Cooling Roadmap for London: Executive Summary

The Cooling Roadmap for London (CRL) provides a strategic framework for sustainable cooling in the capital over the next 25+ years. The outputs from this project will inform the Heat Ready London plan. They will also contribute to meeting the goals of the Mayoral Mandate on 'Delivering a Greener and More Climate-Resilient London', and London's C40 Cool Cities Accelerator commitments.

In November 2024, funding was provided by Carrier for C40 Cities to commission 'Cooling Roadmaps' for two cities. Following a competitive selection process, London and Quezon City in the Philippines were chosen. The overall aim of the CRL project, supported by the Greater London Authority, is to consider the interplay between cooling-related energy demand, potential cooling poverty and heat-related health risks in London. This is in response to the climate emergency facing cities like London.

Delivered by Love Design Studio and Shade the UK; commissioned by C40 Cities; supported by the Greater London Authority; and funding support provided by Carrier. Analysis and conclusions are those of the authors.

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Overview

Temperatures in London are rising due to climate change; the city's dense building stock contributes to a pronounced urban heat island effect, which is compounded by a high concentration of poorly insulated and poorly ventilated buildings, a growing heat-vulnerable population, and increasing pressures on critical infrastructure and the energy grid. Together, these factors place London at the forefront of the UK's cooling challenge, requiring a more urgent and tailored approach to managing thermal comfort, health, and cooling energy demand whilst addressing the disproportionate impacts of climate change and social injustice.

The energy required to maintain comfortable and safe indoor temperatures in London under a Business as Usual (BAU) scenario could **more than double by 2050** (compared to the 2025 baseline). This energy requirement could reach up to **17 TWh per year by 2050** with high uptake of active cooling, such as air conditioning (AC), and could exceed **40 TWh per year by 2080**.

This trajectory is not inevitable. It reflects a scenario in which rising temperatures due to climate change are primarily met with increasing installation and use of active cooling systems and products, including AC units.

The CRL demonstrates that an alternative pathway is possible. Under a Sustainable, Efficient and Equitable Cooling (SEC) scenario that prioritises passive measures, nature-based cooling, efficient systems and equitable deployment, London's cooling energy demand could be reduced by:

- → **0.3–0.4 TWh per year by 2030 (≈4% reduction compared to BAU)**
- → **0.76–2.2 TWh per year by 2050 (≈15% reduction compared to BAU)**

These reductions are achieved while improving heat-related health outcomes, reducing cooling inequity, and easing pressure on the energy grid.

The choice facing London is therefore not whether cooling energy demand will rise, but whether it rises in a way that is unmanaged and unjust or in a way which is strategic, efficient, and equitable.

Project significance

London's heat risk is shaped by five interacting factors:

- Located in the warmest region of the country.
- The urban heat island effect.
- A building stock made up of older, poorly insulated buildings and newer, poorly ventilated and unshaded buildings.
- A growing heat-vulnerable population.
- Increasing pressure on critical infrastructure and the energy grid.

Heat is already contributing to premature mortality and ill health in London, with vulnerable people disproportionately impacted. As temperatures rise, unmanaged growth in cooling energy demand could increase carbon emissions, add to energy grid stress, and result in cooling poverty, where some Londoners can afford active cooling and others cannot.

The CRL reframes cooling as both a climate resilience issue and a social justice issue.

