including repurposed public spaces) supported by inclusive heat action planning, as well as policies and financing mechanisms that are responsive to the differentiated needs of women, men, and marginalized groups.

11. Dr. Vinit Kumar Mishra Environment, Sustainability, ESG expert, EIA, Air & Water Pollution and remediation

I live in one of the hottest and most polluted cities on the world, Delhi, India. Indian cities are increasingly deploying a multi-layered technology stack combining satellite data, IoT, and AI to diagnose urban heat with precision. Satellite-based thermal remote sensing integrated with GIS enables the creation of detailed urban heat maps that identify hotspots and guide targeted mitigation.

Key tech solutions being deployed in Indian cities:

AI & Vulnerability Mapping: Delhi's 2025 Heat Action Plan (HAP) embeds AI and satellite data to create building-level vulnerability maps; collaborations with IIT Mandi and Resilience AI identify the hottest micro-clusters.

Digital Twins: Pilot projects in **Coimbatore and Bhopal (2024–25)** integrate geospatial thermal data and urban morphology to simulate heat dynamics and test mitigation scenarios before physical implementation.

Geospatial Heat Mapping: Cities like Ahmedabad and Nagpur use GIS platforms to embed thermal intelligence into master plans and HAPs.

Reflective / Cool Roof Monitoring: Mumbai's BMC has coated municipal buildings and schools with solar-reflective paint, with IoT-supported performance tracking.

Ward-Level Predictive Planning: Varanasi's ward-level HAPs align with climate forecasts up to 2050 to guide investments in cool roofs and green spaces

Nature-based solutions (NbS) like urban forests, green roofs, and blue infrastructure can lower local temperatures by **2–5°C**,

Green PMAY Integration: Incorporating reflective materials and green building codes into affordable housing under **PMAY-Urban** can embed cooling solutions at scale for the urban poor.

Policy & Planning Tools

Heat Action Plans (HAPs): Ahmedabad's 2013 HAP is a global pioneer; newer-generation HAPs in Delhi and Varanasi embed AI, satellite data, and 2050 projections.

ICLEI's Heat Resilience Toolkit for Indian cities identify causes and prioritizes solutions across four categories: technology/infrastructure, policy mandates (building codes), incentives/financing (rebates, grants), and community participation.

Urban Master Plan Integration: Embedding thermal vulnerability maps and green coverage norms into city master plans is now a recognized best practice.

However, implementation is mostly in tier one cities only, hence more policy initiatives need to be put in place to improve overall situation across the country.

12. Tianyi Wang, PhD Researcher, Urban Heat Island Modelling, Remote Sensing & Climate Adaptation, University of Liège, Belgium

1. Effective Technology Solutions for Understanding and Reducing Urban Heat

The most robust approaches combine remote sensing, high-resolution urban climate modelling, and GIS-based spatial analysis. Satellite-derived Land Surface Temperature (LST) data, from platforms such as Landsat, ECOSTRESS, and Sentinel-3, offer city-scale mapping of heat patterns, while dense networks of fixed and mobile in-situ sensors provide the localized, real-time ground truth needed to validate those models. Neither approach alone is sufficient: remote sensing captures broad spatial variability but misses fine-grained microclimate dynamics, while sensor networks are often too sparse to cover entire cities.

For rapidly growing Asian cities, a practical middle ground lies in integrating these data streams through GIS-based multi-layer analysis. This allows planners to overlay thermal exposure maps with urban morphology data (building density, sky view factor, street canyon geometry) and population distribution, making it possible to identify where heat stress is most intense and who is most exposed simultaneously. High-resolution urban climate models such as UrbClim or WRF, operating at 100-metre resolution — are increasingly being used in this role across European cities

and could be adapted for similar applications in the Asia-Pacific context.

Machine learning methods have also shown promise for downscaling coarse satellite data and predicting thermal comfort indices such as UTCI (Universal Thermal Climate Index) at pedestrian scale, which is more directly relevant to health outcomes than surface temperature alone.

2. Scaling Green and Cool Material Solutions in Dense, Fast-Growing Areas

Building-level interventions (green roofs, cool roofs, green facades, reflective pavements), neighbourhood-level greening (street trees, green corridors, urban wetlands), and district-scale design choices (building layout, ventilation corridors, urban form).

