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Annex to Heat Ready London Technical Report

Adapting the city to a warmer climate

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CONTENTS

Introduction 1

Annex A: Cost benefit analysis methodology and results; and approach to estimating costs 3

- **Deep dive priority area of focus: Retrofitting the highest-risk homes to reduce the risk of indoor overheating – for example shutters, insulation and ventilation, and air conditioning** 3
- **Deep dive priority area of focus: Retrofitting the high-risk non-residential buildings which deliver essential public services, e.g. schools** 31
- **Deep dive priority area: Installing outdoor shading structures to reduce temperatures and decrease sun exposure, for example shade canopies, shade sails and pergolas** 35
- **Deep dive priority area: Maintaining, raising awareness of and, where possible, expanding public drinking water points and public toilets** 39
- **Deep dive priority area: Enhancing community cool spaces and improving links with community-led initiatives.** 43
- **Deep dive priority area: Managing and expanding tree cover and green space in areas of high cooling and shading need and improving access to London's existing blue and green spaces** 45

Annex B: Funding and financing assessment 48

- **Introduction** 48
- **Deep dive: Retrofitting the highest risk homes to reduce the risk of indoor overheating, for example shutters, insulation and ventilation, and air conditioning** 54
- **Deep dive: Retrofitting high-risk non-residential buildings which deliver essential public services e.g. schools** 69
- **Deep dive: Installing outdoor shading structures to reduce temperatures and decrease sun exposure, for example shade canopies, shade sails and pergolas** 81
- **Deep dive: Maintaining, raising awareness of and, where possible, expanding public drinking water points and public toilets** 95
- **Deep dive: Enhancing community cool spaces and linking them with community-led initiatives to increase awareness of heat health risk and engage communities to prepare and respond to heat** 114
- **Deep dive: Managing and expanding tree cover and green space in areas of high cooling and shading need and improving access to London's existing blue and green spaces** 131

Introduction

The Annexes presented in this report provide further detail for the analytical work underpinning the funding and finance deep dives on six areas of focus presented in the Heat Ready London Technical Report (Technical Report). This report is made up of three sections:

1. **Annex A: Cost benefit analysis methodology and results; and approach to estimating costs.** This section contains a detailed description of the methodology used to undertake a bespoke cost benefit assessment for retrofitting at-risk homes, along with the results of the analysis. It also contains information on the approach to estimating the costs for each of the deep dives. The cost estimates are intended to be indicative.

2. **Annex B: Funding and financing assessment**. This section sets out the benefits registers, beneficiaries' assessment, and assessment of a range of funding and financing models that could potentially play a role in supporting the selected areas of focus examined through the funding and finance deep dives discussed in the Technical Report. It also sets out the methodology used to inform the selection of models discussed in the Technical Report itself. The approach is intended to provide a consistent framework for considering and comparing different funding and financing options, while recognising that the evidence base varies significantly across the different deep dives. As a result, the depth and level of analysis varies between areas. The assessment and scores should be considered as indicative rather than definitive and are intended to support comparison and inform the identification of potentially promising models rather than to provide directly comparative or conclusive assessment across the full set of measures explored.

Annex A and B are structured according to the six priority areas of focus selected for the funding and finance deep dives in the Heat Ready London Technical Report. These are:

- Retrofitting the highest-risk homes to reduce the risk of indoor overheating – for example shutters, insulation and ventilation, and air conditioning.

- Retrofitting the highest-risk non-residential buildings that deliver essential public services, e.g. schools.

- Installing outdoor shading structures to reduce temperatures and decrease sun exposure – for example shade canopies, shade sails and pergolas.

- Maintaining, raising awareness of and, where possible, expanding public drinking-water points and public toilets.

- Enhancing community cool spaces and improving links with community-led initiatives.

- Managing and expanding tree cover and green space in areas of high cooling and shading need; and improving access to London’s existing blue and green spaces.

Annex A: Cost benefit analysis methodology and results; and approach to estimating costs

<u>Deep dive priority area of focus:</u> Retrofitting the highest-risk homes to reduce the risk of indoor overheating – for example shutters, insulation and ventilation, and air conditioning

Summary

This priority area of focus looks at retrofitting homes at highest risk of overheating, using targeted interventions to reduce indoor temperatures. It responds to the growing and unevenly distributed risk of residential overheating in London, driven by rising temperatures, the urban heat island effect, and a housing stock historically designed to retain heat rather than dissipate it. Without adaptation, the majority (nearly 96 per cent) of existing homes are projected to experience overheating in a typical summer,[1] with significant impacts on health, wellbeing and productivity, particularly for vulnerable households who are less able to adapt independently.

Cost-Benefit Analysis Methodology

This section sets out the methodology used to conduct a Cost-Benefit Analysis (CBA) to assess the costs and benefits of different packages of retrofit interventions to reduce overheating for London's at-risk dwellings. Given the commission's scope, available resources, timeframe, and the data available, a bespoke CBA was undertaken for this priority area only.

The assessment builds on existing analysis by Arup undertaken in 2022 for the Climate Change Committee (CCC) on the costs and performance of cooling retrofit measures in the UK.[2] Arup subsequently published an updated analysis for the CCC *Well-Adapted UK Report*.[3] As this latter report was not available when the Heat Ready London assessment was undertaken, an across-the-board sensitivity adjustment was applied to understand how the lower cost assumptions presented in the updated Arup report affect the results. See cost calculations methodology below for further detail.

The analysis provides a useful initial indication of the potential value for money of different cooling retrofit packages specific to London. However, it is a modelling exercise based on assumptions about exposure, costs, effectiveness and outcomes, reflecting the evidence available at the time. Significant evidence gaps and uncertainties therefore remain. Further

[1] London City Hall (2026) London is overheating – are our homes ready for rising temperatures?
[2] Arup (2022) Addressing overheating risk in existing UK homes
[3] Arup (2026) Heat risk and adaptation in the urban built environment

analysis using the latest cost data and improved evidence will be needed to further refine the findings and inform future policy and investment decisions.

Scope and analytical framework

The analysis evaluates the costs and benefits of applying different retrofit packages to address heat risk to different dwelling types across London, over the 2025 to 2060 time period. The CBA follows UK government Green Book appraisal guidance.[4]

The analysis focuses on measuring changes relative to a baseline scenario where no retrofits are undertaken. It is assumed that no dwellings in the baseline scenario benefit from measures to reduce their internal temperature. The analysis estimates both the incremental costs (capital, operating, and replacement costs) and the incremental benefits (avoided deaths, reduced morbidity, and prevented work days lost) that would result from deploying different retrofit packages across London's housing stock.

All monetary values are adjusted to 2024-25 GBP.

Model structure

The model is organised into six main analytical sections:

- **Packages and scenarios**: definition of the retrofit packages and time profiling of their deployment from 2030-2050
- **Costs**: calculation of capital expenditure (CAPEX), operating expenditure (OPEX), and carbon costs
- **Mortality**: estimation of deaths averted and quality-adjusted life years (QALYs) gained through heat risk reduction
- **Morbidity**: estimation of hospitalisations and health-related QALYs averted
- **Productivity**: estimation of work days recovered through two pathways: reduced heat stress for home workers and improved sleep quality
- **Valuation and aggregation**: application of discount rates, valuation of non-monetised benefits (mortality, morbidity, productivity), and calculation of net present values (NPV) and benefit-cost ratios (BCR)

Packages and scenarios

Packages

The analysis evaluates seven retrofit packages spanning different levels of intervention, from low-cost passive measures to comprehensive packages combining passive and active cooling measures.

Packages 1 to 5 are defined by the Arup (2022) report and represent a progression of retrofit intensity as set out in the table below:[5]

[4] HMT (2026) The Green Book
[5] Arup (2022) Addressing overheating risk in existing UK homes

Table 1 - Arup package definitions by archetype

Archetype	Package 1	Package 2	Package 3	Package 4	Package 5
Houses	Blinds, roof insulation (where not already present in baseline), low g-value window film	External shutters instead of blinds, roof insulation (where not already present in baseline), low g-value window film, ceiling fan	Package 2 + solar reflective walls	Package 3 + window replacement (low g-value and openable)	Package 1 + active cooling
Flats	Blinds, low g-value window film	Package 1 + ceiling fan	External shutters instead of blinds, low g-value window film, ceiling fan	Package 3 + window replacement (low g-value and openable)	Package 1 + active cooling

For the purposes of this analysis, two additional packages have been defined. Package 6 combines the measures from Package 4 (the deepest passive retrofit) but also assumes that active cooling (AC) is installed to address residual heat risk, allowing investigation of how a comprehensive passive cooling retrofit combined with AC performs. Package 7 is the same but combines Package 3 with AC. Package 7 allows for an assessment of how a deep passive retrofit combined with AC performs without the more expensive intervention of window replacement. These packages allow assessment of how passive and active cooling measures complement one another in improving resilience to heat risk.

Package effectiveness

Arup (2022) assesses their five packages against two TM59 criteria.[6] TM59 is a widely adopted methodology developed by the Chartered Institution of Building Services Engineers (CIBSE) and is considered industry-standard practice for assessing overheating risk in residential buildings, commonly used to demonstrate compliance with Approved Document O of the Building Regulations which focuses on overheating. It is based on limits for both the frequency of daytime overheating across occupied rooms and night-time temperatures in bedrooms (see Criteria A and B below). Arup assess scores for the two criteria in a current climate scenario and a 2 degrees warming scenario.

[6] Arup (2022) Addressing overheating risk in existing UK homes

- Criterion A (for living rooms, kitchen and bedrooms) assesses overheating during all summer occupied hours using an adaptive approach that defines the maximum acceptable temperature based on the external temperature;
- Criterion B (for bedrooms only) assesses night-time overheating based on a fixed temperature threshold of 26°C.

Arup's scoring of the packages against these two criteria (Tables 16 and 17 in its report) is used as a basis for this analysis' calculation of package effectiveness in mitigating the risk of overheating. The criteria are scored on the following measures:

- Criterion A – The percentage of hours where the operative temperature exceeds the comfort temperature by one degree Celsius or more during the period May to September inclusive.
- Criterion B – The number of hours where the operative temperature in the bedroom from 10 pm to 7 am exceeds 26 °C.

These measures are then converted into a 'pass' or 'fail' based on the matrix below (see Table 2).

Table 2 - TM59 retrofit performance assessment matrix

	Criterion A	Criterion A	Criterion B	Criterion B
	Min	Max	Min (hrs)	Max (hrs)
Pass	0 per cent	3 per cent	0	32
Moderate fail	3 per cent	6 per cent	32	64
Severe fail	6 per cent	15 per cent	64	160
Extreme fail	15 per cent		160	

This analysis converts these scores into a unified measure of effectiveness as follows. First each criterion's score is converted into a measure of effectiveness such that a 'pass' is assumed to be 100 per cent effective and an 'Extreme fail' is assumed to be 0 per cent effective. Any score between a 'Pass' and an 'Extreme fail' is scaled linearly between the maximum score for a 'Pass' (3 per cent or 32hrs) and the minimum score for an 'Extreme fail' (15 per cent or 160hrs). For example, a score of 6 per cent for Criterion A would be scaled such that 1 – ((6 per cent - 3 per cent) / (15 per cent - 3 per cent)) = 75 per cent effective.

The two criterion specific effectiveness ratings are then averaged to get an overall effectiveness rating.

Based on the Arup data, package effectiveness (by dwelling type) can be calculated for the current climate (assumed to be equivalent 1 degree of global average warming for

modelling purposes[7]) and a 2 degrees (global average) warming scenario. These scenarios are used to differentiate between different segments of this analysis' time horizon. This allows for variance in package effectiveness over time, as the climate changes. The '1 degree' climate effectiveness ratings are used for years 2025 to 2030 and the '2 degrees' effectiveness ratings are used for the period 2041 to 2060. For the period 2031 to 2040, effectiveness for a 1.5 degree scenario are used where the effectiveness ratings in this scenario are estimated as being the average of the 'current' climate and '2 degrees' scenarios. This method aligns with the CCC's benchmark for adaptation planning in the UK (that is adapt to 2°C by 2050, prepare for 4°C by 2100).[8]

As is the case for Package 5, Packages 6 and 7 are assumed to be able to achieve 100 per cent effectiveness in mitigating the risk of overheating when passive measures are combined with AC to address residual risk.

The resulting effectiveness ratings are set out in Table 3 below.

Table 3 - Retrofit package effectiveness rating by dwelling type, by global warming level (GWL)

Dwelling type	GWL (°C)	Baseline (per cent)	Package 1 (per cent)	Package 2 (per cent)	Package 3 (per cent)	Package 4 (per cent)	Packages 5, 6 & 7 (per cent)
Mid-terraced house	1.0	66	90	100	100	100	100
Semi-detached house	1.0	65	90	100	100	100	100
Detached house	1.0	72	88	100	100	100	100
End-terraced house	1.0	68	93	100	100	100	100
Flat	1.0	50	71	96	100	100	100
Mid-terraced house	1.5	56	70	91	92	92	100

[7] The IPCC's Sixth Assessment Report states: 'Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020'. IPCC (2023) Climate Change 2023: Synthesis Report

[8] Climate Change Committee (2026) CCC Adaptation Monitoring Framework

Dwelling type	GWL (ºC)	Baseline (per cent)	Package 1 (per cent)	Package 2 (per cent)	Package 3 (per cent)	Package 4 (per cent)	Packages 5, 6 & 7 (per cent)
Semi-detached house	1.5	58	70	93	95	96	100
Detached house	1.5	61	69	93	96	100	100
End-terraced house	1.5	59	72	94	97	98	100
Flat	1.5	49	60	73	84	100	100
Mid-terraced house	2.0	46	50	83	83	84	100
Semi-detached house	2.0	50	50	86	90	92	100
Detached house	2.0	50	50	85	92	99	100
End-terraced house	2.0	50	50	88	93	96	100
Flat	2.0	48	50	50	68	100	100

Deployment scenarios

The analysis considers different deployment scenarios across groups of dwellings with differing level of heat risk.

To define the scale of intervention, the number of dwellings in scope was identified using heat-risk mapping developed by Arup for the Greater London Authority (GLA),[10] combined with the London Building Stock Model (LBSM v2).[9] This enabled a count of residential properties by dwelling type across different levels of heat-risk (categorised based on heat risk scores).

Arup's analysis assesses the heat risk of different dwelling types based on three factors:[10]

[9] Greater London Authority (2026) London Building Stock Model v2

[10] Arup (2024) Properties Vulnerable to Heat Impacts in London. The Arup analysis was unable to identify whether dwellings already benefitted from cooling measures and so it may be that some of the dwellings identified as at-risk, are less so due to existing cooling measures. This would reduce the future cost of a

- Heat hazard (Outdoor temperature)
- Property vulnerability to overheating
- Socioeconomic vulnerability to high temperatures

For the purposes of the cost–benefit analysis, the identification of houses at risk of overheating focused on two factors: exposure to high outdoor temperatures and the vulnerability of the building itself to overheating. This is because the effectiveness of retrofit measures is determined (solely) by their impact on indoor temperatures. Demographic vulnerability is accounted for separately in the cost–benefit analysis by considering how age and sex mediate the relationship between indoor temperature and mortality risk, health outcomes, and productivity impacts, where this information is available.

In this analysis, overheating risk is divided into four categories; low, medium, high and very high risk.[11] The resulting distribution of dwellings by dwelling type and by heat risk level is set out in Table 4 below. The result is that roughly 26 per cent of London's dwellings are categorised as at high or very high risk of overheating.[12]

Table 4 - Number of dwellings by dwelling type by overheating risk level

Overheating Risk Level	Detached house	End-terraced house	Flat	Mid-terraced house	Semi-detached house	Total
Low	116,156	200,627	1,035,394	422,373	355,608	2,130,158
Medium	11,614	46,804	475,449	143,985	48,862	726,714
High	12,776	39,569	604,488	127,320	42,999	827,152
Very high	940	3,818	182,945	12,924	1,919	202,546
Total	**141,486**	**290,818**	**2,298,276**	**706,602**	**449,388**	**3,886,570**

The analysis estimates how costs and benefits vary depending on different retrofit deployment strategies. The three deployment scenarios considered are:

1. **Central option** - All very high risk dwellings retrofitted by 2035 and all high risk dwellings retrofitted by 2040.

retrofit programme but also the future benefits and, all else being equal, would have no impact on the benefit cost ratio (BCR) the programme could realise.

[11] Low = Arup levels 2 to 4; Medium = Arup level 5; High = Arup level 6 and; Very high = Arup levels 7 to 9.

[12] This results in approximately 200,000 homes (5.2 per cent of the housing stock) classified as at very high risk and around 800,000 homes (21.3 per cent) at high risk, which together form the basis for the deployment and costing scenarios.

2. **Expanded option** - All very high risk dwellings retrofitted by 2035, all high risk dwellings retrofitted by 2040 and all medium risk dwellings retrofitted by 2045.

3. **Accelerated option** - All very high risk dwellings retrofitted by 2030 and all high risk dwellings retrofitted by 2035.

The central option is considered to be the most realistic deployment time profile of the three. The expanded and accelerated options are included as part of a sensitivity analysis. They allow for assessments of how results would change if either the deployment strategy was widened to include medium risk dwellings or if there was a more rapid deployment schedule.

In all cases, it is assumed the first retrofit work begins in 2027 and the first completion results in 2028. This 1-year implementation period is applied across the model.

Throughout, this analysis explores situations in which all of the packages are applied to all dwellings identified as requiring retrofit. Further analysis could explore the implication of the differential application of packages according to the expected heat risk of that dwelling such as, more extensive retrofit for dwellings at greatest heat risk and/or prioritising active cooling for high-risk properties where implementation of passive options is more challenging (e.g. flats in high density developments).

Costs Calculation

The costs section of the model calculates three types of costs: capital expenditure on retrofit interventions, operating expenditure (including maintenance), and carbon costs associated with energy consumption. This section describes each in turn.

Capital expenditure (CAPEX)

To provide wider context on the scale of potential capital costs associated with delivering heat-resilient buildings, evidence from new-build and refurbishment standards offers an indicative benchmark for high-performance design.