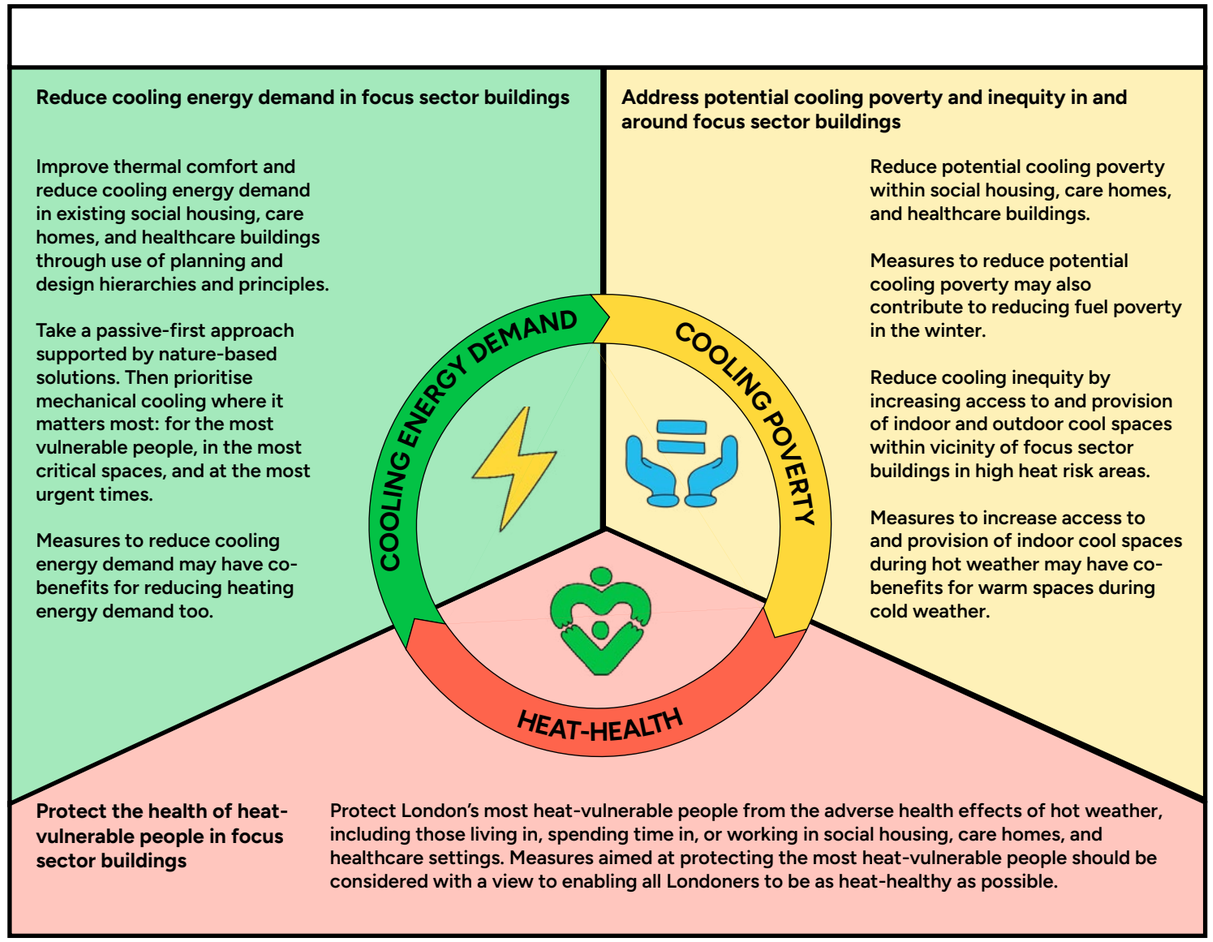
The focus sectors

The CRL prioritises three critical sectors where heat risk is most acute:

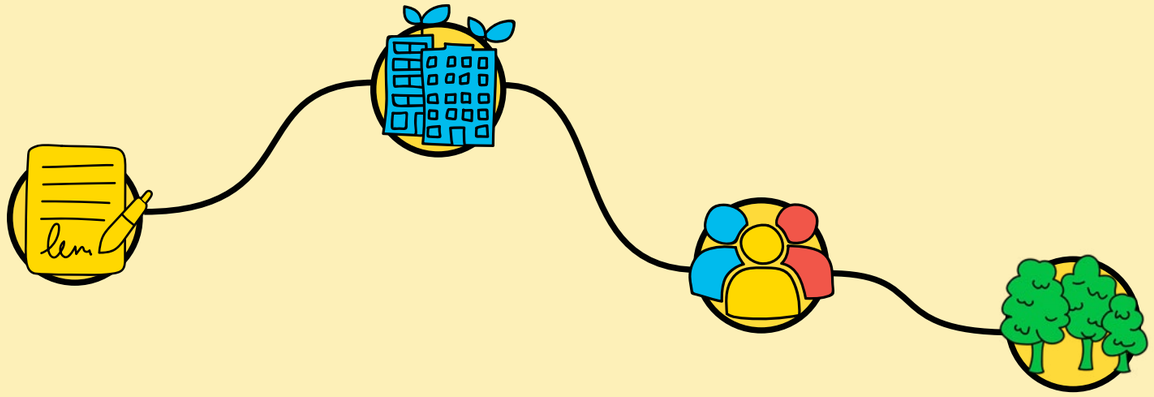
- → **Social housing**
- → **Social care**
- → **Healthcare**

Buildings in these focus sectors are home to, and care for, some of the most heat-vulnerable people in London. Many are difficult to keep sufficiently cool, securing financing is challenging, and many occupants have limited agency to adapt their environments.

The intention is that other sectors will be able to translate or replicate relevant findings from the CRL project to achieve sustainable cooling, in keeping with the Mayoral Mandate on 'Delivering a Greener and More Climate-Resilient London'.



