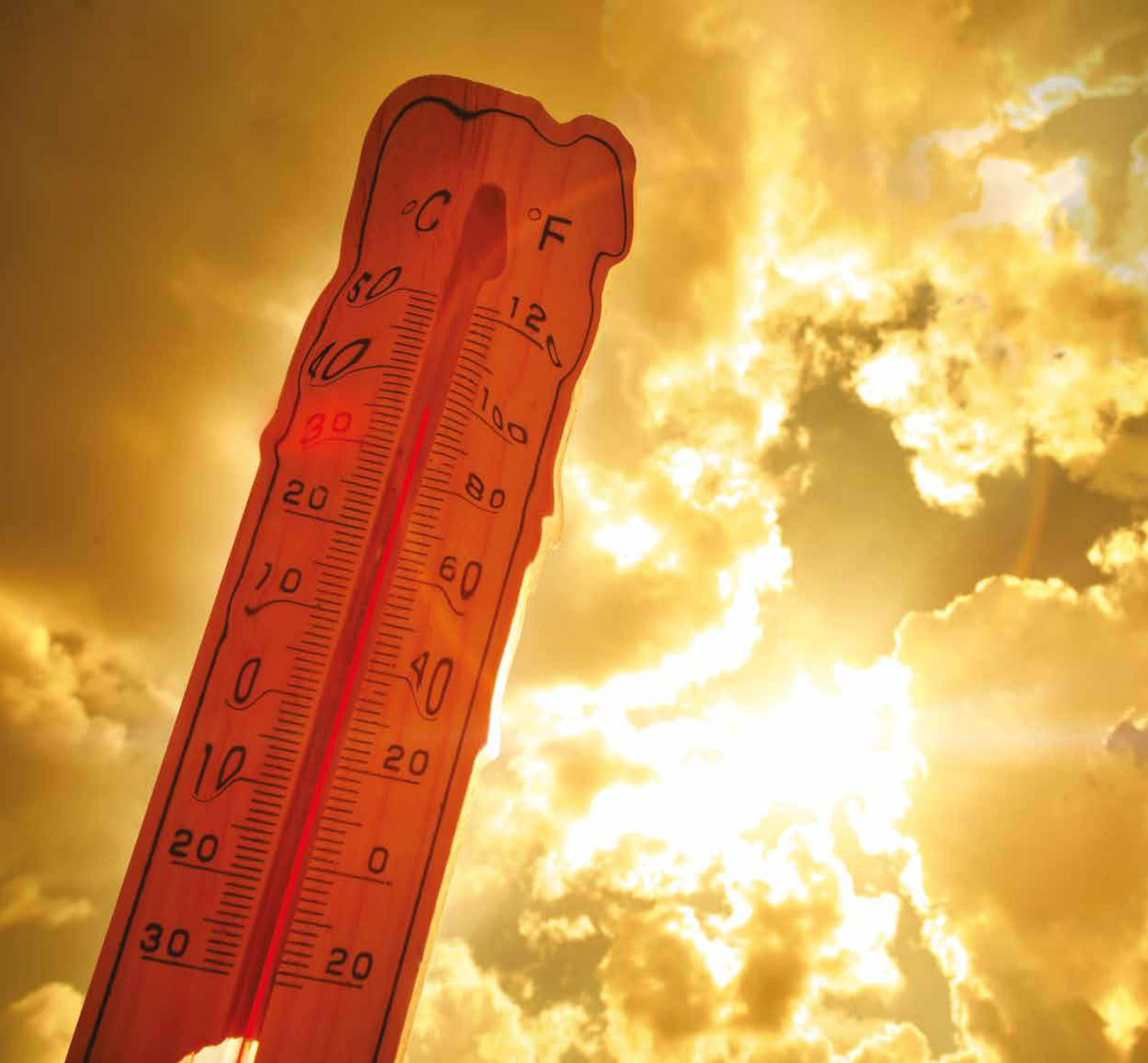
iFOREST

INTERNATIONAL FORUM FOR ENVIRONMENT, SUSTAINABILITY & TECHNOLOGY

POLICY BRIEF

INTEGRATED HEAT AND COOLING ACTION PLAN



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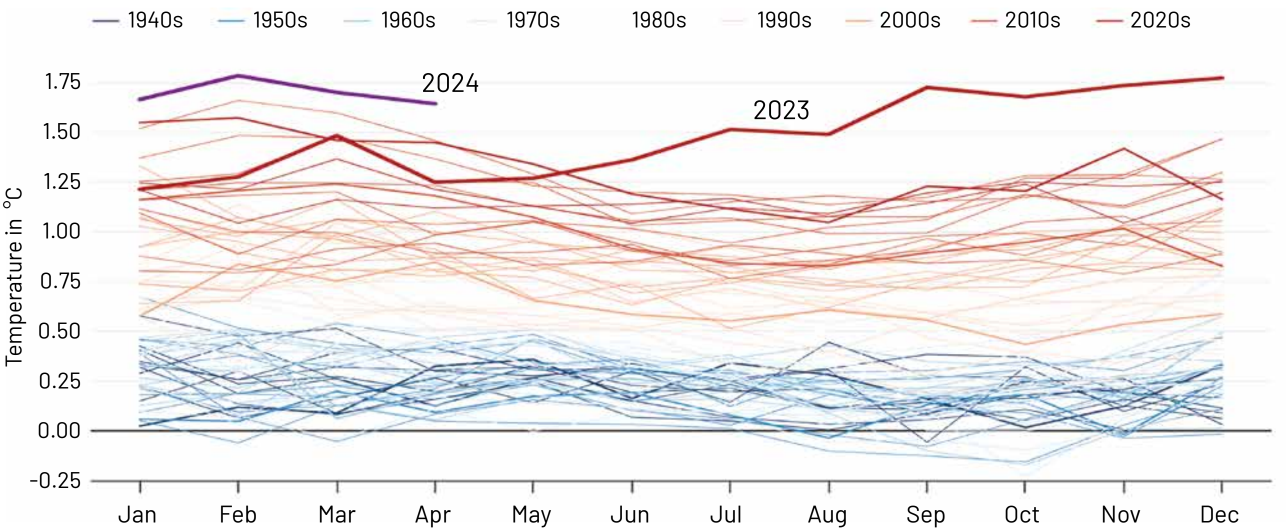
1. Facing the Heat