Box 1: Example indicative cost benchmark for heat-resilient housing design

Evidence suggests that achieving Passivhaus-level design standards, used here as a proxy for high-performance, heat-resilient housing, may involve an additional capital cost uplift of around 8–9 per cent above baseline construction costs, reducing to approximately 4 per cent at scale.[13] This equates to an indicative additional cost of approximately £115/m² (based on 2019 UK cost analysis)[14]. Applied to average London dwelling sizes (around 80.7m²),[15] this equates to approximately £9,280 on top of current cost of construction. However, costs will also vary depending on dwelling type, scheme constraints, and the extent to which measures are incorporated as part of wider energy

[13] Passivhaus Trust (2019) Passivhaus Construction Costs
[14] AECOM (2019) Research into overheating in new homes
[15] Greater London Authority (2021). Housing Research Note 6 An analysis of housing floorspace per person

Box 1: Example indicative cost benchmark for heat-resilient housing design

and fabric upgrades. However, these additional capital costs are expected to be partially offset over time through reduced energy demand and lower household energy bills.[16]

While the figures shown in Box 1 reflect the costs of delivering high-performance design standards in new or comprehensively refurbished housing, the analysis presented here focuses specifically on the cost of targeted retrofit measures, based on intervention-level estimates for different dwelling types and packages.

CAPEX costs used in this CBA are sourced from Table 30 in Arup's 2022 report (see Table 5).[17] The unit costs vary by individual intervention measure (e.g. blinds, external shutters, window replacement, active cooling installation) and by dwelling type (detached, semi-detached, mid-terrace, end-terrace, and flats).

Table 5: Retrofit intervention unit costs

Intervention	Description	Mid-Terrace	Semi-Detached	Detached	End Terrace	Old Flat	Modern Flat
1	Install Blinds	£4,356	£7,502	£7,018	£4,477	£2,541	£2,420
2	Install Curtains	£3,993	£8,470	£7,865	£5,687	£2,662	£2,541
3	Install Fixed Shading (overhang – horizontal south, vertical east/west)	£10,890	£24,200	£25,410	£16,940	£29,040	£14,520
4	Install External natural shading – east and west orientation	£0	£9,680	£7,260	£0	£0	£0
5	Install External Shutters	£20,570	£24,200	£39,930	£21,780	£19,360	£18,150
6	Install Internal Shutters	£13,310	£14,520	£16,940	£12,100	£9,680	£9,680
7	Low G window film	£3,630	£6,050	£7,260	£3,630	£2,420	£2,420

[16] Costanzo, V., Fabbri, K. and Piraccini, S., 2018. Stressing the passive behavior of a Passivhaus: An evidence-based scenario analysis for a Mediterranean case study. *Building and Environment*, *142*, pp.265-277.

[17] Arup (2022) Addressing overheating risk in existing UK homes

Intervention	Description	Mid-Terrace	Semi-Detached	Detached	End Terrace	Old Flat	Modern Flat
8	Replacement of window with low g value glazing	£30,250	£65,340	£72,600	£30,250	£24,200	£21,780
9	Install openable windows	£0	£25,410	£65,340	£26,620	£21,780	£18,150
10	Install Solar Reflective Walls	£4,840	£15,730	£22,990	£8,470	£8,470	£7,260
11	Install Solar Reflective Roof	£10,890	£21,780	£32,670	£19,360	£0	£0
12	Install Roof Insulation	£8,470	£14,520	£19,360	£14,520	£0	£0
13	Install Ceiling Fans	£2,420	£3,630	£3,630	£2,420	£2,420	£2,420
14	Install MVHR	£6,050	£7,260	£7,260	£6,050	£6,050	£6,050
15	Install Active Cooling (Reversible heat pumps)	£14,520	£20,570	£22,990	£13,310	£14,520	£10,890

Different retrofit packages comprise different combinations of these interventions. In some cases, a given package can also consist of different interventions for flats versus houses. For example, Package 2 for houses includes roof insulation whereas the same package for flats does not. The total CAPEX cost for any dwelling-package combination is the sum of the unit costs for each individual intervention in that package.

For packages that include active cooling (such as reversible heat pumps), the model separately tracks replacement costs. Units are assumed to have a 15-year replacement period. Replacement costs are calculated using the same unit costs as the initial installation and are incurred in years where they fall within the analysis period.

Arup reports that their costs should be considered with a tolerance of +/- 50 per cent. With that in mind, and considering that there is substantial scope for economies of scale and scope by conducting multiple retrofit interventions at once and/or by conducting interventions across multiple dwellings at once, the analysis considers a cost scenario where Arup's CAPEX costs can be discounted by 50 per cent.[18] A further justification for

[18] DESNZ (2024) Whole House Retrofit (WHR) and Social Housing Decarbonisation Fund Demonstrator (SHDF(D))

this substantial reduction to these 2022 cost estimates is that those reported in Arup (2026) are significantly lower, by approximately 66 per cent.[19]

Arup's CAPEX costs are in 2022 GBP and so they are inflated to 2024-25 GBP for use in the analysis.

Operating expenditure and carbon costs

Operating costs comprise two components: energy costs and carbon costs. Both are calculated based on annual energy consumption, which varies by dwelling type and retrofit package, with the underlying Arup analysis accounting for the fact that retrofit packages can influence the amount of energy needed for both active cooling and winter heating. Throughout, it is assumed that domestic heating is fuelled by gas and the energy needed for domestic appliances and active cooling is provided by electricity.

Energy costs are calculated as:

> *Annual energy costs = (Heating consumption in kWh × long-run variable cost of gas per kWh) + (Appliance and cooling consumption in kWh × long-run variable cost of electricity per kWh)*

Energy consumption (in kWh) by dwelling type and retrofit package is taken from Tables 37 and 38 of Arup (2022) which provides energy consumption under current and future climate scenarios.[20] The time-varying long-run variable costs (LRVC) of gas and electricity are sourced from Department for Energy Security and Net Zero (DESNZ, 2023). The raw LRVCs are in 2022 GBP and so the series are inflated to 2024-25 GBP for use in the analysis.[21]

Carbon costs reflect the carbon intensity of energy consumption and are valued as follows:

> *Annual carbon costs = ((Gas consumption in kWh × gas emissions factor) + (Electricity consumption in kWh × electricity emissions factor)) × carbon value per tonne CO_2e*

The time-varying long-run marginal carbon emissions intensity of the UK grid are sourced from DESNZ (2023),[22] and the carbon emissions intensity of domestic gas consumption is sourced from DESNZ (2025).[23] Retrofits that reduce energy consumption generate carbon cost savings.

[19] Arup (2026) Heat risk and adaptation in the urban built environment, The Arup (2026) report was released too late into this project's lifecycle to be integrated into this component of the analysis.
[20] Arup (2022) Addressing overheating risk in existing UK homes
[21] DESNZ (2023) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Data tables 1 to 19
[22] Ibid.
[23] DESNZ (2025) Greenhouse gas reporting: conversion factors 2025

The carbon values series is sourced from DESNZ (2023) in 2022 GBP and so the series is inflated to 2024-25 GBP for use in the analysis.

Benefit Calculations

Mortality Calculation

The mortality section of the model estimates deaths averted from reducing excess heat-related mortality through the application of retrofit packages. Retrofits that improve thermal performance (e.g. through shading, insulation, and ventilation) reduce the indoor temperature relative to the baseline scenario, thereby reducing heat exposure and associated heat-related mortality risk.

The calculation begins by estimating the size and distribution of the at-risk population. The next step is to assess the risk they are exposed to, now and in the future, as measured by indoor temperatures. A relationship between indoor temperatures and mortality is then used to estimate the number of heat related deaths in the at-risk population in the baseline scenario. The number of deaths is then translated into an estimate of the number of Quality-Adjusted Life Years (QALY) lost. Finally, the calculation assesses how retrofits would impact baseline heat-related mortality.

At risk population estimation

Baseline mortality risk is estimated by first estimating the number of at-risk people where the at-risk population is defined as daytime occupants[24] of their dwelling. The number of at-risk people, by dwelling type, by heat risk level, by age group and by sex is estimated as follows:

> *number of daytime occupants (people) = number of dwellings (dwellings) * occupancy rate (%) * average household size (people/dwelling) * daytime occupancy rate (%)*

This calculation relies on the following data (see Table 6):

Table 6 - Mortality calculation data description

Description	Granularity	Notes
Number of dwellings[25]	By dwelling type and by heat risk level	See ‘deployment scenarios’ above.

[24] The analysis focuses on daytime occupants because mortality-related risk is assessed using the average daily temperatures experienced by the exposed population, which can only be estimated with confidence for those occupying their dwellings during the day. Daytime occupants are also expected to face the greatest risk of overheating within their homes and are therefore most likely to benefit from the dwelling-based measures being assessed. Although this approach aligns with the methodology in AECOM (2019) research into overheating in new homes, it may underestimate mortality risk. For example, occupants who are away from home during the day may still be exposed to high daytime temperatures elsewhere before returning to an overheated dwelling in the evening and overnight.

[25] Arup (2022) Addressing overheating risk in existing UK homes

Description	Granularity	Notes
Occupancy rate[26]	By dwelling type	
Average household size[27]	By dwelling type	
Daytime occupancy rate[28,29]	By age group and by sex	For working age population, age group and sex specific daytime occupancy rates for the UK in 2019 (AECOM, 2019) adjusted using the ratio of homeworking rate in 2022 in London to the homeworking rate in 2019 in the UK (ONS, 2022) to account for post-pandemic changes in homeworking.
Population forecast	By age group and by sex	

Temperature and indoor conditions

Heat risk in this model is measured by exposure to high indoor temperatures. To estimate this exposure, the analysis relies on projections of maximum (and minimum) daily outdoor temperatures in the Greater London area for the period 2025 to 2060.[30] Projections at the highest available spatial resolution for the Greater London area (2.2 km) are only available for the RCP 8.5 (high emissions) climate scenario. As RCP 8.5 is the highest emissions scenario, it produces the warmest projected future temperatures. The emissions trajectory underlying those projections is now widely regarded as increasingly implausible for a business-as-usual trajectory, particularly in the second half of the 21st century.[31] However, the possible range of average global temperature increases by 2050 under RCP 8.5 remains consistent with the CCC's benchmark for adaptation planning in the UK (that is, adapt to 2°C by 2050, prepare for 4°C by 2100).[32]

Maximum daily outdoor temperatures are then converted into maximum indoor temperatures using the following formula:[33]

[26] ONS (2023) Accommodation type by household size
[27] Ibid.
[28] AECOM (2019) Research into overheating in new homes
[29] ONS (2022) Homeworking in the UK – regional patterns
[30] UKCP (2026) UK Climate Projections – UKCP Local
[31] Hausfather, Z and Peters, G. (2020) Emissions – the 'business as usual' story is misleading, *Nature* 577, 618-620
[32] Climate Change Committee (2026) CCC Adaptation Monitoring Framework, See Page 7 of IPCC (2019) and Table 4.2 of IPCC (2022) for context on the compatibility of RCP 8.5 with 2 degrees of global warming by 2050.
[33] AECOM (2019) Research into overheating in new homes

Maximum indoor temperature = (2-day mean maximum outdoor temperature × 0.7802) + 8.048

This is an indicative rule of thumb relationship only but reflects the thermal characteristics of the dwelling stock and the extent to which buildings passively cool relative to ambient temperature.

The maximum indoor temperature is then converted into an average indoor temperature using the formula:[34]

*Indoor daily mean temperature = Indoor maximum temperature - (f * daily outdoor temperature range / 2)*

Where the daily outdoor temperature range is taken from the outdoor temperature data discussed above and f is an 'attenuation factor' which captures how much more dampened the indoor temperature swing (amplitude) is than the outdoor swing. The assumed (average) attenuation factor used in the analysis is 0.25 based on a full range of 0.1-0.5 found in the literature.[35] It is important to note that attenuation factors determine how a building retains and loses heat with respect to surrounding temperatures only. They do not capture other factors that can influence internal temperatures including: orientation, solar gains, occupancy gains and internal gains. In addition, attenuation factors for individual building elements are not directly equivalent to the whole building behaviour.

The indoor temperatures resulting from this formula are assumed to be a 'central' estimate and therefore those experienced by household with a 'medium' heat risk level. It is assumed that high risk households experience mean indoor temperatures 7.5 per cent higher than the central estimate and very high-risk households experience indoor temperatures which are 15 per cent higher than the central estimate.

The estimate of a 15 per cent range in indoor temperatures between 'medium' and 'very high' heat risk households is based on the findings from a 2014 study of 100 dwellings across London which found that certain dwellings could have mean summer daytime and nighttime indoor temperatures which were as much as 3°C higher than the median of roughly 24°C.[36] Given the small sample in this study, this 12.5 per cent difference between median and 'hot' dwellings was rounded up to 15 per cent to reflect the fact that it is

[34] This make the simplifying assumption that the indoor daily temperature range is twice the difference between the daily peak and the 24-hour mean temperature, following the approach, for example, of Harrington-Lynn (2017) Here Comes the Sum in CIBSE Journal, June.
[35] Kucynski, T., Staszczuk, A., Gortych, M. Stryjski, R. (2021) Effect of thermal mass, night ventilation and window shading on summer thermal comfort of buildings in a temperate climate, *Building and Environment*, 204 report f values of between 0.23 and 0.51 for buildings in Poland, a broadly similar temperate climate to the UK, during a heatwave. Mantesi, E., Hopfe, C., Mourkos, K., Glass, J. and Cook, M. (2019) Empirical and computational evidence for thermal mass assessment: The example of insulating concrete formwork *Energy and Buildings* report f values of between 0.1 and 0.25 for buildings in Guildford, UK.
[36] Mavrogianni (2014) Monitoring summer indoor overheating risk and ventilative cooling behaviour in London homes.

unlikely that this limited study managed to capture the most at-risk dwellings in London. The 7.5 per cent increase for high-risk dwellings is a linear interpolation between the 'medium' and 'very high risk' dwellings.

Conversion of heat exposure into heat-related mortality

The relationship between heat exposure and heat-related mortality used in this analysis is set out in Figure 2 of Office for National Statistics (ONS, 2026).[37] The study models the relationship between average daily outdoor temperatures over 22 degrees and relative mortality risk in London (see Figure 1). The study only covers temperatures up to 29°C and so, for days with average temperatures beyond this level, it is assumed relative risk increases linearly as a function of temperature. This is a simplifying assumption, rather than being empirically verified, representing an important limitation to the analysis.[38] For average temperatures of 22°C and below, it is assumed there is no heat-related mortality.

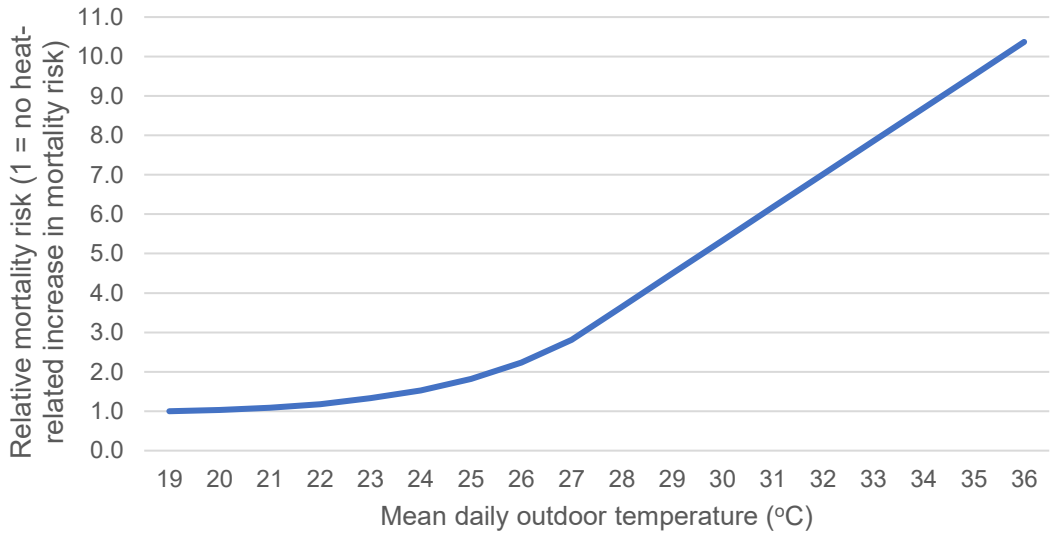


Figure 1 - Relative mortality risk by temperature

The analysis makes the simplifying assumption that the heat mortality risk function, derived using outdoor temperatures, also applies to people experiencing those temperatures indoors.[39] As such, in a given year, each day where average indoor

[37] ONS (2026) Climate-related mortality, England and Wales: 1998 to 2025

[38] Further limitations to the analysis, common to many other studies that explore the relationship between high temperatures and mortality, include that the analysis does not take account of humidity, length and occurrence of heatwaves (beyond the use of the 2-day mean maximum outdoor temperature when calculating indoor daily maxima), and occupancy behaviours.

[39] It is recognised that the relationship reported by the ONS between outdoor temperature and mortality will, in part, reflect mortality among people who remain indoors during periods of high outdoor temperatures. However, this group is estimated to represent a relatively small proportion of the overall population (less than 10%), although it will account for a larger proportion of those most vulnerable to temperature-related mortality. However, in the absence of evidence on the relationship between indoor temperature and mortality, this approach was considered preferable to one based solely on outdoor temperature. In particular, an outdoor-temperature-based approach would not capture how changes in indoor temperatures resulting from retrofit measures may affect mortality risk. Academic analyses have also acknowledged 'a lack of direct

temperatures are projected to exceed 22 degrees is associated with an increase in relative mortality (1.0 = no heat-related increase in relative mortality). Multiplying the number of days with a given average temperature by the increase in the mortality rate associated with that average temperature gives an estimate of the increase in mortality risk. This is measured in terms of the risk-day equivalents associated with the total number of days with that temperature in that year. A risk-day equivalent is a unit of risk equal to the risk of being exposed to the average daily mortality risk level for one day. For example, 10 days spent in temperatures of 25ºC, where 25ºC is associated with a relative mortality risk of 1.5, is associated with an increase in heat-related mortality risk of (1.5 – 1.0) x 10 = 5 risk-day equivalents.

To estimate the total increase in heat related mortality risk for each at-risk individual, the increase in risk-day equivalents associated with all the different over-22 degree average temperature days is added together. For example, it may be that there are 10 days with average indoor temperatures at 25ºC which leads to an increase of 5 risk-day equivalents (as per example above) and this is added to the increases associated with 23ºC, 24ºC and 26ºC days and so on.

This total number of risk-day equivalents, driven by overheating, is then multiplied by that at-risk individual's average baseline daily mortality risk (specific to their age and sex) to estimate their annual heat-related morality risk. So, if one is exposed to 100 additional risk-day equivalents over a year as a result of average indoor temperatures over 22ºC, that is equivalent to a heat-related increase in baseline mortality risk of 100/365 = 27 per cent. The average sex and age specific mortality risk data is sourced from the ONS.[40]

Applying the age and sex specific heat-related mortality rates to the at-risk population gives heat related deaths by heat risk level, by dwelling type, by age group and by sex.

