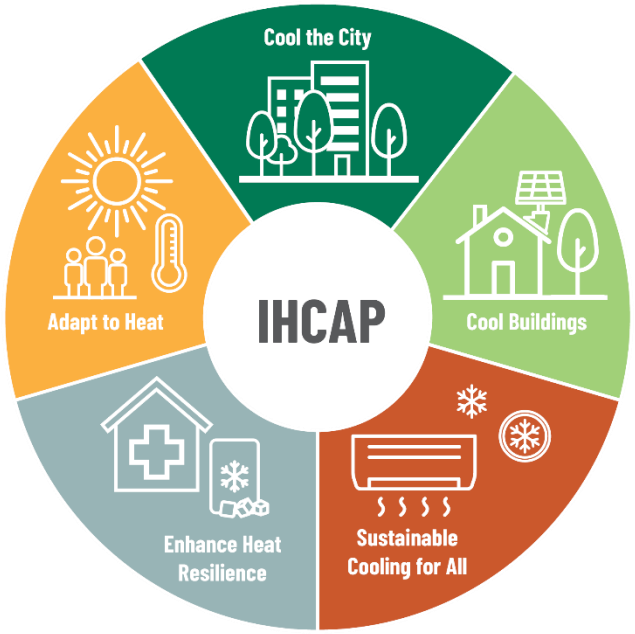
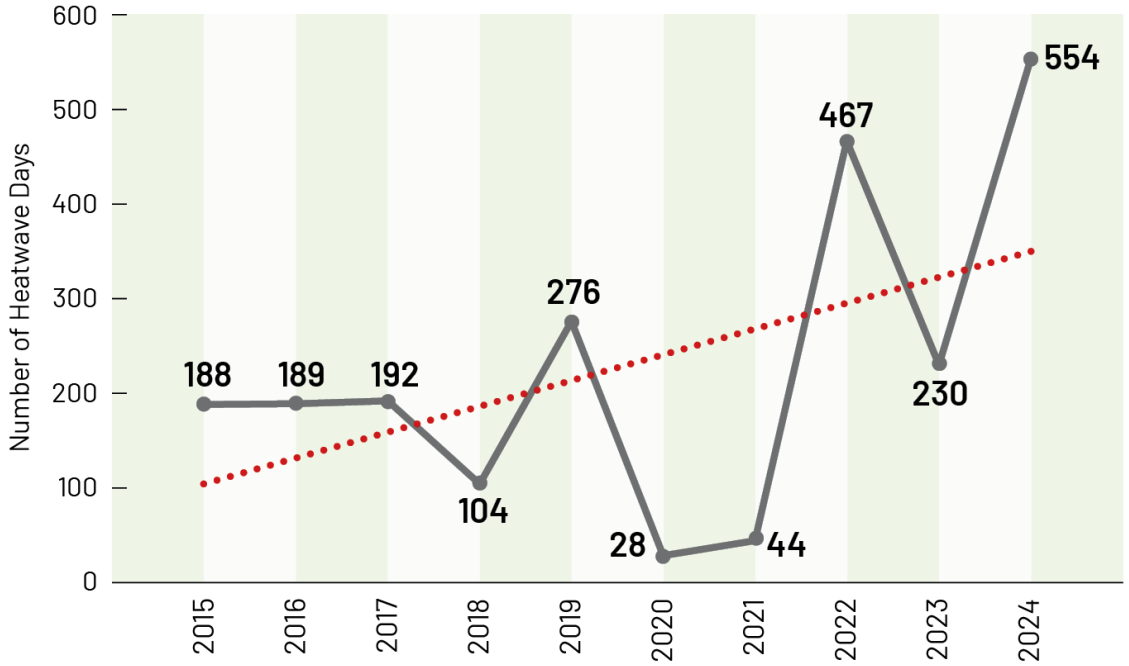


Bhubaneswar IHCAP

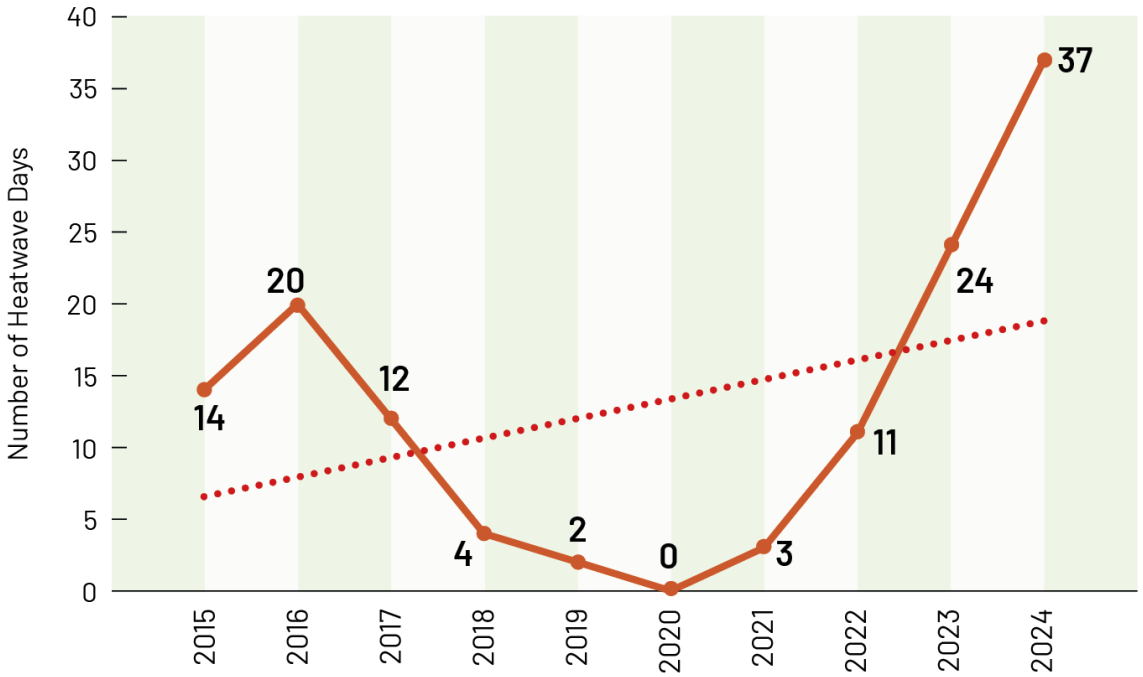
Dr Chandra Bhushan
President and CEO,
International Forum for Environment, Sustainability and Technology

Heatwaves in India



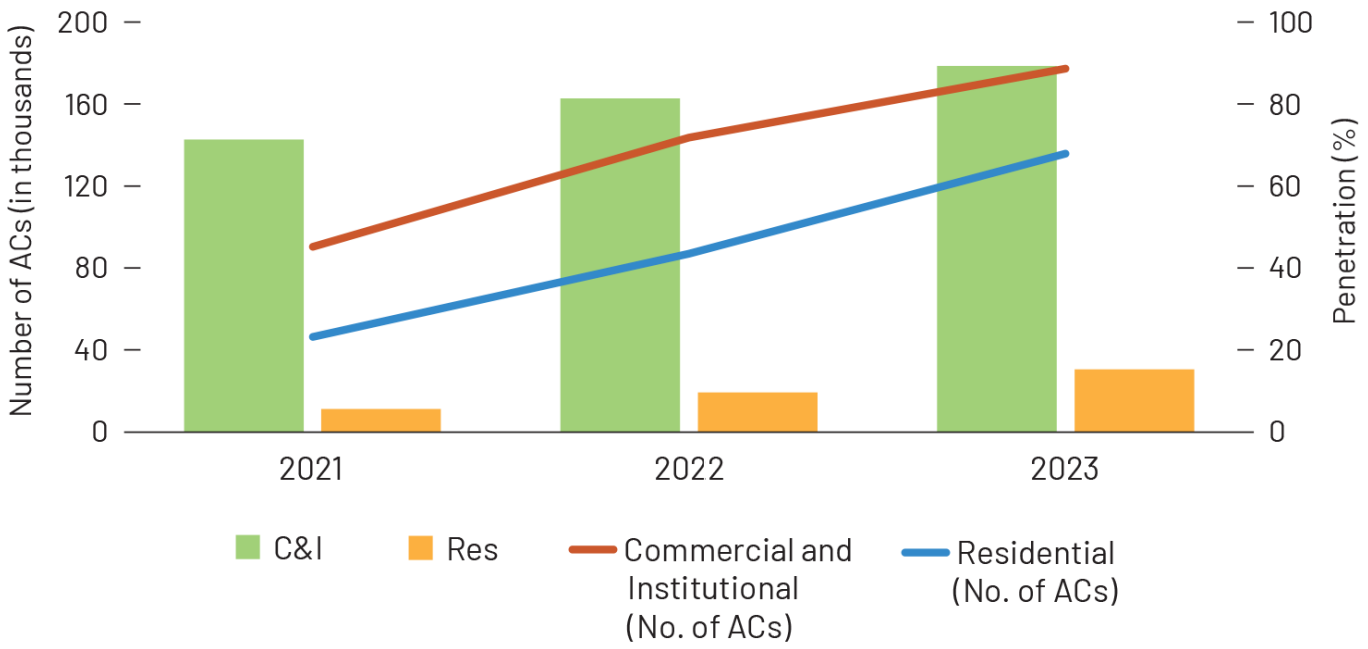
The frequency and intensity of heatwaves are rapidly increasing due to global warming.

