Cooling Roadmap for London

Summary Report

August 2026

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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Cover image: Photo of buildings in London.

Foreword

Mayor of London and Co-Chair of C40 Cities, Sadiq Khan

Year after year, we are seeing record-breaking heatwaves and the profound impacts they are having on our economy, infrastructure, and livelihoods. In the summer of 2025, London endured four separate heatwaves with temperatures exceeding 30°C, causing an estimated 315 heat-related deaths across the city.

To protect our most vulnerable residents today and in the long term, I am pleased to introduce the Cooling Roadmap for London (CRL), which provides a framework for the next 25+ years. Co-created by the Greater London Authority and alongside London boroughs, this document sets out a practical plan to assess the impact of rising temperatures on city residents' health, energy poverty, cooling poverty, and cooling-related energy demand within buildings. The CRL forms part of the evidence base for Heat Ready London, which I published in June this year, and contributes to my Delivering a Greener and More Climate-Resilient London programme and delivers on London's C40 Cool Cities Accelerator commitments.

Through reducing energy demand and addressing cooling poverty and inequity, as well as addressing the health impacts from extreme heat, the implementation of the CRL will deliver cross-cutting solutions across policy and governance, landscaping, buildings and technology, and community and culture.

Extreme heat due to climate change is a danger to us all, and the CRL prioritises three sectors where heat risk is most acute – social housing, social care and healthcare, testing this in London boroughs.

More than one million children in London are living in homes at risk of overheating, most of which are socially rented homes. Residents in elderly care often have complex health conditions, making indoor temperatures a critical determinant of health and wellbeing. Plus, an estimated 90 per cent of England's hospital buildings are found to be vulnerable to overheating, even during moderate outdoor temperatures. By prioritising our most at-risk populations, we can save lives.

The climate crisis is not a business-as-usual situation; the urgency of extreme heat demands action now, and I am proud to say that London is positioned to become a global leader in sustainable, efficient and equitable cooling.

Portrait of Sadiq Khan, Mayor of London

About

Project Delivery Team

Love Design Studio

Love Design Studio are a team of built environment and sustainability specialists, drawing on engineering, architectural, academic, and scientific backgrounds. Together, we share a vision to create a more sustainable and equitable built environment for all. We recognise the urgent need to cut carbon and reduce our reliance on fossil fuels. We also understand our responsibility to respond to a climate that is already changing. We support this transition through a range of environmental services. These include support for planning, energy and retrofit projects, climate adaptation strategies for buildings and public spaces, zero-waste approaches, and sustainability certification.

Shade the UK

Shade the UK is a community interest company (CIC) focused on adapting buildings and public spaces to protect people from the impacts of a changing climate. Shade the UK's guiding mission is to reach zero deaths from overheating in the UK and to ensure the health and wellbeing of vulnerable people is safeguarded during hot weather. We work collaboratively to raise awareness through campaigns, exhibitions, research, practical resources, and technical guidance.

Client Team

C40 Cities

C40 Cities is a network of nearly 100 mayors from the world's leading cities who are working to take the urgent action needed to address the climate crisis and create a future where everyone, everywhere can thrive. The mayors of C40 cities are committed to using a science-based, people-centred approach to help the world limit global warming to 1.5°C and build healthy, equitable and resilient communities. The strategic direction of the C40 Cities is determined by an elected Steering Committee of C40 mayors, currently co-chaired by Mayor Sadiq Khan of London, United Kingdom, and Mayor Yvonne Aki-Sawyerr of Freetown, Sierra Leone.

Greater London Authority

The Greater London Authority (GLA) is the regional governance body for London. It comprises one Mayor and 25 Assembly Members who are elected by Londoners. With the support of appointed officials and City Hall's staff they work to make London the best big city in the world. The GLA recognises climate change as a climate emergency that threatens the health and wellbeing of people and exasperates inequalities in London. In response, the GLA has made progress in formulating and delivering a range of climate related policies, plans, programmes and projects. A number of strategies support long-term planning for the impacts of climate change including heat risk.

Carrier

Carrier Global Corporation, global leader in intelligent climate and energy solutions, is committed to creating innovations that bring comfort, safety and sustainability to life. Through cutting-edge advancements in climate solutions such as temperature control, air quality and transportation, we improve lives, empower critical industries and ensure the safe transport of food, life-saving medicines and more. Since inventing modern air conditioning in 1902, we lead with purpose: enhancing the lives we live and the world we share. We continue to lead because of our world-class, inclusive workforce that puts the customer at the center of everything we do. For more information, visit carrier.com or follow Carrier on social media at @Carrier. Carrier. For the World We Share.

Project Management and Governance

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Related projects and programs

London Climate Resilience Review

The London Climate Resilience Review (LCRR) is an independent report commissioned by the Mayor of London following the extreme heat events which took place in the summer of 2022, to take stock of London's preparations for climate impacts and make recommendations. The report was published in 2024, with key recommendations including the development of a regional strategic plan for adapting to heat in London, and the prioritisation of actions to make the existing built environment more climate resilient. It is within the context of these recommendations that the CRL project has emerged to address gaps in understanding around current and future cooling energy demand in London.

Pathways2Resilience

The Pathways2Resilience (P2R) programme is a European Union (EU) funded programme to support 40 regions to develop locally-led pathways towards a climate-resilient future. It will deliver against some of the recommendations from the London Climate Resilience Review, aims to address key barriers for London, and places a strong emphasis on community engagement. The key outputs of the P2R programme for the London region will be the Heat Ready London Plan.

C40 Cool Cities Accelerator

The C40 Cool Cities Accelerator is a shared commitment for signatory cities to protect their residents from extreme heat. It focuses on both urgent life-saving actions and long-term urban adaptation and design transformation. London is a signatory of the Cool Cities Accelerator, along with other global cities, such as Accra, Quezon City, and Rio de Janeiro.

Glossary and Abbreviations

Glossary

Active, or mechanical, cooling measures Electrical systems or products, such as fans or air conditioners, that remove heat and lower indoor temperature.

Borough-level Across individual London Boroughs.

Cool space A publicly accessible indoor or outdoor space for people to shelter from the sun, cool down, rest and take respite on hot days.

Cooling degree day A day in which the average temperature is above a defined threshold temperature. The number of degrees above this threshold determines the cooling degree day. For example, if the threshold temperature is defined as 22°C and the average temperature for a specific day is 22.5°C, this would contribute 0.5 cooling degree days to the annual sum. Alternatively, an average temperature of 27°C would contribute 5 cooling degree days.

Cooling energy demand The amount of cooling energy required to maintain the desired indoor temperature and comfort level in a building or space. Can refer to the theoretical demand that exists even where a cooling system is not present or the demand for use of cooling from installed systems.

Cooling hierarchy A framework which prioritises passive and low-energy cooling measures, such as external shade and cool surfaces, before resorting to active cooling measures, such as fans and air conditioning, to reduce indoor temperatures.

Cooling inequity The inequitable distribution of cooling technologies and resources, adversely affecting the neighbourhoods, buildings and people who need them most.

Cooling measure[1,2,3] A physical, operational or environmental intervention that directly or indirectly reduces cooling energy demand in buildings, while improving thermal comfort and heat-health outcomes.

Cooling poverty or summer energy poverty The potential for cooling poverty or summer energy poverty occurs when a person, household or building occupant is unable to keep their home or building at a comfortable temperature during hot weather in an affordable way. It is similar to winter energy poverty as it is a systemic issue caused by a political and commercial failure to provide universal access to affordable, efficient and sustainable sources of thermal comfort. It is also a result of the systemic failure to ensure buildings are planned, designed and retrofitted to prevent energy waste, reduce energy bills, and adapt to a changing climate.

Cooling Roadmap for London A key output of the Cooling Roadmap for London project that provides options for action for achieving sustainable, efficient and equitable cooling for London.

Equitable cooling strategies[4] Deliberate efforts to ensure that access to cooling technologies and resources is distributed fairly across society, ensuring vulnerable populations are protected from extreme heat. Such efforts move beyond simply providing cooling solutions and aim to address the underlying systemic inequalities that make some populations more vulnerable to heat stress than others.

Focus sectors The three sectors (social housing, healthcare, and social care) that this project is centred around.

Fuel poverty[5] and winter energy poverty[6] Fuel poverty occurs when a person or household is unable to afford to keep their home adequately warm at a reasonable cost. The policy definition of fuel poverty used in London is 'a household in a property that has fuel costs above the national average (median) and a residual income below the poverty line after paying for those fuel costs. The policy definition used by national government is a property with an energy efficiency rating of band D or below, or that needs to spend 10% or more of its income on energy in order to maintain a satisfactory heating regime.

Health[7] A state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity.

Heat-health A state of physical, mental and social wellbeing during hot weather, where the human body is not overheating and is not at risk of heat stress or heat-related health conditions. Positive health outcomes are enabled, and negative health outcomes are prevented during hot weather.

Heat-related deaths[8,9] Heat-related deaths are defined as those where exposure to high ambient temperatures either caused the death or significantly contributed to it.

Heat-related health conditions[10,11] Health conditions caused by heat stress on the human body due to exposure to high temperatures and/or physical exertion. High temperatures are associated with a range of adverse health outcomes, with significant premature mortality, through exacerbation of underlying health issues. These include cardiovascular and respiratory disease, diabetes, mental health conditions, and neurological disorders. Indirect impacts on health include an increase in the risk of accidents, rates of domestic violence and transmission of some infectious diseases. At the extremes, acute overheating of the body can lead to heatstroke - this is a medical emergency with a high-case fatality rate. Heatstroke is often associated with physical exertion in high temperatures and is a risk even for those who are fit and healthy.

Heat-resilience The capacity of people, buildings, infrastructure, services, and environments within the urban systems of London to prepare for, withstand, adapt to, and recover from extreme heat events with minimal disruption and damage.