QALY calculation

The number of heat related deaths by heat risk level, by dwelling type, by age group and by sex is converted to heat related QALYs lost by estimating the life expectancy of the individuals who die. This conversion uses QALY life tables from McNamara et al. (2023) by age and sex.[41]

Retrofit effectiveness and intervention impact

evidence on indoor temperatures and mortality'. See Taylor, J., Symonds, P, Wilkinson, P., Heaviside, C., Macintyre, H., Davies, m., Mavrogianni, A., Hutchinson, E. (2018) Estimating the Influence of Housing Energy Efficiency and Overheating Adaptations on Heat-Related Mortality in the West Midlands, UK. *Atmosphere*, 9, 190

[40] ONS (2026) Mortality rates (qx), principal projection, England and Wales

[41] McNamara et al. (2023) Quality-Adjusted Life Expectancy Norms for the English Population

The model applies the effectiveness factors set out in *Table 3* to the baseline series of QALYs lost and the resulting reduction in QALYs lost is the benefit associated with the application of the relevant retrofit package.

Morbidity Calculation

The morbidity section of the model estimates health-related quality of life improvements from reductions in heat-related hospital admissions and non-fatal heat stress impacts, which are valued in QALYs.

The calculation begins by estimating the number of heat-related hospitalisations in London in the baseline scenario. The next step is to determine how many QALYs are lost per hospitalization. Finally, the calculation assesses how retrofits would impact the number of QALYs lost.

Heat-related hospital admissions

Heat-related hospital admissions by age group and gender are estimated using the relationship between heat-related hospital admissions and heat-related deaths in England and Wales during recent warm weather periods.[42] On average, a 2022 ONS study found that, in the warmest four months of the year, there were, on average, 1,780 additional hospital admissions linked to warmer weather each year and 82 additional deaths linked to warmer weather each year. This suggests that for each additional heat-related death, there are approximately 21.7 additional hospital admissions.[43] The analysis applies this ratio, based on nationwide data, to the estimate of expected number of deaths from high temperature for London (using the methodology set out above) to generate an estimate of the total number of hospital admissions in London associated with high temperatures. It should be noted that the ONS is working on updated version of this dataset in response to external review and that, as such, these estimates should be considered highly provisional.

QALY impact of morbidity reduction

Hospital admissions prevented are converted to QALYs using standard health economic methods.

*QALYs lost (years) = number of hospitalisations (#) * average length of hospitalisation (years) * loss of health-related quality of life (utility)*

[42] ONS (2022) Climate-related mortality and hospital admissions, England and Wales: 2001 to 2020

[43] The average number of excess deaths per year because of heat is based on data for England and Wales over the period 2001 to 2020 while the average number of extra admissions is based on data from England for the period 2010 to 2018. The inclusion of data from Wales for excess deaths implies that the ratio used for estimating morbidity effects is an underestimate. The numerator and denominator for the ratio are also based over different time periods although the impact of this difference is reduced by focusing on per year averages.

The average length of the hospital admission is assumed to be that of a typical admission in NHS England which was 5.1 days in 2024-25.[44]

The loss of health-related quality of life (QoL) is estimated based on the findings of Hvidberg and Hernandez Alava (2023) who summarise the relative utility of those with and without different health conditions in the UK.[45] Of the conditions covered in this study, diseases of the respiratory system and of the circulatory system are deemed to be the most representative of heat-related morbidity. They estimate the level of utility for a 50-year old with a disease of the respiratory system or circulatory system as 0.78 and 0.74 respectively. These 'scores' are relative to a baseline for a 50-year old male of 0.90 and for a 50-year old female of 0.91. Taking the average utility of the two disease types, 0.76, implies that, on average, these diseases lead to a loss in utility of 15.6 per cent and 16.5 per cent for men and women respectively.

The analysis applies these percentage losses in utility to the age and sex specific baseline utility scores set out in McNamara et al. (2023) to get age and sex specific utility losses in health-related QoL.[46]

Effectiveness of retrofits in reducing morbidity risk

The model applies the effectiveness factors set out in *Table 3* to the baseline series of QALYs lost and the resulting reduction in QALYs lost is the benefit associated with the application of the relevant retrofit package.

Productivity Calculation (sleep loss)

The model estimates the lost days of work which result from heat-related loss of sleep. Retrofits that improve thermal performance (e.g. through shading, insulation, and ventilation) reduce the indoor nighttime temperature relative to baseline, thereby reducing heat exposure and reducing heat-related sleep loss.

In this calculation, the at-risk population are all those in employment. The first step is to assess the risk they are exposed to, now and in the future, as measured by nighttime indoor temperatures. A relationship between nighttime indoor temperatures and sleep loss is then used to estimate the hours of sleep lost in the at-risk population in the baseline scenario. The number of hours of sleep lost is then translated into an estimate of the number of work hours lost using a relationship sourced from the academic literature. Finally, the calculation assesses how retrofits would impact baseline sleep loss.

At risk population estimation

[44] NHS (2025) Hospital Admitted Patient Care Activity, 2024-25
[45] Hvidberg and Hernandez Alava (2023) Catalogues of EQ-5D-3L Health-Related Quality of Life Scores for 199 Chronic Conditions and Health Risks for Use in the UK and the USA
[46] McNamara et al. (2023) Quality-Adjusted Life Expectancy Norms for the English Population

The number of at-risk people, by dwelling type, by heat risk level, by age group and by sex is estimated as follows:

*number of employees (people) = number of dwellings (dwellings) * occupancy rate (%) * average household size (people/dwelling) * employment rate (%)*

This calculation relies on the same data used to estimate the number of daytime occupants (see mortality calculation) with the only addition being the employment rates which are sourced from the GLA.[47]

Nighttime temperature

Heat risk is measured by exposure to hot indoor nighttime temperatures. To estimate this exposure, the analysis takes the maximum and average indoor temperature for dwellings estimated for the mortality analysis described above. From this, it estimates the hourly indoor temperature between 11pm and 7am for each dwelling type in the Greater London area for the period 2025 to 2060 using the formula:[48]

*Hourly indoor temperature = Max indoor temp - (f * (daily outdoor temperature range / 2) * (1 – cos (2π * (h - 16) / 24))*

Where f is the attenuation factor and h is the hour. This relationship reflects the thermal characteristics of the dwelling stock and the extent to which buildings passively cool relative to ambient temperature. The average nighttime temperature is then calculated across the 8-hour period between 11pm and 7am.

As for the mortality calculation, the series of daily nighttime average indoor temperatures resulting from this formula are assumed to be a 'central' estimate and therefore those experienced by a dwelling with a 'medium' heat risk level. It is assumed that the average nighttime temperature in a high-risk dwelling is 7.5 per cent higher than the central estimate and that in a very high-risk dwelling the average nighttime temperature is 15 per cent higher than the central estimate. See mortality above calculation for further explanation.

Conversion of heat exposure into sleep loss

The relationship between heat exposure and sleep loss used in this analysis is based on that set out in Section 5.2 of AECOM (2019).[49] This earlier report assumed that one hour of sleep is lost if the nighttime temperature exceeds 26°C for 2 hours increasing to two hours of sleep lost where the nighttime temperature exceeds 29°C for two hours or more. This current analysis measures exposure based on average nighttime temperature and so assumes one hour of sleep loss for average nighttime temperatures between 26°C and

[47] GLA (2025) Employment Rates by Gender and Age or Disability, Borough
[48] This assumes temperatures follow a 24-hour sinusoid with a daily maximum temperature at 16:00.
[49] AECOM (2019) Research into overheating in new homes

29°C and 2 hours of sleep loss where the average nighttime temperature exceeds 29°C. For bedroom temperatures of 25ºC and below, it is assumed there is no heat-related sleep loss. This is acknowledged as an indicative relationship with more research needed to more confidently parametrise this relationship.

Applying this relationship to the number of nighttime hours at each temperature per year leads to an estimate for the number of hours of sleep lost per worker per year.

This relationship is assumed to be the same across age groups and sex.

Conversion of sleep loss into productivity loss

Hafner et al. (2016) estimates that sleeping roughly 1.5 hours less per night (6-7 hours compared to 7-9 hours) is associated with an annual productivity loss of 3.7 working days.[50] The analysis makes the simplifying assumption that this relationship is linear and, assuming 240 workdays per year, this equates to an estimate of 0.0103 working days lost per hour of sleep lost.

This relationship is assumed to be consistent across age groups and sex.

Applying this factor directly to the total number of heat-related hours of sleep lost per worker leads to an estimate for the number of workdays lost per worker, per year, if they worked every day of the year. To determine how many workdays are lost per worker, this value needs to be adjusted for the share of days which are actually worked.[51] This involves the implicit assumption that there is an equal likelihood of experiencing hot nighttime temperatures on worknights and on non-worknights.

The share of days worked per year is estimated as the weighted average of days worked per year by full time and part time workers. This accounts for the fact that roughly 19 per cent of London workers work part time and that part time workers work, on average, 16.5 hours per week.[52,53]

> *Weighted average % of days worked per year = (19% * 104 days + 81% * 240) / 365 days = 59%.*

This assumes 7.5-hour workdays, 20 days of annual leave for full-time workers and 10 days of annual leave for part-time workers.

Retrofit effectiveness and intervention impact

[50] Hafner et al. (2016) Why sleep matters — the economic costs of insufficient sleep
[51] We assume 240 days are worked per calendar year. 52 5-day working weeks minus 20 days of holiday leave.
[52] GLA (2025) Employment by Self-Employed, Full time and Part time and Gender, Borough
[53] ONS (2026) Average actual weekly hours of work for part-time workers (seasonally adjusted)

The model applies the effectiveness factors set out in *Table 3* to the baseline series of workdays lost and the resulting reduction in workdays lost is the benefit associated with the application of the relevant retrofit package.

Productivity Calculation (heat stress for home workers)

The model estimates the lost days of work which result from heat stress-related productivity losses while homeworking. Retrofits that improve thermal performance (e.g. through shading, insulation, and ventilation) reduce the indoor temperature relative to baseline, thereby reducing heat exposure and reducing heat stress for those working from home.

In this calculation, the at-risk population are all those who work from home for some portion of their work week. The first step is to assess the risk they are exposed to, now and in the future, as measured by indoor temperatures. A relationship between indoor temperatures and productivity loss, sourced from the academic literature, is then used to estimate the number of workdays lost by the at-risk population in the baseline scenario. Finally, the calculation assesses how retrofits would impact baseline home working productivity.

At risk population estimation

The number of at risk people, by dwelling type, by heat risk level, by age group and by sex is estimated as follows:

> *number of homeworkers (FTE)[54] = number of dwellings (dwellings) * occupancy rate (%) * average household size (people/dwelling) * employment rate (%) * homeworking rate (% to total hours worked)*

This calculation relies on the same data used to estimate the number of daytime occupants (see mortality calculation above) with the only addition being the employment rates which are sourced from the GLA.[55]

Indoor temperature

Heat risk is measured by exposure to hot indoor temperatures. The average indoor temperature series used for this calculation are the same as those used for the mortality calculation. See the mortality calculation for a full explanation.

Conversion of heat exposure into productivity loss

The relationship between heat exposure and productivity loss used in this analysis is set out in Seppanen et al. (2006).[56] They identify the following relationship:

[54] FTE refers to full-time equivalents. The homeworking rate is interpreted as the share of total hours worked which are worked at home; acknowledging the increasing role of hybrid work arrangements.
[55] GLA (2025) Employment Rates by Gender and Age or Disability, Borough
[56] Seppanen et al. (2006) Room Temperature and Productivity in Office Work

$$Productivity\ (\%\ of\ max) = 0.16475T - 0.00583T^2 + 0.00006T^3 - 0.46853$$

where T is the room temperature (°C). Temperatures below 22°C are assumed to have no heat-related effect on productivity. The curve produced by this equation is exhibited in Figure 2.

This relationship is assumed to be the same across age groups and sex.

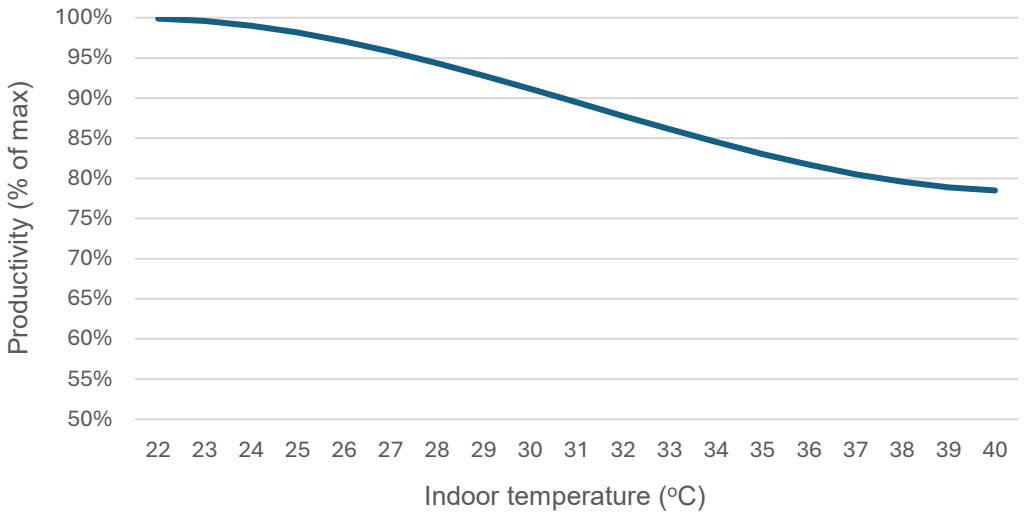


Figure 2 – Productivity (per cent of max) by indoor temperature

The analysis applies this function to the average indoor temperatures as calculated above[57] to generate an estimate of the reduction in productivity per worker, per year, if they worked every day. To determine how many workdays are lost per worker, this value needs to be adjusted for the share of days which are actually worked. This involves the implicit assumption that there is an equal likelihood of experiencing hot temperatures on workdays and on non-workdays. The adjustment is made in the same way as in the productivity loss (sleep loss) calculation. See productivity calculation (sleep loss) above for full explanation.

Retrofit effectiveness and intervention impact

The model applies the effectiveness factors set out in *Table 3* to the baseline series of workdays lost and the resulting reduction in workdays lost is the benefit associated with the application of the relevant retrofit package.

[57] Use of the average daily indoor temperature means that this calculation may underestimate the productivity reduction since people tend to work during the hotter parts of the day, although there may be some behavioural adaptation in the baseline that would lead people to work during the cooler parts of the day.

Valuation

In order to estimate a benefit-cost ratio (BCR) for the retrofit packages, it is necessary to value the physical benefits (QALYs and workdays saved).

Each QALY saved is valued using the £70,000 QALY valuation (2020-21 prices) set out in by Green Book guidance.[58] This equates to £82,225 in 2024-25 GBP. It is assumed that this value is constant in real terms over time.

Workdays saved are valued using London's Gross Value Added (GVA) per hour worked. The GLA reports this to be £51.70 per hour in 2022 (£60.58 in 2024-25 GBP).[59] Combining the hourly productivity rate with an assumption that the average worker works 7.5 hours per day, leads to an estimate for GVA per workday of £454.32 (2024-25 GBP). This value is assumed to grow in real terms at the Office for Budget Responsibility (OBR) long term labour productivity forecast for the UK of 1.50 per cent.[60]

Health benefits (mortality and morbidity) are discounted at a rate of 1.5 per cent whereas the other benefits, and the costs, are discounted at a rate of 3.5 per cent. This is consistent with Green Book guidance on discounting.[61]

Results

Central scenario results

Figure 3 and Figure 4 below set out, respectively, the present values of the costs and benefits associated with deploying each of the seven home retrofit packages in the central deployment scenario, that is where all very high risk dwellings are retrofitted by 2035 and all high risk dwellings are retrofitted by 2040.

CAPEX costs dominate, accounting for over 93 per cent of total costs across the packages (Figure 3). For each package, reduced carbon emissions deliver carbon cost savings of £66m–£115m, while additional OPEX costs could be as high as £1.3bn. However, differences in CAPEX costs are the main driver of overall cost differences between the packages.

[58] Department for Transport (2022) TAG Unit A4.1: Social Impact Appraisal
[59] GLA (2025) The State of London Report 2025
[60] OBR (2025) Long term economic determinants: March 2025
[61] HMT (2026) Green Book supplementary guidance: Discounting

The highest CAPEX and overall costs are associated with packages with the deepest passive retrofit interventions (for example, installation of openable windows is expensive).

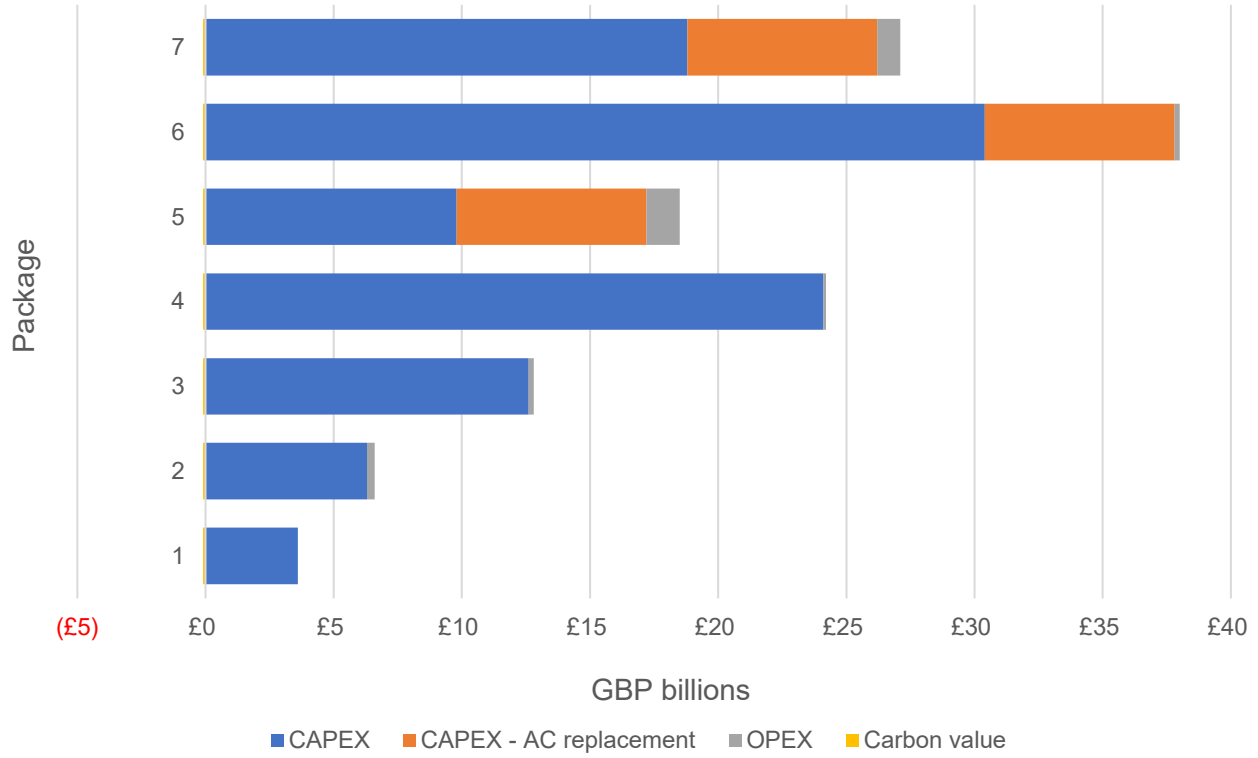


Figure 3 - Present Value (PV) of cost by type by retrofit package (GBP billions)

Figure 4 shows that productivity benefits from heat retrofits are estimated to be the largest source of benefits quantified in this analysis. Across the packages, they account for around 66 per cent of the total valued benefits. Of these productivity benefits, those associated with the alleviation of heat stress while working from home are estimated to be greater than those associated with improving sleep quality.