The year 2023 was reported as the hottest year globally, with the average near-surface temperature in 2023 being 1.45 °C above the pre-industrial baseline according to the World Meteorological Organization (WMO) State of the Global Climate 2023 report.[1]

These temperatures are likely to surge even further, with each of the first three months of 2024 setting a new record. Estimates suggest that the average global temperature could pass the 1.5°C guardrail in the near future.[2]

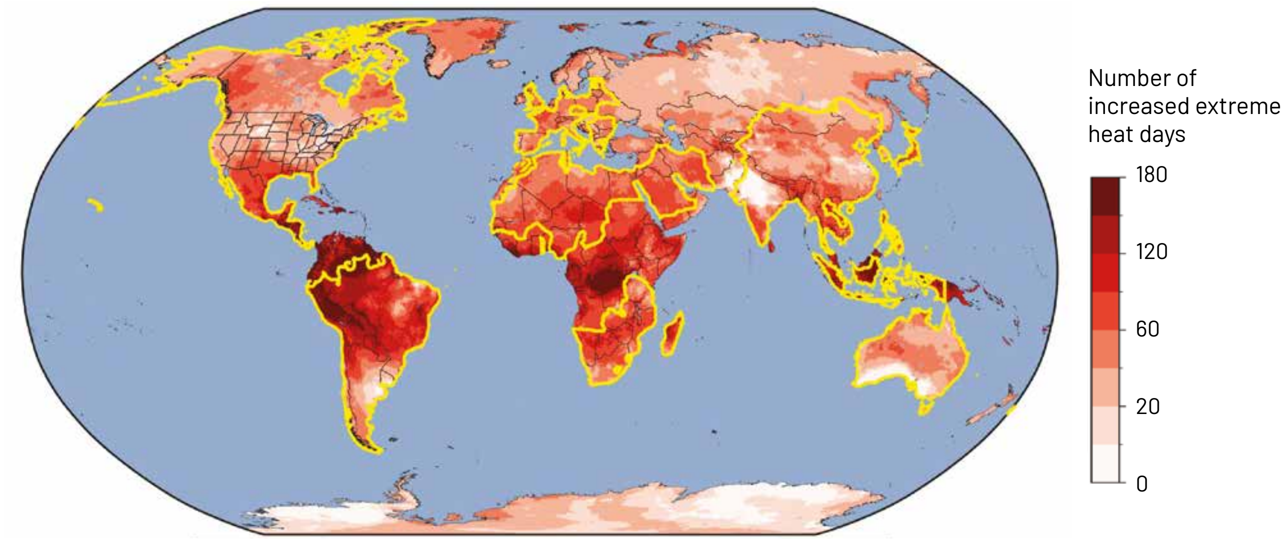
Figure 1: Monthly global average temperatures from the 1940s to 2024



Source: Adopted from state of the climate article by Carbon Brief, 2024

Increasing global warming is leading to increased frequency, intensity, and duration of heat waves across all regions of the world, impacting wider geographical areas that were previously unimpacted.

Map 1: Number of increased extreme heat days across the world in 2023



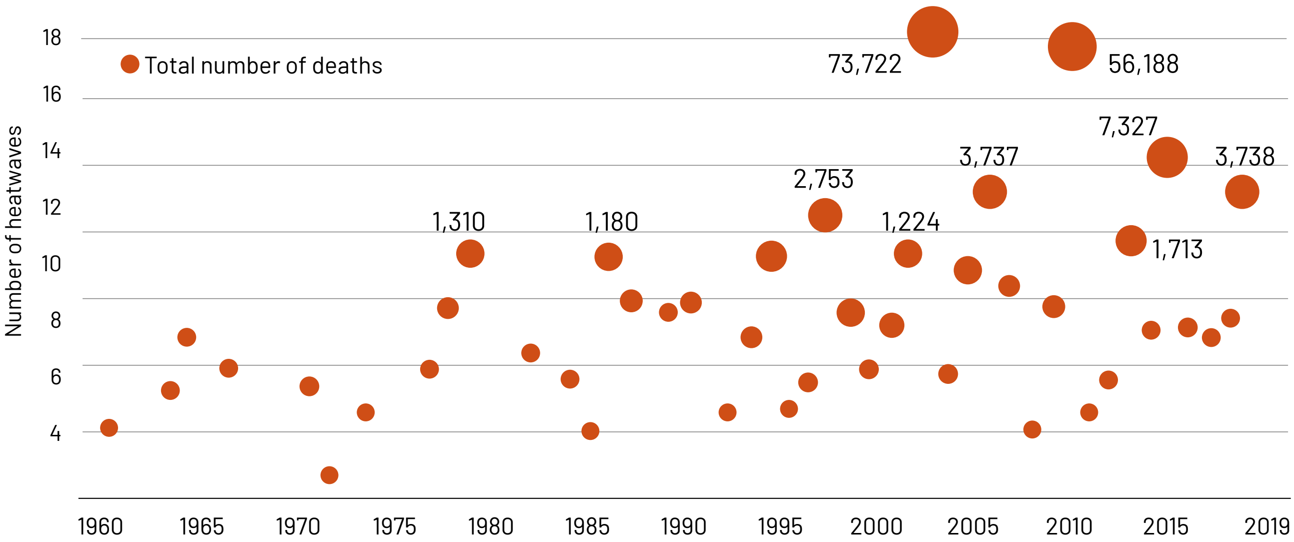
Source: Adopted from Climate Change and the Escalation of Global Extreme Heat by the World Weather Attribution, the Red Cross Red Crescent Climate Centre, and Climate Central, 2024.