Heatwaves in Odisha



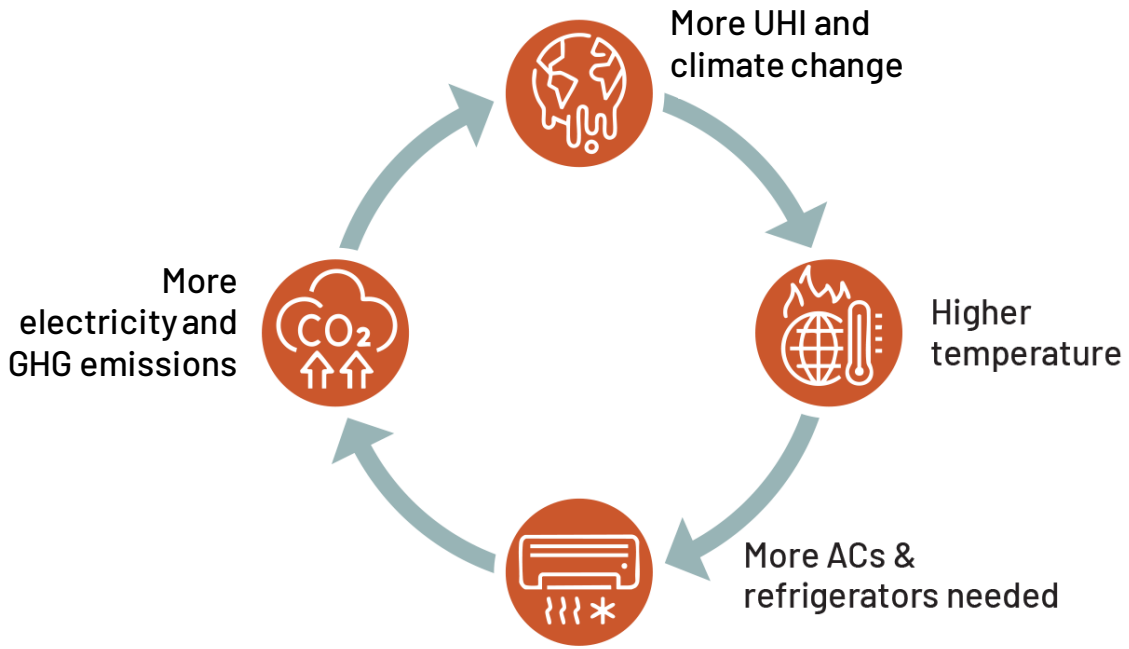
- Since 2020, there has been a steep rise in extreme heatwave days.
- Bhubaneswar experienced 17 consecutive days of temperatures above 40^{O}C in 2024.

Growing Air Conditioning Demand in Bhubaneswar



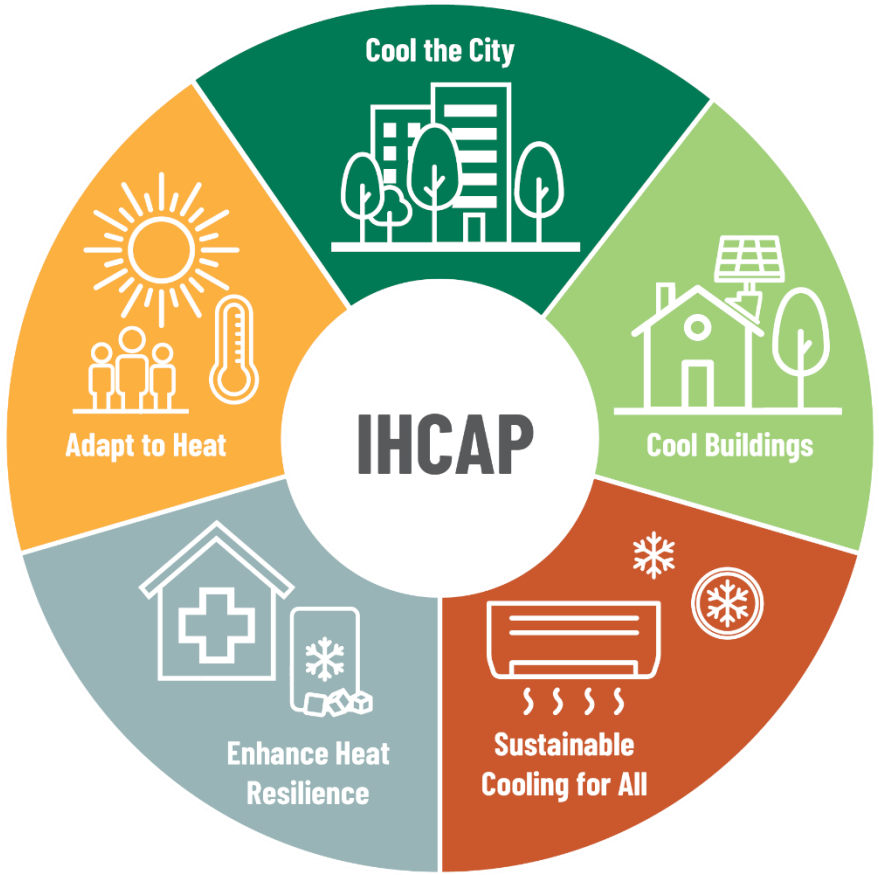
Between 2021 and 2023, AC ownership in the residential sector rose from 6% to 15%, growing at over 70% annually.