Within the health benefits, the reduction in heat-related mortality is estimated to be more significant than the reduction in heat-related morbidity. Morbidity benefits are valued in the tens of millions, making them a relatively small contributor to overall benefits under this model, ranging from £2.5bn to £33.7bn.

Overall benefits are estimated to be highest for packages 5, 6 and 7. These packages deliver the same level of benefit because they all include active cooling measures to remove any residual heat risk (either in combination with passive measures or standalone) and are therefore assumed to be 100 per cent effective in mitigating overheating risk.

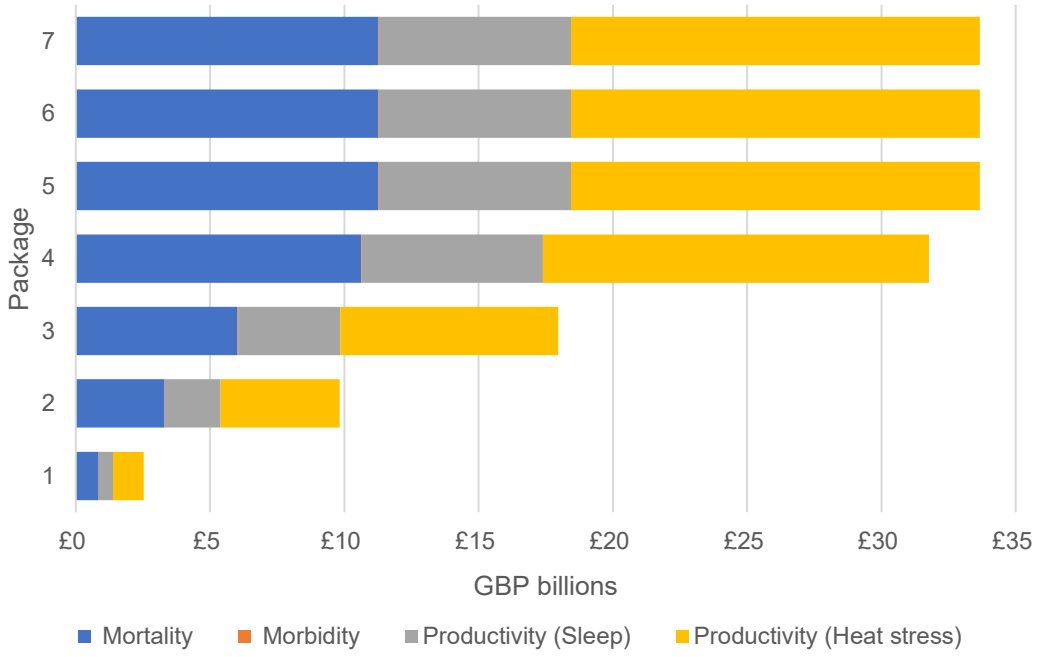


Figure 4 - Present Value (PV) of benefits by type by retrofit package (GBP billions)

Table 10 shows that Package 5, the basic passive cooling measures with active cooling package, is the best overall performer in terms of both its NPV and BCR. The moderate passive retrofit Packages 2 and 3 are the next best performers with BCRs of 1.52 and 1.42 respectively. The overall takeaways from the results of the indicative model are that:

1. The largest net benefits and BCR are achieved through 'Minimal passive retrofit with active cooling' (Package 5). However, the analysis does not capture the wider risks and costs associated with adopting active cooling without first maximising passive measures. These include, placing significant additional pressure on electricity networks during hot weather, when cooling is most needed;[62]producing additional waste heat that raise surrounding outdoor temperatures, worsens the urban heat island effect and potentially contributes to overheating in nearby homes; and increasing summer energy bills, which could exacerbate energy poverty for many households.

2. Neither the 'Minimal passive retrofit' scenario (Package 1), nor the 'Maximal passive retrofit with ceiling fan and active cooling' scenario (Package 6), has a BCR above 1 or a positive NPV. This reflects different issues at either end of the intervention spectrum. Minimal passive retrofit measures, such as installing internal blinds, provide too little reduction in heat risk to generate significant benefits alone. By contrast, maximal

[62] Beyond that captured in the Green Book's log run variable cost estimate for electricity supply.

passive retrofits already reduces most of the heat risk, meaning the additional benefit of active cooling is too small to justify its extra cost.

3. This leaves four packages: 'Enhanced', 'Extensive', and 'Maximal' passive retrofit with ceiling fan packages (packages 2, 3 and 4), as well as Package 7 **'**Extensive passive retrofit with ceiling fan and active cooling' (which combines package 3 with active cooling). These all have positive NPVs of £3 to £8bn and BCRs of 1.2 to 1.5. Packages 4 and 7 have the highest NPVs, suggesting they may be preferrable where the aim is to maximise overall heat-risk reduction. Packages 2 and 3 which include enhanced and extensive retrofit have the highest BCRs which may make them more relevant where public and private retrofit budgets for retrofit are highly constrained, though ultimately less effective than packages 4 and 7 in reducing overall heat risk.

Table 7 – Central scenario results summary by retrofit package applied across London's homes rated at high and very high risk of overheating

Package	PV (cost) (£ bn)	PV (benefits) (£ bn)	NPV (£ bn)	BCR
1	£3.4	£2.5	-£0.9	**0.74**
2	£6.5	£9.8	£3.4	**1.52**
3	£12.7	£18.0	£5.3	**1.42**
4	£24.2	£31.8	£7.5	**1.31**
5	£18.5	£33.7	£15.2	**1.82**
6	£38.0	£33.7	-£4.3	**0.89**
7	£27.0	£33.7	£6.7	**1.25**

Note: Box 2 in GLA (2026) Heat Ready London Technical Report cites a BCR for package 7 of 1.21. Methodological refinements undertaken after the publication of the Technical Report led to an increase from 1.21 to the 1.25 cited above.

Table 8 – Package definitions by archetype adapted from Arup 2022

Package	Houses	Flats
Package 1: Minimal passive retrofit	Blinds, roof insulation (where not already present in the baseline), and low g-value window film	Blinds and low g-value window film
Package 2: Enhanced passive retrofit with ceiling fan	External shutters instead of blinds, roof insulation (where not already present in the baseline), low g-value window film, and ceiling fan	Package 1 plus ceiling fan
Package 3: Extensive passive retrofit with ceiling fan	Package 2 plus solar-reflective walls	External shutters instead of blinds, low g-value window film, and ceiling fan
Package 4: Maximal passive retrofit with ceiling fan	Package 3 plus window replacement, using low g-value and openable windows	Package 3 plus window replacement, using low g-

		value and openable windows
Package 5: Minimal passive retrofit with active cooling	Package 1 plus active cooling	Package 1 plus active cooling
Package 6: Maximal passive retrofit with ceiling fan and active cooling	Package 4 plus active cooling to address residual heat risk	Package 4 plus active cooling to address residual heat risk
Package 7: Extensive passive retrofit with ceiling fan and active cooling	Package 3 plus active cooling	Package 3 plus active cooling

Sensitivity analysis results

This section presents the results of a sensitivity analysis exploring each of the seven retrofit packages under two alternative deployment scenarios and one alternative cost scenario. The scenarios explored as part of the sensitivity analysis are:

- Expanded option – Medium risk dwellings are targeted, in addition to high and very high risk dwellings.
- Accelerated option – Full deployment is reached 5 years earlier.
- EE CAPEX scenario – The CAPEX costs of retrofit measures which could be included in energy efficiency (EE) retrofits are excluded from the CAPEX calculation (with all else the same as in the central scenario).[63]

Table 9 below sets out the different deployment and cost scenario combinations.

Table 9 - Deployment and cost assumptions by scenario

Scenario	Very high risk dwellings retrofit by:	High risk dwellings retrofit by:	Medium risk dwellings retrofit by:	Subtract EE measure CAPEX:
Central deployment	2035	2040	N/A	No
Expanded deployment	2035	2040	2045	No
Accelerated deployment	2030	2035	N/A	No
No EE CAPEX	*2035*	*2040*	*N/A*	*Yes*

[63] These measures include curtains, roof insulation and window replacement. These costs are excluded from this scenario on the basis that they may already be supported by programmes focused on energy efficiency. These results help to illustrate the benefits of integrating cooling retrofit measures into existing energy efficiency programmes.

Comparing the central results with expanded deployment highlights the benefits of targeting any retrofit programme. BCRs are substantially lower when medium-risk dwellings are included, as the benefits of retrofitting are lower when the instances of overheating are lower. Indeed, looking at medium-risk dwellings in isolation, none of the retrofit packages has a BCR above 1.

Accelerated deployment increases the BCR for the minimal, enhanced, and extensive passive retrofit packages (packages 1, 2 and 3) but is neither more nor less attractive for the other, more-intensive, retrofit packages. This is because these packages are much more effective at mitigating overheating in the current climate than in a climate with 2°C of warming. Implementing these measures five years earlier therefore provides an additional five years in which they have a high effectiveness rating, generating relatively high benefits per unit.

Removing CAPEX costs associated with measures that could instead be assigned to an energy efficiency (EE) retrofit has a very positive effect on BCRs. With these EE CAPEX costs removed, all packages have BCRs above 1. This also changes which packages have the strongest economic case. When energy efficiency measure costs are excluded, the maximal passive retrofit package, Package 4, has the highest BCR at 2.75 (see Table 10). This is because window replacement has the highest unit CAPEX cost of any retrofit measure, so excluding these costs from a heat-risk reduction retrofit programme significantly improves the BCR.[64]

Table 10 – BCRs for sensitivity analysis by retrofit package

Package	Central	Expanded Deployment	Accelerated Deployment	No EE CAPEX
1	0.74	0.49	1.01	1.08
2	1.52	1.15	1.76	1.82
3	1.42	1.10	1.51	1.55
4	1.31	1.02	1.32	2.75
5	1.82	1.44	1.82	1.94
6	0.89	0.70	0.89	1.33
7	1.25	0.98	1.25	1.30

Opportunities to strengthen the evidence base

In addition to the caveats and limitations discussed above, the analysis highlights several areas where further research could support future assessments of the costs and benefits

[64] In practice, costs that are common to both heat-risk reduction retrofit and energy efficiency retrofit programmes would likely to be shared between these two programmes. In this context, the implicit assumption in the central scenario is that the costs are entirely allocated to a programme of heat retrofit and in the sensitivity scenario that they are entirely allocated to an energy efficiency retrofit programme are alternative extremes of how these costs might be allocated.

of cooling retrofit. Considerations for future research and for organisations seeking to replicate or build on this approach include:

- Development of a consistent framework for assessing the costs and benefits of cooling retrofit, including a standardised approach to temperature exposure metrics, particularly the use of mean versus maximum temperatures.

- Publication by UKHSA of the epidemiological relationships used for their modelled heat-health impact assessments to support a standardised approach to assessing the health impacts associated with daily maximum temperatures.

- Development of evidence-based conversion factors for different London housing archetypes to support robust translation between outdoor and indoor temperatures.

Deep dive priority area of focus: Retrofitting the high-risk non-residential buildings which deliver essential public services, e.g. schools

Summary

This priority area proposes to retrofit high-risk non-residential buildings that provide key public services, such as schools, public buildings, and health and social care facilities. GLA's analysis identified numerous schools, hospitals, and care homes that are in high heat risk areas.[65] Care homes, health facilities, schools, and prisons are all particularly vulnerable to overheating, reflecting a combination of high exposure, sensitive populations, and building characteristics that limit adaptive capacity.[66]

Approach to estimating costs

GLA's *Properties Vulnerable to Heat Impacts in London report* data[67] was used to identify schools, hospitals, and care homes situated in high heat risk areas (defined as those with an UHeatRank of 4 or 5). 1361 out of 3372 schools (40 per cent), 60 out of 134 hospitals (45 per cent), and 351 out of 1271 care homes (28 per cent) were subsequently identified as being in high heat risk areas and are therefore priority locations for interventions.

A unit-based approach was adopted to compile cost data for care homes and schools. Ibbetson et al.'s 2025 paper "Cost-benefit analysis of interventions to protect care home residents in England against heat risks" estimated per-intervention costings for various physical and behavioural cooling interventions in three contrasting UK care homes coded CS1, CS2 and CS3 (see Table 10). Care home CS1 is large, modern, and highly

[65] High heat risk Lower Level Super Output Areas (LSOAs) defined as those with UHeatRank 4 or 5. See: Greater London Authority (2024): Properties Vulnerable to Heat Impacts in London
[66] Shade the UK & Love Design Studio (2024): Building Heat-Resilient Neighbourhoods
[67] Greater London Authority (2024): Properties Vulnerable to Heat Impacts in London

insulated, care home CS2 is small, old, and uninsulated, and care home CS3 is of moderate size, age, and insulation.[68] The different unit costs for the varying types of cooling measures for each of the three different care homes are provided below. Costs include low-cost behavioural measures and minor passive interventions, medium-cost passive and moderate capital upgrades, and high-cost installation of active cooling systems or major retrofits.

Table 11: Unit costings for various physical and behavioural interventions in three contrasting care homes (Ibbetson et al., 2025)[69]

Intervention	Care home	Mean cost (£ 2024 GBP)
Solar control window film	CS1	£5,646
	CS2	£788
	CS3	£1,281
Solar control window film with external louvres and side fins and night time ventilation applied in communal spaces only	CS1	£19,184
	CS2	£2,506
	CS3	£5,481
External louvres and side fins	CS1	£13,958
	CS2	£1,728
	CS3	£4,012
Increased thermal mass by stripping existing dry lining and night time ventilation applied in communal spaces and bedrooms	CS1	£2,621
	CS2	£943
	CS3	£1,785
	CS1	£7,257

[68] Ibbetson et al. (2025): Cost-benefit analysis of interventions to protect care home residents in England against heat risks. *Environmental Research: Health*, *3*(4), p.045014.
[69] Ibbetson et al. (2025): Cost-benefit analysis of interventions to protect care home residents in England against heat risks. *Environmental Research: Health*, *3*(4), p.045014.

Increased thermal mass by use of phase change materials and night time ventilation applied in communal spaces and bedrooms	CS2	£1,380
	CS3	£2,466
Portable active cooling by air conditioning in communal spaces only	CS1	£8,703
	CS2	£295
	CS3	£1,981
Wall-mounted active cooling by air conditioning in communal spaces only	CS1	£22,160
	CS2	£753
	CS3	£5,067
Portable active cooling by air conditioning in communal spaces and bedrooms	CS1	£23,347
	CS2	£1,980
	CS3	£6,968
Wall-mounted active cooling by air conditioning in communal spaces and bedrooms	CS1	£40,438
	CS2	£4,129
	CS3	£14,565
Night time ventilation applied in communal spaces only	CS1	0
	CS2	0
	CS3	0
Night time ventilation applied in communal spaces and bedrooms	CS1	0
	CS2	0
	CS3	0

A proxy-based and unit-range costing approach was adopted to estimate the costs to adapt schools. Indicative capital cost ranges per intervention type were used, rather than

precise site-specific estimates, drawing on aggregated costs of adaptation measures across varying school types. As part of London's Climate Resilient Schools Programme, 60 schools received bespoke Climate Adaptation Plans to identify effective climate adaptation measures that could be implemented in the future.[70] *The Climate Adaptation Plans for Schools: Overview Report* collected indicative capital cost ranges for some of the most commonly recommended adaptation measures.[71] Cost ranges and scale assumptions are provided for each adaptation measure in Table 11 below. Site-specific costs will vary due to differing school sizes, layouts, and contractor pricing. The below costs are for the upfront implementation of the measures, while ongoing maintenance costs are not captured.

Table 12: Indicative capital cost range (per measure), along with an estimate of the costs to install a selection of commonly recommended measures from the Climate Adaptation Plans for Schools: Overview Report[72] for all relevant schools included in the study.

Measure	Cost range per measure	Lower total cost estimate	Upper total cost estimate	Scale assumptions
Rain garden: linear	£60/m2 - £120/m2	£64,500	£129,000	Assuming 25 m² per measure
Grounds shade: sail	£2,700 - £5,300	£116,100	£227,900	Assuming metal frame structure, approx. 3m x 3m
Internal water efficiency measures	£2,000 - £12,000	£84,000	£504,000	Assuming 10 items upgraded per measure
Rainwater harvesting: water butt	£380 - £860	£14,820	£33,540	Assuming water butt of approx. 1300 L
Permeable surface: hard	£140/m2 - £290/m2	£518,000	£1,073,000	Assuming 100 m² per measure
Grounds shade: pergola	£1,800 - £3,400	£55,800	£105,400	Assuming frame structure of approx. 3m x 3m per measure
Rain garden: non-linear	£30/m2 - £60/m2	£78,000	£156,000	Assuming 100 m² per measure

[70] London Assembly (n.d.): Climate Resilient Schools | London City Hall
[71] Greater London Authority (2023): Climate Adaptation Plans for Schools
[72] Greater London Authority (2023): Climate Adaptation Plans for Schools

Measure	Cost range per measure	Lower total cost estimate	Upper total cost estimate	Scale assumptions
Channel drain	£250/m - £488/m	£6,000	£11,712	Assuming approx. 8m long x 0.1m wide x less than 0.3m deep
Filter drain	£4,000 - £7,800	£68,000	£119,000	Assuming approx. 8m long x 1m wide x 3m deep
Awning or canopy	£800 - £1,500	£13,600	£25,500	Assuming 2.5m-3.0m wide by 2.0m-2.5m deep per measure
Trees	£210 - £2,000	£3,150	£30,000	Assuming one tree with 4 m² pit area

Deep dive priority area: Installing outdoor shading structures to reduce temperatures and decrease sun exposure, for example shade canopies, shade sails and pergolas

Summary

This priority area of focus aims to reduce heat exposure in outdoor public spaces through the installation of engineered shading structures. It addresses increasing risks associated with direct solar exposure, which can make public spaces uncomfortable and, in some cases, unsafe to use, with disproportionate impacts on vulnerable groups. Fixed and demountable built interventions such as shade sails, canopies, and pergolas, provide a practical and flexible approach to improving thermal comfort in public spaces, particularly in dense urban areas where tree planting and other green or blue infrastructure are constrained.