A consistent finding is that no single measure is sufficient. In dense areas with limited land, building-scale passive solutions tend to have higher implementation feasibility. Cool roofs with high albedo coatings have demonstrated measurable surface temperature reductions of 1–2°C in demonstration areas across cities as different as Melbourne, Guangzhou, and Osaka. Green roofs and facades provide additional co-benefits including stormwater retention and biodiversity, which are particularly relevant in tropical and subtropical climates.

The more difficult challenge is maintenance and long-term performance. Green infrastructure requires sustained operational investment that resource-constrained cities often cannot guarantee. One approach that has shown traction in East Asia is regulatory mandates combined with municipal subsidy programmes: Osaka's green building ordinance and NYC's Local Laws 92/94 both demonstrate that mandating green or cool roofs at scale can shift baseline surface thermal properties city-wide, though enforcement capacity varies considerably between high-income and lower-income contexts.

For fast-growing cities in South and Southeast Asia where informal settlement patterns make top-down mandates harder to apply, community-level implementation, pairing awareness campaigns with accessible cool material retrofits, may offer a more realistic near-term pathway.

13. Jyoti Singh, Senior Program Associate at WRI, India

Urban heat is emerging as a silent intense killer. I am sharing some of my thoughts on urban heat discussion below:

1. We need a better network of sensors to measure heat and its impact. Currently the heatwave alerts are based on limited sensors in cities which ignore the differential vulnerability aspect of heat. One of the localised ideas could be to call for volunteers to install sensors on their vehicles to measure surface temperature which can be used to identify heat patterns. This will also pave a path to better geospatial intelligence and increase citizen participation.
2. One of the major challenges in the cities is the lack of space. We need to move to an integrated green infrastructure which takes development and improving the microclimate of the cities together. Some of the methods I can think of are Miyawaki forests (implemented in Kochi), implementation of cool roofs by using reflective paints and cool construction materials and avoiding usage of glass as a construction material to reduce building energy.
3. We need to be able to move from pilot projects to scaling systemic policy. We can do so by first identifying vulnerable populations and areas that are affected the most by heat. Because this is a function of many indicators like socio-economic status, housing, this adds to multiple layered problem which needs better measurement to solve the larger issue of urban heat.

Citizen science is an effective tool to solve this data crunch in places where resources are limited. In addition, we also need to make people aware

of this issue and amplify the need to long-term solutions.

14. Enriko Siahaan, Nbs Expert, Sintang Regency Border Infrastructure, Indonesia

Hello, I'm came from Indonesia Border and rural Area, we've offering solution based on earthenware to reduce Urban Heatwave within a presentation about half megabyte ([Click Here](#)).

15. Zubia Raza, IRMS Risk Manager, Pakistan

Thought-provoking discussion, planting dense native trees along roads, schools, bus stops, and slum clusters can reduce surrounding temperatures significantly.

Issues in the Asia-Pacific are not limited to climate change; there are issues associated with:

- urban density,
- informal settlements,
- poor infrastructure,
- and energy poverty.

Thus, any heat relief solutions developed for such places need to take into consideration cost and community participation rather than purely being technologically driven.

16. Nancy Tuammen

Mud building materials have been known to keep houses cool. The heat in Asia-Pacific could be mitigated by using mud for building houses. These houses could be covered with green roofs which would not only serve to

bring oxygen into the environment but also keep the houses cool as well.

Secondly, more trees could be planted to purify the air. Plants such as snake plants oxygenate the air, thereby reducing the heat.

Burning of industrial waste could also be reduced. Cleaner options such as solar and wind power could be introduced to substitute fossil fuel. Digitalized electric cars are environmentally friendly and will not add to the environment heat.

Furthermore, digitalized geoengineering measures such as cloud seeding could be carefully and sparingly used to create rain in this region, which will serve in dousing the heat with rainwater and cooling the environment. However, this should be measured and carefully used to avoid a counter effect such as dangerous floods.