Vicious Cycle of Heat and Cooling



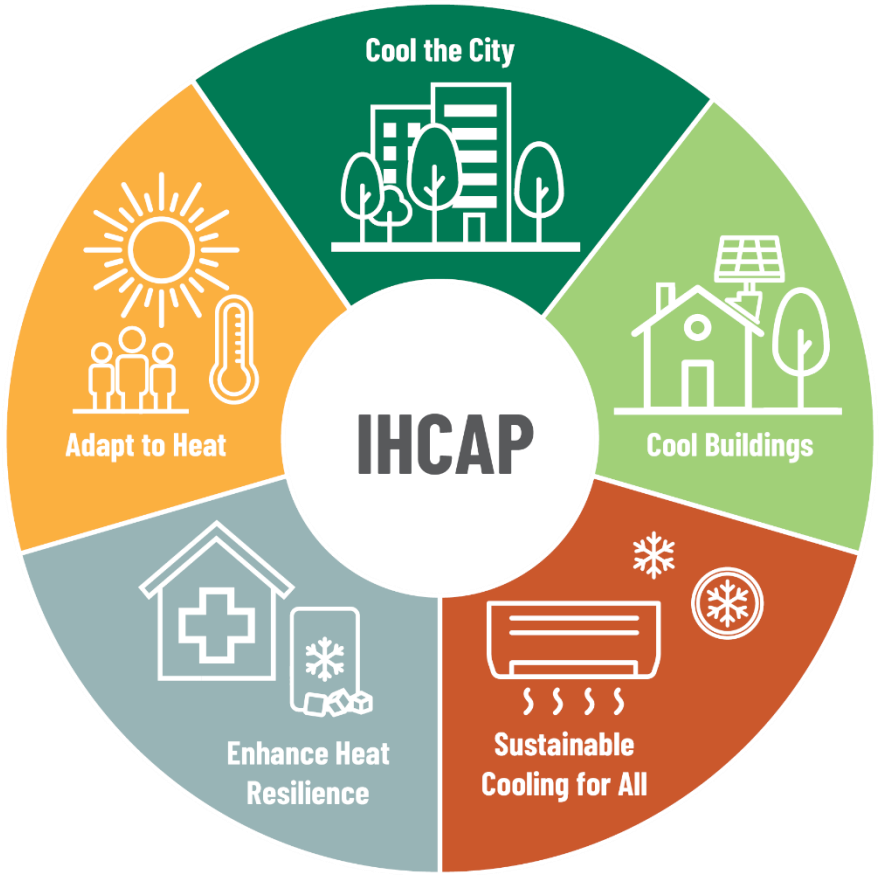
We must break this cycle and transform how we provide cooling and protect people from heat stress.

Integrated Heat and Cooling Action Plan



A framework developed by iFOREST to tackle two growing crises—rising heat stress and the explosion in Air Conditioning demand.

Integrated Heat and Cooling Action Plan



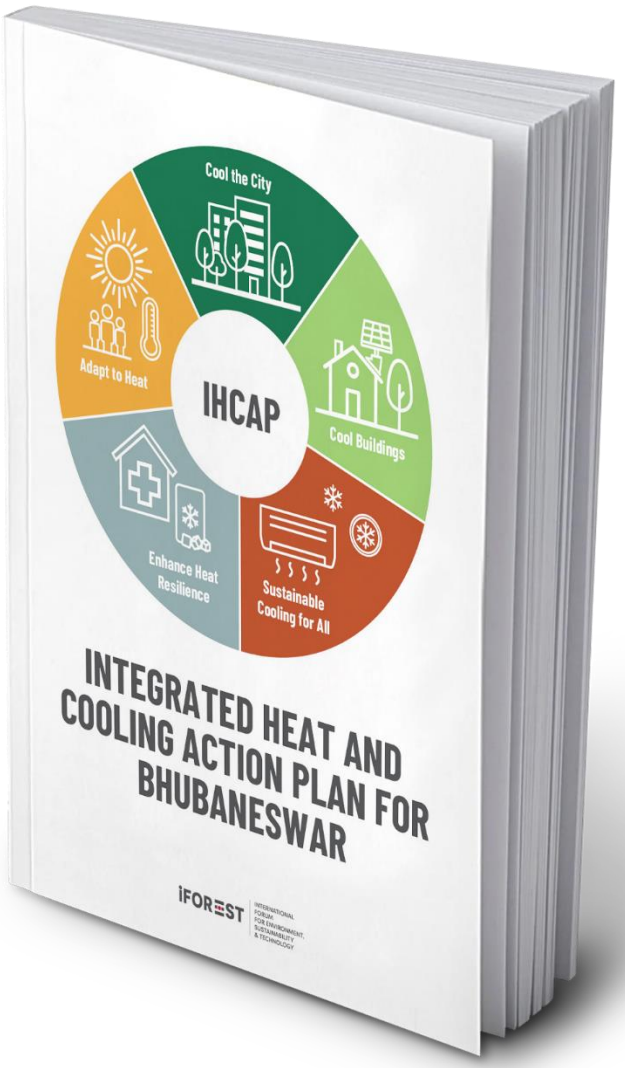
Pillar 1: Cool the City: Reduce the Urban Heat Island effect through nature-based solutions and climate-sensitive urban design.

Pillar 2: Cool Buildings: Implement energy conservation building codes and promote climate-responsive designs to enhance indoor comfort.

Pillar 3: Sustainable Cooling for All: Ensure access to affordable, efficient, and climate-friendly cooling solutions.

Pillar 4: Enhance Heat Resilience: Strengthen critical sectors like electricity, water and health; build cooling shelters and provide basic amenities.

Pillar 5: Adapt to Heat: Update heat alert thresholds to account for humidity, provide insurance for vulnerable workers, and expand awareness campaigns.

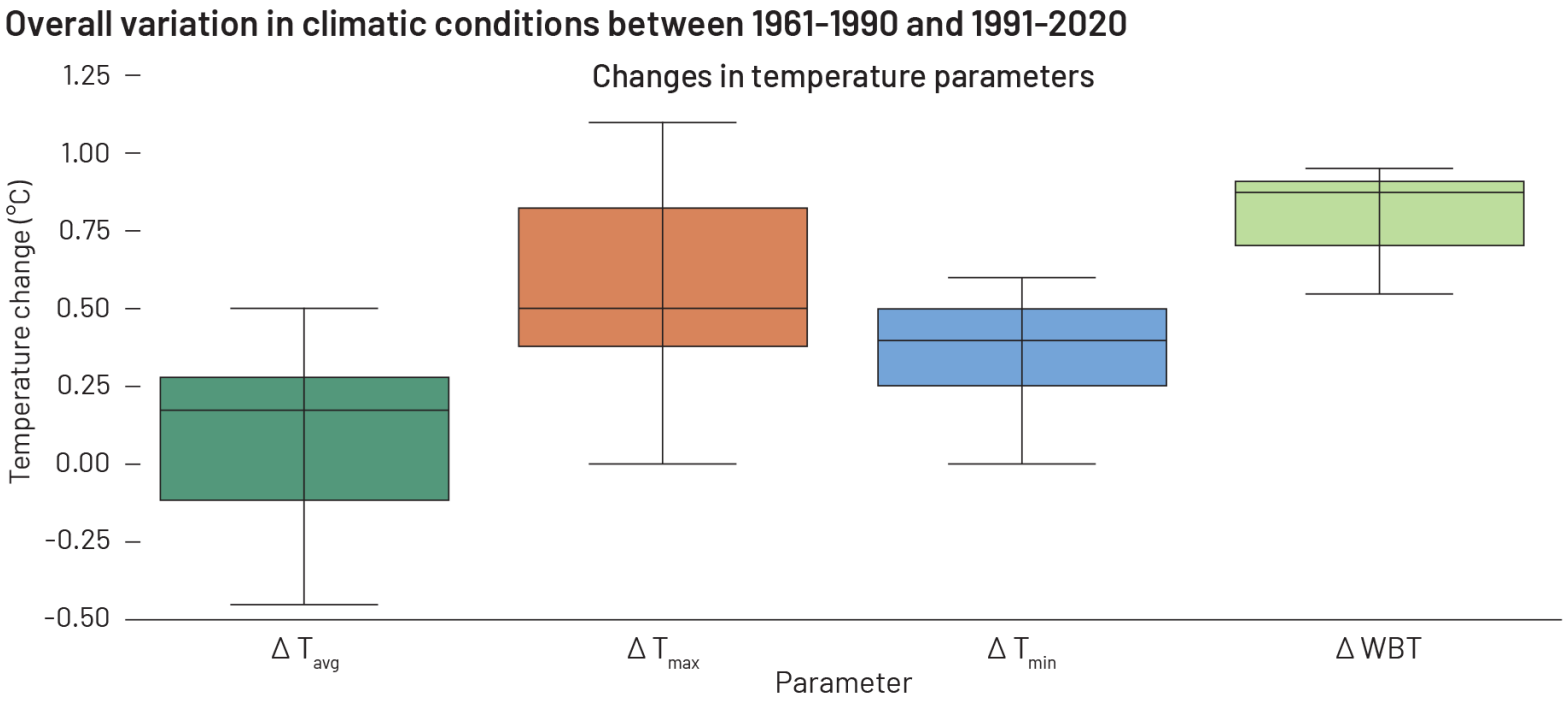

Cool the City
Adapt to Heat
IHCAP
Cool Buildings
Enhance Heat Resilience
Sustainable Cooling for All
INTEGRATED HEAT AND COOLING ACTION PLAN FOR BHUBANESWAR
iFOREST
INTERNATIONAL FORUM FOR ENVIRONMENT, SUSTAINABILITY & TECHNOLOGY