A recent report revealed that approximately 6.3 billion people, which accounts for about 78% of the global population, encountered at least 31 days of extreme heat (hotter than 90% of temperatures observed in their local area over the 1991-2020 period) from May 2023 to May 2024.[3]

2. Escalating Impact of Heat Waves

This increasing heat stress has significant and varying impacts, including implications for public health, mortality, labour productivity, and the economy. With the number of people exposed to extreme heat growing exponentially, heat stress claims more lives worldwide than any other climate-related disaster.[4]

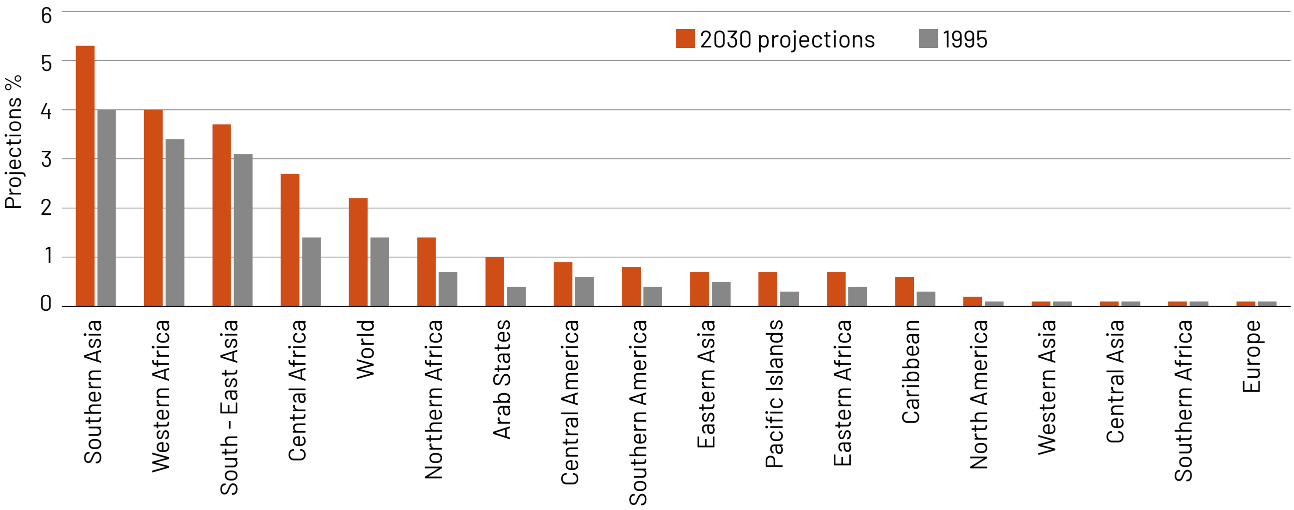
Figure 2: Total number of heat wave days and deaths from 1960 to 2019



Source: Adopted from Extreme Heat: Preparing for the Heatwaves of the Future by the United Nations Office for the Coordination of Humanitarian Affairs, the International Federation of Red Cross and Red Crescent Societies, and the Red Cross Red Crescent Climate Centre, 2022

Besides heat-related deaths, extreme heat can also cause more chronic and pervasive impacts that often are unreported and unmanaged.[5] According to a recent study by the International Labour Organization (ILO), outbreaks of chronic kidney disease were diagnosed among workers performing heavy manual labour in hot temperatures in various regions across the world.[6]

Figure 3: Working hours lost to heat stress (by subregion)



Source: Adopted from Working on a Warmer Planet by the International Labour Organization, 2019.

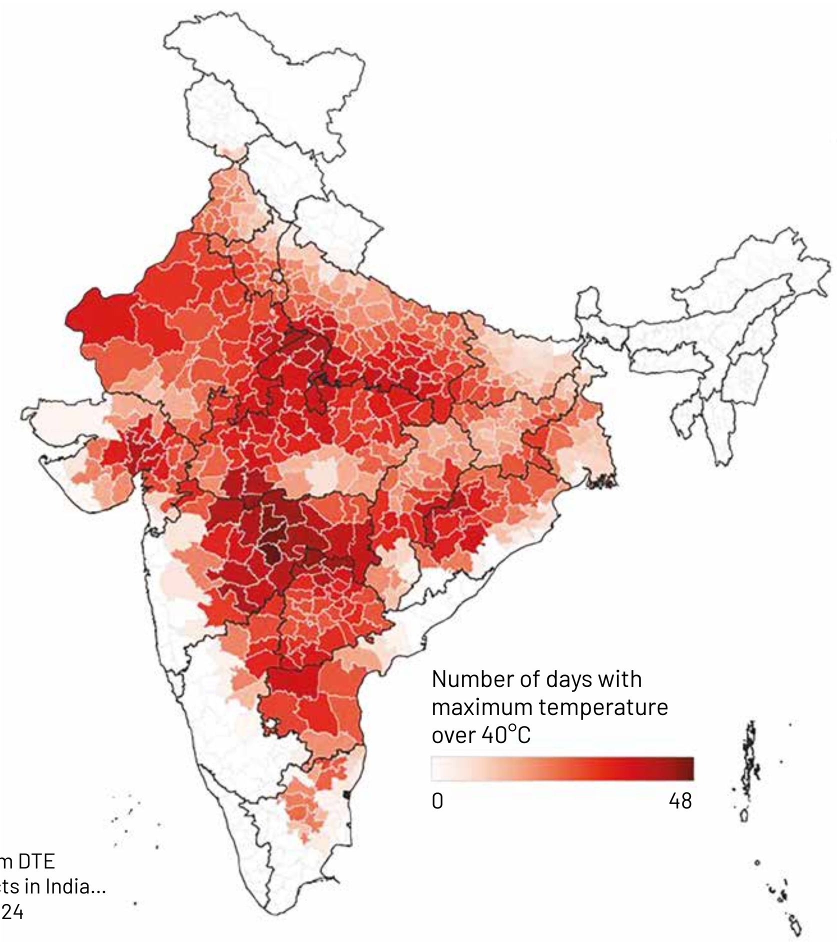
Heat stress also significantly impacts economic activity, with high temperatures reducing the ability of businesses to operate during the hottest hours. According to the ILO report, by 2030, more than 2 per cent of total working hours worldwide are projected to be lost yearly, with the loss of working hours reaching 5 per cent in parts of Southern Asia and Western Africa. It is also estimated that the cumulative financial loss due to heat stress could reach US$2,400 billion by 2030.[7]