17. APCTT INPUT 1

Dear Members,

These are 2 Infographics We have incorporated all of your responses and inputs along with other references and have generated this Infographic representation using AI. ([Click Here](#))

18. APCTT INPUT 2

Dear Members,

I would like to share a few inputs on the topic of urban heat, specifically drawing from what I have observed and thought about in the context of Delhi.

The following are solutions I feel could be worth exploring or strengthening:

1. Use of heat-reflective paint on rooftops: Applying heat-reflective paint tested on roofs can help block UV rays and keep buildings and apartments cooler. This is a low-cost and accessible option that I have noticed being used in Delhi. Public water supply points: The government could introduce water supply points at regular intervals, such as every 1 km, to ensure people have access to water when moving through the city during heat.
2. Shaded walkways: Providing sheds or covered walkways along public routes so people can move through the city without direct sun exposure.
3. Color-coded heat alert system: A system that uses a heat map of Delhi to identify the most heated and humid zones and sends alerts to people accordingly. For example: *"This is a high heat area please do not go out without an umbrella or water"* or *"This is a safer zone you can stay here."*

These are ideas I have gathered from observing what is happening in Delhi and thinking about what technology, particularly AI and remote sensing, might help make more effective. I hope they are useful as a starting point for discussion.

Below are some related resources addressing these 4 viewpoints in details:

[**Amid scorching temperatures, India turns to ideas both old and new to beat the heat**](#)

[**Cool Roofing Solutions for Reducing Heat Stress in Delhi Slums - EPIC-India**](#)

[**cool-roofs-policy-factsheet-20231207.pdf**](#)

[Singapore: Tackling urban heat island effect with innovation | PreventionWeb](#)

[Cool Walkability Planning | Planetizen Blogs](#)

[Bangkok Post - Urban heat is a man-made hazard](#)

[Heatwave Map Spotlight: Northern, Central, and Eastern India | IQAir India](#)

[Satellite Remote Sensing for Measuring Urban Heat Islands and Constructing Heat Vulnerability Indices | NASA Earthdata](#)

[Australia: Smart Satellite Mapping to Combat Urban Heat Risks - OpenGov Asia](#)

[Artificial intelligence applications in urban extreme heat management: A systematic review of forecasting, monitoring, mitigation and decision support - ScienceDirect](#)

[Artificial intelligence applications in urban extreme heat management: A systematic review of forecasting, monitoring, mitigation and decision support](#)

19. APCTT INPUT 3

Dear Members

Thank you for excellent and enriching discussions on Urban Heat so far. I would like to add a few points not raised so far.

1. Technical Assumptions

a. Cool roofs: Cool roofs are supposed to critical in urban heat mitigation.

However, in some contexts, they may produce adverse outcomes. For e.g., in dense urban environments with narrow streets, reflected solar radiation doesn't always escape into the upper atmosphere but is redirected to adjacent buildings, intensifying heat stress (called by researchers the Sky View Factor). We need to keep this in mind else we will replace one thermal problem for another.

b. Soil health: Soil health presents another blind spot. Nature-based solutions are often shown as scalable interventions, but only where the substrate supports them. Green infrastructure installed over compacted or sealed ground will always underperform. De-paving and restoring soil moisture capacity determines whether nature-based solutions deliver evaporative cooling in practice or merely in theory.

2. Financing Superstructure

Getting initial capital for cooling infrastructure is challenging but achievable. However, sustaining such infrastructure over decades is where most strategies fail. Two instruments deserve serious examination here:

a. Performance-based contracts where private partners receive remuneration tied to verified cooling or energy outcomes than upfront expenditure.

b. Resilience bonds - unlike conventional green bonds, these can be structured specifically around heat-health outcomes, providing municipalities with a more durable and accountable funding stream than time-limited grants.

3. Social Equity Issues

a. Mandatory Rest Periods for outdoor workers: We all know that heat is not a neutral phenomenon. It affects disproportionately those with the least capacity to adapt, and any strategy needs to resolve social equity issues. Out

door workers bear the highest levels of direct heat exposure and need protection – maybe in the form of mandatory rest periods during peak temperature hours and adjusted working schedules.

b. Ensuring that greener buildings do not displace lower income people: As environmental quality of residences improves, property values tend to go up, and lower income residents are displaced. Adequate measures to protect against such displacement could be integrated into design.