“Feels Like” Temperature in Bhubaneswar

Heat Index (°C)		Alerts	Days crossing the threshold in each month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
36	45	Yellow	0	4	23	17	14	10	27	30	25	26	1	0	**177**
45	55	Orange	0	0	0	10	17	20	3	1	3	1	0	0	**55**
> 55		Red	0	0	0	0	0	0	0	0	0	0	0	0	**0**

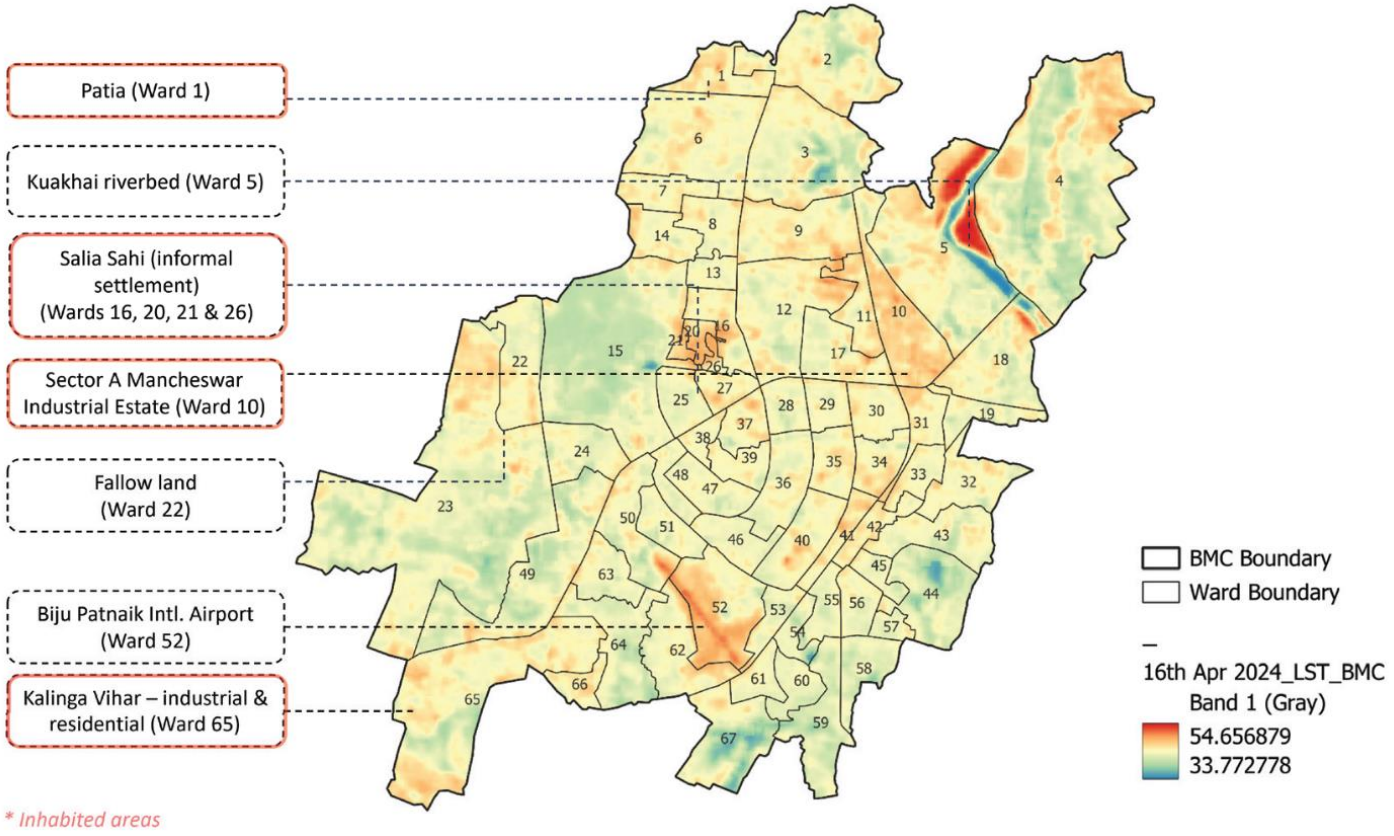
If we use IMD’s “Feels Like” index, which uses temperature and humidity to measure heat stress, the city endured nearly 232 days of Yellow (Heat) or Orange (Severe Heat) alerts in 2024, extending from February to October.

Long-term Climate Trends



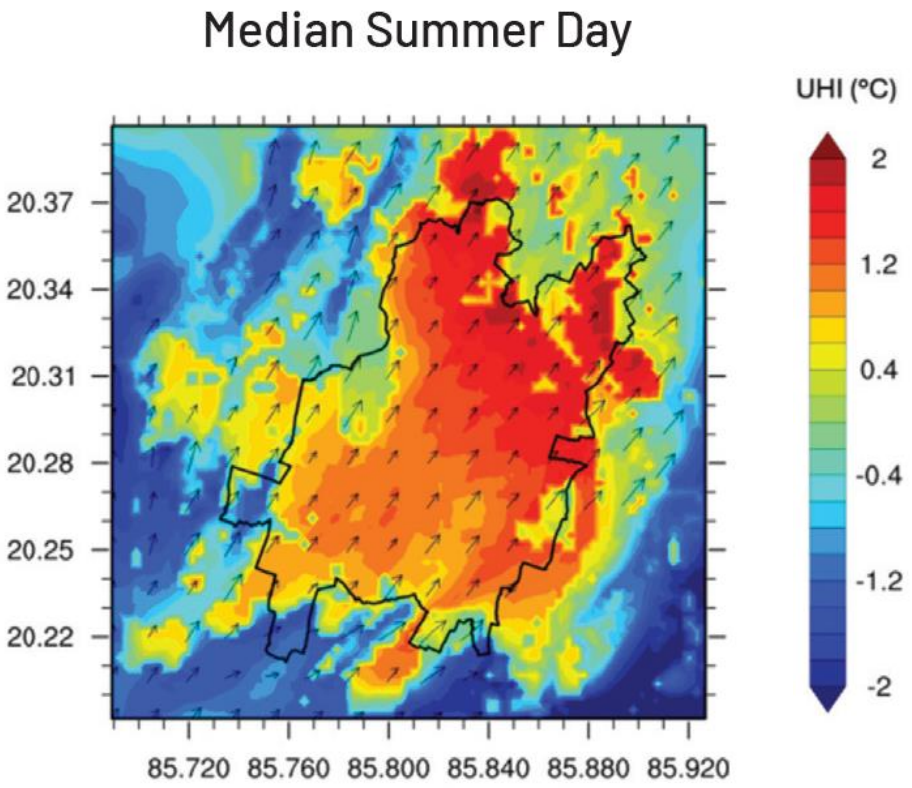
- Temperatures and humidity levels have risen steadily.
- Summer temperatures are now more than 1.0°C higher.
- Night-time temperatures have also risen.
- Wet-bulb temperatures have increased across all months.

