

FRAMEWORK TO KEEP COOL

A multi-tiered approach to help Jaipur achieve sustainable cooling and heat-proof its wards

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INDIA'S DEMAND for cooling is exploding. By 2037, it is expected to grow eight-fold, says the “India Cooling Action Plan 2019” (ICAP 2019), released by the Ozone Cell of the Union Ministry of Environment, Forest and Climate Change. According to an article published by the World Economic Forum (WEF) in 2019, India already has among the highest cooling degree days (CDD) in the world—more than 3,000 per year. CDD is an indicator of cooling demand in terms of the number of degrees by which a day’s average temperature exceeds 18°C.

A warming environment makes cooling inevitable. Air conditioning already accounts for about 40 per cent of peak electricity demand in cities like Delhi and Mumbai during summer, says the WEF article. The increase in use of air conditioners (ACs) poses risks including pressure

on water and energy sources, power shortage, high energy costs and grid stability. The rising magnitude of energy-intensive cooling could throw the country off the path of meeting its climate and net-zero commitments.

According to “India Energy Security Scenarios”, released in 2017 by government think tank NITI Aayog, 65 per cent of the energy demand in buildings comes from space cooling and heating. The tropical and sub-tropical climate of India makes space cooling a crucial component of energy transition. As energy efficiency gains pace with aggressive targets in global discussions, it becomes vital for India to plan for such cooling infrastructure and integrate it with urban development.

There is some recognition of the energy issues linked to the demand for cooling and thermal comfort. For instance, the Union government’s Atal Mission for Rejuvenation and Urban Transformation (AMRUT) includes initiatives for research on interpreting energy impact of land use and new energy efficiency considerations in development control regulations. However, there is lack of a coordinated action to mobilise policies, institutions and markets.

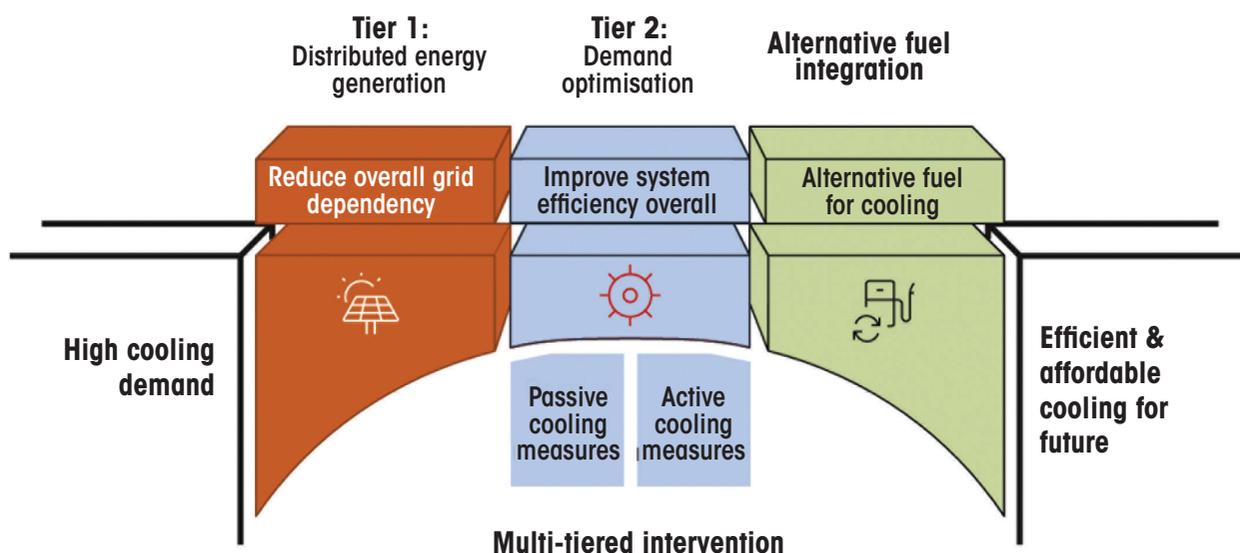
Without coordinated action, a warming environment and energy-intensive cooling will strain power grids, increase emissions dramatically and leave vulnerable populations exposed to deadly heat. Therefore, cities need to work on sustained action for energy efficient cooling and heat proofing. A cooling masterplan framework can enable this by bringing a city’s heat challenges and intelligent cooling possibilities to the drawing table.

A master plan to avert the energy crisis in making

Centre for Science and Environment (CSE), a Delhi-based think tank, is developing a cooling master plan framework for the city of Jaipur to improve cooling energy efficiency and thermal comfort in the city. This framework stems from ICAP 2019 that aims to provide thermal comfort for all and reduce the cooling energy demand by 20-25 per cent by 2037-38 through a combination of cooling strategies. The framework internalises several strategies to draw a heat-resilient and energy efficient development trajectory for a Tier-2 city like Jaipur.