Options for action A range of optional actions which, if implemented over the next 5-25 years, could contribute to reducing cooling energy demand, addressing cool poverty/energy poverty and improving public health. The ultimate goal of the options for action is a more sustainable, energy and resource efficient, equitable and heat resilient future for London.

Passive cooling Solutions that reduce temperatures without using mechanical or electrical systems, such as shading, cool surfaces, openable windows, and greening.

Population health In the context of heat and cooling, population health is an approach to improving physical and mental health outcomes, promoting well-being, and reducing health inequalities for groups of people most at risk from extreme heat in London. This approach aims to prevent heat-related illness and to foster healthier communities by addressing the wider determinants of health in relation to the management of heat risk and engaging people and communities in health improvement efforts.

Residents' health Refers to the health of people living in residential care homes or the general health of the residents in a local community, which is often supported by local authorities and healthcare providers. For care home residents, healthcare involves on-site staff, regular GP visits, personalised care plans, medication management, and often specialist support like dietitians or physiotherapists. For the general community, improving resident health involves addressing determinants of health like housing and poverty, promoting mental and physical wellbeing through community programs, and encouraging healthy activities.

Roadmap[12,13] A roadmap is an informative, actionable, and evidence-based plan that shows how a policy area, product or service is likely to develop over time. It represents intentions not commitments. Roadmaps need to be easy to understand, and simple to adjust and update as when priorities or situations change.

Social justice The principle that all people should have fair and equitable access to opportunities, resources, and rights, while addressing and reducing systemic inequalities in society.

Sustainable, efficient and equitable cooling[14] The provision of affordable and effective thermal comfort during hot weather through low carbon and low waste means that ensures the health and safety of Londoners, and targets the areas, buildings and people that need it most, when they need it most.

Acronyms

BAR	Baseline assessment report
BAU	Business as usual
C40	C40 Cities
CDD	Cooling degree day
CO2e	Carbon dioxide equivalent
F-gas	Fluorinated gas
GHG	Greenhouse gas
GLA	Greater London Authority
GP	General practitioner
GWP	Global warming potential
IMD	Indices of multiple deprivation
LAEP	Local area energy plan
LSOA	Lower super output area
NHS	National health service
SEC	Sustainable, efficient and equitable cooling
UKCP	United Kingdom concentration pathway

1. Executive Summary

Overview

The Cooling Roadmap for London (CRL) provides a strategic framework for sustainable cooling in the capital over the next 25+ years. The outputs from the CRL project will inform the Heat Ready London plan. They will also contribute to meeting the delivery ambitions 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 support was provided by Carrier for C40 Cities to commission 'Cooling Roadmaps' for two cities. After 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 (GLA), is to consider the interplay between cooling-related energy demand, potential cooling poverty and heat-related health risks in London.

Temperatures in London are rising due to climate change and the urban heat island (UHI) effect. This is causing challenges for poorly insulated and poorly ventilated buildings, a growing heat-vulnerable population, and for 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, 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, including air conditioning.

The Cooling Roadmap for London (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)**
- **Up to 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, therefore, is 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 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'.

Project objectives

The CRL project aims to address the following three interconnected strategic objectives:

- **Reduce cooling energy demand in focus sector buildings.**
- **Address potential cooling poverty and cooling inequity in and around focus sector buildings.**
- **Protect the health of heat-vulnerable people in focus sector buildings.**

The CRL sets out 19 'options for action' to address the identified gaps in policy and practice. The intention of the options for action is to guide London away from the projected increases in cooling energy demand, potential cooling poverty, and heat-related health issues within the focus sectors.

Options for action

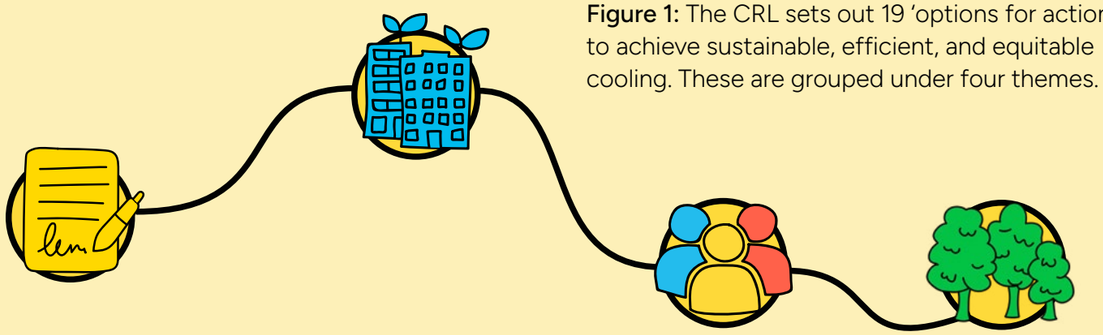


Figure 1: The CRL sets out 19 'options for action' to achieve sustainable, efficient, and equitable cooling. These are grouped under four themes.

Policy and Governance

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

Buildings and Technology

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

Community and Culture

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

Landscape and Public Realm

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

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 that:

- 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 to maintain comfort, with limited coordination or prioritisation of deployment, and estimates 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 per year 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 has a vital role to play in keeping Londoners healthy and safe in a hotter world, but overreliance 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 right-sized, more cost-effective, and highly 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 a 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 equitable outcomes.
- 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 legacy, high-carbon, or inequitable cooling pathways.

2. Introduction

Heat risk in London

As the UK's largest city, located in the warmest southeast region, London is uniquely exposed to rising temperatures compared to the rest of the country. Its dense building stock, uneven distribution of green and blue space, high proportion of artificial surface materials, and heat generating equipment and activities, result in a pronounced urban heat island effect.

This means parts of London can be several degrees hotter than surrounding rural or greener areas, especially at night[15]. This is compounded by vulnerabilities in London's aging housing stock, which is generally not designed for a changing climate and often lacks adequate shading, insulation and ventilation. Further, there is growing strain on London's critical infrastructure, the energy grid, and an increasingly heat-vulnerable population.

Record-breaking temperatures of over 40°C in the summer of 2022 resulted in approximately 2,985 heat-related deaths, with an estimated 387 deaths in London, and a national Level 4 Heatwave Alert was triggered for the first time ever in England[16]. With the successive 30°C+ heatwaves during the summer of 2025, the UK's hottest ever summer[17], it is clear that London needs to take more urgent action to adapt to hot weather.

Anyone can experience heat stress, heat exhaustion, heatstroke or heat-related mortality when exposed to heat for a prolonged period, either indoors or outdoors. The 2022 heatwaves were far more intense and widespread than previous heatwaves, which resulted in impacts beyond the health and social care system, and meant that even fit and healthy people were at risk.

However, heat disproportionately impacts vulnerable populations, this includes, but is not limited to:

- Older people
- Young children
- Pregnant people
- People with a physical or mental health conditions
- Disabled people
- Low-income groups
- Ethnic minority communities
- People experiencing homelessness
- Outdoor workers

Extreme heat events can cause disruptions to transport networks and place pressure on water, energy and telecommunication demand. Railway lines and road networks can be strained at very high temperatures as they buckle and melt, leading to severe disruptions and financial losses. Furthermore, excess heat can lead to surges in water and energy demand, with the risk of overwhelming existing networks.

Natural systems are also severely disrupted and recover slowly from extreme heat. This can have subsequent impacts on food production and an increased risk of hazards, such as wildfires, with cascading impacts on the economy and society.

The economic impacts of heat exposure are estimated to be £260-300 million per year. This figure is expected to triple by 2050 due to losses in potential labour hours and risk of excessively high working temperatures, such as in the construction industry[18].

The sustainable cooling challenge

Widespread use of active cooling products and systems, for example air conditioning (AC), in buildings outside the office, retail and hospitality sector, is not currently 'the norm' in London. This leaves vulnerable occupants and building users at risk during heatwaves. Most homes in London do not currently have active cooling systems installed, and those homes that do tend to be at the higher price level and newer end of the residential market. However, installation rates are increasing and, as a result, domestic cooling energy demand is expected to rise and become a substantial contributor to London's total annual cooling energy demand[19].

In addition, London is still experiencing a cost-of-living crisis, with personal and household budgets tight and public sector finances stretched to meet competing demands and priorities.

Potential 'cooling poverty' is emerging; those who need active cooling most are often least able to afford it, while those who can afford it are more likely to adopt inefficient active cooling systems. Cooling poverty is exacerbated by the waste heat generated by active cooling systems, which contributes to the warming of environments around buildings with (actively) cooler internal spaces. This adds to heat risk for those without access to cool spaces, and compounds 'cooling inequity'.

Within the context of climate change and heat risk, a better understanding of how limited resources can be deployed to achieve 'the greatest good for the greatest number' in terms of value for money, and positive environmental and social impact, is key.

Furthermore, London does not exist in isolation. It is a complex urban, climatic and ecological 'system of systems', with diverse and inter-related sectors, buildings, stakeholders, people and environments. Therefore, this report acknowledges that efforts to adapt to hotter weather in London need to be considered in collaboration with relevant cross-sector stakeholders at the global, national, regional and local level, and those who represent the buildings and people in the public, private, voluntary and community sectors.

Together, these factors put London at the forefront of the UK's heat risk challenge, requiring an urgent, place-based and people-centred approach to effectively manage thermal comfort, safeguard public health, and address future energy needs.

London is also well positioned to reframe this challenge as an opportunity to put environmental, social and economic justice at the heart of action to prepare for, respond to and recover from heat impacts in the context of climate change.

Two air conditioning units mounted on a brick wall

The focus sectors

The CRL project has focused on three priority sectors ('the focus sectors'), with the intention being that other sectors will be able to translate or replicate relevant findings. The focus sectors are the social housing, social care and healthcare sectors as buildings within them are home to, and care for, some of the most heat-vulnerable people in London. Buildings in these sectors which overheat, and which do not have appropriate cooling measures, put vulnerable people at risk during heatwaves.