UNPRECEDENTED HEAT EXTREME IN INDIA IN 2024

From April until July, India experienced one of its worst-ever and longest-running heat waves. Temperatures during this period reached 50°C, with a night-time low of 37°C, reportedly the highest ever recorded in India. It left at least 40,000 people with heatstroke and over 100 dead.[8]

During April and May, over 500 of the 741 districts in India, which constitute around 70% of the total districts, reported a daily maximum temperature of 40°C at least once.[9]

Map 2: Number of days with maximum temperature over 40°C



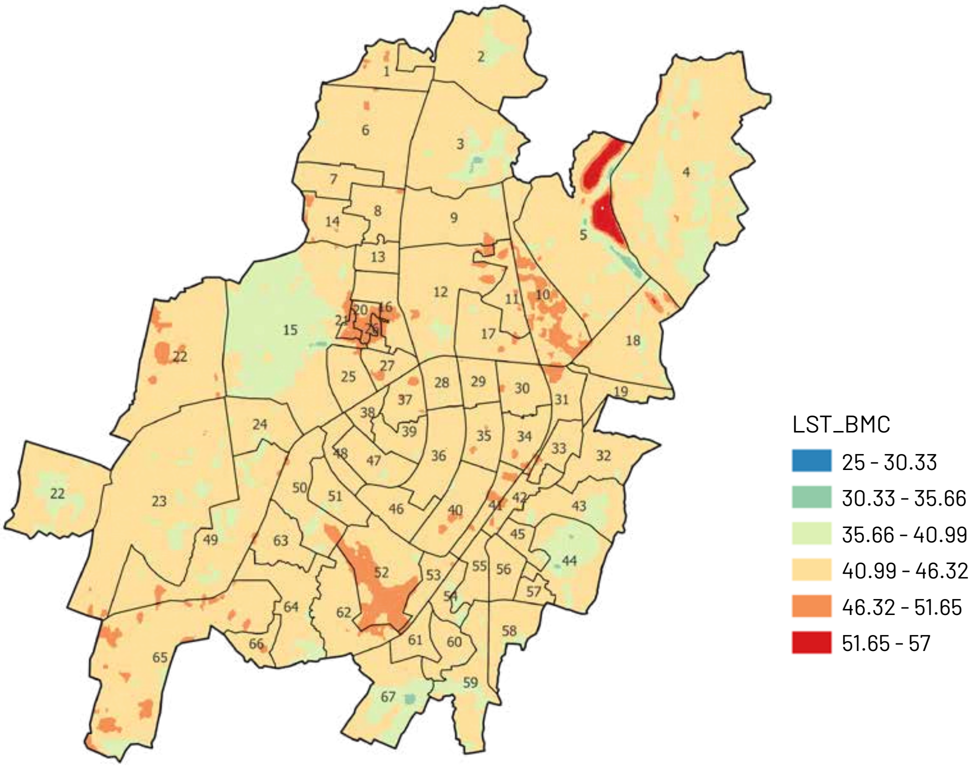
Source: Adopted from DTE Analysis: 70% Districts in India... by Down To Earth, 2024

3. Cities on the Brink

Urban areas typically encounter higher temperatures than their surrounding areas due to the urban heat island (UHI) effect. This is a result of various factors, some of which include:

- **Urban surfaces:** Human-made building materials such as pavement and concrete reflect less sunlight and absorb more heat than natural surfaces. With the increasing use of heat-absorbing and heat-retaining materials and reduced coverage of natural vegetation and water bodies, urban surfaces quickly heat up during the day and are slow to release the heat at night.
- **Urban geometries:** Reduced air circulation from densely built infrastructure traps the heat near the surface.
- **Anthropogenic heat:** Waste heat released from vehicles and cooling devices installed in buildings and industries can significantly impact the microclimate and lead to increased local temperatures.

Map 3: Heat hotspots in the city of Bhubaneswar



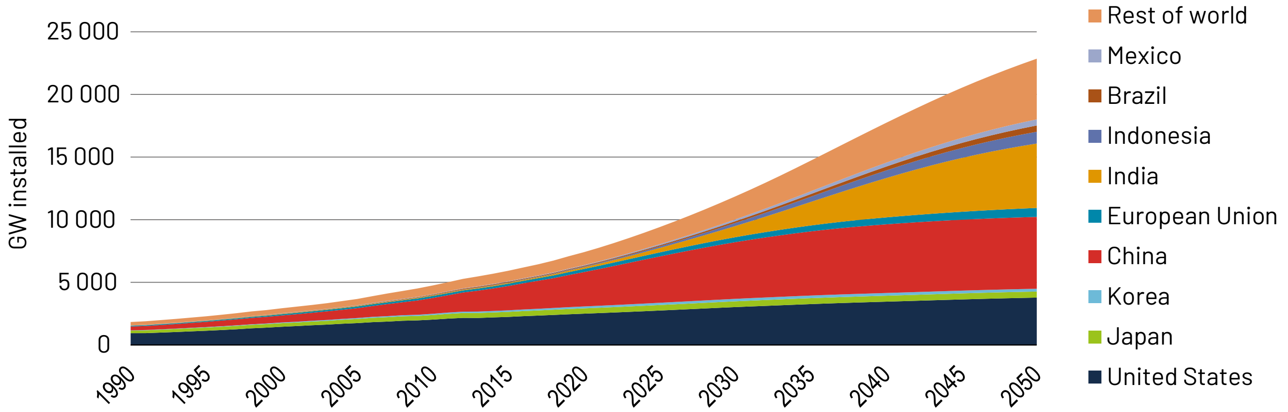
Source: iFOREST analysis using Landsat 8 data