Urban Heat Island Effect



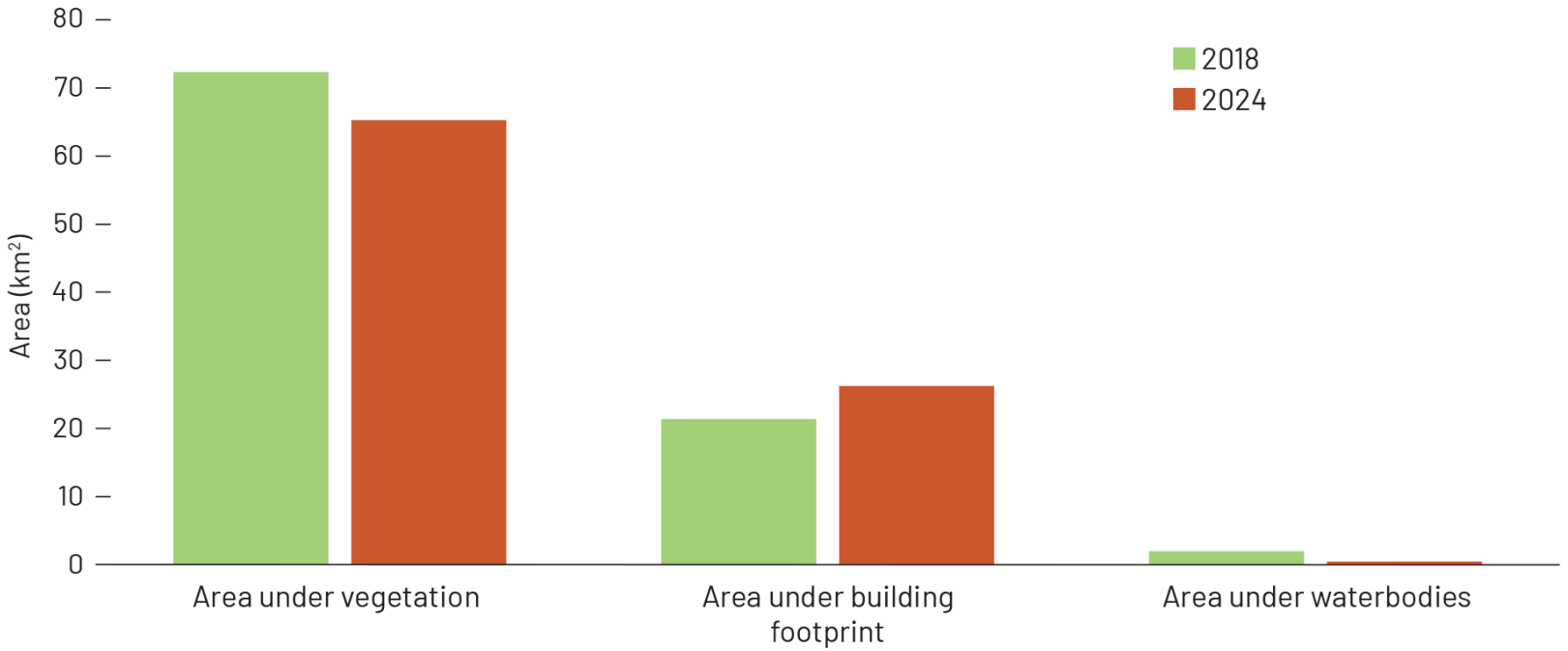
Surface temperatures across different parts of Bhubaneswar vary by as much as 20°C during a typical summer day.

Urban Heat Island Effect



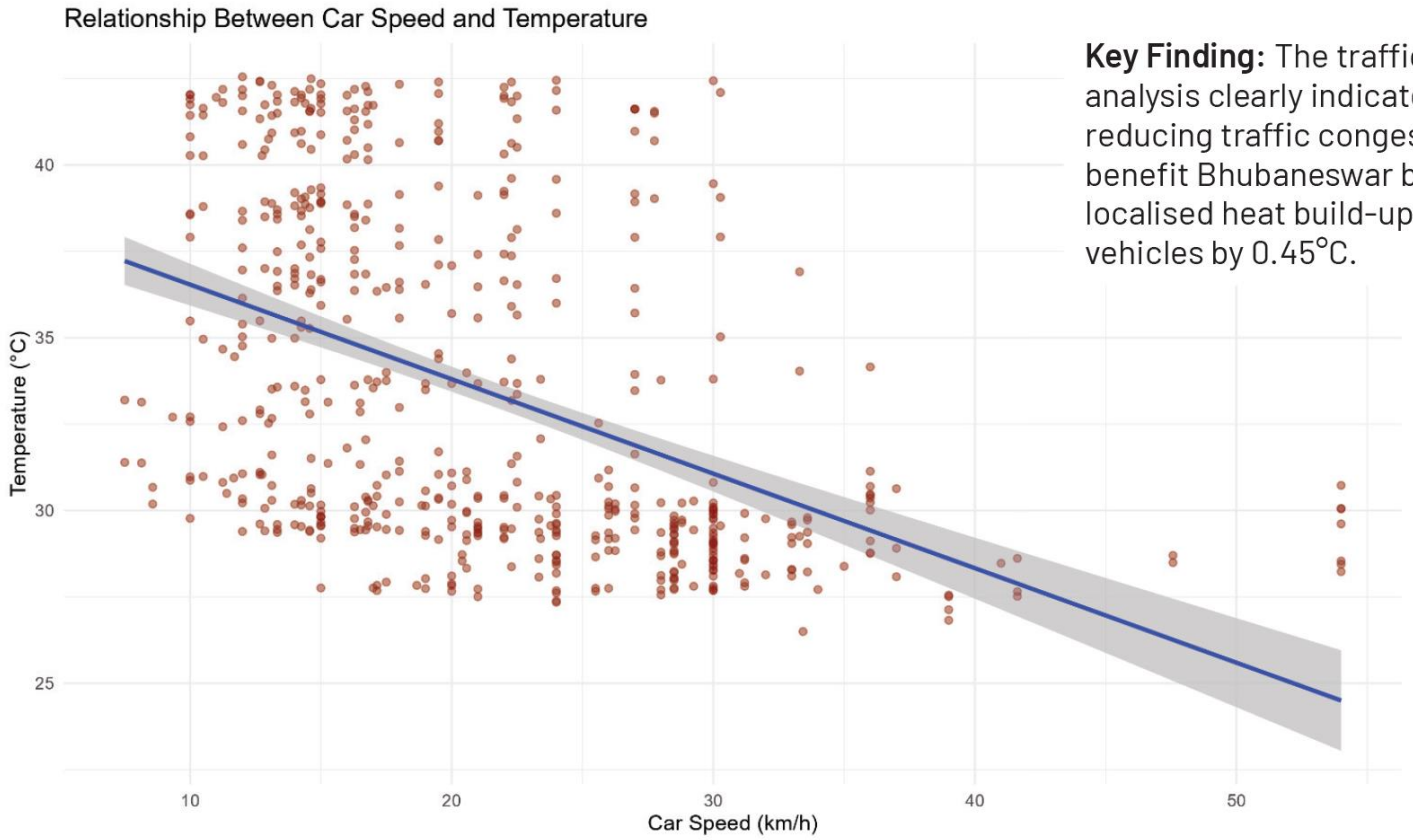
The temperature differences between the city and surrounding rural areas range from 2.0°C to 5.0°C.

Land-Use Changes



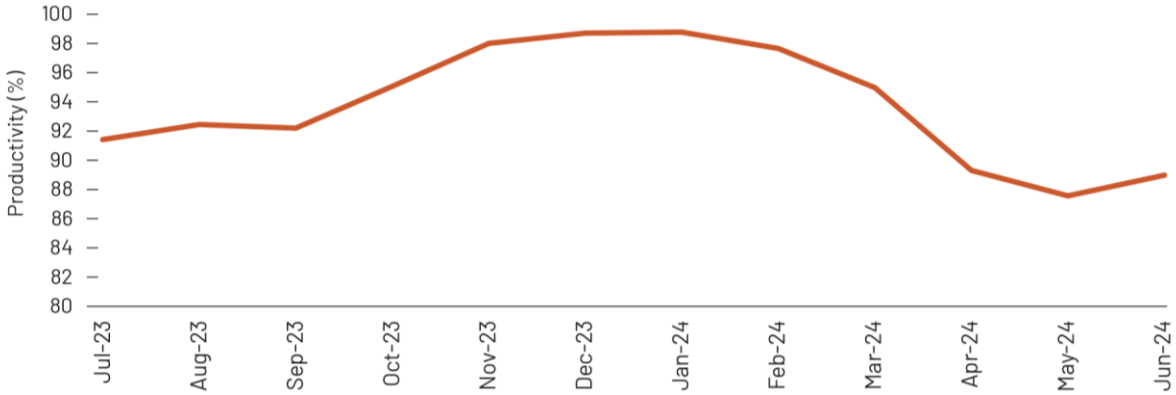
Between 2018 and 2024, Bhubaneswar's built-up area expanded by 23%, while vegetation fell by 9.8% and water bodies by 75%.