Most spaces in these buildings rely on passive measures, which aren't always enough to maintain comfortable and safe indoor temperatures.

Temporary active cooling solutions (for example additional fans or portable AC units) tend to be deployed during times of extreme heat, and there is limited capacity or funding for major building upgrades to improve thermal comfort.

The focus sectors need to be considered both individually and in combination, as while they have distinctive features, they do not exist in isolation and are intrinsically linked. As heat-related health impacts are experienced across complex settings within the focus sectors, a strategic and coordinated approach to reducing heat risk while minimising cooling energy demand is needed.

Healthcare

London's healthcare sector is characterised by an exceptionally mixed and ageing building stock. This architectural diversity contributes to variation in thermal performance, ventilation strategies, and resilience to overheating. The sector includes, but is not limited to, hospitals, primary care clinics, GP practices, urgent treatment centres, community health centres, hospice care facilities, pharmacies, and specialist mental health buildings. Across these settings, heat risk is very high, driven by the high vulnerability of patients. The increase in heat-related illnesses amongst vulnerable populations is expected to further burden the health care sector within London due to increased hospital admissions and mortality.

Healthcare buildings, particularly hospitals, have a high risk of overheating, even during moderate outdoor temperatures[24]. Healthcare buildings themselves pose a risk to vulnerable people during warm weather, and, within London, hospitals located within the central and eastern regions demonstrate the highest heat risk[25]. While critical areas such as operating theatres and intensive care units may have active cooling, many general wards, outpatient spaces, and waiting areas lack active cooling, leaving patients and staff exposed to elevated indoor temperatures during heat events.

In addition to the risk to vulnerable patients, hospital infrastructure itself is not resilient to heat stress and the evidence of disruption to service delivery is increasing. **Major London hospitals had to declare a heat-related 'critical site incident' in July 2022, when the 40°C temperatures led to the failure of two data centres at Guy's Hospital and St Thomas' Hospital[26].** This took down most of the clinical IT systems at Guy's, St Thomas' and Evelina London hospitals and related community services. Staff had to resort to a paper-based operating model (a 'Paper Hospital' situation) to support clinical activity. The technical recovery of IT systems took several weeks and cost the NHS over £1.4 million pounds for one incident .

The sector faces multiple structural and operational barriers to implementing more resilient cooling solutions. The overstretched NHS budget constrains large-scale investment, and major works can cause severe service disruption.

Social Care

The social care sector in London comprises a wide range of building types serving people with a range of support needs. The sector includes, but is not limited to, elderly residential care homes, day centres, group homes, independent living facilities, child and youth care homes, nurseries, mental health centres, rehabilitation centres. The majority of residents in elderly care often have complex health conditions, limited mobility, and reduced ability to regulate body temperature, making indoor temperatures a critical determinant of health and wellbeing. Many care homes and social care facilities do not have comfort cooling and, during heatwaves, often rely on portable or temporary air conditioning units, which are typically inefficient, noisy, and challenging to operate at scale.

People aged over 65 years spend more than 80% of their time indoors, with this rising to 90% for people aged over 85 years[27]. Older residents in care settings face the highest risk of heat-related mortality among their age group. Risks are further heightened for people with cognitive impairments, dementia, or learning disabilities, who may struggle to recognise heat dangers, adjust their behaviour, or communicate their needs. This places a heavy responsibility on care staff to manage indoor environments proactively.

Overheating is already occurring in parts of the sector even during average summer conditions, and projected climate warming is expected to worsen this substantially[28]. Despite the clear risks, the sector faces substantial barriers to adaptation. Rising costs (including utilities) and limited access to capital funding potentially limit the capacity of care providers to install shading, improve ventilation, or undertake heat risk assessments. Basic passive cooling strategies are often underutilised, as window opening patterns and ventilation practices can be poorly understood or difficult to implement safely for vulnerable residents.

Social Housing

The social housing sector in London encompasses a large, varied, and ageing building stock, with approximately 800,000 homes owned by local authorities and housing associations[20]. Crucially, the sector faces high levels of heat risk driven by factors such as the density of estates, prevalence of single-aspect rooms, constrained layouts, unconsidered building orientation, and heat-vulnerable occupants[21].

Over one million children in London are living in homes at risk of overheating, most of them within social rent homes, elevating the urgency of intervention[22]. Children living in flats also face additional heat-related dangers, such as risks of falling from height through open windows during hot weather, highlighting the intersection between thermal comfort and building safety[23].

Many residents in the sector, including low-income households, older adults, people with health conditions, and those experiencing social isolation or overcrowding, have limited capacity to cope with extreme heat or modify their environments. Despite this, most social housing does not have comfort cooling, and tenants typically cannot install passive cooling measures themselves, especially any external or building fabric-related interventions.

The sector faces multiple systemic barriers to adapting homes for rising temperatures. Funding constraints, increased utility costs, and competing priorities (including fire safety, cladding remediation, damp and mould, and fuel poverty reduction) place pressure on budgets.

Project objectives

In November 2024, funding was provided by Carrier for C40 Cities to commission 'Cooling Roadmaps' for two cities. After a competitive selection process London and Quezon City in the Philippines were chosen. The CRL project provides evidence and insights about how increasing temperatures due to climate change impact heat risk, cooling energy demand, potential cooling poverty, and people's health in London.

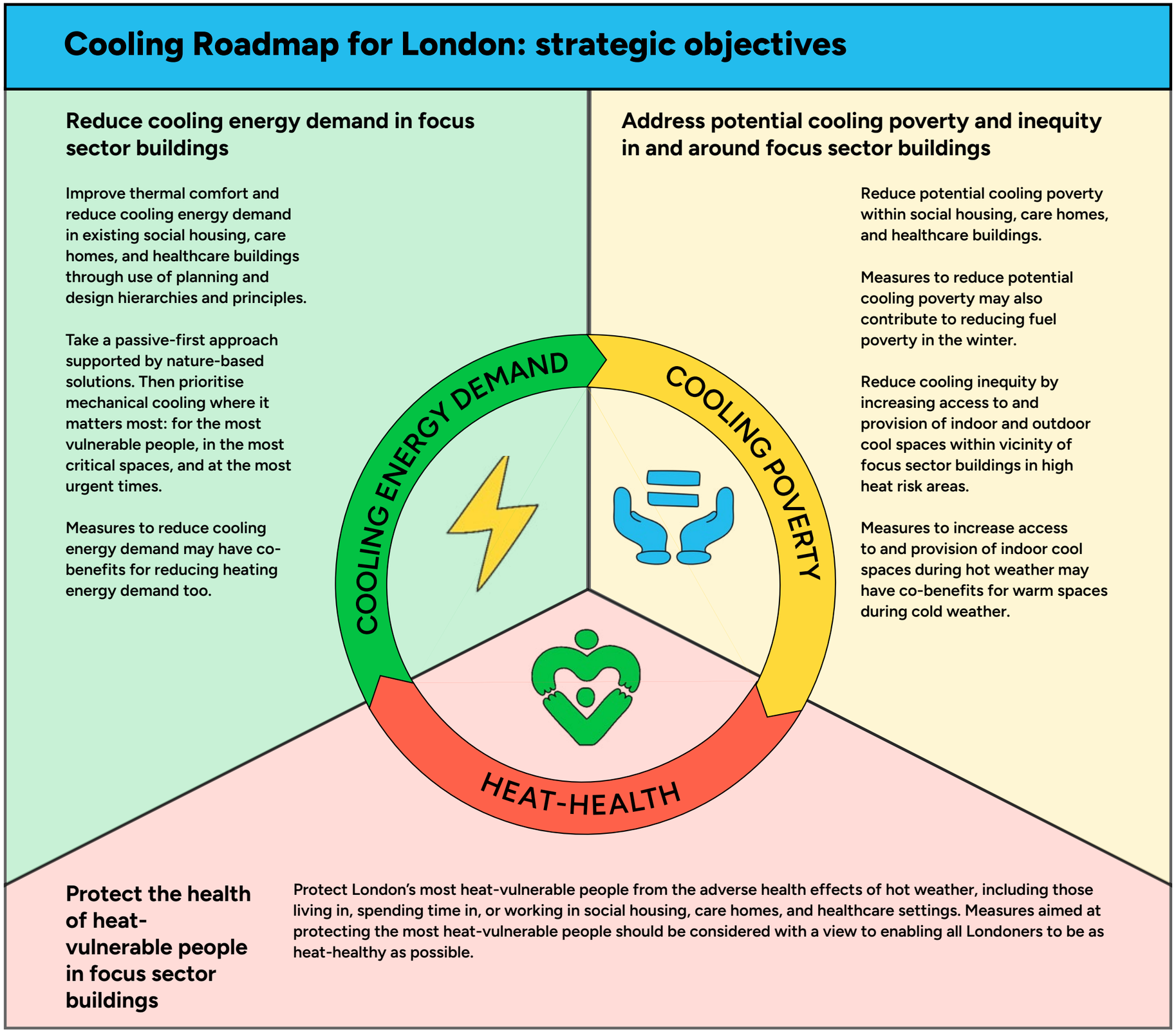
The CRL project has produced a roadmap which provides a strategic, evidence-based plan to achieve sustainable, efficient, and equitable cooling across the city. Following recommendations within the London Climate Resilience Review (2024)[29], the CRL will inform the Heat Ready London plan.

The CRL project aims to address the three interconnected strategic objectives set out in Figure 2.