This heat stress from the UHI effect displays uneven spatial distributions, with certain areas of the city experiencing greater impact. Research on Indian cities has revealed that UHI can lead to temperature increase by up to 8°C.[10]

4. The Cooling Challenge

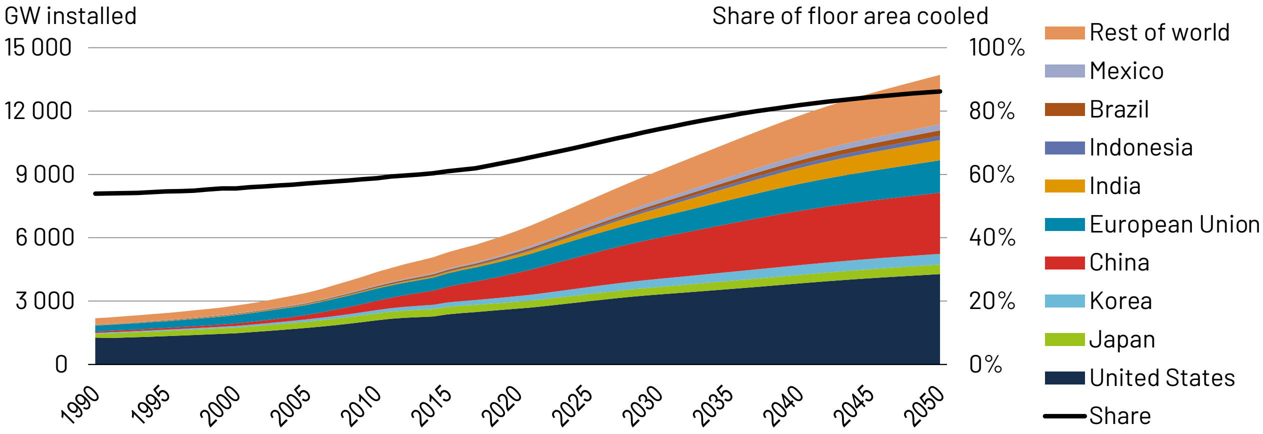
The demand for cooling is increasing because of the rising global temperatures and extreme weather events. This, in turn, has led to higher emissions from the cooling sector, contributing to more global warming and leading to a vicious cycle of increasing heat and cooling demand.

Figure 4: Increase in residential cooling capacity by country/region



Source: Adopted from The Future of Cooling by International Energy Agency, 2018

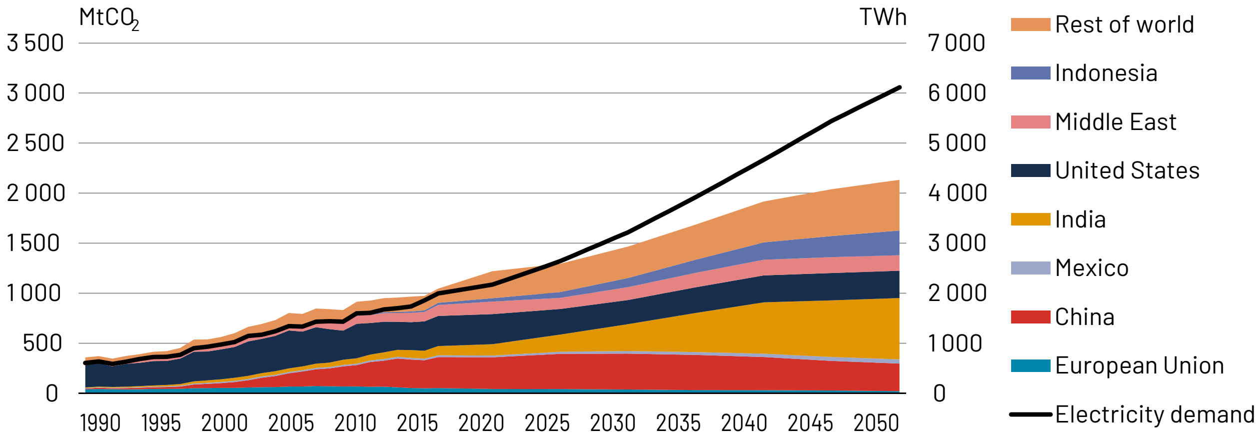
Figure 5: Increase in commercial cooling capacity by country/region



Source: Adopted from The Future of Cooling by International Energy Agency, 2018

The International Energy Agency (IEA) projects significant growth in cooling demand worldwide. In the residential sector, the total space-cooling requirement increased nearly fourfold from 6,200 gigawatts (GW) in 2016 to almost 23,000 GW in 2050. This trend is echoed in the commercial sector, where the cooling capacity grows from 5,500 GW to slightly less than 14,000 GW.[11]

Figure 6: Increase in electricity demand and CO_2 emissions from space cooling by country/region



Source: Adopted from The Future of Cooling by International Energy Agency, 2018

The increased energy demands for cooling have led to the installation of new fossil-fuel power plants. This has slowed the decarbonisation process and heightened reliance on fossil fuels for power generation.[12]

5. Policy Framework around Heat and Cooling Sectors

Several countries around the world have established action plans for the heat and cooling sector. While there exists an internationally approved framework for the cooling sector at the national level, there is currently no such framework for extreme heat. Instead, each country develops its own policy documents at the national or sub-national level based on either some internal guidelines or past experiences.