Shading interventions are likely to deliver favourable value for money, despite limited availability of robust UK-specific benefit–cost ratios. Further evidence strengthens this conclusion, particularly in relation to behavioural responses. This behavioural evidence complements the economic and dwell time relationships already outlined in the Heat Ready London Technical Report, and reinforces the conclusion that shading interventions can enhance the value derived from public spaces. Overall, the balance of evidence suggests that shading interventions are likely to offer favourable value for money when wider public health, social and economic co-benefits are considered, even where monetised benefit–cost ratios are not robustly quantified.

Approach to estimating costs

The cost estimates provide an initial benchmark for understanding the capital investment required across different shade structure types commonly applicable within London's public realm.

At this strategic stage, it was not considered feasible or proportionate to develop a detailed cost estimate for London or generalised site-specific costings for playgrounds, squares, high street, or transport hubs, as each site and shading intervention required presents unique spatial, structural, and operational constraints that will influence both design and cost. Instead, the approach uses representative unit costs to provide indicative ranges, which can be scaled and refined over time to inform the phasing, prioritisation, and sequencing of interventions as delivery programmes are developed.

The high-level capital costs of a range of potential shade interventions are outlined in the table below. Operational costs not included are: routine maintenance, inspections, and periodic replacement cycles.

Shade intervention	Intervention detail	Indicative cost range within London	Cost range and detail
Shade sails	**Shade sails** can take several structural forms depending on space and site constraints.[73] Hypar sails are the most widely used, with corner posts creating a tensioned, twisted surface. They are relatively cost-effective and commonly used in schools and commercial settings, offering a flexible solution that can be adapted to different space sizes and layouts. Other configurations (e.g. conic or perimeter sails) are available, but are typically selected for more specific spatial or structural constraints.	Indicative costs for installed shade sail structures (hypar sails) typically range from approximately **£300–£1,030 per m²** per installation, depending on size and specification.[74,75] Although often assumed to be a low-cost intervention, overall costs can increase significantly due to foundation requirements.	The cost of a shade sail depends on factors such as design, size, fabric type, and post materials. Example shade sail costs are detailed below: • 9 m² (3m x 3m): approx. £2,700 – £5,300[74] • 16 m² (4m x 4m): approx. £16,500[75] • 64 m² (8m x 8m): approx. £21,250[75] Research from the GLA's Climate Adaptation Plans for Schools project found that implementing 43 grounds shade sails (within 37 schools) would likely have a capital cost in the range of £116,000 to £228,000.[74]
Tensile membrane canopies	**Tensile membrane canopies** are engineered fabric structures that use tensioned architectural membranes supported by steel frames or cable systems to create lightweight, spanning forms. They are designed as permanent or semi-permanent structures, providing both shade and weather protection.	Indicative costs for tensile membrane canopies (e.g. star and shield designs) are approximately **£510–£1,160 per m²** depending on size and design complexity.	This range reflects fully installed, engineered canopy systems comprising steel frames, tensioned architectural membranes, and associated foundation works. Example Tensile Membrane Canopy Costs:[75] • 16 m² (4m x 4m): approx. £18,500 (Star) • 49 m² (7m x 7m): approx. £25,000 (Star) • 24 m² (4m x 6m): approx. £22,500 (Shield) • 60 m² (6m x 10m): approx. £33,250 (Shield)

[73] Kensington Systems. n.d: Shade Sails for Playground and Commercial Uses
[74] Greater London Authority. (2023): Climate Adaptation Plans for Schools Overview Report (ARUP Report)
[75] Street space structures. (n.d): Canopy Estimator

Shade intervention	Intervention detail	Indicative cost range within London	Cost range and detail
Polycarbonate canopies	**Polycarbonate canopies** can take several structural forms depending on layout and site requirements. They provide shade by diffusing and reducing direct solar radiation, while maintaining high levels of natural daylight. ***Monopitch canopies*** have a single sloping roof supported by a steel frame.[76] ***Asymmetric canopies*** feature an offset or curved roof profile, allowing them to be positioned alongside buildings and directing rainwater to one side for drainage.[77] ***Symmetric span canopies*** use a curved roof form to achieve wider clear spans, making them suitable for larger covered areas such as dining or social spaces.[78]	Indicative costs for polycarbonate canopies range from approximately **£435–£1,420 per m²**, reflecting variation in structure type (e.g. monopitch, asymmetric, and walkway configurations) and scale, with costs reducing significantly for larger installations. These costs also include integrated drainage and foundations.	Costs vary with size, configuration, and site constraints, with examples ranging from small steel frame canopies to larger canopies and linear walkways. Installed systems include steel frames, polycarbonate roof panels and drainage systems, foundations. Example Polycarbonate Canopy Costs:[75] • 12 m² (3m x 4m): approx. £13,750 m² (Monopitch canopy) • 12 m² (3m x 4m): approx. £17,000 m² (Asymmetric canopy) • 32 m² (2m x 16m): approx. £23,240 (Symmetric Steel Frame Walkway) • 60 m² (3m x 20m): approx. £34,000 (Monopitch canopy) • 100 m² (5m x 20m): approx. £43,500 m² (Asymmetric canopy)
Pergolas / open-frame shade structures	Open-frame (timber or steel) structures providing partial shade via slats or planting; typically used in parks and squares	Indicative costs for pergola structures are approximately **£200–£380 per m²**, based on typical 3 m × 3 m units[79]	Costs are likely to vary depending on material selection (e.g. timber vs steel), design complexity, and site conditions, and may increase where additional features such as integrated seating, planting, or groundworks are required.

[76] Street space structures (2025): Monopitch Polycarbonate Canopies
[77] Street space structures (2025): Asymmetric Polycarbonate Canopies
[78] Street space structures (2025): Symmetric Polycarbonate Canopies
[79] Greater London Authority (2023): Climate Adaptation Plans for Schools

Deep dive priority area: Maintaining, raising awareness of and, where possible, expanding public drinking water points and public toilets

Summary

This priority area aims to maintain and expand the network of public drinking water points, ensuring hydration infrastructure is accessible, well maintained, free of charge, and physically and digitally advertised. Public toilets should also be well maintained and accessible to promote hydration, sanitation, and use of cool outdoor areas during heat events. Supporting effective hydration reduces heat-related health risks, including dehydration, heat exhaustion and heatstroke. This can include incorporating public drinking fountains and toilets into existing and new developments and public spaces, reopening previously closed facilities, and encouraging partnerships with local organisations and businesses to offer provision to the public.

The benefit-cost ratio for this priority area is currently a major evidence gap that needs to be filled in the short term. Benefits include reducing heat-induced health incidents, increased productivity for outdoor workers, reduced costs from purchasing bottled water in public spaces, and decreased plastic waste and recycling.

Approach to estimating costs

Public drinking water points

Cost estimations are based on a combined unit-based and programme-based approach. Evidence was drawn from a range of existing public drinking water point initiatives across London, alongside indicative supplier-level unit-based costs. This method was selected as drinking water infrastructure is relatively modular and scalable, making unit-based costing appropriate, while programme data provides important London-specific context.

The analysis considered a range of cost components, including capital costs associated with the cost of the water fountain unit, unit installation, and mains water connection, and ongoing operational and maintenance costs such as signage, services, repairs, and cleaning. Cost savings can be delivered when water fountain installation is integrated into wider urban improvement and retrofit programmes. Analysis focused on priority locations where public drinking water provision can deliver the greatest potential benefits, such as parks and high footfall and heat risk areas. The costs below are provided as illustrative examples, as costs vary widely depending on fountain model, site conditions, availability of pre-existing water and drainage infrastructure, and cleaning and maintenance contractors.[80]

Numerous relevant programs were identified to provide cost estimates. For example, GLA partnered with the Zoological Society of London and Thames Water to install 138 free drinking water fountains in high footfall areas. GLA also provided an initial £5 million in funding to purchase and install the accessible water fountains, with an additional £680,000

[80] #OneLess (2019): A guide to installing drinking fountains

to install 20 in schools. GLA contributed £4,800-£4,900 towards each accessible fountain from 2017-2022,[81] with combined unit and installation costs standing at £8,500-£9,500 per fountain. These figures are based on the first six installations.[82] The water fountains are of the Halsey Taylor Outdoor HydroBoost Bottle Filling Station Model 4400BF, which was the only outdoor drinking fountain product that was Water Regulation Approval Scheme (WRAS) compliant at the time the fountain procurement took place.[83] Thames Water is managing installation, maintenance and cleaning of the fountains for at least 25 years, costing £6,000 per fountain per year (£15m total value).[84]

#OneLess, a UK-based environmental campaign and network focused on reducing plastic pollution,[85] provided indicative costs for various types of water dispenser units, along with their installation and annual maintenance costs (see Tables 12 and 13).

Table 13: Indicative costs of different types of water fountain units from #OneLess (2019)[86]

Type	Water dispensers	Indicative cost (excluding VAT)
Indoor		
Wall-mounted	Bottle filler only	£800
Wall-mounted	Bottle filler and drinking fountain	£1,600
Floor-standing	Bottle filler	£2,000
Outdoor		
Wall-mounted	Bottle filler	£1,800
Floor-standing	Bottle filler	£2,300
Floor-standing	Bottle filler and drinking fountain	£3,000
Floor-standing	Bottle filler and drinking fountain and pet station (dog bowl)	£4,000
Floor-standing	Bottle filler and double drinking fountain	£4,200

[81] London Assembly (2022): FOI - Water Fountains [Nov 2022]
[82] London Assembly (2019): Water Fountains (1)
[83] London Assembly (2022): FOI - Water Fountains [Nov 2022]
[84] London Assembly (2019): Water Fountains (1)
[85] #OneLess (n.d.): About #OneLess - OneLessBottle
[86] #OneLess (2019): A guide to installing drinking fountains

The above costs do not include installation kits, flow-meter, or delivery. Prices are from #OneLess's UK supplier, MIW Water Cooler Experts, in April 2019.

Table 14: Indicative installation and maintenance costs per annum from #OneLess (2019)[87]

Location	Existing water supply and drainage	Installation cost (approximate)	Maintenance cost per annum (approximate)
Park, outdoors. Floor-standing fountain	Yes	£4,000	Incorporated into existing daily cleaning regimes Servicing: £350
Street, outdoors. Floor-standing fountain	No	Thames Water Connection: £1,800 Installation: £1,200 Total: £3,000	£300
Street, outdoors. Floor-standing fountain	No	Thames Water Connection: £1,700 Installation: £800 Signage: £220 Total: £2,500	Cleaning: £1,144 Servicing: £230
Inside a building. Wall-mounted fountain.	Yes	£750	£150
Pedestrian area, outside Wall-mounted fountain.	Yes	£1,500	£350
Transport hub, outside. Floor-standing fountain	Yes	£300-£800, plus extra for landscaping	£300-£800
Park, outdoors. Floor-standing fountain	Yes	£340	£200
Pedestrian area. Floor-standing filler and fountain	Yes	£5,200	£230 for two services a year. £100 for consumables. Cleaning absorbed into existing staff time.

[87] #OneLess (2019): A guide to installing drinking fountains

Public toilets

A variety of cost components were explored, including capital costs of building new facilities and refurbishing existing ones, and ongoing costs such as cleaning, restocking essential consumables, and maintenance checks to plumbing, drainage, and ventilation.[88] TfL invested £75,000 CAPEX to install an accessible toilet within existing facilities at Hackney Downs Overground Station.[89] The GLA incurs OPEX for maintaining two public toilet facilities across London. The Trafalgar Square facility consists of 12 cubicles and urinals, 2 disabled toilets, 2 baby change facilities. It experiences very high use and costed almost £170,000 for cleaning and consumables in 2020/21. The Thames Barrier facility consists of 4 cubicles, 3 urinals, 1 disabled toilet, 1 baby change facility. It experiences much lower use and costed around £8,000 for cleaning and consumables in 2019/20.[90] There are difficulties associated with determining unit costs for public toilets in London as facilities are often delivered as part of larger capital redevelopment programmes, hindering understanding of isolated unit costs that could be applied across the city. Costs of public toilets vary widely between new installations and refurbishment, across locations and size and type of facilities, and depending on existing water and wastewater connection to the location. This variability hinders a single average or area-based estimate from providing a reliable representation of costs.

[88] TfL (2024): Improving our toilet provision
[89] London Assembly (2025): Toilet installation cost on the TfL network
[90] London Assembly (2021): FOI - Public Toilets [Jul 2021]

Deep dive priority area: Enhancing community cool spaces and improving links with community-led initiatives.

Summary

This priority area aims to increase the access to cool spaces across London by designating new spaces, improving existing cool spaces, and better publicising the existing network. This includes public spaces such as libraries, and voluntary, community and faith sector (VCFS) organisations, including mosques, food banks, and community centres, offering shaded areas, hydration, and respite to vulnerable residents. Cool spaces are often stocked up with 'Cool Kits', including cooling gels, electrolytes, supplements, basic first aid supplies, and printed health guidance and direction towards additional support services.

Spaces may require building modifications to align with or improve on the requirements of cool spaces. This can include upfront capital costs associated with improving thermal comfort such as upgrades to cooling systems, shading, ventilation, blinds, heat-reflective films, and water provision. Implementation of measures that guarantee lower indoor temperatures than outside can allow a cool space to upgrade from a Tier 2 to a Tier 1 cool space. Ongoing costs associated with the operation and maintenance of cool spaces include increased energy and water use, staffing needs, training and capacity building of staff, extended opening hours, promotion of cool spaces, and the provision of 'Cool Kits'.

Evidence of the effectiveness of cool spaces in reducing heat risk across UK or similar countries is currently limited, with further research required.[91] There is also currently an evidence gap concerning the costs and benefits of cool spaces in London. Modelling suggests that using pre-existing cool public spaces and buildings to help keep vulnerable people cool can bring cost-effective reduction in excess heat-related mortality, with a benefit-cost ratio of 1.7:1 by the 2050s.[92] While these findings indicate potential benefits, the current evidence base does not support the development of estimates for reduced heat-related mortality and morbidity to be directly attributed to the use of cooling centres or cool spaces, and further research is needed to establish their effectiveness in relation to both qualitative and quantitative outcomes.

Approach to estimating costs

Cost estimations for the establishment, operation, and maintenance of cool spaces remain a data gap that requires further exploration. In the absence of comprehensive and standardised data, a proxy-based and programme-informed costing approach was adopted, drawing on available real-world examples from London boroughs that have already implemented cool spaces initiatives. Cool spaces are highly context-specific, varying due to factors such as building types, presenting impracticalities in applying a uniform unit-based costing framework across boroughs.

[91] Dearman et al. (2025): Public health effectiveness of cooling centres during periods of adverse hot weather: a systematic literature review
[92] Climate Change Committee (2026): A Well-Adapted UK

There are opportunities to align cool space adaptation funding with broader climate mitigation and retrofit programmes. For example, the installation of water fountains in libraries in Barnet was supported through Carbon Offsets funding, demonstrating how adaptation measures can be integrated with existing decarbonisation funding streams.

There are limitations associated with transferring these observed costs to cool spaces in different boroughs, due to factors such as variations in building types, existing infrastructure, geographic context, scale of provision, and required level of service. This means potential costs could range from relatively low, where only minor facility enhancements are required in existing buildings, to very high, where more extensive structural work is required or where active cooling measures are required to be installed.

Deep dive priority area: Managing and expanding tree cover and green space in areas of high cooling and shading need and improving access to London's existing blue and green spaces

Summary

Maintaining and expanding tree canopy cover and green infrastructure will be an important response to urban heat risk, providing shade and local cooling while supporting the usability of public spaces during extreme heat. This priority area of focus prioritises neighbourhoods with high heat exposure and limited existing green provision, using spatial tools such as the London Green Infrastructure Framework (LGIF) to target intervention.[93]

Evidence shows that urban green infrastructure can reduce local temperatures by an average of 1.07°C across European cities, with local cooling effects reaching up to 2.9°C.[94] London's canopy cover is currently estimated at 19.6 per cent (±0.3 per cent), with no statistically significant change since 2016.[95] Increasing canopy cover towards around 30 per cent at neighbourhood scale is widely associated in the literature with meaningful reductions in heat-related mortality and broader co-benefits.[96]

The effectiveness of this depends not only on canopy extent but on how green infrastructure is designed, located and managed. Species selection, planting conditions and long-term maintenance all influence cooling performance, with benefits increasing as the canopy matures, reinforcing the value of early and sustained investment.

Approach to estimating costs

The costs presented in the table below are illustrative examples drawn from recent London borough schemes and are intended to be indicative. In practice, there is a large range of possible costs, driven by differences in site conditions, constraints, delivery mechanisms, specification, approvals, and the scope of works included. As a result, actual delivery costs may fall outside the ranges shown, and figures should be interpreted as indicative benchmarks rather than definitive estimates.

[93] Greater London Authority (n.d.) London Green Infrastructure Framework
[94] Marando, F., Heris, M.P., Zulian, G., Udías, A., Mentaschi, L., Chrysoulakis, N., Parastatidis, D. and Maes, J. (2022). Urban heat island mitigation by green infrastructure in European Functional Urban Areas
[95] London City Hall (2024) London's trees in a changing climate
[96] European Commission (2023). Increasing tree coverage to 30% in European cities could reduce deaths linked to urban heat island effect

Greening and green infrastructure interventions	Intervention detail	Indicative cost range for London
Tree planting (streets and estates)	Targeted tree planting in streets and housing estates to expand canopy cover	Indicative costs for street-tree planting and establishment maintenance in London typically range from **£1,200-1,800.** However, large-scale delivery programmes can significantly reduce unit costs.
Protection and maintenance of trees	Protection and proactive management of mature and new planting	Indicative annual maintenance cost for urban trees: **£15–£30 per tree per year**. Evidence from the London Borough of Camden indicates annual tree maintenance expenditure of approximately £1.2 million for a managed stock of around 39,000–44,000 trees, equivalent to an average cost of approximately £27–£31 per tree per year.[97] Newly planted trees need regular care in the first few years, including watering and inspections. Once established, maintenance requirements reduce, with annual checks and occasional pruning. The estimated cost of maintaining a healthy tree is around £15 per year.[98]
Pocket parks and parklets (creation of new small green spaces)	Creation of pocket parks in high-need, high heat-risk locations	Broad unit-cost envelope of approximately £700–£1,200 per m² for pocket parks, with parklets representing lower-cost interventions typically ranging from £15,000 to £40,000 per installation.
Ongoing parks and green	Ongoing maintenance of existing parks and green infrastructure to	Maintenance requirements and delivery costs vary significantly between boroughs due to differences in the scale, condition, and management of

[97] London Borough of Camden (2023): 04. CE Scrutiny September 2023 Tree Maintenance Policy Update - Final.pdf
[98] GreenBlue Urban (n.d.): Who Will Maintain Green Infrastructure, and at What Cost? -

Greening and green infrastructure interventions	Intervention detail	Indicative cost range for London
space maintenance	prevent degradation of nature, biodiversity and cooling benefits	green space assets; as such, no standardised cost estimates can be provided.