The project aims to achieve these objectives by:

- Assessing the impact of rising temperatures in London on cooling energy demand within buildings from 2026-2050, with a particular focus on 2026-2030 to align with London's net zero carbon targets.
- Focusing on existing buildings in three focus sectors: social housing, social care and healthcare, and on areas of high deprivation and poverty, where focus sector buildings are located. These sectors have been chosen as they encompass buildings and groups of people that are particularly affected by, and vulnerable to, heat.
- Developing a CRL that guides London away from the projected increases in cooling energy demand, potential cool poverty, and heat-related health issues.
- Applying the CRL to two selected London boroughs, based on a multi-criteria analysis, to assess its usefulness within the context of local demographics, building stock, adopted planning policies, and green infrastructure provision.
- Contributing to the evidence base for the Heat Ready London plan.

Figure 2: The three strategic objectives of the CRL project



3. Project Process

Baseline assessment

A review was undertaken of publicly available data related to heat vulnerability and cooling energy demand in London. A baseline range of the current annual cooling energy demand for London was estimated along with projections for how that cooling energy demand might change under a 'Business As Usual' (BAU) scenario, if no action is taken. Reviews were also undertaken of relevant policy and regulation, and heat-related health impacts.

Stakeholder engagement

Three groups of stakeholders were identified for engagement to inform this project:

- Group A: Institutional stakeholders for data and information requests – to inform the baseline assessment.
- Group B: Focus sector stakeholders – to inform the baseline assessment and the CRL by conducting semi-structured interviews. This was used to understand the experiences of individuals from the focus sectors to help contextualise the quantitative data analysis and highlight practical considerations for the CRL.
- Group C: Borough-specific stakeholders - to encourage collaboration and transparency. To ensure that the CRL is reflective of the local context and other opportunities and challenges in the focus sectors within two selected London boroughs.

Cooling Roadmap for London (CRL)

A CRL was created consisting of 19 'options for action' for implementation over the next 25 years to contribute to meeting the strategic objectives of the CRL project. This time period was selected with a particular focus on 2026-2030 to align with London's net zero targets, and with a wider view from 2030-2050 to align with national and focus sector net zero targets.

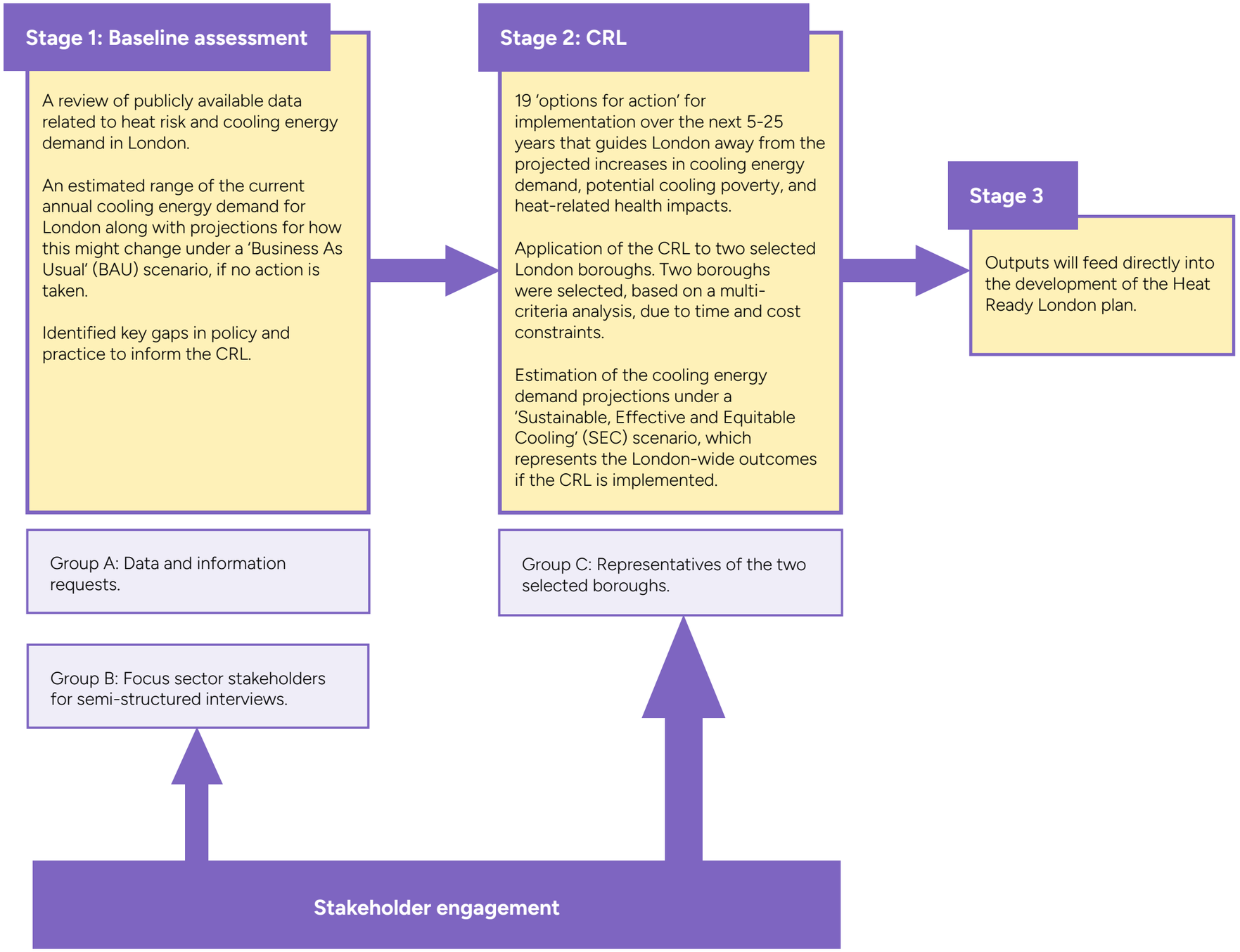


Figure 3: Outline of the process of the CRL project

4. Baseline Cooling Energy Demand

Current and projected cooling energy demand

A baseline range of the current annual cooling energy demand for London was estimated along with projections for how that cooling energy demand might change under a BAU scenario, if no action is taken.

Within the BAU scenario, three trajectories (BAU 1, 2 and 3) were developed to gauge how cooling energy demand may change from 2025 to 2080, with a lower (low) and upper (high) projection established for each trajectory. The year 2080 was chosen as the end year for the projections as the Met Office Cooling Degree Day (CDD) data[30] used to inform the rate of increase in annual cooling energy demand was taken from the 3.0°C global warming dataset, and it has been assumed that this level of global warming is likely to occur by 2080.

CDDs are a measure of the number of degrees that a day's average temperature is above a defined threshold in any given location. They can be used to monitor cooling energy use. Based on Met Office data, CDDs for London are projected to increase substantially between 2025 and 2080.

The BAU scenario assumes rising reliance on active cooling to maintain comfort, with limited coordination or prioritisation, which estimates that:

- Cooling energy demand more than doubles by 2050 (up to 17 TWh per year).
- Growth 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 electricity demand during heatwaves.
- Greater stress on critical infrastructure.
- Higher carbon and waste heat emissions (depending on grid decarbonisation trajectory).
- Deepening cooling inequity and potential cooling poverty.

A description of the three trajectories are provided below:

BAU 1: Increasing ambient temperatures only

1a. Low cooling energy demand: annual cooling energy demand has been scaled with increasing CDDs based on the 'median' data set produced by the Met Office.
1b. High cooling energy demand: same as BAU 1a but using the baseline (high) estimate value for cooling energy demand as the starting figure for 2025.

BAU 2: Increasing ambient temperatures and ageing population

2a. Low cooling energy demand: same as BAU 1a but with baseline annual cooling energy demand figures for the domestic and health sector scaled with a projected increase in over 65-year-old population in London, based on the GLA Population Projections Explorer[31].
2b. High cooling energy demand: same as BAU 2a but using the baseline (high) estimate value for cooling energy demand as the starting figure for 2025.

BAU 3: Increasing ambient temperatures and uptake of active cooling systems

3a. Low cooling energy demand: same as BAU 1a but with an increasing uptake of active cooling systems and related cooling energy demand. This is assumed to grow at 5% annually in domestic buildings and 2% in non-domestic buildings.
3b. High cooling energy demand: same as 3a but using the baseline (high) estimate value for cooling energy demand as the starting figure for 2025.