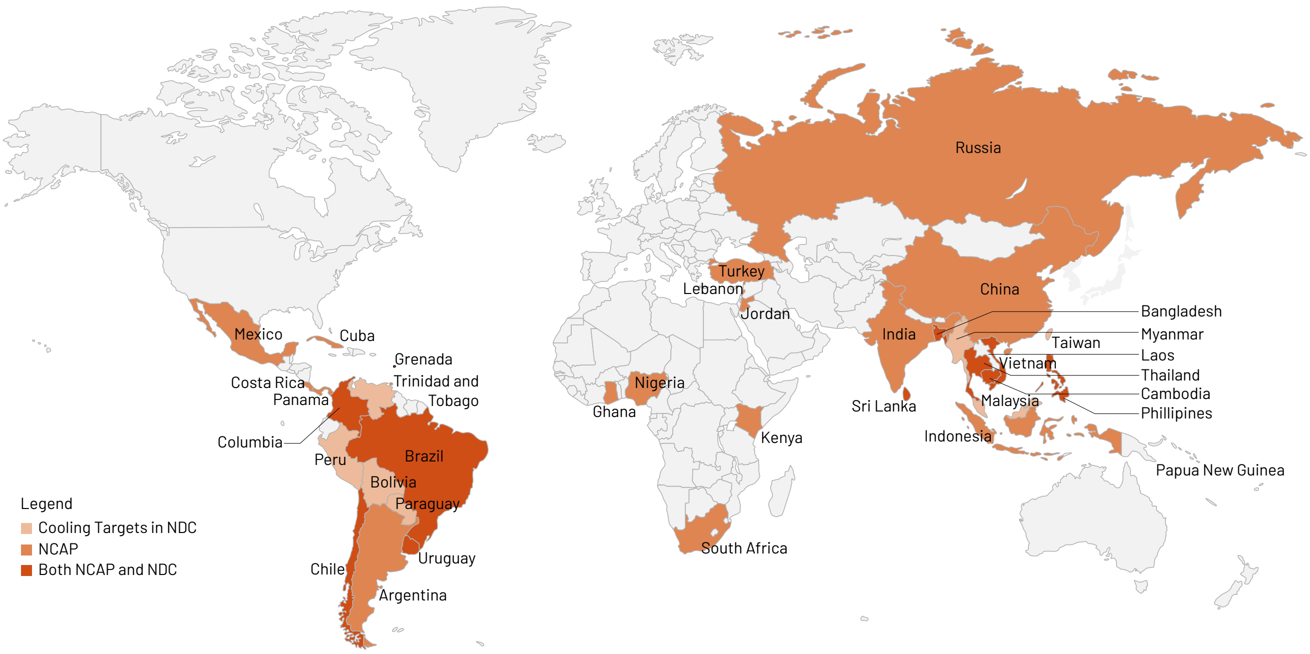
National Cooling Action Plans

The National Cooling Action Plans (NCAPs) are the primary policy initiative to develop integrated and comprehensive long-term strategies for achieving sustainable cooling objectives at the national level.[13]

In 2018, several countries started developing NCAPs with technical support from specialised agencies. According to the Cooling Coalition, about 39 countries are preparing their NCAPs and are at different stages of development.[14] In addition, many countries have included cooling action plans as part of their Nationally Determined Contributions (NDCs).

This landscape is rapidly evolving, particularly in Latin America and Asia, where several countries are implementing NCAP and integrating cooling into their key climate strategies.

Map 4: Countries which have developed the NCAP

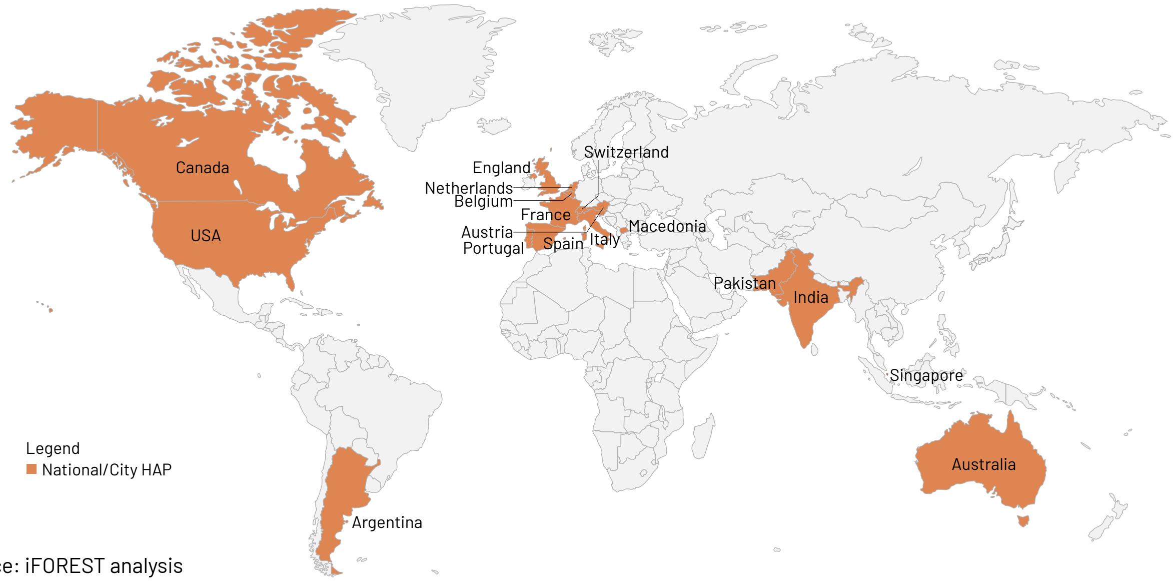


Source: iFOREST analysis

Heat Action Plans

Heat Action Plans (HAPs) are guidance documents developed at the subnational, or city level to establish a framework for preparing for, responding to, recovering from, and learning from heat waves. A HAP integrates a portfolio of assessments and actions to respond to and reduce heat-related impacts. These plans may include both emergency response activities and long-term heat preparedness and cooling interventions across sectors. Cities worldwide have developed or are in the process of developing HAPs.