Annex B: Funding and financing assessment

Introduction

This section of the Technical Annex provides more information on the methodology and results associated with the funding and finance chapter of the Heat Ready London Technical Report. It sets out the methodology used to inform the selection of models discussed in the Technical Report itself. The approach is intended to provide a consistent framework for considering and comparing different funding and financing options, while recognising that the evidence base varies significantly across the different deep dives. As a result, the depth and level of analysis varies between the different areas explored. The assessment and scores should therefore be considered as indicative, intended to support comparison and inform the identification of potentially promising models.

Figure 5 sets out 5-step methodology for this analysis. The Technical Report already provides the results from the barrier analysis (step 2) and highlights the funding and financing models that are considered most relevant and the enabling environment reforms that they require (step 5). Accordingly, this annex provides more information about the methodologies for the benefits registers and beneficiary assessment (both parts of step 1), the approach taken to developing the long list of models (step 3) as well as how the multi-criteria assessment was undertaken (step 4) to help inform the selection of short-listed models discussed in the Technical Report. After the methodological discussion, this section provides the tabulated indicative findings for each of these steps for each deep-dive.

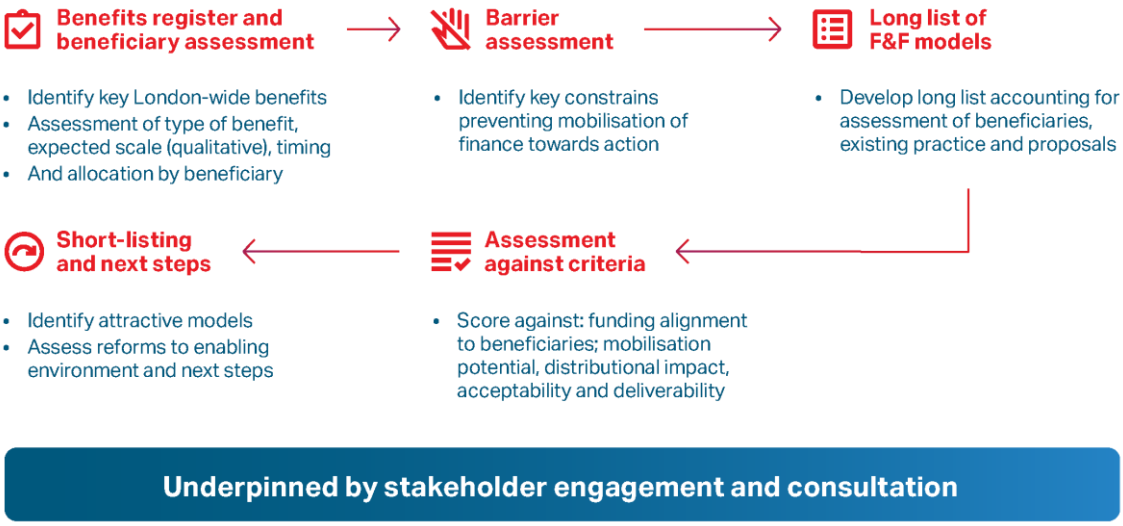


Figure 5: Analytical steps for assessing funding and financing models

Methodology

Benefits register

The benefits registers identify the indicative benefits that the measures in each deep dive is likely to deliver. Consistent with UK government appraisal guidance[99], the analysis focuses on benefits accruing to society as a whole, rather than benefits experienced by one group at the expense of another.

The registers specify the groups expected to experience each benefit and provide a qualitative indication of when those benefits are expected to arise, relative to the commencement of the measures.

The benefits registers classify expected benefits using categories commonly applied in His Majesty's (HM) Treasury business case guidance, including the Guide to Developing the Programme Business Case.[100] Three broad categories of benefit are used:

- **Direct public sector benefits** (those derived by the organisation expected to originate the action) which can be further categorised as:
    - Cash-releasing benefits, that is those that reduce spending or generate income, freeing up budget for other uses.
    - Monetisable but not cash-releasing benefits, in other words benefits that can be given a financial value but do not have a budgetary impact.

[99] HM Treasury (2026): The Green Book
[100] HM Treasury (2018): Guide to Developing the Programme Business Case

    - Quantifiable but not readily monetisable benefits, that is benefits that can be measured numerically, but that cannot be easily/credibly converted into monetary terms.
    - Qualitative but not readily quantifiable benefits. This includes benefits that are important and observable but best described narratively rather than numerically.
- **Indirect public sector benefits** i.e. those derived by the public sector but not by the organisation expected to originate the action. These can be disaggregated using the same categories as for direct public sector benefits.
- **Wider benefits to UK society** (e.g. households, individuals, businesses). These are disaggregated as following.
    - Monetisable, including cash benefits such as benefits to households, businesses or society that can be expressed in monetary terms, including direct financial gains or avoided costs.
    - Quantifiable, but not readily monetisable benefits, such as benefits to society that can be counted or measured, but are difficult to value robustly in money terms.
    - Qualitative but not readily quantifiable benefits. These include wider benefits that matter to wellbeing but are best described narratively.

Each identified benefit is assigned an indicative qualitative **magnitude score** using a three-point scale: high, medium and low. Drawing on Green Book principles, within each deep dive, the score indicates the extent to which further investment in the measure may generate additional social value. It considers both the significance of the benefit and the number of people likely to experience it. The scoring rubric is as follows:

- **High:** The benefit is directly linked to the purpose of the action, affects a large proportion of beneficiaries and/or relates to outcomes that have a high monetary valuation[101];
- **Medium/Moderate[102]:** The benefit is plausible and important but affects a narrower group of beneficiaries and/or the potential benefits has a lower societal value. This scoring is used when benefits are more dependent on location, uptake, behaviour or design quality.
- **Low:** The benefit is limited to a small subset of users or dependent on specific circumstances and is therefore unlikely to materially affect the overall case for action.

Scores are based on available literature, intervention-specific evidence (in particular, the cost-benefit analysis developed for residential retrofits), and professional judgement. The scoring is relative to the benefits identified for the same action and should not be interpreted as comparable across actions. This reflects the fact that the evidence base on

[101] For example, avoiding mortality impacts are accorded a high monetary valuation.
[102] Medium and moderate are used interchangeably throughout

the overall scale of benefits varies significantly across actions and is not sufficiently developed to support robust cross-action comparison.[103]

Assessment of beneficiaries

The assessment of beneficiaries builds on the benefits register by identifying the groups most likely to have an interest in the successful delivery of each measure.

They start by reclassifying the information in the benefits register by beneficiary group, drawing on the expected scale of benefits and the groups expected to realise them. However, the assessment also records cases where a group may experience a private or distributional benefit that is not counted as a net benefit from a London- or UK-wide economic perspective. For example, retailers located near new shading structures may benefit from increased footfall, but some of this activity may be displaced from retailers elsewhere. Similarly, construction companies may benefit commercially from retrofit activity, but payments to those companies would be treated as costs in a wider economic assessment and are therefore not included as benefits in the benefits register.

The scoring of benefits by beneficiary group follows the same general approach used in the benefits registers. Scores based on available literature, intervention-specific evidence, and professional judgement, recognising that the evidence base varies significantly across the different deep dives. As a result, the depth and level of analysis varies between areas. Scores should therefore be interpreted only in relation to other beneficiary groups for the same action. The beneficiary assessment also includes a confidence assessment, reflecting professional judgement on the strength of the evidence base underpinning each score.

Long-list of funding and financing models

The assessment of beneficiaries, together with a review of existing and proposed models, is used to develop a longlist of potential funding and financing models that could play a role for each priority area measures covered in the deep dives. For each model, the longlist tables include the following information:

- the name for the model;
- a brief description of how the model would operate;
- the party or parties expected to provide upfront finance;
- the party or parties expected ultimately to fund ongoing operation and maintenance costs, and any returns to finance providers; and
- other relevant information to the model

For some actions, additional columns are added to provide further information. For example, for managing and expanding tree cover and green space, the table identifies

[103] As noted further below, there is, at present, limited rigorous analysis of the benefits associated with the deep dive actions on cool spaces and public toilets and drinking water fountains.

whether each model is better suited to new asset creation, maintenance expenditure, or both. Where a large number of funding and financing models has been identified, the models are further grouped using categories that are relevant to the specific action.

Assessment of funding and financing models

The assessment of the funding and financing models uses five criteria:

- *Alignment with who benefits.* This assesses whether, if this was the predominant model for the action, would those who benefit from the action be the ones who would be funding it? This influences both the long-term sustainability of the model and also aligns to some conceptions of fairness.
- *Expected scale of resources that can be mobilised.* This asks whether the funding and financing model raises resources at the scale needed to deliver a substantial proportion of London's expected requirement for the action, either in the short or longer term?
- *Distributional implications.* This considers both whether the funding and financing model enable benefits to be targeted towards the most vulnerable groups, and is the funding approach progressive, with those who have greater ability to pay making a larger contribution?
- *Acceptability.* This criterion is focused on understanding whether key stakeholders are likely to support the model, including public bodies, political leaders, delivery partners, funders, businesses and affected communities. It does not take account of how the distributional implications of the model may affect acceptability, which is considered in the criterion above.
- *Deliverability.* This considers how easy or not it would be to operationalise the model, considering, in particular, whether there are significant legal, regulatory, institutional, administrative or market barriers that would need to be resolved before implementation.

Assessment against these criteria is based on a qualitative five-point scale:

- high;
- moderate/high;
- moderate;
- low/moderate;
- low

This assessment is to be interpreted as indicative and is based on available evidence and expert judgement with, on each occasion, a commentary provided on each score. Table 15 sets out what the analysis considers to be a high and low score for each criterion, used to calibrate the scoring.

Table 15: Calibrating high and low scores in the assessment of funding and financing models

Criteria	What constitutes a high score?	What constitutes a low score?
Alignment with who benefits	The main beneficiaries of the action make an appropriate contribution to its costs, and groups receiving little or no benefit are not expected to fund it.	The main beneficiaries make little or no contribution, while funding obligations fall on groups that receive limited benefit or no benefit from the action.
Expected scale of resources that can be mobilised	The model could mobilise significant resources and support delivery of a large proportion of London's expected investment need, both in the short and long term.	The model is likely to mobilise only limited resources and would support only a small proportion of London's expected investment need, particularly in the short term.
Distributional implications	The model supports targeting towards the most heat-vulnerable groups and avoids placing disproportionate costs on low-income or otherwise vulnerable households, communities or organisations.	The model risks excluding or under-serving vulnerable groups, or places disproportionate costs on those least able to pay.
Acceptability	The model is likely to be politically and publicly acceptable, with a clear rationale, visible benefits, and limited opposition from key stakeholders.	The model is likely to face significant political, public or stakeholder resistance, or would be difficult to justify or communicate.
Deliverability	The model could be implemented using existing powers, institutions, processes and funding routes, with limited additional complexity or set-up time.	The model would require major new powers, regulation, institutions, delivery capacity or market development before it could be implemented, implying that significant transaction costs would be incurred.

Deep dive: Retrofitting the highest risk homes to reduce the risk of indoor overheating, for example shutters, insulation and ventilation, and air conditioning

Table 16: Indicative benefits register

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Increased thermal comfort	Reduced overheating improves occupants' comfort, sleep quality and ability to use the home during hot weather	• All occupants where retrofit takes place	• Wider benefit to UK society (Monetisation depends on being able to identify Willingness to Pay (WtP) for cooling[104])	High – All households that undertake retrofit will see this benefit	Any heat episode after retrofit undertaken
Increased productivity [105]	Cooler homes improve both sleep and working conditions for those who work from home	• All occupants in employment • Employers of those occupants	• Wider benefits to UK society (monetisable)	High – Bespoke CBA shows that this is significant due to high value attached to additional work	Any heat episode after retrofit undertaken
Improved learning outcomes	Cooler homes improve both sleep and working conditions for those studying, potentially leading to	• All occupants who are studying	• Wider benefits to UK society (qualitative but not readily quantifiable benefits)	Moderate – Impact of sleep deprivation on learning is highly relevant for affected groups although only some households	Any heat episode after retrofit undertaken

[104] WtP measure would also capture occupant-share of benefits from increased productivity, improved learning outcomes, reduced mortality, reduced morbidity and lower energy costs.

[105] Note that the comfort, health, productivity, learning and avoided damage benefits will either be much lower or not arise at all if households would otherwise install active cooling measures. In this assessment, it is assumed that most buildings would not otherwise install active cooling measures. If they would otherwise use active cooling then the benefits would relate to the avoided costs of operating active cooling and GHG savings.

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
	improved performance in exams			have occupants that are studying	
Reduced mortality	Reduced indoor heat exposure lowers the risk of heat-related premature death	• Occupants, especially older people, very young children, disabled people and those with underlying health conditions	• Wider benefits to UK society (monetisable) • Indirect public sector benefit (cash releasing)	High – Bespoke CBA shows as significant due to high value attached to avoiding mortality	Any heat episode after retrofit undertaken.
Avoided heat-related illness and care burden	Reduced indoor heat exposure lowers heat-related ill-health and associated health and care demand.	• Occupants, especially same vulnerable groups as above • Care providers and NHS organisations	• Wider benefits to UK society (monetisable) • Indirect public sector benefit (cash releasing)	Moderate – Bespoke CBA suggests smaller impact than for mortality	Any heat episode after retrofit undertaken.
Reduced risk of property and contents damage	Reduced overheating makes property and their contents less susceptible to fire risks, degradation of electrical equipment etc.	• Property owners • Occupants • Insurance companies	• Wider benefits to UK society (monetisable)	Low (but uncertain) – Only relatively small number of properties expected to see lower fire risk. Low value of items inside most homes	Any heat episode after retrofit undertaken.
Lower energy costs	Retrofit measures can reduce energy needs and costs associated with implementation of active cooling measures (both within and at nearby	• All occupants where retrofit takes place (in relation to short run variable costs of energy supply) • All energy consumers (in relation to any avoided	• Wider benefits to UK society (monetisable)	Low – Bespoke CBA suggests relatively small when compared to retrofit costs and other benefits	Any heat episode after retrofit undertaken Any winter after retrofit undertaken.

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
	premises) and *some* measures may reduce winter cooling demand.	network expansion from reduced peak demand etc.)			
GHG savings	Lower energy needs result in fewer GHG emissions.	• Global benefit from reduced climate change risks	• Wider benefits to UK society (monetisable)	Low – Follows from energy cost reduction being small	Any heat episode after retrofit undertaken (in the case of active cooling). Any winter after retrofit undertaken.

Table 17: Identification of beneficiaries

Beneficiary	Key benefits	Indicative magnitude	Economic, financial or fiscal	Confidence
Occupants	Health, productivity and comfort benefits. Lower energy costs with measures that reduce winter heating demand and/or for occupants that would otherwise install active cooling. Especially pronounced among the most vulnerable occupants.	High - Primary recipients of high-scoring comfort, health and productivity benefits.	Economic - Fewer deaths, improved health and wellbeing. Financial – some financial benefits where gains are reflected in reduced impacts on wages or income.	High
Owner occupiers (as subset of above)	All of the above plus potential increases in house value as a result of retrofit works.	High - Mainly through occupant benefits, whereas incremental asset-value benefits are uncertain.	As above, in addition to financial gains from potential incremental asset-value.	High - As above Low - More evidence needed to understand

Beneficiary	Key benefits	Indicative magnitude	Economic, financial or fiscal	Confidence
				benefits associated with incremental asset value uncertain
Hospital management and other patients	Fewer admissions into hospital from heat-related ill-health resulting in fewer operational pressures (i.e. reduced pressure on acute services) and therefore better health outcomes for other patients.	Medium–High - Benefits are material but depend on the extent to which retrofit reduces acute healthcare demand.	Economic	High
Central government	Lower costs from avoided and shorter NHS admissions. Potential benefit from increased productivity may also lead to higher tax revenues.	Medium–high - Productivity and NHS benefits, but partly non-cash-releasing.	Fiscal	Medium – unclear what proportion of benefit is cash-releasing
Construction sector and associated suppliers	Increased revenue and profits from installing retrofit measures.	Medium–High - Depends on roll-out assumptions and on whether retrofit measures displace other construction activities.	Financial	High
London Boroughs and emergency responders	Lower social care demand as vulnerable populations can stay in their own homes for longer and reduced pressure on local crisis response and civil contingencies, and adult social care services.	Medium - Local resilience and social-care benefits, but partly indirect.	Fiscal	High
Housing associations	Potential increase in capital value (with same caveats as above). Health benefits for (vulnerable) occupants and the potential for lower energy costs - especially if households would otherwise use AC - may result in lower arrears. With passing of Awaab's law,	Medium - Tenant welfare benefits strong; financial benefits less certain.	Financial - Although capital value increases may not be as liquid as for private landlords.	Low - especially for financial benefits

Beneficiary	Key benefits	Indicative magnitude	Economic, financial or fiscal	Confidence
	potential reduction in liability risk if tenants might otherwise overheat.			
Employers of those benefiting from retrofit	Improved workforce health increases productivity, which is partly captured by employers.	Medium - Using ONS preferred measure for labour/capital share around 40 per cent of productivity gains is captured by firms - assuming average capital share equals marginal.	Financial - Reduced absenteeism and disruption), reflecting partial capture of productivity gains.	Medium
Social care providers	Reduced pressure on care provision and staff due to reduced needs.	Low–Medium - Depends on how care needs increase during heat episodes.	Economic	Medium
Mortgage providers	Where owner occupiers are mortgage holders, improved health of occupants may reduce risk of default on mortgage. In cases where occupiers are private renters then reduced ability to pay rent may threaten landlord's ability to repay mortgage.	Medium – according to latest English Housing Survey data, around 28% of London homes are owned with a mortgage and a further 28% are privately rented.[106]	Financial	Low - theoretically possible but no data on this, as yet
Insurance providers	Fewer insurance payouts as fewer people admitted to private health care facilities because of heat-related conditions, fewer life insurance payouts associated with mortality events, less frequent claims on income protection policies as people are able to work more, and potentially reduced property and	Low - Insurance companies identify a link to property/appliance damage. However, for risks that would be most likely motivate retrofit – i.e. health and productivity – low	Financial	Low - more analysis needed to understand links between heat risk and insurance