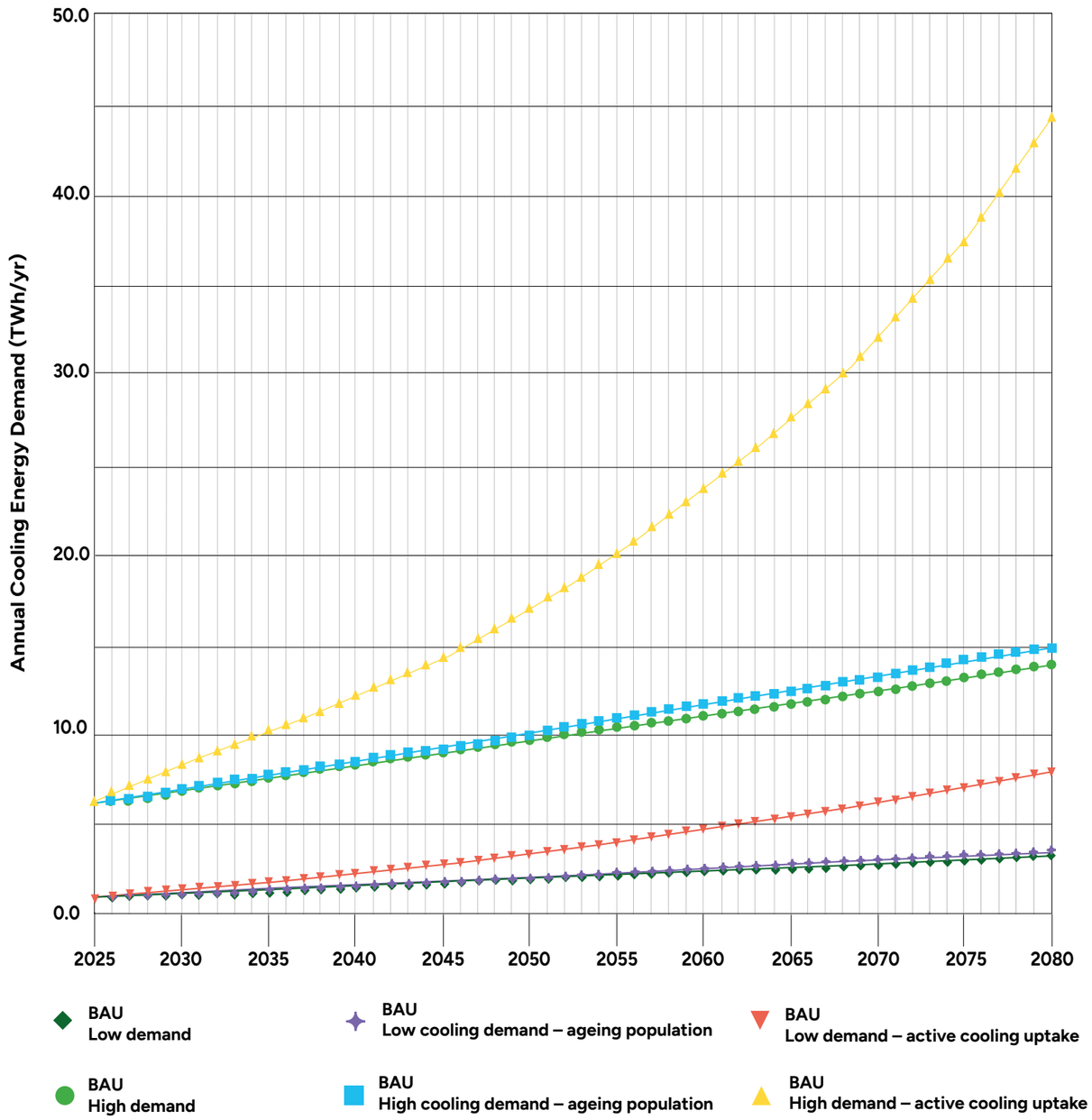


Figure 4: Baseline cooling energy demand projections for London from the BAR (2025-2080)

5. Cooling Roadmap for London

The roadmap

A roadmap is an informative, actionable, and evidence-based plan that shows how a policy area, product or service is likely to develop over time. It represents intentions, not commitments. Roadmaps need to be easy to understand, and simple to adjust and update as priorities or situations change.

The 'Cooling Roadmap for London' (the CRL) comprises the following:

- 19 'options for action' to achieve sustainable, efficient and equitable cooling in London over the next 25+ years (2026-2050).
- An estimation of cooling energy demand under a Sustainable, Efficient and Equitable Cooling (SEC) scenario, whereby the CRL is implemented across London.
- Application of the London-wide CRL to two London boroughs.

The 19 options for actions are grouped into four themes:

Policy and Governance (P.01-P.06) – existing legislation, policies and guidance.

Buildings and Technology (B.01-B.05) – relating to the planning, design and engineering of London's buildings and using appropriate technology.

Community and Culture (C.01-C.04) – relating to meaningful engagement with communities, greater public and professional awareness, and normalising of sustainable cooling practices.

Landscape and Public Realm (L.01-L.04) – relating to the planning, design, and management of London's urban landscape and public realm.

The full options for action can be viewed within the **Cooling Roadmap for London: Report** document accompanying this summary report. A short overview of the options for action is set out in Figure 6 (page 15) and in Figure 7 (page 16-18).

The fundamentals of sustainable cooling

It is generally understood within the UK built environment industry that a core set of physical, environmental, and operational measures are required to reduce cooling energy demand and reduce overheating risk in buildings. These measures are referred to in this section of the report as the 'fundamentals' of sustainable, efficient, and equitable cooling.

The fundamentals can be grouped into four types of measures:

- Passive cooling measures.
- Active and energy efficient cooling measures.
- Nature-based and external environment cooling measures.
- Operational and behavioural measures.

The CRL options for action relate to the four fundamentals either by:

- Directly enabling them to be implemented (for example B.02 'Integrate year-round thermal comfort into retrofit programmes' drives large-scale deployment of external shading, cool roofs, ventilation improvements, and insulation upgrades).
- Indirectly enabling them to be implemented (for example P.06 'Explore financial incentives and align climate finance strategies for passive and sustainable cooling' helps to unlock funding mechanisms which accelerate the deployment of cooling measures).

Figure 5: The fundamentals of Sustainable, Efficient and Equitable Cooling

Passive cooling measures

Measures that reduce solar heat gain, improve natural ventilation, or help buildings maintain more stable indoor temperatures.
Examples include:

- External shading (shutters, louvres, overhangs, awnings)
- Internal shutters (blinds, curtains)
- Solar control glazing
- Stack and cross-ventilation improvements
- Cool roofs and façades
- Increased thermal mass
- Reduced internal heat gains

Active and energy efficient cooling measures

Measures that reduce the energy required to deliver necessary cooling.
Examples include:

- Heating, ventilation, and air conditioning (HVAC) system efficiency upgrades
- Air-to-air heat pump cooling
- Portable air conditioning (AC) units (only where clinically or socially justified)
- District cooling networks and waste-heat reuse

Nature-based and external environment cooling measures

Measures that reduce ambient temperatures and cool the urban environments surrounding buildings, including streets, public spaces, and building façades.
Examples include:

- Tree planting
- Roof and facade greening, pergolas, climbing plants
- External shading structures
- Blue-infrastructure elements

Operational and behavioural measures

Changes in practice that reduce unnecessary cooling or improve the performance of passive measures.
Examples include:

- Window management/shading protocols
- Improved operational management of existing mechanical cooling systems
- Skills, training, maintenance, and monitoring/control strategies

Cooling Roadmap Options for Action Matrix

Figure 6: The relative impact of each CRL option for action against the project objectives, as well as an indication of the relative effort and cost of implementation. This is to support decision makers to prioritise options and identify 'quick wins' within the CRL i.e. options for action which offer meaningful benefits at relatively low cost and low effort and can be implemented sooner. 'Immediate term' options for action (taken forward within the next two years) can also help decision-makers prioritise early interventions that help to build momentum and lay the groundwork for longer-term interventions.

Key:

- Small reduction in energy cooling demand, low impact on health outcomes, limited impact on cooling poverty, or low level of effort or cost (relative)
- Medium reduction in energy cooling demand, medium impact on health outcomes and cooling poverty, or medium level of effort or cost (relative)
- High reduction in energy cooling demand, high impact on health outcomes, and cooling poverty, or high level of effort or cost (relative)

Options for action	Impact on cooling energy demand	Impact on cooling poverty and inequality	Impact on health outcomes	Effort	Cost
P.01 Clarify indoor maximum temperature guidance for vulnerable settings					
P.02 Future-proof overheating assessments in planning					
P.03 Heritage-sensitive heat adaptation of priority focus sector buildings					
P.04 Strengthen leadership and accountability for heat risk					
P.05 Encourage sub-LSOA public realm heat risk studies					
P.06 Explore financial incentives and align climate finance strategies for sustainable cooling					
B.01 Prioritise overheating assessments for existing focus sector buildings					
B.02 Integrate 'year-round thermal comfort' into retrofit programmes					
B.03 Encourage cross-sector innovation and demonstration for sustainable cooling					
B.04 Identify opportunities to integrate cooling into district heat networks					
B.05 Improve data on cooling systems, products, and indoor comfort conditions					
C.01 Co-design cooling and adaptation with affected communities					
C.02 Targeted and timely communication on heat, cooling equity, and passive cooling					
C.03 Integrate heat-health and cooling topics into existing training pathways					
C.04 Expand sustainable cooling-related skills in the workforce					
L.01 Create shaded routes and public spaces in high heat risk areas					
L.02 Increase equitable access to cool, healthy and safe spaces					
L.03 Expand use of cool and green roofs and façades in priority buildings					
L.04 Reduce and reuse waste heat from transport and buildings					

Figure 7: The Cooling Roadmap for London

Cooling Roadmap for London

Stage 1: Early steps

Prioritised overheating assessments, pilot projects in high heat risk areas and spaces in and around focus sector buildings. These options for action deliver small but structured reductions in cooling energy demand, laying the behavioural and governance foundations needed for later success.

Stage 2: Scaling

Year-round thermal comfort becomes standard in retrofit programmes, cool spaces and shaded walking and wheeling routes expanded, better alignment with climate finance.

Stage 3: Embedding

Most technically and socially feasible passive cooling measures have been deployed in priority focus sector buildings and locations, and the emphasis moves to making these measures work reliably over decades.

Policy and Governance: utilising existing policies and governance structures can create an enabling environment for other options for action towards sustainable, efficient and equitable cooling.

Immediate term 2025-2027

- P.01 Clarify indoor temperature thresholds for vulnerable buildings and spaces and their occupants. This will help identify areas where cooling measures are most urgent, and support escalation procedures when indoor temperatures become unsafe for certain people, aligning with existing heat-health alerts and emergency preparedness protocols.
- P.04 Strengthen leadership and accountability for heat risk through the development and implementation of the Heat Ready London plan.
- P.05.1 Funding and co-ordination to support public realm heat risk studies in each London borough. Pilot assessments undertaken in some boroughs.
- P.06 Explore financial support and incentives for sustainable cooling as per the published the Heat Ready London plan.

Short term 2027-2030

- P.02 Future-proof overheating in planning. Future reviews of planning and building energy policy could consider how best to incorporate updated weather files and more extreme future scenarios, particularly for buildings in the focus sectors, while continuing to prioritise passive measures and minimising the need for active cooling.
- P.03 Heritage-sensitive heat adaptation for focus sector buildings. Heritage policies could be carefully reconsidered to support well-designed, heat-resilient adaptations to existing buildings, alongside energy efficiency and micro-generation measures.
- P.05.2 Undertake public realm heat risk assessments in London boroughs, aligned with place-based priorities.