4. Integration into city planning

Numerous issues may be considered at city planning level. Reducing private vehicle use in cities needs to be recognised as a thermal management strategy, not merely as a pollution reducing issue. Similarly, for high-density urban zones, district cooling systems could be considered seriously as they are centrally managed and thermally efficient and address the cumulative heat load generated by thousands of individual air conditioning units operating simultaneously across a city.

Hope this helps enrich the discussion.

20. APCTT INPUT 4

Dear members, good afternoon.

While researching urban heat islands today, I generated this infographic (using AI) that I think is quite insightful. I feel it offers a helpful way to revisit the basic understanding of the phenomenon, while also presenting both the challenges and potential solutions in a clear and visually engaging manner. Thank you. ([Click here](#))

Many thanks to all who contributed to this query!

<mailto:apctt@un.org> This Consolidated Reply is a systematic compilation of all responses received and additional desk research. If you have further information to share on this topic, please send it at apctt@un.org.

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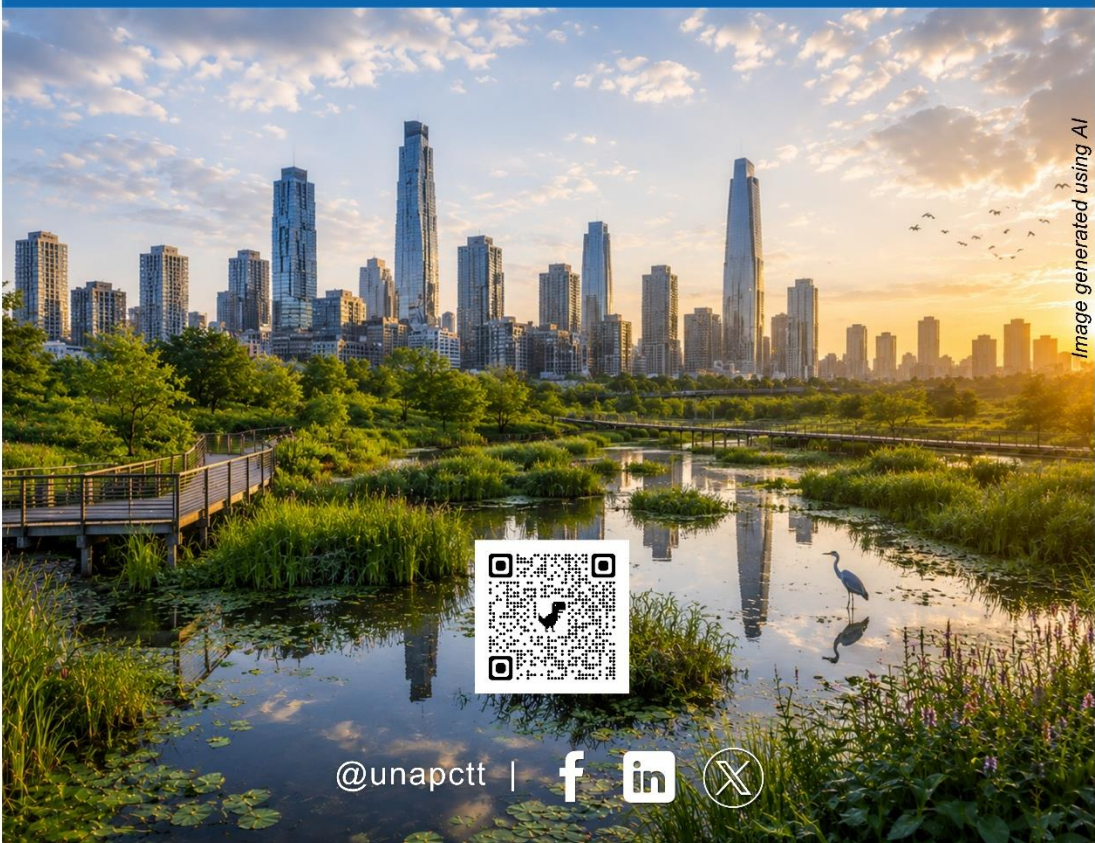


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