Map 5: Countries which have developed national or city level HAP



Source: iFOREST analysis

6. Disconnect between the HAP and the NCAP

Despite HAPs and NCAPs sharing common goals, they are often found to be lacking as each action plan singularly focuses on and caters to only one aspect. There is also a disconnect at the spatial level; while HAPs are essentially implementable at the city-level, NCAPs are country-level strategies.

With the HAPs only focusing on heat management and developing strategies to protect people from extreme heat, they miss out on understanding the effects of the increasing cooling demand and how that further propels increasing temperatures. They also miss out on the aspects related to reducing heat within the city and buildings.

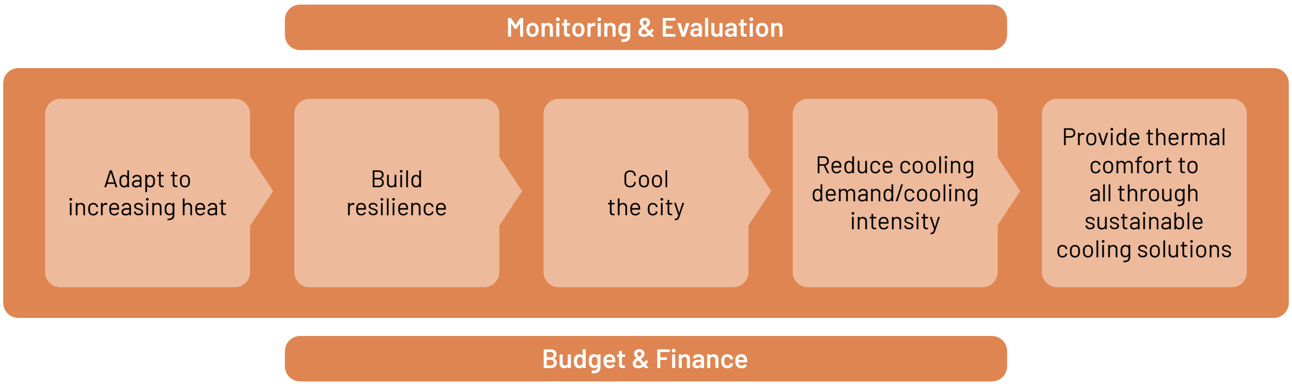
On the other hand, while the NCAP takes an integrated approach to cooling, it overlooks the essential aspect of reducing heat, which can be as critical as providing sustainable cooling in addressing cities' growing cooling demand.

To overcome the existing gaps and inefficiencies, we need to develop a framework to address this dual challenge at the city level. An Integrated Heat and Cooling Action Plan (IHCAP) must be developed to address the pressing need to adapt and mitigate extreme heat and provide sustainable and equitable cooling without further warming the urban environment.

7. Proposed framework for IHCAP

The IHCAP has been designed for intervention at the city level and includes five pillars:

Figure 7: Framework of the IHCAP



1. Adapt to increasing heat

Figure 8: Key components related to extreme heat adaptation

This aspect involves immediate interventions to save lives by developing a system for effective communication and preparing key departments during heat waves. Some of the major interventions are:

i. **Defining thresholds for an early warning system:** The criteria for determining temperature extremes vary significantly due to specific climatological, built environment and vulnerability factors. Therefore, every city must define the conditions under which heat becomes a hazard and identify the local heat threshold for early warning alerts.

ii. **Regulate timings:** Regulate the timings for schools, public transport, and offices and enforce similar modifications in labour guidelines to prevent direct exposure at peak heat timings.

iii. **Preparing key sectors:** Cities need to prepare key services critical for dealing with heat waves, such as healthcare and fire departments, and enhance their capacity. This could include developing heat wards in hospitals, developing mobile medical facilities, and so on.

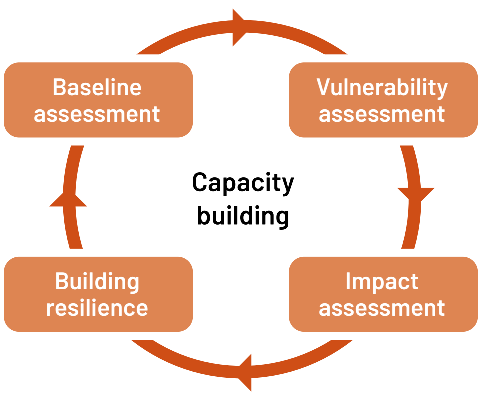
iv. **Developing inter-agency coordination, protocols and systems:** Cities must develop an effective coordination mechanism between key departments to deal with heat waves. This should include Standard Operating Procedures (SOPs) for key departments, with clear responsibilities and action plans.

v. **Creating an effective communication plan:** Developing a communication plan to effectively convey the risks is key to saving lives. This involves an early warning system which acts as the trigger point for responding to heat management, with each stakeholder tasked to carry out tasks outlined for them. In addition, establishing a formal communication channel to alert relevant departments, health practitioners and hospitals, emergency responders, media outlets, and other key stakeholders, should be the key part of the communication plan.

vi. **Public awareness and community outreach:** It is crucial to create public awareness and issue heat advisories with detailed protocols on dealing with and preventing heat illness. These advisories should outline steps that are crucial in minimising the health impact and enabling people to take first aid and precautionary measures. All possible mediums should be used to increase awareness, convey warnings to the most at risk and work with community groups

2.Building resilience

Figure 9: Key components related to extreme heat resilience



This aspect involves understanding the vulnerabilities and impacts, predicting future heat waves and their impacts on various sectors, improving infrastructure and identifying the population which is at a higher vulnerability to the impacts and finding specific solutions for them. Some of the key components involve:

A. **Baseline assessment and future projections:** Understanding the city's heatwave trends and developing future projections under different scenarios.