Medium term 2030-2035

- P.05.3 Incorporate borough-level heat adaptation strategies based on recommendations from the public realm heat risk studies.

Long term 2035-2050+

	Immediate term 2025-2027	Short term 2027-2030	Medium term 2030-2035	Long term 2035-2050+
Buildings and Technology: planning, design, engineering and management of London's existing buildings and indoor spaces, using appropriate technology, to achieve sustainable, efficient and equitable cooling.	B.01.1 Identify focus sector buildings in high heat risk areas that should be prioritised for overheating assessments.	B.01.2 Undertake overheating assessments for existing high risk focus sector buildings.	B.01.3 Undertake overheating assessments for all existing focus sector buildings, aligned with the rollout of retrofit programmes (B.02).	B.01.4 Adapt and retrofit focus sector buildings based on recommendations from the overheating assessments, aligned with established year-round retrofit programmes (B.02).
	B.02.1 Develop a strategy to incorporate heat adaptation and resilience requirements within the mechanisms of existing retrofit programmes. Identify buildings in focus sectors within high heat risk areas for immediate rollout of enhanced 'year-round thermal comfort retrofit' works based on pilot overheating assessments (B.01).	B.02.2 Integrate 'year-round thermal comfort' into retrofit programmes. Fast-track delivery of retrofit works for buildings in focus sectors identified as high heat risk, within the mechanisms of existing retrofit programmes.	B.02.3 Launch a new retrofit programme for focus sector buildings to roll out 'year-round thermal comfort retrofit' works. Post-retrofit monitoring of indoor temperatures and health outcomes of residents, occupants, staff and service users.	B.02.4 Retrofit all focus sector buildings based on the results and recommendations of the overheating assessments (B.01).
	B.03.1 Encourage cross-sector innovation and demonstration projects for sustainable cooling solutions. For example, efficient, low-GWP active cooling systems.	B.03.2 Continued research and development for sustainable cooling solutions.	B.03.3 Encourage installation of efficient, low-GWP cooling solutions.	B.03.4 All newly installed cooling systems are efficient and low-GWP.
		B.04.1 Incorporate cooling energy demand into Local Area Energy Plans to address the high-level viability of district cooling networks at the sub-regional and borough level.	B.04.2 Pilot district cooling systems that are deemed economically and technically feasible. Undertake monitoring of the performance and benefits.	B.04.3 Expand district cooling networks to additional priority areas within and across boroughs if deemed economically and technically feasible.
		B.05.1 Improve data on cooling systems and products through indoor environment sensors in focus sector buildings.	B.05.2 Improve data on cooling systems and products through outputs of overheating assessments (B.1) and retrofit projects (B.02) for focus sector buildings. Link this data into existing datasets in London.	
meaningful engagement to co-design and raise awareness of cooling solutions.	C.01.1 Engage with focus sector stakeholders to understand specific cooling needs. Co-design cooling and adaptation measures with focus sector stakeholders based on the outcomes of the needs-assessments.	C.01.2 Ongoing engagement with communities to monitor the impact of interventions and respond to the changing needs of communities over time.		
	C.02.1 Improve communication on passive and sustainable cooling solutions. Promote case studies and existing resources from boroughs to amplify awareness and application of sustainable cooling systems for buildings and sustainable cooling more widely.	C.02.2 Develop more targeted communication on sustainable cooling. For example, campaigns to educate the general public about the impacts of extreme heat, the risks of indoor overheating, and the benefits of passive cooling and behaviour change.	C.02.3 Continue engaging the general public on sustainable cooling, especially as new technologies are developed and become available on the market (B.03). Introduce sustainable cooling topics into school curricula, youth programmes, and professional qualifications to build long-term awareness.	

	Immediate term 2025-2027	Short term 2027-2030	Medium term 2030-2035	Long term 2035-2050+
	C.03.1 Enhance practice of integrating heat-health and sustainable cooling topics into existing training pathways for focus sector staff. For example, training programmes for medical, nursing, pharmacy and allied health professional and running pilot workshops or online sessions for frontline staff in care homes, GP practices, and housing associations in boroughs with high heat risk.	C.03.2 Pilot workshops or online sessions for focus sector staff. Encourage housing associations to develop handbooks for tenants and tenant support officers on how to maximise passive cooling and respond to extreme heat situations.	C.03.3 Continue engaging with focus sector staff on passive and sustainable cooling, especially as new technologies are developed and become available on the market (B.03).	
		C.04.1 Expand sustainable cooling-related skills in the workforce by utilising existing green skills programmes. For example, include skills for the installation, maintenance, and management of low-carbon cooling systems.	C.04.2 Ensure a clear pathway for existing professionals from the gas industry to transition to electric systems. Establish direct routes to training as a cooling engineer through courses and apprenticeships.	
Landscape and Public Realm: streets, parks, estates and community infrastructure can contribute to sustainable cooling and reduce cooling energy demand in focus sector buildings.	L.01.1 Expand shaded routes and public spaces in high heat risk areas. Within current greening programmes, prioritise the greening and shading of pedestrian and public transport routes from social housing estates in high heat risk areas to social care and healthcare buildings and services.	L.01.2 Plan for further shading of key routes and public spaces by undertaking neighbourhood-level public realm heat risk studies to inform solutions.	L.01.3 Incorporate public shading strategies based on recommendations from the public realm heat risk studies.	L.01 .4 Ensure adequate long-term maintenance of installed greening solutions.
	L.02.1 Increase equitable access to cool, healthy and safe spaces by improving the visibility and identity of existing cool spaces through marketing and communication strategies. Identify locations for potential new cool spaces.	L.02.2 As part of the public realm heat risk studies for each borough (see P.04), create new cool spaces in strategic locations where they can provide the most benefit.	L.02.3 Continue expanding equitable access to cool, healthy and safe spaces.	L.02.4 Ensure 100% of borough residents are within a 10-minute walk from a cool space (an outdoor space, park or building that provides good levels of thermal comfort, health and safety for vulnerable people during hot weather).
	L.03.1 Identify focus sector buildings that are suitable for a cool or green roof retrofit, prioritising buildings in high heat risk areas first.	L.03.2 Pilot cool and green roofs programme for buildings in the focus sectors, prioritising buildings in high heat risk areas first.	L.03.3 Deploy the cool and green roofs programme for buildings in the focus sectors, based on technical feasibility and outcomes from the overheating assessments (B.01).	L.03.4 Retrofit all suitable roofs on buildings within the focus sectors with a cool or green roof.
	L.04.1 Continue to encourage urban planning and development that reduces motor vehicle use and motor vehicles' contribution to waste heat.	L.04.2 Promote the research and development of re-using waste heat from large cooling sources, such as data centres and offices. This waste heat could be used to generate useable energy for suitable buildings during hotter months.		

5.1 Towards Sustainable, Efficient, and Equitable Cooling

The following sections presents an illustrative analysis of how cooling energy demand in London could be reduced if the recommended options for action and related cooling measures are implemented effectively over time.

The analysis builds directly upon the BAU cooling energy demand projections and overlays the expected impact of implementing the CRL, and moving towards the **Sustainable, Efficient and Equitable Cooling (SEC) scenario**.

The objective is not to forecast precise future cooling energy use or demand but to illustrate:

- The scale and timing of potential reductions in cooling energy demand.
- The contribution of different options for actions and the related cooling measures or 'fundamentals'.
- Differences in impact on cooling energy demand between boroughs due to their building stock, land-use mix, urban morphology, and heat-vulnerability profile.
- Specific implications for existing buildings in the focus sectors.

This SEC scenario demonstrates a 'what good looks like' trajectory for London and its boroughs if early, coordinated, and equity-led heat-resilience action using the CRL.

A phased breakdown from 2026–2050 sets out which measures are implemented or playing out and the cumulative uptake of the measures (for example, the percentage of applicable building stock). The three phases are as follows:

- Stage 1 – Early steps (2025-2030)
- Stage 2 – Scaling (2031-2035)
- Stage 3 – Embedding (2036-2050)

This produces a trajectory of gradually widening divergence between the BAU scenario curve and the SEC scenario 'good practice implementation' curve. This represents a best-case scenario for when particular cooling measures could be implemented, rather than dictating what is feasible and realistic for London as this will explored and established by the Heat Ready London plan.

Key findings

Under the SEC scenario, prioritising 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)**
- → **up to 2.2 TWh per year by 2050 (≈15% reduction compared to BAU)**

Phase 1 - Early steps

The start of Phase 1 focuses on awareness (C.02), assessments (B.01), and behaviour change (C.02), rather than capital works. Clear indoor maximum temperature guidance (P.01), improved monitoring (B.04), staff training (C.03) and simple operational adjustments (C.02) (for example, shading use, window management, early night ventilation) start to reduce unnecessary active cooling or overcooling and enable better building management. These options for action deliver small, but structured, reductions in cooling energy demand, laying the behavioural and governance foundations needed for later success.

Initial physical measures are introduced through early pilot programmes, especially in early 'year-round comfort' retrofits that install internal and external shading, improved natural ventilation, cool roofs, and reduced internal heat gains. By the end of Phase 1, the first demonstrator retrofits are complete, proving the effectiveness of passive first design.

Phase 2 - Scaling

In Phase 2, the future-proofing of policies and pilot projects in the focus sectors are turned into programmes.