Impact of Traffic Congestion



Key Finding: The traffic congestion analysis clearly indicates that reducing traffic congestion can benefit Bhubaneswar by lowering localised heat build-up from idling vehicles by 0.45°C.

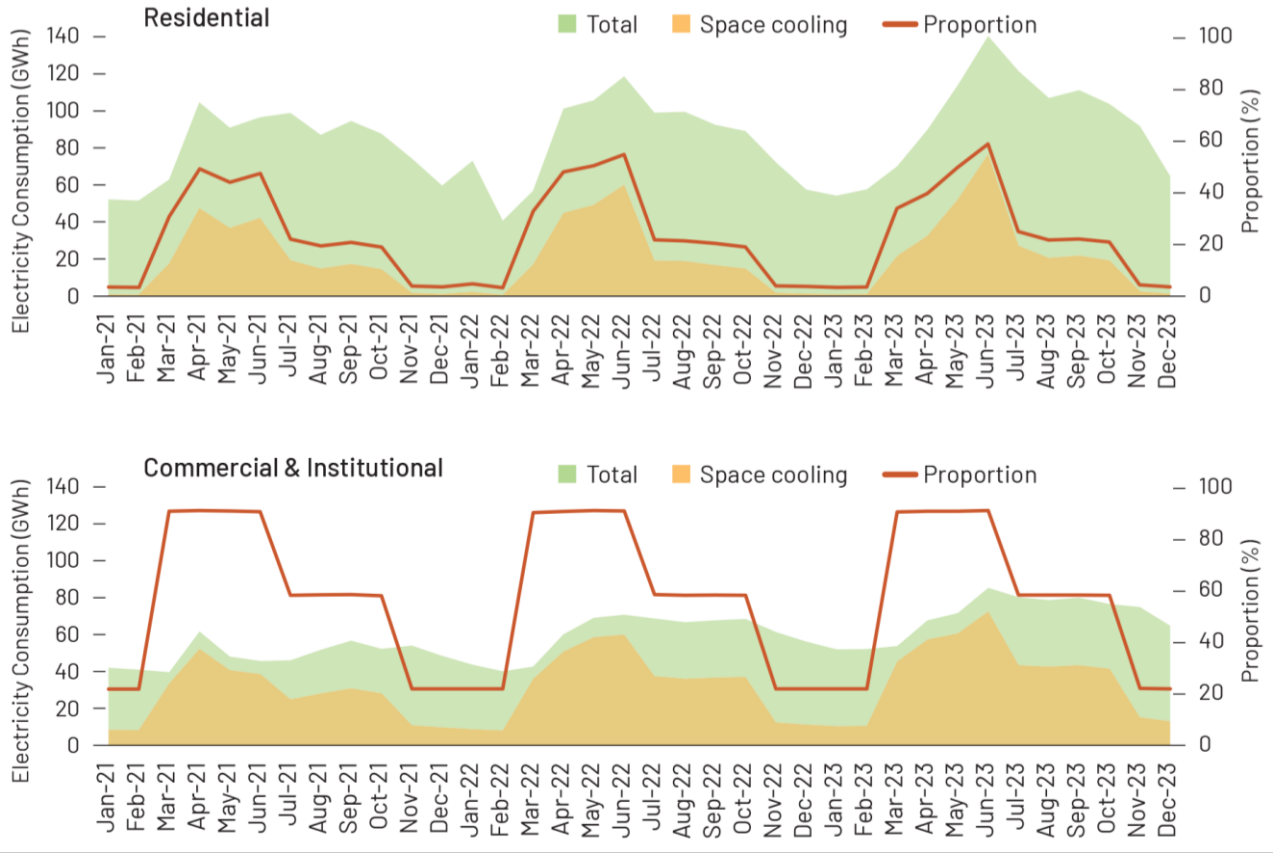
Impact of Heat Stress: Productivity Losses



- About 1/3rd of Bhubaneswar's workforce faces wage loss of 20-30%.

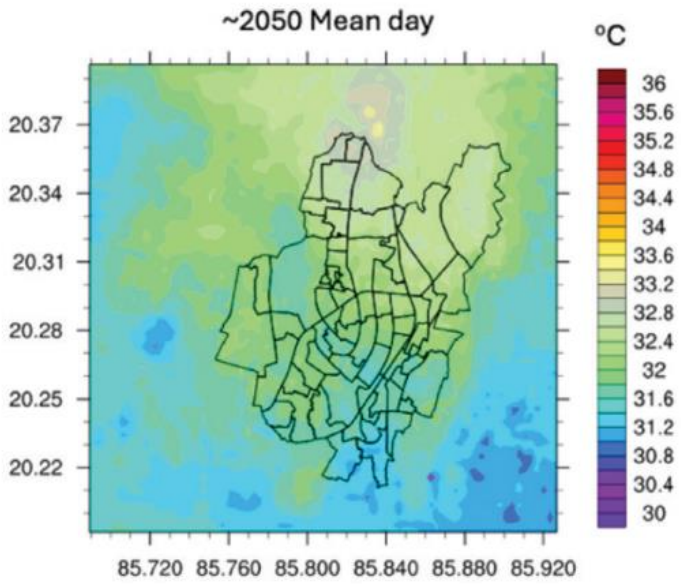
- Bhubaneswar cumulatively suffered an earnings loss of 8.6% due to heat stress.

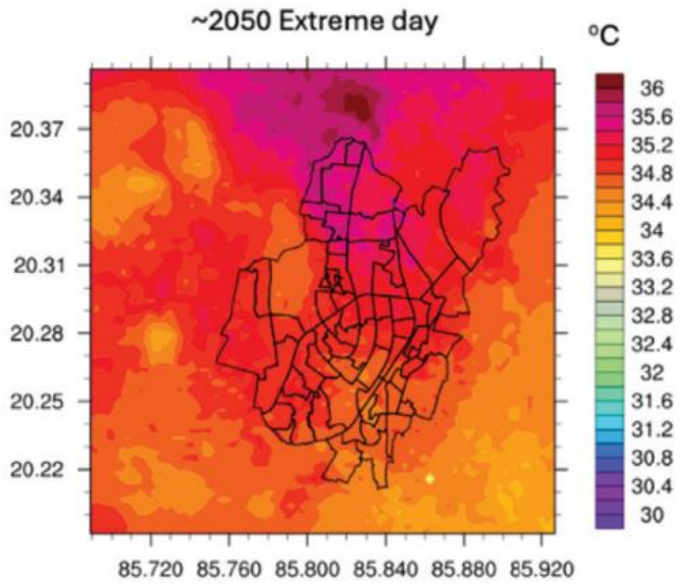
Impact of Heat Stress: Electricity Use for Cooling



- ACs account for 22–25% of residential and 54–55% of C&I electricity consumption.
- During summers, ACs account for 45–55% of residential and ~85% of C&I electricity consumption.