B. **Vulnerability assessment:** This involves identifying vulnerable population and areas.

- **Identification of vulnerable populations:** Heat waves disproportionately affect certain groups of people who are more vulnerable to heat-related mortality and morbidity. It is crucial to identify these groups to prioritise actions to effectively manage heat-related illnesses and minimise the potential threats.
- **Identification of vulnerable areas:** The impact from heat is also spatially unevenly distributed, with certain parts of the city becoming warmer than their surroundings. It is important to identify these heat hotspots to develop effective measures.

C. **Impact Assessment:** Assessing the impact of heat waves and increasing cooling demand across various sectors, including electricity, water, health, transport, housing, and so on.

D. **Short and medium-term strategies for building resilience:** After understanding the impact of extreme temperatures and identifying the vulnerable populations and areas, and impacts on sectors, an action plan needs to be prepared for vulnerable populations and areas and to strengthen city infrastructure to deal with extreme heat. This could include strengthening the local grid, provision for backup for water supply and electricity, establishing cooling centres, strengthening health infrastructure, temporary shading for traffic police and outdoor workers, etc.

E. **Capacity building:** Establishing a comprehensive training program to build the capacity of the identified stakeholders is crucial to ensuring improved and more effective management of heat waves.

3. Cool the city

This step involves developing strategies to reduce the UHI effect and urban hotspots. Emphasis is placed on heat-minimising planning, using thermally favourable materials, and expanding nature-based spaces. Some of these strategies include:

- **Promoting cool surfaces:** A shift towards using reflective urban surfaces for building rooftops and pavements can help make our cities cooler by reducing the amount of heat transmitted from the earth's surface and trapped in the atmosphere. Effective implementation can significantly mitigate the UHI effect and decrease the need for mechanical cooling in buildings.
- **Integrating blue-green infrastructure:** Natural features provide cooling benefits through evapotranspiration and direct shade in the case of trees and other vegetation and by acting as heat sinks in the case of bodies of water. Land use planning should integrate vegetation and water bodies into the urban fabric to mitigate the UHI effect and reduce local and ambient temperature.
- **Including nature into the urban fabric:** It is important to incentivise policies and community initiatives to introduce nature into the urban fabric through various means such as urban farming, urban greening initiatives, installing vertical greens, and so on.

4. Reduce cooling demand

This step focuses on improving buildings' thermal performance and reducing their need for mechanical cooling, as well as decreasing their overall energy consumption and emissions footprint, through the use of thermally efficient building design and construction and promoting passive cooling techniques. The main regulatory mechanism for this step includes:

- **Mandatory or voluntary building energy codes:** Building energy codes are the key policy mechanism for thermally efficient design and construction in buildings. While the potential of building energy codes is well-documented, this potential remains largely untapped due to a number of implementation and enforcement barriers arising from a combination of factors, including institutional challenges, regulatory challenges, a lack of enabling mechanisms to create and sustain markets, low stakeholder motivation due to split incentives, and a lack of awareness and capacities.

While these strategies are easier and most cost-effective to incorporate during new construction, they can also apply to existing buildings, especially during renovation and repurposing. Some techniques well suited to existing buildings include installing high-performance windows, adding insulation, adding shading devices, and implementing cool roofs.

5. Providing thermal comfort through sustainable cooling solutions

This step focuses on serving a building's cooling load through the most appropriate and efficient cooling system that minimises the use of refrigerants having high global warming potential (GWP) to deliver the required cooling with the least amount of energy and emissions. It also entails strategies for efficient operations and optimising user behaviour. Some of the key strategies in this step are:

- **Promotion of centralised cooling systems:** At larger scales, such as in large office buildings, commercial complexes, and industrial facilities, centralised cooling systems like variable refrigerant flow air conditioners and chillers are often preferred. This is mainly because they offer improved efficiency and easier maintenance compared to individual units.

  As the scale expands to include multiple buildings within a region or entire district, district cooling becomes a viable choice. It provides significantly lower emissions and energy utilisation and increases affordability due to economies of scale.

- **Develop incentives to promote energy-efficient and not-in-kind cooling technologies:** With a wide range of cooling technologies available for space cooling and enhancing thermal comfort, their careful selection is essential to drive the transition towards efficient and best-fit solutions. Therefore, the choice of the most energy-efficient cooling technology with low GWP will depend on several factors such as building scale and typology, type of construction, building ownership profile, climate zone, immediate environmental attributes and specific local factors (such as utility rates and service sector capacity and capability).
- **User adaptations and behaviour changes:** The lack of awareness amongst consumers about energy usage from their appliances, combined with low electricity prices, gives them little incentive to manage their cooling use more effectively. However, encouraging energy-saving habits and adopting technologies like controllers and sensors can significantly lower energy consumption without compromising comfort, health, or productivity.
- **Capacity-building in the service sector:** Proper maintenance and servicing of cooling equipment can greatly impact its performance efficiency and reduce the environmental impact associated with the release of these refrigerants into the atmosphere.

  There is a need to develop proper operation and maintenance (O&M) practices and enhance service sector capacity. This is to ensure a skilled workforce for appropriate equipment installation, maintenance, and the implementation of correct refrigerant management practices.

6. Budgeting and Finance

Finance is key to IHCAP. Every department must budget for the action plan. The action plans must identify funding sources to ensure successful implementation of the recommended strategies.

7. Monitoring and evaluation system

To ensure the action plans achieve their intended goals, a monitoring and evaluation process must be established outlining the key performance indicators, the timeline for monitoring, and the responsible stakeholder for conducting the assessment. The evaluation is also important to identify future needs and potential gaps besides assessing the effectiveness of the plan.

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