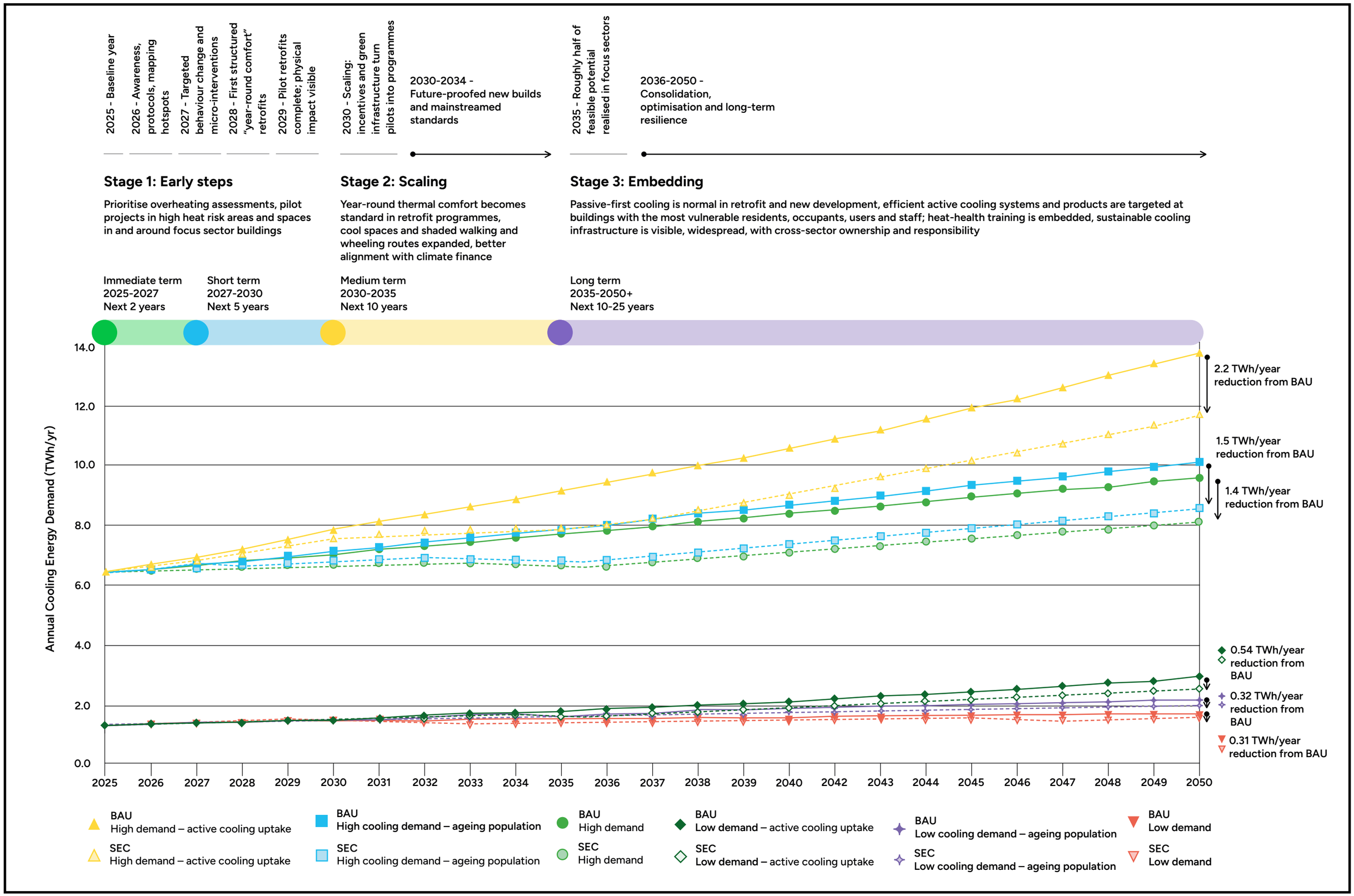
With financial incentives and climate finance alignment (P.06) in place, proven measures in pilot projects begin to be rolled out at scale. Future-proofed planning and retrofit standards mean that new buildings and major refurbishments default to passively resilient designs with low heat gain. External shading, solar-control glazing, effective natural ventilation, and cool roofs and walls are widely specified. Active cooling systems are increasingly efficient and correctly sized, operating in buildings with lower baseline cooling loads. By 2035, around half of the realistic cooling energy demand reduction potential in high-priority focus sector buildings has been achieved. Most remaining gains come from finishing deeper retrofits, consolidating green infrastructure, filling shading gaps, and upgrading active cooling plants where still required.

Phase 3 - Embedding

Phase 3 is all about embedding sustainable cooling and ensuring long-term heat resilience. By this stage, most technically and socially feasible passive cooling measures have been deployed in priority focus sector buildings and locations (B.02, L.01 and L.03). The emphasis moves to making these measures work reliably over decades, adapting them to future climate conditions. Cooling energy demand does not fall to zero, but it becomes structurally lower, flatter across heat events, and more predictable than in the BAU trajectory by:

- Older cooling plants replaced with high-efficiency systems sized to much lower loads and there is system-level optimisation (controls, setpoints, zoning, and scheduling).
- Cumulative urban cooling effects, as mature tree canopy cover, cool roofs and façades, and shaded routes reduce ambient temperatures and peak heat exposure.
- Behavioural resilience, as heat-aware operational practices (C.03 and C.04) are embedded into professional norms rather than relying on campaigns.

Figure 8: Annual cooling energy demand projections for London based on the CRL and SEC scenario (2026-2050)



5.2 Borough Insights

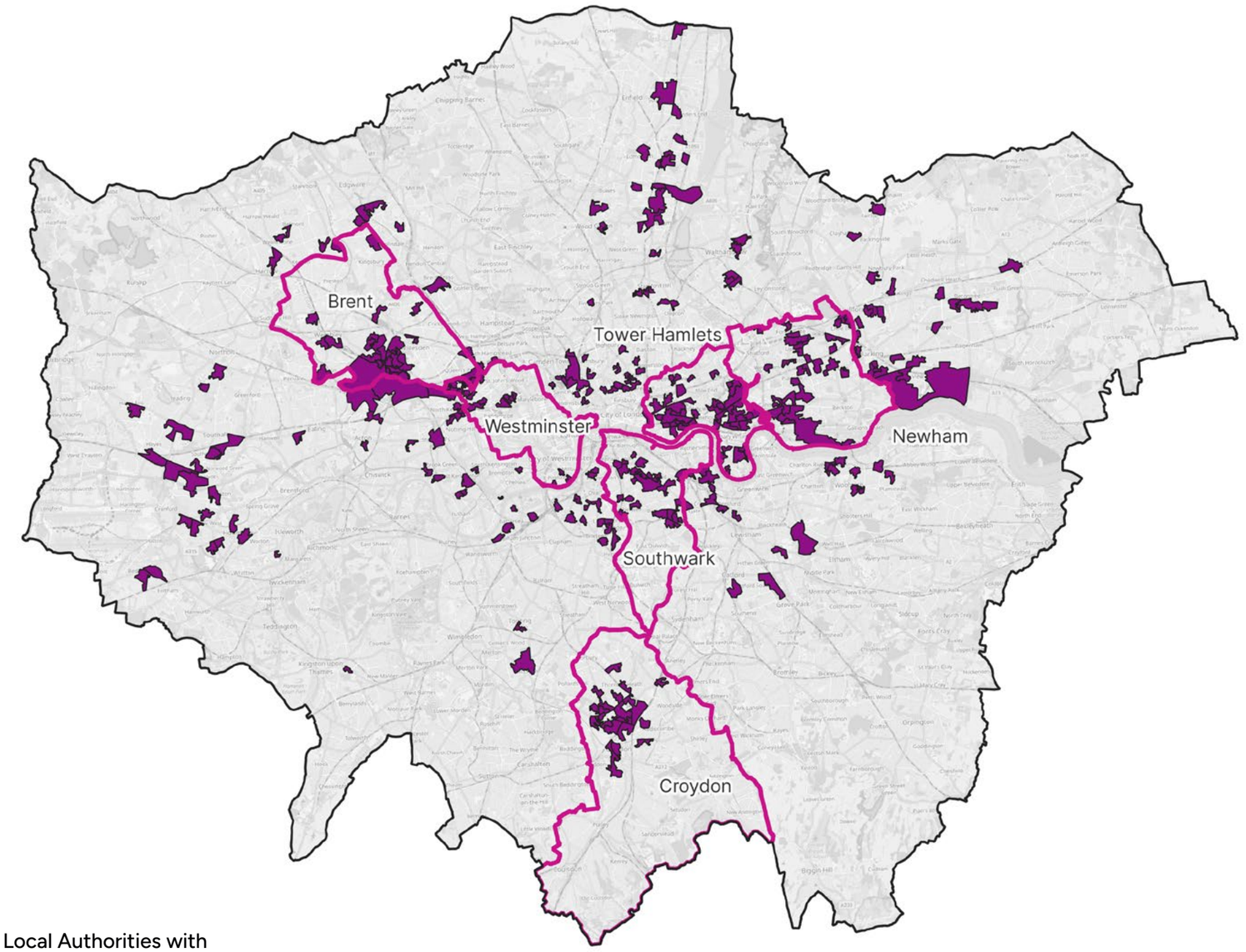
The CRL is intended to be used across all boroughs in London, particularly for the three focus sectors within them. The CRL has been applied to two London boroughs, informed by a multi-criteria analysis of the 32 boroughs and the City of London to compare relevant factors. These included the proportion of sensitive population, healthcare, social care and social housing buildings, public green space, policy frameworks, and population density. Heat risk was also taken into consideration, specifically by mapping the top five boroughs with the highest number of 'high risk' Lower Super Output Areas (LSOAs) according to the GLA's Climate Risk Map[32] (see Figure 9). From this assessment, two boroughs were selected due to their distinctly different characteristics as inner- and outer-London boroughs, respectively, which both contain a high number of areas with high heat risk.