Jaipur, the capital city of India’s largest state Rajasthan, lies in a hot semi-arid region where summer temperatures often exceed 45°C and nights remain above 30°C, according to

MULTI-TIERED APPROACH FOR JAIPUR’S COOLING MASTER PLAN



Source: Centre for Science Environment

BOOST FOR ENERGY EFFICIENCY

Plan to double global improvement launched at COP30

ENERGY EFFICIENCY remains a slow-moving area in global climate action, improving only by approximately 1.3 per cent per year since 2019, according to the International Energy Agency. This is despite the world's cognisance of the strong need for a transition to clean energy. Sustainable Energy for All (SEforALL), a UN-hosted organisation, has launched Mission Efficiency, a global initiative that aims to double the global rate of energy efficiency improvement by 2030 and keep the energy transition feasible under capital, grid and supply-chain constraints. The initiative identifies sufficiently coordinated and investable delivery system for energy efficiency as the key constraint.

At the 30th Conference of the Parties (COP30) to the UN Framework Convention on Climate Change in November 2025, a COP30 "Activation Group" developed and launched the Plan to Accelerate Doubling Energy Efficiency (PAS) led by SEforALL and Mission Efficiency, with the meet's Presidency. The Plan is a coordinated roadmap to deliver the doubling target

through national, subnational and sectoral action. PAS mobilises several partners and coordinated actions across policy frameworks, training and workforce development, technology deployment, investment pipeline creation and accountability frameworks.

One of the key PAS actions is a De-risking Platform that aims to make energy efficiency investable by creating stronger policies (strategies, plans, standards, and targets), stronger institutions (clear mandates and capacity across ministries/departments, regulators, utilities, and financiers), and stronger markets (demand drivers, project aggregation, and risk-mitigation mechanisms).

The initiative also aims to support developing economies in adjacent agendas such as renewable energy, energy planning, and the wider energy transition in addition to PAS commitments. This includes delivering near-term energy intensity reductions in emissions- and demand-heavy economies like India.

cse analysis. Over the past 15 years, climate change and rapid urbanisation have increased heat stress. The city's mean annual temperature has risen by about 0.53°C per decade. About 3.1 million residents now face prolonged heat exposure, higher health risks and growing dependence on air-conditioning.

Thermal intensity mapping for Jaipur has revealed that of the 250 wards, 13 per cent or 33 wards see a departure from the adaptive thermal comfort threshold of the National Building Code by more than 12°C, while 82 per cent or 205 wards see a departure of 8-12°C. This shows why cooling has shifted aggressively from convenience to necessity in Jaipur.

cse estimated Jaipur's residential AC penetration to be 21 per cent in 2025, considering the city's socio-economic dynamics. This could increase to 49 per cent in 2037. This estimate is based on ICAP projection for urban residential AC penetration of 27 per cent in 2025 and 65 per cent in 2037 and does not include commercial and institutional ACs.

cse's assessment revealed 38 high-priority and 172 medium-priority wards that must explore the most appropriate cooling solutions depending on the thermal departure, land use, population density, socio-economic status and presence of natural heat sinks.

Identifying cooling solutions for all

Jaipur's cooling master plan evolved as a multi-tiered approach to address rising heat stress and dependence on mechanical cooling (mainly air conditioning). Under this approach,

A cooling master plan framework provides cities the opportunity to respond to their heat problems and, at the same time, combine energy efficiency with urban planning. It also helps implement the India Cooling Action Plan

the first step is to offset the use of conventional energy by integrating renewable sources of energy with cooling especially through rooftop solar. According to the Global Solar Atlas, Jaipur receives solar radiation of 6–7 kilowatt hours per square metre per day, for most of the year. This approach reduces dependence on the grid and improves grid health by providing opportunity for demand flexibility and reducing peak time load. CSE estimates that if 50 per cent of existing residential buildings in Jaipur adopt rooftop solar by 2037, cooling energy demand could decline by nearly one-third.

The second tier involves optimisation of the cooling demand through nature-based solutions and use of passive and active methods of cooling. Passive measures such as retrofitting buildings, installing green roofs, improving insulation, and increasing vegetation can lower cooling demand by 20–30 per cent. Active measures like district cooling systems can save energy consumptions by up to 50 per cent and have the potential to reduce peak power demand by 45 per cent (using thermal storage) as compared to individual ACs. District cooling systems also save on refrigerants and cooling water. This makes them a good cooling solution for new and re-developments.

The third aspect is to explore and diversify energy sources for large-scale cooling systems. Agricultural residues can fuel power absorption chillers or combined cooling, heating and power (CCHP) systems. Biogas from animal waste can provide clean fuel for thermal processes. Waste heat from industries can be channelled into cooling systems instead of adding to urban heat, and offers a long-term option by using stable underground temperatures.

The advantage of this framework is that it will not only lower indoor temperatures but also the outdoor temperature, making available the benefits of a cooler city to all. Other benefits include lesser carbon locking in buildings, reduction in peak power demand and offloading the grid which are crucial components of national and international energy efficiency commitments.

Without integrated planning, cities make piecemeal decisions that could work against each other. Indian cities have launched cool roof programmes and energy conservation building codes, which only scratch the surface against the mammoth challenge of meeting cooling needs sustainably, affordably and also mitigating ambient heat at the same time.

A cooling master plan framework provides cities the opportunity to respond to their heat problems and, at the same time, combine energy efficiency with urban planning. While ICAP provides the goal and strategies for thermal comfort, there is no clear direction to implement it. This framework provides one method to implement ICAP, in a way that makes cooling affordable and accessible rather than a private luxury. This makes cooling master plan a tool for inclusive energy-efficient urban planning which is consistent with reducing the carbon intensity of the economy towards a net-zero future. ■