[106] Ministry of Housing, Communities and Local Government (2026): English Housing Survey - Chapter 1: Profile of households and dwellings

Beneficiary	Key benefits	Indicative magnitude	Economic, financial or fiscal	Confidence
	contents claims arising from fire or heat-related appliance damage.	expected correlation between vulnerability to extreme heat and private health/life insurance or income protection policy coverage.		
Private landlords (when not also occupants)	Potential increase in capital and/or rental values. This would require similar dynamics as seen in energy efficiency retrofits which may or may not be relevant for cooling retrofit. Energy efficiency retrofit experience suggests comfort increases are rarely reflected in higher rents.[107] (Fuerst et al, 2026). However, with passing of Awaab's law, there is potential reduction in liability risk if tenants might otherwise overheat.	Unclear, as link to property values not yet established although reduced liability risk may lead to higher levels of funding.	Financial	Low - more evidence needed to understand links between reduced overheating and property and rental value
Energy network companies	Passive retrofits could help avoid cost associated with network expansion needed for active cooling (depending on regulatory settlement).	Low - given stated counterfactual that active cooling will not be installed. Could become much higher if counterfactual is installation of active cooling.	Financial	Low - given uncertainty in counterfactual and because it depends on regulatory arrangements
Those in vicinity	Lower ambient temperatures (e.g. from reflective walls) providing localised comfort and health benefits.	Low - at dwelling level, potentially higher if retrofits are spatially clustered.	Economic	Low - depends on measures adopted

[107] Fuerst, F., Huang, X. and Sheppard, M. (2026) The Impact of Minimum Energy Efficiency Standards on the Private Rental Market, Energy Policy, 210, March

Beneficiary	Key benefits	Indicative magnitude	Economic, financial or fiscal	Confidence
Global	If retrofit measures reduce winter heating demand, this will result in lower GHG emissions.	Low - modelled GHG savings modest.	Partly economic, partly financial.	High - for those measures that reduce heating demand

Table 18: Funding and financing archetypes for housing retrofit

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
Building owner funded models				
Fully private model	Building owner choose or are required to undertake retrofit (potentially in response to advertising campaigns[108] and/or subsidised assessments highlighting the benefits). This could be fully left to individual decisions, supported by tax incentives and/or ultimately mandated.	Building owner (and taxpayers if tax incentives also provided).	Finance is provided to owners by private banks or other credit providers including potentially secured lending through mortgage extension.	Most viable where retrofit increases property value or reduces bills sufficiently to justify private borrowing. Existing models for EE retrofit (e.g. Nationwide Green Additional Borrowing)[109] can help inform what this might look like. In the future, national policy may also support the extension of financial products from banks or credit providers.
Blended finance model	Building owner chooses to undertake retrofit - again supported by information measures such as advertising campaigns and/or subsidised assessment - but can access concessional finance to make	Building owner, partly subsidised by taxpayers. If funded through an outcome bond structure, then also partly funded by	Blend of public and private. Private finance comes from banks or other private credit providers but supported by public	

[108] Historically, there have been advertising campaigns associated with residential energy efficiency measures such as 'It All Adds Up'.
[109] Green Additional Borrowing | Nationwide

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
	retrofit more affordable (possibly complemented with additional tax incentives such as salary sacrifice arrangements).	impact investors accepting more risk.	subsidy to reduce costs, e.g. interest rate subsidy, capital grant top-up.	
Property-linked financing (like PACE)	Building owner undertakes retrofit with repayment tied to property rather than to individual through e.g. council tax, energy bill.	Current and future property owners or occupants.	Private banks or other credit providers.	
Property improvement facility	Public financed vehicle finances houses on the open market, undertakes retrofits and then re-sells properties at a premium.	Those who purchase the houses after the retrofit has been undertaken.	National /local government (taxpayers) and its lenders, i.e. investors buying gilts. Could be structured as a vehicle that also attracts private capital.	
Housing association balance sheet finance	Housing association takes out debt (bonds, bank loans or from Green Finance Fund) to upgrade housing stock and uses long term rental income to repay debt. This could be combined with grants and/or access to blended finance mechanisms that ease access to finance for the housing association.	Tenants of housing association, potentially supported through taxpayer-funded grants.	Housing association and its debt providers. This could include borrowing from the public sector.	Cooling retrofit could be integrated into existing energy efficiency retrofit programmes. Likewise, the National Wealth Fund is already providing guarantees to banks offering loans to social housing providers for EE retrofit. Eligibility of the Green Finance Fund could be expanded to allow boroughs to access low-cost finance for cooling

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
				retrofit, but this depends on boroughs willingness to borrow for this, which has not been clearly expressed to date. For this reason, this is not something actively explored.
Taxpayer funded models				
Central government funded model	Central government grants – either administered directly or allocated to local authorities – cover the cost of implementing upgrades in dwellings.	National taxpayers.	National government (and its lenders).	Already used for EE retrofit, e.g. Warm Homes: Local Grant. While the focus is on dwellings, the model would also be relevant for other public buildings.
Local government funded model	Either through borrowing (e.g. through community/municipal green bonds or potentially Green Finance Fund if eligibility expanded), or through revenue resources, local government helps cover costs of implementing upgrades in dwellings.	Local authority taxpayers (in case of borrowing).	If borrowing, then local authority and its lenders.	Existing local and regional energy efficiency retrofit programmes could be extended to incorporate heat-risk reduction retrofit. Eligibility of the Green Finance Fund could be expanded to allow boroughs to access low-cost finance for cooling retrofit, but this depends on boroughs willingness to borrow for this, which has not been clearly expressed to date. For this reason, this is not something actively explored.

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
Pay for performance models	Private entity finances and undertakes upgrades with either local authority or central government paying according to the performance of the retrofits in addressing heat risk.	Local or national taxpayers.	Private company or consortium of investors.	Two variants: (i) energy performance contracting (performance measured at output level) and (ii) social impact bonds (performance measured at outcome/ impact level).
Energy company/customer funded models				
Socialised on-bill financing	Energy suppliers are mandated to implement measures that will reduce heat risk within dwelling and recover costs through regulated levy on bills.	Energy bill payers nationally.	Energy company shareholders and debt providers.	
Other models				
Employer-supported retrofit model	Employers make contribution to retrofit measures in dwellings of workers in recognition of productivity benefits they will realise. Could for example be through, i) encouragement, ii) tax incentives or iii) regulation/mandating (cf. Apprenticeship Levy).	Employers (both private sector employers and public sector). If employers are encouraged through tax incentives, then taxpayers also provide funding.	Depends on the size of the employer contribution. If it fully covers costs, then there are no financing needs. If only part-funding, then residual financing likely to be met from banks or other private credit providers.	
Insurance providers	Insurance companies make contribution to cost of retrofit models on anticipation of lower	Shareholders of insurance companies.	Banks or other private credit providers, possibly	

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
fund retrofit measures	future payouts from extreme heat events.		supported by government subsidy.	

Table 19: Assessment of archetypes against criteria

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Building owner funded models					
Fully private model	High - for owner occupied buildings (although lower if owners expect to move in near term), Low - in rented accommodation. Alignment increases if value of retrofit measures are reflected in capital values (owner-occupied) and/or rents (private rental accommodation).	Likely low - May increase if information campaigns lead to measures being reflected in capital and rental values.	Low - likely that only the most affluent will benefit.	High - can be left to homeowners and retrofit suppliers to decide outcomes, potentially supported by information campaigns.	Moderate–High - few challenges for those willing to make investment, but greater challenges to achieve scale if this requires regulation. Also challenges in ensuring workforce has right skills to implement measures, but this will apply to all of the models below.
Blended finance model	High - for owner occupied buildings (although lower if expect to move in near term).	Medium - Higher than in fully private model, directly linked to the scale of the subsidy offered. As with fully private model, scale of	Medium - would help to address the concern in the private model that benefits would	Potential to be high, depending on the detailed design i.e. the interest rates which result, any wrap-around support	Low - setting up blended finance scheme will be challenging with likely economies of scale from developing a regional or national scheme.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	Low - in rented accommodation. Alignment increases if value of retrofit measures are reflected in capital values and/or rents.	resources increase if measures are reflected in capital values and /or rents.	skew to the most affluent, although, by itself, benefits are still likely to accrue to owner-occupiers.	provided in addition to the concessional support.	
Property-linked financing (like PACE model)	High - assuming retrofit measures are not reflected in capital values then, for consistently owner-occupied dwellings. Low - in cases where dwelling is (or switches to) rented accommodation (assuming measures not reflected in rental vales)	Likely low - given that, unless active cooling has been installed, most measures will not reduce energy costs. Current owners may be concerned that a property linked charge will reduce buyer interest at time of sale. Reputational impact of Green Deal may also undermine interest/trust.	Medium - scheme should help to widen accessibility compared to other owner-funded models.	Low - based on experience of Green Deal, exacerbated by the fact that the measures may not provide an immediate financial benefit.	Medium - mechanisms developed for the Green Deal could be updated to account for lessons learned and change in context.
Property improvement facility	Unclear - potentially high if the benefits of retrofits are reflected in the market value of the properties, otherwise low.	Likely low – given that it is currently judged to be unlikely that cooling retrofits will be reflected in house prices.	Moderate - facility could target lower value properties, but ultimately benefits are still likely to accrue	Potential to be high.	Moderate - would take some time to set up and maybe challenging to source public finance.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
			to owner-occupiers.		
Housing association balance sheet finance	High - assuming tenants ultimately pay for some of retrofit through higher rents.	Potentially high - especially if measures become mandated by regulation, although borrowing constraints may be a limit.	Medium - ensures benefits are widened to more vulnerable residents, although would likely be reflected in rents (which will account for large share of spending).	Moderate - would depend on extent that retrofits lead to rent increases (and extent to which comfort benefits are valued by tenants) and whether housing associations have the financial headroom.	High - existing regulatory models make it reasonably easy to deliver.
Central government funded model	High - especially if targeted towards most vulnerable who have greatest health vulnerabilities (and who would otherwise place additional burden on NHS).	Depends on willingness of central government to provide resources. Potential to be high but with wide variance, especially given current fiscal context.	High - central government tax revenue are progressive, and funding can be targeted towards the most vulnerable.	Medium - incremental impact on government budget would be relatively low, but current fiscal context may pose a barrier to acceptability.	High - since there are opportunities for integrating into existing energy efficiency retrofit programmes such as the UK Government Warmer Homes Plan, although delivery model for disbursing funding would need to be decided.
Local government funded model	Medium - highest in cases where targeted towards those already in social care, or at risk	Low–Medium - Challenging fiscal position for local governments.	Moderate - all would be able to benefit but funding via council taxes (in particular) likely	Medium - current fiscal context may pose a barrier to acceptability for some local authorities.	High – since there are opportunities for integrating into existing energy efficiency retrofit programmes,

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	of moving into social care.		to be more regressive than overall tax system.[110]		although delivery model for disbursing funding would need to be decided.
Pay for performance models	High - especially when used to target those who have greatest health vulnerabilities or (expected) social care needs.	Low - likely to require piloting to understand whether and how it can work, so likely low in the short-term but potential to grow over time.	Moderate to high depending on source of payments.	Medium–High - the fact that public funding will only be allocated if measures are successful may increase acceptability.	Low - likely to be complicated to design in the correct Key Performance Indicators, especially for Social Impact Bond variant.
Energy company/customer funded models					
Socialised on-bill financing	Low - as funding is averaged across all households regardless of whether they benefit.	Potentially high - especially if measures become mandated by regulation.	Moderate - funding can be targeted at most vulnerable but energy bills account for larger proportion of low-income household spending than for higher income households.	Low–medium - concerns over energy bills and cost of living (as well as incentivising electrification, if applied just to electricity bills) may be a challenge.	High - can be integrated into existing schemes.
Other models					

[110] Bourquin, P. and Waters, T. (2019) The Effects of Taxes and Benefits on UK inequality, IFS Briefing Note BN249

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Employer-supported retrofit model	Medium - employers typically expected to capture ~40 per cent of any productivity gains (which could inform potential size of funding contribution). No alignment when those benefiting from retrofits are not in work.	Depends on how operationalised: i) Encouragement only - Low ii) Supported by tax incentives for employers - Medium iii) Mandated - High	Low–Medium - under a voluntary scheme, more likely to be supported by employers of higher income workers. Under compulsory scheme, wider range of beneficiaries but still restricted to those in work.	Depends on how operationalised: i) Encouragement only - High ii) Supported by tax incentives so no net cost to employer - potential to be high, so long as not too complicated Mandated - low, as there is a risk of being perceived as 'tax on jobs'.	Low - particularly challenging for employees in rented accommodation where building owner involvement will also be needed. Will also be practical challenges associated with extent of home-working within and between employers.
Insurance providers fund retrofit measures	Low–Moderate - for those with health/life assurance cover, some overlap, although health insurance cover only accounts for around 11 per cent of population, and concentrated in 30-64 year age group.[111] Greater	Low - give lack of correlation between beneficiaries from retrofit measures and those with health insurance, further exacerbated by most private medical insurance not covering emergency care.[112] Even where overlap (i.e. property and	Low - mechanism only works for those with insurance, expected to be the more affluent.	Likely high.	High - based on similar models already in operation for other insurance policies.

[111] Commission on the Future of Health and Social Care in England (2014): The UK private health market.
[112] Ibid.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	overlap around property and contents insurance if retrofit reduces fire/property risk.	contents) insurance companies at best likely to make contribution/provide additional incentive rather than provide large sums of upfront capital given mismatch between typical premia for these polices and retrofit costs.			

Deep dive: Retrofitting high-risk non-residential buildings which deliver essential public services e.g. schools

Table 20: Indicative benefits register

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Reduced mortality	Improved thermal conditions, continuity of power, and appropriate care responses reduce the risk of heat-related premature death during extreme heat events.	• Residents/patients in hospitals, care homes and social care facilities, especially older people and those with underlying health conditions	• Wider benefits to UK society (monetisable)	High – directly protects highly heat-vulnerable residents from fatal exposure.	Any heat episode after measures introduced.
Avoided heat-related illness	Reduced indoor heat exposure lowers heat stress, dehydration, sleep disruption and	• Residents/patients in hospitals, care homes and social care facilities especially same	• Wider benefits to UK society (monetisable)	Moderate - reduces common heat harms among	Any heat episode after measures introduced.

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
	exacerbation of existing conditions, reducing healthcare use and care needs.	vulnerable groups as above • Care providers and NHS organisations	• Indirect public sector benefit (cash releasing)	highly vulnerable residents, but lower valuation than for avoided mortality.	
Increased thermal comfort for patients and residents	Reduced overheating improves occupants' and residents' comfort, sleep quality etc. during hot weather	• All occupants where retrofit takes place	• Wider benefit to UK society (Monetisation depends on being able to identify WtP for cooling)[113]	Moderate – all residents benefit but lower value attached to these gains than for health-related gains.	Any heat episode after measures introduced.
Reduced burden on family and unpaid carers	Fewer heat-related incidents and less service disruption reduce worry, additional visits, and informal caring demands during hot weather.	• Families and other unpaid carers of residents and patients	• Wider benefit to UK society (qualitative)	Low–Medium - indirect benefit; formal care limits unpaid carer burden.	Any heat episode after measures introduced.
Service continuity and reduced disruption	Greater heat resilience reduces the risk of disruption to health (and social) care delivery, cancelled activity, emergency transfers and other crisis response measures.	• Care providers and NHS organisations • Local authorities	• Direct and indirect public sector benefit (likely cash-releasing benefit)	High - ensures critical care delivery.	Any heat episode after measures introduced.

[113] WtP measure would also capture occupant-share of benefits from increased productivity, improved learning outcomes, reduced mortality, reduced morbidity and lower energy costs.

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Improved staff productivity and retention	Better thermal conditions and clearer heat-response practices improve working conditions maintaining productivity and enhancing staff retention.	• Staff at care providers and NHS organisations • Care providers and NHS organisations	• Direct and indirect public sector benefit (either quantifiable but not monetisable or qualitative)	Moderate - improves working conditions, reduces errors, but retention impacts less certain.	During and following any heat episode after measures introduced.
Reduced risk of property and contents damage	Reduced overheating makes property and their contents less susceptible to fire risks, degradation of electrical equipment etc.	• Care providers and NHS organisations • Occupants • Insurance companies	• Wider benefits to UK society (monetisable)	Low (but uncertain) - secondary benefit with limited supporting evidence to date.	Any heat episode after measures introduced.
Lower energy costs	Some measures can reduce energy needs and costs associated with implementation of active cooling measures and *some* cooling retrofit measures may reduce winter cooling demand.	• Care providers and NHS organisations where retrofit takes place (short run variable costs of energy supply) • All energy consumers (avoided network expansion from reduced peak demand etc.)	• Wider benefits to UK society (monetisable)	Low - based on evidence from housing retrofits and recognising only some measures will deliver this benefit.	Any heat episode after measures (active cooling) Any winter after measures undertaken.
GHG savings	Lower energy needs result in fewer GHG emissions.	• Global benefit from reduced climate change risks	• Wider benefits to UK society (monetisable)	Low - following logic for low energy costs.	Any heat episode after retrofitting undertaken (active cooling). Any winter after measures.

Table 21: Identification of beneficiaries from enhanced resilience of care homes, social care facilities and hospitals to extreme heat

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal?	Confidence
Residents/patients	Improved comfort and reduced risk of morbidity and mortality.	High - primary recipients of high-scoring mortality, illness and comfort benefits.	Economic - health outcomes/ QALYs.	High
Care providers	Reduced risk of service disruption/greater ability to provide high quality services as staff productivity and retention is elevated, and fewer challenges with staff turnover. Avoided costs from crisis response.	Medium–High - service continuity benefit is high, with supporting staff benefits.	Mixed - partly economic; partly financial (for private social care provision where increased staff productivity more attractive offering to customers and avoided costs); partly fiscal if avoided costs would otherwise be borne by taxpayers.	High
Construction sector and associated suppliers	Increased revenue and profits from installing retrofit measures.	Medium–High - financially material if roll-out is substantial; but depends on whether retrofit measures displace other construction activities.	Financial	High
Health and social care staff	Improved comfort and wellbeing, reduced risk of morbidity and absenteeism.[114]	Medium - staff benefits are material but secondary to resident outcomes.	Partly economic, potentially some financial, if/as higher productivity translates into higher pay, but this is likely to be small.	High for overall benefit, low for translation to financial benefit.