The two selected boroughs have been anonymised for the purpose of this report, as one was content to be named and the other preferred anonymity. Therefore for parity they are referred to as 'Borough #1' and 'Borough #2'. Borough #1 is an inner-London borough with a higher concentration of healthcare facilities, social housing, rented accommodation, and heritage buildings. Borough #2 is an outer-London borough with a higher proportion of social care buildings.

As part of the two case studies, consideration was given to how the three focus sectors might utilise the CRL at a more local level. The purpose of this exercise is evaluate how useful the CRL is in a real-world local authority context, taking account of adopted planning policies, infrastructure plans, energy strategies, and retrofit programmes. The intention is for London boroughs to use this approach to scale up sustainable cooling measures.

The following section sets out how the CRL could be applied to each borough.

Figure 9: The top five boroughs in London with the highest number of 'high heat risk' LSOAs, according to the GLA's Climate Risk Map.



Borough #1

Overview

Borough #1 is one of London's most densely built and visited boroughs. It has a resident population of over 200,000 across a relatively small footprint, and many more people visiting and working in the borough daily.

The borough has a young demographic profile, with the proportion of heat-sensitive population (over 65 year olds and under 10 year olds) being close to the London average. However, Borough #1 has a high proportion of single-person households (45%), increasing vulnerability during heatwaves, particularly for older adults.

Housing, urban form and heritage

The housing profile of Borough #1 is dominated by the rental and social housing sector, with over 70% rented households and over 30% rented social housing, making sustainable cooling investment dependent on landlord or freeholder action rather than tenants. This could potentially slow retrofit progress, or alternatively could represent an opportunity to retrofit at scale. Borough #1 also contains over 50 conservation areas, covering over 75% of the surface area of the borough, which restricts the extent and ease of permissible adaptations, especially external shading, façade treatments, or major retrofits.

Health and social care infrastructure

Borough #1 faces heat adaptation challenges due to the high proportion of health care buildings and health inequalities across its wards. It's healthcare buildings play a critical regional role during heatwaves. The borough's wide disparities in health outcomes between wards mean that sustainable cooling measures must be designed to address both clinical settings and community-based risk, ensuring adequate protection for residents with pre existing health conditions.

Urban heat and the environment

Although Borough #1 has many public parks, opportunities to expand green corridors and create connected natural shade networks are limited by its compact and heavily developed landscape. Tree canopy cover is unevenly distributed, with lower levels of shade in areas of higher deprivation, exacerbating heat exposure for more vulnerable communities.

The borough's low car reliance and extensive public transport, walking and cycling networks help limit waste heat from motorised vehicles and support cooler local temperatures. However, as a major tourist destination, with a high concentration of administrative and commercial buildings, the borough experiences intense pedestrian activity and high building occupancy levels, which can amplify the urban heat island effect.

Policy context

Borough #1 shows strong leadership on climate resilience and sustainable cooling policy. The borough has established robust overheating and cooling guidance, including Supplementary Planning Documents and other strategies regarding sustainable cooling. This framework commits the borough to supporting climate-adapted development and integrating sustainable cooling principles throughout the planning process. However, despite this strong policy direction, heritage constraints and the high proportion of rented housing in the borough present delivery challenges, limiting the pace and scope of building-level retrofit.

Summary

Borough #1 is one of London's most densely built and visited boroughs, facing acute heat adaptation challenges due to its intense urban form, health inequalities, and a high concentration of social housing and healthcare buildings. Retrofitting for cooling and adaptation can be challenging, as landlords, tenants, heritage constraints, and planning processes all affect delivery and uptake. Despite these challenges, Borough #1 benefits from a strong policy foundation that supports heat resilient approaches.

Potential priority actions for Borough #1 to consider are set out below:

Phase 1 - Early steps

- Prioritise overheating assessments of focus sector buildings, especially heritage buildings, and the co-designing of solutions with building users (see B.01 and C.01)
- Continue piloting social housing retrofits and neighbourhood-based cooling pilots in deprived areas with low tree canopy cover (see B.02 and L.02).
- Establish feasibility of integrating district cooling networks into plans for upgrading district heating networks (see B.04).

Phase 2 - Scaling

- Retrofit focus sector buildings with passive cooling and shading (see B.02).
- Increase green corridors and pocket parks where space allows (see L.01 and L.02).

Stage 3 - Embedding

- Ensure long-term monitoring and responsive adaptation for vulnerable populations, especially in socially rented housing (see B.05 and C.01).

Borough #2

Overview

Borough #2 is one of London's most populous boroughs and, with a rapidly growing and ageing population, it is projected to reach over 500,000 residents by 2050. This demographic shift increases the borough's exposure to heat-related risk, particularly as Borough #2 has a higher than average proportion of heat-vulnerable people (young children and older adults) and a greater number of deprived areas than the London average.

Housing, urban form and heritage

Borough #2 has a large and diverse housing stock, including over 20 conservation areas. There is a lower proportion of social housing than the London average, but this is concentrated primarily in the north and eastern parts of the borough, meaning that heat risk vulnerabilities are unevenly distributed. The borough has delivered high levels of affordable housing and continues to see a high rate of additional dwellings.

Health and social care infrastructure

The health system in the borough is a critical asset during heatwaves. Although Borough #2 has a lower proportion of healthcare buildings than the London average, it has one of the highest number of social care buildings of all London boroughs. Given the shift toward community-based care and falling residential care admission rates, heat resilience and sustainable cooling efforts must extend beyond acute healthcare buildings and formal social care facilities into the borough's distributed network of health centres, clinics, community centres, and the homes of older adults.

Urban heat and the environment

Borough #2 has ambitions to strengthen green infrastructure networks and deliver incremental shading and cooling benefits over time. This is particularly important in a borough with heavy reliance on private transport, which currently limits the co-benefits more commonly seen in areas of London with stronger public and active transport provision.

Policy context

Local policy within Borough #2 is currently under review, and includes references to the cooling hierarchy, shading, and green infrastructure.

However, the borough does not currently have specific overheating guidance, mandatory requirements for overheating assessments, nor a dedicated sustainable cooling strategy. This creates gaps in resilience planning, particularly for social housing, social care, and healthcare buildings that accommodate some of the borough's most heat-vulnerable residents. It also represents an opportunity to use the borough's assets and follow good practice policy examples from other London boroughs.

Summary

Borough #2 has a growing and ageing population, concentrations of social housing, pockets of deprivation, and a number of residential care homes. It is moving towards more community-based health and care networks which makes it one of London's most strategically important boroughs for heat risk action.

While the borough benefits from strong and innovative delivery of affordable housing and commitments to green infrastructure, gaps in overheating and adaptation policy present some challenges. Borough #2 could begin by prioritising efforts towards developing policy frameworks for sustainable cooling and heat adaptation to establish a basis for implementing the options for action within the CRL. The borough could also utilise its large amount of lower density spaces and upcoming green infrastructure projects, to target cooling strategies towards its growing heat-vulnerable population and high deprivation areas.

Potential priority actions for Borough #2 to consider are set out below:

Phase 1 - Early steps

- Develop local overheating policy and sustainable cooling guidance and strategies (see P.04).
- Continue tree planting and shading programs (see L.01) while starting community engagement to co-design sustainable cooling strategies (see C.01).
- Map vulnerable populations and priority focus sector buildings for implementation of sustainable cooling measures (see B.01 and B.02).

Phase 2 - Scaling

- Scale up green infrastructure strategies (for example, planting street trees and enhancing existing green spaces) and require cool roofs and walls in new developments (see L.02, L.03).
- Retrofit social care buildings with passive cooling and ventilation measures (see B.02).
- Expand community cooling hubs in deprived areas (see L.02).

Phase 3 - Embedding

- Ensure long-term resilience through established 'year round thermal comfort' retrofit for all focus sector buildings and ongoing urban greening programmes (see B.01 and L.01-L.03).

6. Conclusion and Next Steps

Conclusion

London is at the forefront of the UK's heat risk challenge, requiring an urgent, place-based and people-centred approach to effectively manage thermal comfort, safeguard public health, and address future energy needs. London is also well positioned to reframe this challenge as an opportunity to put environmental, social and economic justice at the heart of action to prepare for, respond to and recover from heat impacts in the context of climate change.

Following the BAU scenario puts London at risk of an increase in cooling energy demand and social inequity. However, this is not inevitable. Using the CRL to move towards the SEC scenario could deliver transformative benefits for London in terms of climate resilience, cooling energy reduction, cooling equity, residents' health and social justice.

Starting with the focus sectors is a priority as residents and occupants of buildings in these sectors are disproportionately impacted by heat. They often cannot relocate, control their environments, or tolerate heat, putting them at greater risk during hot weather.

The CRL provides a city-wide strategic framework that boroughs can interpret and apply according to their local context. The CRL enables the prioritisation and normalisation of passive and nature-based cooling measures and the mainstreaming of more sustainable and efficient active cooling products and systems. The resulting reductions in annual cooling energy demand could lower the risk of cascading failures resulting from an overstretched energy grid during hot weather. This would reduce the risk of related disruption to healthcare, transport, and essential services, whilst protecting London's most heat-vulnerable populations and ensuring social justice.

Understanding the spatial distribution of heat risk is also essential for prioritising cooling strategies, as it highlights where place-based or building-based approaches are most needed. It also ensures that responses reflect differences in local building stock, demographic profiles, and policy readiness.

The contrasting case studies of the two selected London boroughs illustrate how the same set of options for action can be adapted to the distinct characteristics of a local area. This helps to support borough-led decision-making, while maintaining a coherent, London-wide approach to reducing heat risk.

Next steps

The insights and evidence from the CRL will directly support the development of the Heat Ready London plan, ensuring that decisions about resilience investment reflect an understanding of current and future cooling energy demand, heat vulnerability, and focus sector-specific needs.

The findings from the CRL will also contribute to strengthening city-wide preparedness for extreme heat and protecting the health of London's most vulnerable residents as the climate and the city continue to heat up.

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