The CRL sets out 19 ‘options for action’, grouped under four themes:



Policy and Governance

The ‘enabling environment’ for sustainable, efficient and equitable cooling using existing legislation, policies, guidance and institutional structures.

Example: support adaptation retrofits for heritage buildings through policies and guidance.

Buildings and Technology

Planning, design and engineering of London’s buildings using appropriate technology.

Example: incorporate overheating measures within current retrofit programmes, such as the Warmer Homes London Programme.

Community and Culture

Meaningful engagement with communities of interest, greater public and professional awareness and normalising of sustainable, efficient and equitable cooling practices.

Example: understand the needs of vulnerable communities to co-design solutions.

Landscape and Public Realm

Planning, design, and management of London’s urban landscape and public realm.

Example: prioritise the greening and shading of pedestrian and public transport routes between focus sector buildings in high heat risk areas.

Borough-level implications

The CRL framework has been tested with two London boroughs to understand how cooling energy demand trajectories and intervention priorities differ across borough contexts. A multi-criteria analysis of London’s 32 boroughs informed the selection process to ensure representation of inner- and outer-London boroughs with high heat risk neighbourhoods. This testing and analysis demonstrates:

- Cooling challenges and heat vulnerability are spatially uneven across London.
- Cooling energy demand is greatly influenced by building type and uses.
- A city-wide strategy must be adaptable at the borough-level.

A more granular understanding of heat exposure and vulnerability within buildings will be essential to prioritise future investment effectively.

Future cooling scenarios: BAU vs SEC

Business as Usual (BAU) scenario

This scenario assumes growing reliance on active cooling, such as AC, to maintain comfort, with limited coordination or prioritisation of deployment. Under BAU it is estimated that:

- Cooling energy demand more than doubles by 2050 (up to 17 TWh per year).
- Growth in demand accelerates after 2035–2040 as active cooling becomes widespread.
- Annual cooling energy demand could exceed 40 TWh by 2080.

While this may reduce indoor temperatures, it risks:

- Increased energy demand during heatwaves.
- Greater stress on critical infrastructure and energy grid.
- Higher carbon and waste heat emissions.
- Deepening cooling poverty.
- A positive feedback loop where increased active cooling dumps more heat outside, raising ambient temperatures and driving even greater cooling demand.

Active cooling plays a vital role in keeping Londoners healthy and safe, but over reliance on it will have adverse consequences.

Sustainable, Efficient and Equitable Cooling (SEC) scenario

The SEC scenario represents the potential city-wide outcomes if the options for actions in the CRL are implemented. To achieve SEC, the following cooling measures must be prioritised:

- Passive and nature-based cooling.
- Improved building design and retrofit standards.
- Efficient and correctly sized active cooling systems.
- Operational optimisation and skills.
- Targeted investment in vulnerable building sectors.

Under the SEC scenario:

- Cooling energy demand growth is moderated.
- Peak cooling loads are flattened.
- Active and passive cooling provision becomes more equitable.
- Buildings both generate and absorb less heat.

Importantly, SEC does not eliminate active cooling. Rather, it ensures that where active cooling is required, particularly in the social housing, social care and healthcare sectors, it is efficient, appropriately deployed and supported by passive and nature-based measures.

Strategic implications for London

The CRL makes five strategic insights clear:

1. **The rise in cooling energy demand is a resilience risk.** Without intervention, London faces rising energy demand and infrastructure pressure during extreme heat events.
2. **Cooling inequity is a social justice issue.** Vulnerable residents are disproportionately impacted by heat and least able to afford active cooling.
3. **Delay increases lock-in risk.** If buildings are retrofitted for winter performance only, or default to active cooling as a first response, cooling energy demand will escalate.
4. **Passive-first and nature-based action reduces long-term active cooling costs.** Buildings that absorb less heat require smaller, cheaper and more efficient active cooling systems.
5. **Cooling is cross-cutting.** Solutions must be co-ordinated with retrofit policy, public health, biodiversity, energy planning, housing strategy and climate adaptation.

Conclusion

Following the BAU trajectory could put London at risk of a rapid increase in cooling energy demand and social inequity. However, this is not inevitable. The SEC pathway demonstrates that cooling energy demand growth can be moderated in ways that:

- Protect vulnerable Londoners, safeguarding health, lives, livelihoods and social justice.
- Reduce long-term critical infrastructure pressure, supporting the city’s resilience.
- Deliver measurable cooling energy and carbon savings, aligning with London’s net zero targets
- Promote nature-based solutions, enhancing biodiversity and contributing to water resilience.

Collectively, the CRL positions London to become a global leader in sustainable, efficient and equitable cooling, demonstrating how major cities can respond to rising heat risk without locking themselves into high-carbon, inequitable cooling futures.