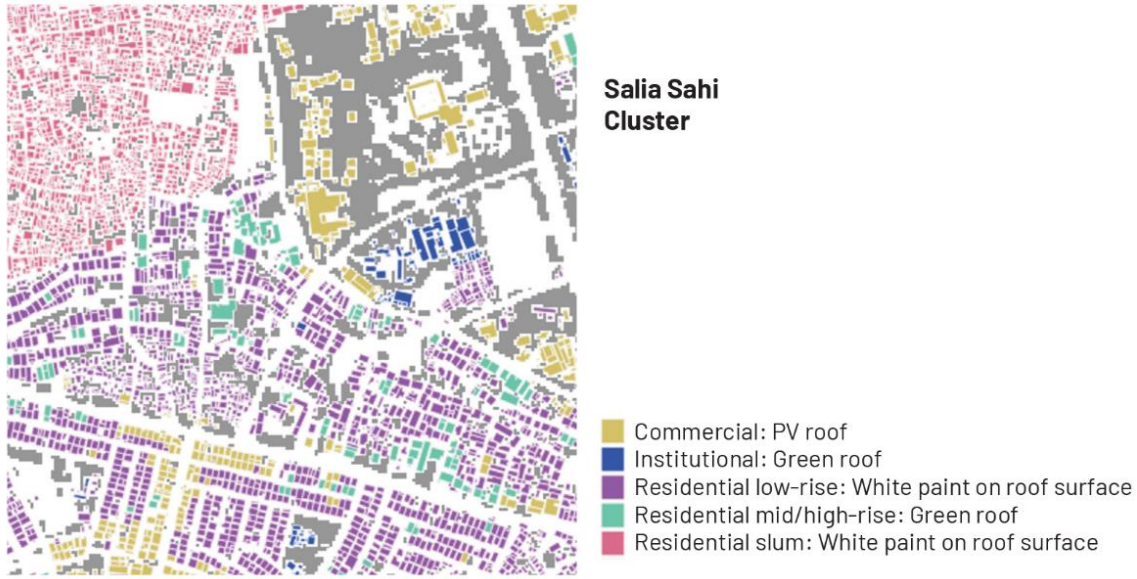
Future Heat Stress in Bhubaneswar

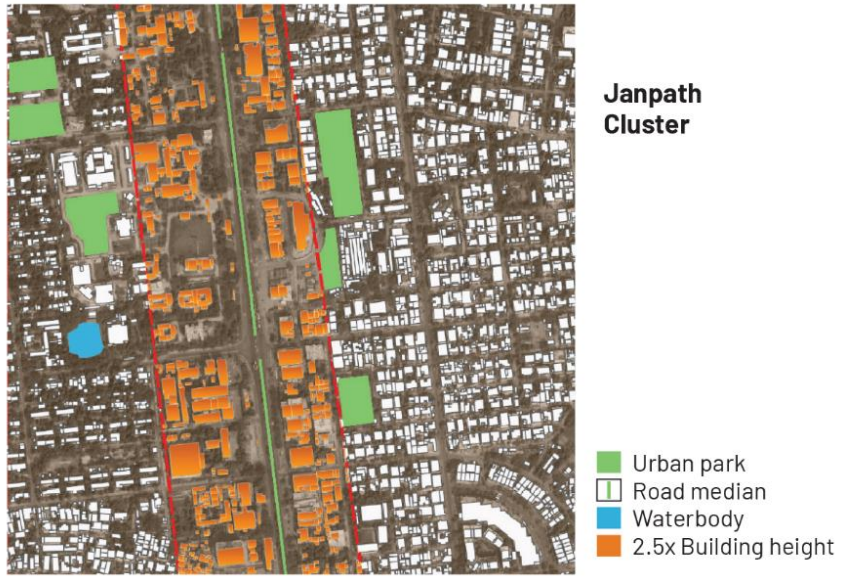




- Under the intermediate climate scenario (SSP2-4.5), : a “normal hot day” in 2050 will feel like today’s extreme heat days.
- An extreme heat day in 2050 will be 2.0-2.5^{O}C warmer than current extreme heat days.

Modelling Heat Mitigation Strategies

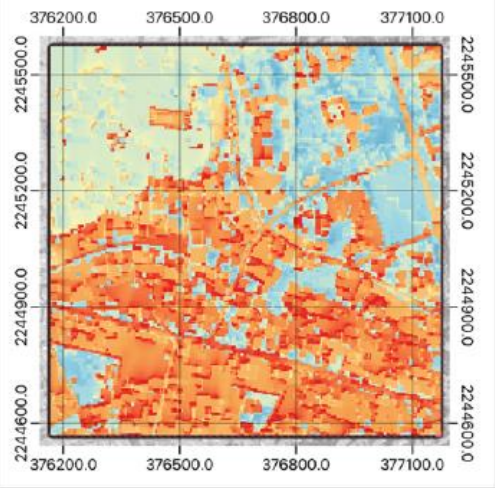




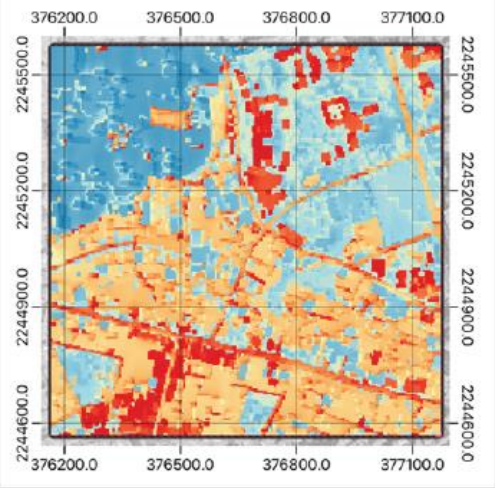
The study modelled heat mitigation strategies in two clusters - Salia Sahi (slum and low-rise-dominated) and Janpath (commercial corridor with taller buildings).

Cool the City: Cool Roof Program

Current Scenario



Intervention Scenario



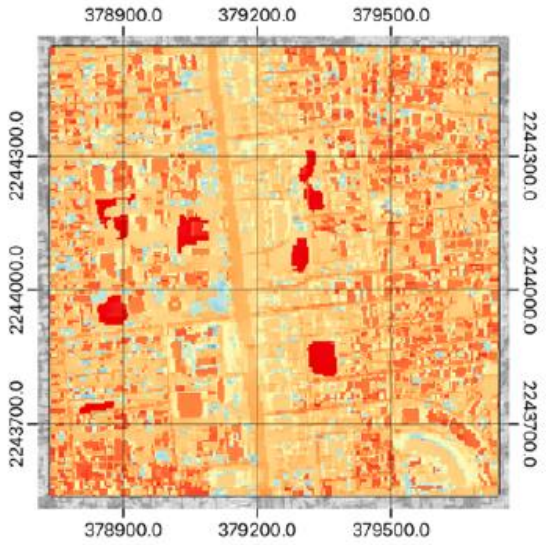
Intervention	Building Typology	Change in Surface Temperature (°C)		
		24-hour Average	Daytime Average	Night-time Average
White Paint	Slum	-3.94	-4.90	-2.92
	Low-rise Residential	-3.90	-8.72	-1.52
Green Roof	High and Mid-rise Residential	-9.43	-22.28	-5.76
	Institutional	-8.15	-17.84	-5.71
PV Roof	Commercial	-0.56	-3.53	2.05

Modelling Results of Salia Sahi

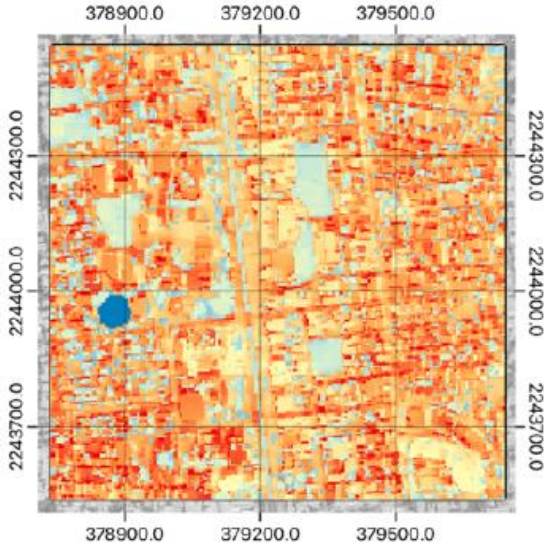
- Roof modifications – white paint, green roofs and solar PV – are highly effective in reducing surface temperatures.
- Overall, the average daily surface temperatures reduced by 2.4°C, with peak daytime reductions of up to 5.1°C and night-time reductions of 1.1°C.

Cool the City: Nature-based Solutions & Urban Design

Current Scenario



Intervention Scenario



Intervention	Change in Surface Temperature (°C)			Change in PET (°C)		
	24-hour Average	Daytime Average	Night-time Average	24-hour Average	Daytime Average	Night-time Average
Urban Parks	-6.56	-16.11	-3.23	-3.42	-8.72	-0.51
Road Medians	-2.38	-2.77	-3.46	-0.95	-3.62	0.05
Water Body	N/A	N/A	N/A	-3.28	-7.77	-1.28
Building densification	-1.05	-2.44	-0.47	-0.95	-2.16	0.002

Modelling Results of Janpath

- Urban parks, water bodies, and green medians on roads deliver significant local cooling.
- Climate-sensitive urban design to improve shading and airflow also reduced daytime heat stress.
- These interventions resulted in a reduction of 0.7°C in daytime surface temperature.

Cool Building: Building Codes and Efficient Appliances

Scenario	Annual Energy Consumption Intensity (kWh/m²/yr)
Current Building	126.9
Improved Building Construction as per ECSBC code	114.1
Improvement	10.1%

Building Typology	Water-based Chiller		
	Current Cooling Appliance	Energy-Efficient Split AC	Energy-Efficient Water-based Chiller
Residential	115.2	105.3 (8.6 %)	-
Commercial	482.2	426.1 (11.6 %)	398.8 (17.3 %)
Institutional	231.1	206.3 (10.7 %)	199.9 (13.5 %)

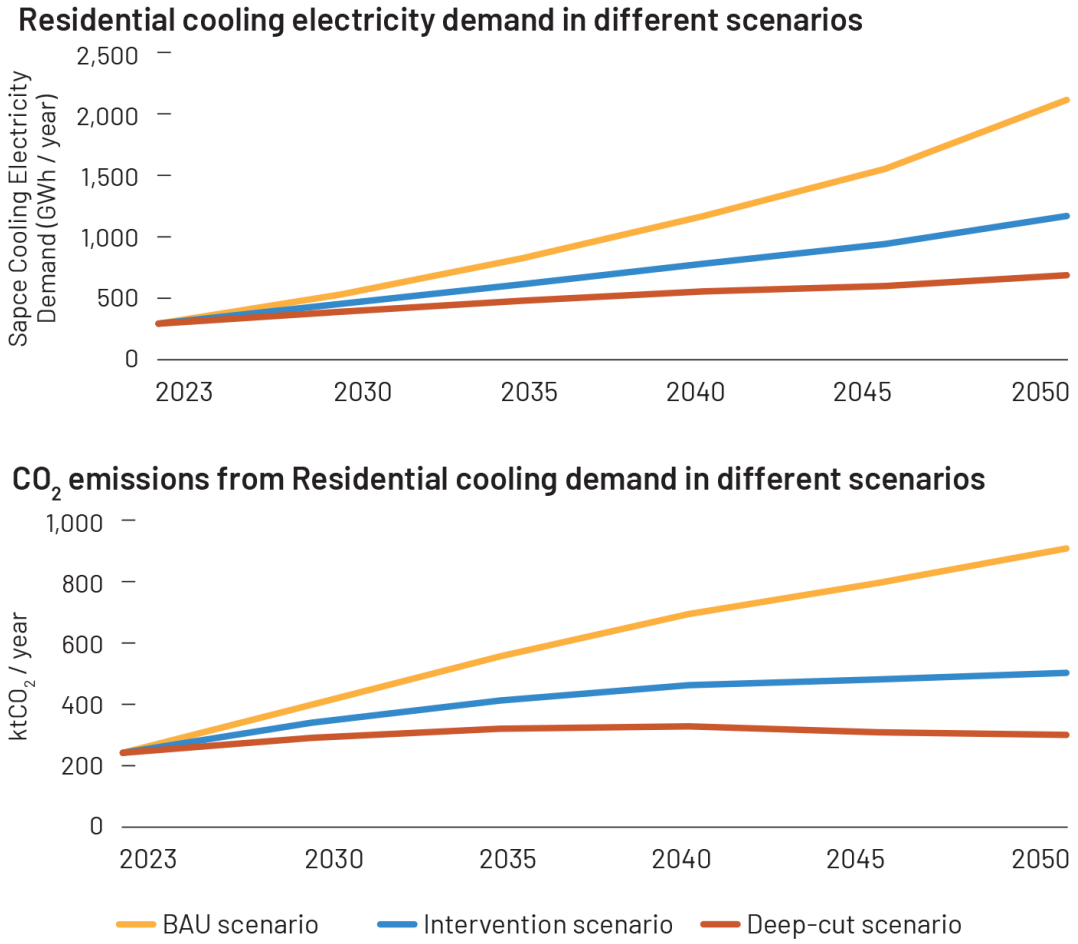
Energy Conservation Building Codes

- Implementing ECSBC, 2024 & ENS, 2024 reduces annual energy intensity by 10.1%.

Cooling Appliance Efficiency

- Replacing 3-star split ACs with 5-star cuts energy consumption by 8.5–11.6%.
- Switching to water-based chiller systems achieves even greater savings of 13.5–17.3% and reduces refrigerant-related GHG emissions.

City-Level Impact of Building and Appliance



- By 2050, cooling electricity demand will increase by **7.6 times** from current levels under Business-as-Usual Scenario.
- However, stricter building codes and efficient appliances can cut electricity use and **GHG emissions between 44–67% from BAU.**
- For a typical Bhubaneswar home, the **payback period for such upgrades is currently 6.5–8.5 years**, likely to shorten as technology costs decline.

Integrated Heat and Cooling Action Plan – Bhubaneswar

Cool the City

- **Urban Greening:** Rapidly expand green cover in low green cover wards to meet WHO's benchmark of 9 m² urban green space per person.
- **Water Body Restoration:** Develop and enforce a Water Body Conservation & Restoration Policy, mapping and reviving degraded ponds, lakes, and streams.
- **Cool Roofs:** Launch a citywide cool roof programme
- **Climate-Sensitive Streets:** Update design guidelines to include shaded walkways, permeable pavements, green medians, and high-albedo surfaces.

Integrated Heat and Cooling Action Plan – Bhubaneswar

Cool Building

- **Revise and implement OECBC 2022:** Lower compliance threshold from 1000 m² to 500 m².
- **Adopt and implement residential codes (ENS 2024)** with stricter envelope standards, lower thresholds, and mandatory cool roofs.
- **Strengthen enforcement** via integration with approvals, capacity building, and incentives.

Integrated Heat and Cooling Action Plan – Bhubaneswar

Sustainable Cooling for All

- **Promote energy-efficient appliances:** Incentivise super-efficient fans and ACs
- **District Cooling:** Identify high-development zones for district cooling and integrate in planned IT and commercial areas.
- **White Roof Program for low-income houses:** Estimated cost for all slum roofs ≈ 33.3 crore.

Integrated Heat and Cooling Action Plan – Bhubaneswar

Enhance Heat Resilience

- **Strengthen Electricity, Water and Fire fighting infrastructure**
- **Health infrastructure:** Introduce mobile clinics and ice-pack dispensaries in vulnerable areas.
- **Build Cooling Centers:** Repurpose existing public buildings, introduce mobile cooling units for outdoor workers.
- **Cool Bus Stops:** Retrofit with shading, ventilation, reflective materials, and greenery.
- **Water Kiosks:** Improve maintenance, expand in underserved wards, ensure reliable supply.

Adapt to Heat

- **Revise Heat Thresholds:** Use temperature and humidity for heat index.
- **Parametric Insurance:** Pilot schemes for vulnerable workers, triggered by heat thresholds, with quick payouts.
- **Finance, awareness & Capacity:** Build municipal capacity, allocate funds, define departmental roles and increase awareness.

Thank You