[114] UK Health Security Agency (2024): Research exploring the experience of social care practitioners in relation to extreme temperatures

Hospital management and other patients	Fewer admissions from social care system, reduced A&E pressure and lower ambulance demands. Less overcrowding in hospitals and reduced wait times leading to improved clinical outcomes.	Medium - indirect benefit through fewer transfers and admissions.	Economic (health outcomes)	High
Central government	Reduced pressures on healthcare system results in lower costs.	Medium - potential NHS savings, but cash-releasing impact uncertain.	Fiscal	Medium - unclear how much of benefits are cash-releasing.
Family and informal carers	Reduced anxiety and less need to provide additional informal care and fewer work/life disruptions during heat waves.	Medium - benefit is indirect; formal care limits unpaid-carer burden.	Economic	Medium
London Boroughs and emergency responders	Reduced pressure for emergency interventions to support social care system during crises and reduced risk of provider failure.	Medium - reduced crisis response and provider failure pressures.	Fiscal	Medium
Insurers (i.e. NHS Resolution or possibly commercial insurer)	Fewer claims linked to clinical negligence associated with heat stress.	Low - only minor, uncertain reduction in heat-related claims.	Financial or Fiscal - depending on whether it concerns a public or private insurer.	Low

Table 22: Funding and financing archetypes for enhanced resilience of care homes, social care facilities and hospitals to extreme heat

Model	How does it work?	Social care or health care	Who is ultimately funding?	Who is providing the finance?	Other

Central government funded model	Central government provides grants and ongoing budgets - supported by taxes and/or borrowing - to fund construction and cover additional operating costs.	Both, although likely to focus on health care.	National taxpayers.	HMG (via general government borrowing/taxation).	This could be implemented through reforming the Public Sector Decarbonisation Scheme to also cover heat adaptation.
Social care funding status quo	Social care providers undertake cooling measures and recover costs through higher fees on private patients and increased revenue from local authorities.	Social care	Residents of social care facilities and local authority revenue providers (mainly council tax and business rate payers).	Owners of social care facilities and their lenders.	
Better Care Fund	Pooled funding from NHS and local authorities jointly funds cooling measures that reflect shared benefits.	Both	National and local taxpayers.	Ultimately, HMG and local authorities through borrowing/taxation.	
Local government financing and funding	Local authorities borrows (e.g. Public Works Loan Board, community/municipal bonds, resilience bond, potentially Green Finance Fund if eligibility expanded) to finance upgrades with repayment from council tax/retained business rates and/or payment from social care providers (rebate on fees otherwise paid).	Much more relevant in social care.	Local authority revenue providers (mainly council tax and business rate payers), potentially supplemented by residents/owners of social care facilities.	Local authorities and their lenders.	Clarifying ownership of upgrade measures within privately owned care homes could be challenging. Eligibility of the Green Finance Fund could be expanded to allow boroughs to access low-cost finance for cooling retrofit, but this depends on boroughs willingness to borrow

					for this, which has not been clearly expressed to date. For this reason, this is not something actively explored.
Private service-based financing e.g. Cooling (and Heating)-as-a-Service	Third party (private) installs and provides ongoing operation of assets that deliver cooling (and heating) and receives payment from facility owner.	Both	Combination of national taxpayers (in health care setting) and local taxpayers and social care residents (in social care setting).	Private company or consortium of investors.	Clarifying ownership of upgrade measures within privately owned care homes could be challenging.
Blended finance vehicle with guarantees or 1st loss capital	Public and private capital pooled in a Special Purpose Vehicle or related facility that finances upgrades (e.g. loans, leasing, or offers service-based models such as cooling-as-a-service). Public sector provides guarantees or 1st-loss capital to reduce risk for private investors (which could be sourced through e.g. an outcome bond structure).	Both (bias towards social care).	Combination of national taxpayers (in health care setting) and local taxpayers and social care residents (in social care setting). If outcome bond structure used then impact investor also fund through additional risk transfer.	Blend of public and private investors.	Could be dedicated window within any blended finance vehicle for housing as well.
Conventional public-private partnership (PPP) Model	Private company/investors finance retrofits across an aggregated portfolio of care homes (and/or other buildings) and receive	Both - but likely to be easier in health care given a) size	National and/or local taxpayers (depending on who is responsible for making payments to private company).	Private company or consortium of investors.	Could be challenging to apply for private sector owned care homes.

	payments over time (potentially linked to the ongoing performance of the retrofit measure).	of facilities and b) common ownership.			
Social impact bond	Private investors fund heat-resilience upgrades to care homes or hospitals and are repaid by government only if agreed health outcomes (e.g. reduced admissions, improved patient outcomes) are achieved.	Both	National and/or local taxpayers.	Consortium of investors.	

Table 23: Assessment of funding and financing model for enhanced resilience of care homes, social care facilities and hospitals to extreme heat

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Central government funded model	Moderate - NHS (as well as other hospital patients) will see some benefits; these account for a relatively small share of total benefits (especially for cooling of social care facilities).	Depends on willingness of central government to provide resources. Potential to be High but with wide variance, especially given current fiscal context.	Potential to be High - benefits could be targeted towards those parts of the social care system with the most vulnerable residents/patients; central government taxation is progressive.	Moderate - incremental impact on government budget would be low, although current fiscal context (and fact that little of the social care funding model is covered by central government revenue) may pose a barrier to acceptability.	Moderate - involvement of central government in social care system is currently relatively low, although no intrinsic deliverability barriers. High - if the focus was exclusively on healthcare (where it could build on existing funding schemes for decarbonisation i.e. Public Sector

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
					Decarbonisation Scheme).
Social care funding status quo	Moderate–High - as funding would come from residents (key beneficiary), social care providers and local authority (important beneficiaries).	Low - social care system already experiencing severe funding challenges.	Moderate - some funding from relatively more affluent residents, much of the remainer from local authorities, whose predominant funding sources (council taxes especially) are likely more regressive than overall tax system.[115]	Low–Moderate - current fiscal context may pose a barrier to acceptability for some local authorities and resident funding of social care facilities can be controversial.	High - would follow status quo.
Better Care Fund	Moderate–High - NHS and local authorities are two key beneficiaries with explicit attempts to align these benefit streams. High - if complemented by resident funding (in	Low–Moderate - focus on pooled funding source may make it easier to attract funding, but both sources face constraints.	Moderate–High - blend of two models above.	Moderate–High - Greater emphasis on using pooled funding resources can help acceptability.	Moderate–High - Established funding modality although governance arrangements still maturing.

[115] Bourquin, P. and Waters, T. (2019) The Effects of Taxes and Benefits on UK inequality, IFS Briefing Note BN249

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	social care context).				
Local government funding and financing	Moderate - implies funding ultimately sourced from residents and local authority taxpayers who are two of beneficiaries.	Low - local authorities already struggling with meeting social care budgetary requirements.	Moderate - some funding from relatively more affluent residents, much of the remainder from local authorities, whose predominant funding sources (council taxes and business rates) are likely more regressive than overall tax system.[116]	Low–Moderate - current fiscal context may pose a barrier to acceptability for some local authorities and resident funding of social care facilities can be controversial. Likely low if it requires council tax increases.	Low–Moderate - clarifying ownership of upgrade measures within privately owned care homes could be challenging.
Private service-based financing e.g. Cooling (and Heating)-as-a-Service)	Moderate–High - as in social care context, funding would come from residents (key beneficiary), social care providers and local authority (important beneficiaries) and in hospital context funding would come from central government	Moderate - multiple different funding sources increases mobilisation potential (although each individual funding source constrained).	Moderate - some funding from residents and central government (relatively progressive funding); some from local authorities (relatively regressive).	Moderate - may be some concerns around private sector service provision.	Low–Moderate - clarifying ownership of upgrade measures within privately owned care homes could be challenging (would need to investigate service level agreements etc.).

[116] Ibid.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	(important beneficiary).				
Blended finance vehicle with guarantees or 1st loss capital	Moderate–High - as in social care context, funding would come from residents (key beneficiary), social care providers and local authority (important beneficiaries) and in hospital context funding would come from central government (important beneficiary).	Moderate–High - blended finance structure could increase finance available for measures, but underlying funding challenges place a limit on resource mobilisation.	Moderate-High - some funding from residents and central government (relatively progressive funding); some from local authorities (relatively regressive). Strong scope to target most vulnerable residents.	Moderate–High – leveraging private capital has potential of being attractive, although challenges remain in sourcing public sector capital to capitalise a Special Purpose Vehicle.	Low–Moderate - significant challenges in developing model, although this has potential of becoming easier over time with scaling potential.
Conventional public-private partnership (PPP) model	Moderate - funding ultimately provided by national or local authority (who are key beneficiaries). But residents themselves – even the more affluent –	Moderate–High - can be high if sufficient pipeline of relevant assets for retrofit can be identified and	Moderate - Can focus on most high risk assets and funding comes from combination of national (progressive) and/or local (more regressive) tax.	Low–Moderate - would need to address concerns over whether conventional PPP models of this type of offer value for money.	Low - in social care setting. Private provision of social care provision invalidates typical logic for PPP structures. Could be more relevant for public owned care homes and hospital, but

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	may not need to pay.	aggregated into single contract.			developing a sufficiently large pipeline may be challenging, especially if focus is on care homes.
Social impact bond	Medium–High - payment would likely come from local and/or central government sources (who are key beneficiaries) with extra benefit that payment only happens when outcomes are delivered. But residents themselves – even the more affluent – may not need to pay.	Low - challenging to develop and calibrate Key Performance Indicators so would likely need to start at pilot scale.	Moderate–High - Performance metrics can be targeted to incentivise delivery in care homes where most vulnerable are located. Funding comes from combination of national (progressive) and/or local (more regressive) tax.	Moderate–High - may be some concerns about the novelty of the model and private sector provision but performance related payments should increase acceptability.	Low - challenging to establish and calibrate the Key Performance Indicators and the model could take a long time to establish.

Deep dive: Installing outdoor shading structures to reduce temperatures and decrease sun exposure, for example shade canopies, shade sails and pergolas

Table 24: Indicative benefits register

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Usability and amenity / recreational value	Shaded areas increase the attractiveness, usability and recreational value of public spaces, especially during hot weather.	• Visitors/users of shaded space (residents, visitors, tourists)	• Wider benefits to UK society (monetisable if WtP estimates can be generated).[117]	High - key benefit realised by all who use shaded space.	Ongoing after shading established with greatest benefits in hot weather.
Additional retail sales	Shaded areas increase footfall, dwell time and spending in nearby businesses (after accounting for displacement, leakage, substitution etc.).	• Retailers and other service providers	• Wider benefits to UK society (monetisable if adjustments can be made, otherwise qualitative)	Moderate - while some evidence of impact, gains will be location dependent and may be displaced from elsewhere.	
Reduced mortality	Shaded environments reduce exposure to extreme heat and risk of skin cancer, lowering the risk of premature death, especially among vulnerable groups.	• Both visitors/users (residents, visitors, tourists) and those in the vicinity especially those with underlying health conditions • NHS	• Wider benefits to UK society (monetisable)	Moderate - high valuation per death avoided but relatively small attributable reduction expected.	

[117] WtP measure would also capture occupant-share of benefits from increased productivity, improved learning outcomes, reduced mortality, reduced morbidity and lower energy costs.

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Reduced morbidity	Shaded environments reduce heat stress, sunburn and related illnesses, reducing illness burden and related service demand (although possibly partly offset if sails have a negative impact on air quality).	• Both visitors/users (residents, visitors, tourists) and those in the vicinity especially those with underlying health conditions • NHS and other health care providers	• Wider benefits to UK society (monetisable) • Indirect public sector benefit (cash releasing)	Moderate – reasonably high value for exposed users in hot weather, although evidence on long-term improved health impacts unclear.	
Enhanced productivity for outdoor workers	Shade can reduce heat exposure, health risk and discomfort for outdoor workers, supporting safer and more productive work during hot weather.	• Outdoor workers • Employers of outdoor workers	• Wider benefits to UK society (monetisable) • Indirect public sector benefits (monetisable non-cash releasing benefit)	Moderate - important for exposed workers, but limited population coverage.	
Lower energy costs	Where shading structures reduce solar gains to adjacent buildings, transport facilities or cooled public assets, they can reduce cooling demand and associated energy costs.	• Occupants (energy bill payers) in connected/ adjacent buildings • All energy consumers (avoided network expansion from reduced peak demand etc.)	• Wider benefits to UK society (either monetisable or qualitative)	Low - limited to adjacent buildings.	

Table 25: Identification of beneficiaries from shading structures in public places

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal?	Confidence
Residents	Increased comfort and lower health risks (heat exposure, skin cancer etc.) while under the shading structure. Benefits especially felt by elderly, children and those with otherwise less access to cooling.	High - direct recipients of high-scoring comfort and health benefits.	Economic - improved wellbeing. Financial - some financial gains if improved health outcomes allow higher incomes as a result of reduced exposure and heat- and UV-induced health impacts.	High – evidence both that shading attract people[118] and that ultraviolet light exposure is significantly lower[119].
Retailers and other businesses (near or integrated to shaded spaces)	Increases in revenues and profits as dwell time of customers increase. Improved productivity of staff, and potentially lower energy costs for those using active cooling.	Medium–High - many businesses should see some benefits.	Financial	Medium - likely to depend a lot on the type of business and location of shading structure.
Hospital management and other patients	Fewer hospital admissions leading to reduced A&E pressure and lower ambulance demands. Less overcrowding in hospitals and reduced wait times leading to improved clinical outcomes for patients more broadly.	Medium–High – potentially high health value, but impacts on hospital management are expected to be more limited.	Economic - health outcomes.	Medium

[118] Buller, D., English, D., Buller, M.K., Simmons, J., Chamberlain, J., Wakefield, M., Dobbinson, S. (2017) Shade Sails and Passive Recreation in Public Parks of Melbourne and Denver: A Randomized Intervention, American Journal of Public Health, 107 (12):1869-1875.
[119] Dobbinson, S. J., Bard Buller, D., Chamberlain, J., Simmons, J., Buller, M.K. (2022) Solar UV Measured under Built-Shade in Public Parks: Findings from a Randomized Trial in Denver and Melbourne, Int J Environ Res Public Health, 19 (17): 10583,

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal?	Confidence
Vendors of shading structure	Increases in revenues/profits from sale of shading structures.	Medium–High - high per beneficiary benefit, although only relatively small number of ultimate beneficiaries. Depends on roll-out assumptions.	Financial	High
Visitors/tourists	Increased comfort and lower health risks (heat exposure, skin cancer etc.) while under the shading structure.	Medium–High - same intensity of benefit as for residents but, in most locations, expected to be fewer overall number of beneficiaries.	Economic	High
Central government	Lower costs from avoided and shorter NHS admissions (via both reduced heat stress and reduced skin cancer risk). Increased taxes from enhanced economic performance of businesses benefiting from shade (although this may be mostly diverted from other locations).	Medium - per beneficiary benefit is high, even if relatively small number of cases avoided, but benefits are very diffuse.	Fiscal	Low - unclear how much of the benefits are cash-releasing. Increased tax take even more uncertain.
GLA and London Boroughs	Increases in attractiveness/footfall leads to higher local tax take (local business rates) if shading structures attract new businesses to the areas or increases attractiveness to tourists.	Medium - local amenity and fiscal gains, but indirect.	Fiscal	Low - indirect and uncertain link to fiscal outcomes.

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal?	Confidence
Outdoor workers	Health, comfort, well-being and productivity benefits for those working outside where shading structures deployed, e.g. construction workers, street cleaners, police officers.	Medium - material for exposed workers, but limited coverage.	Economic - improved wellbeing. Financial - some financial effects where productivity gains are reflected in wages or income as a result of reduced exposure.	High
Employers of those who benefit from shading structure (including outdoor workers)	Improved health of employees leads to enhanced productivity.	Low–Medium - employer capture limited and location-dependent.	Financial - reduced absenteeism and disruption, reflecting partial capture of productivity gains.	Low–Medium.
Health and life insurance providers	Fewer insurance payouts as fewer people admitted to private health care facilities because of heat-related conditions and skin cancer. Fewer life insurance payouts associated with mortality events.	Low - small, indirect reduction in claims exposure.	Financial	Low
Global	Reduced GHG emissions if shading structures reduce the need for air-condition use.	Low - impact on active cooling use potentially limited.	Economic and/or Financial.	Low

Table 26: Funding and financing archetypes for shading structures

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
Taxpayer funded models				

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
Central government funded model	Central government grants to local authorities or delivery organisations to fund construction and maintenance of shading structures.	National taxpayers.	HMG and its lenders.	
Local government funded model	Local authorities use existing revenues and/or borrows (borrows (e.g. Public Works Loan Board, community/municipal bonds, resilience bond) repaid through council tax, retained business rates or other revenues.	Local authority taxpayers (or other providers of local authority revenue).	Local authorities and their lenders.	
Public-private partnership (PPP) / concession model	Public sector grants concession to private partner who designs, builds, finances and operate shading structure and receives return from 'availability payments' made by local or national government.	National or local taxpayers (depending on model), net of any funding met through other innovative sources.	Private company or consortium of investors.	
Outcome-based / pay-for-performance PPP	Version of PPP model where availability payments vary according to the cooling benefits delivered rather than simple asset availability.	National or local taxpayers (depending on model), net of any funding met through other sources.	Private company or consortium of investors.	Availability payments from public sector could be reduced through sponsorship or advertising.
Existing businesses and property owner funding models				
Business Improvement District (BID) funding	Businesses collectively vote to formally approve a levy on local business rates with revenue used to fund shading structures.	Existing local businesses, and potentially their customers.	Typically treated as providing revenue funding (i.e. funding = financing) although BID income could	Could be combined with other measures intended to provide cooling and wider

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
			be used to leverage further finance if predictable.	amenity benefits, i.e. urban greening.
Anchor investment from retail/hospitality sector	One or more businesses operating in or adjacent to the area collectively agree to pool resources to purchase shading structure.	Existing local businesses, and potentially their customers.	Local businesses.	As above.
Quasi - taxpayer increment financing	Businesses required to pay additional business rates once the shading structure has been installed. Local authorities can borrow on expectation of future increases (cf. Crossrail).	Existing local businesses, and potentially their customers.	Local authorities and their lenders.	As above.
Infrastructure provider model	Infrastructure providers (especially transport companies) are mandated to provide shading structure.	Customers/users of the infrastructure, or taxpayers if infrastructure provided is subsidised at the margin.	Depends on how the infrastructure company is financed.	
Levies and mandates				
Developer funded models	Developer contributions, including via Section 106 planning obligation contributions or Community Infrastructure Levy (CIL) receipts earmarked for shading structures.	Developers (and their shareholders) as well as buyers/tenants in their development.	Shareholders/lenders of development companies and/or retained earnings.	Could be combined with other measures intended to provide cooling and wider amenity benefits.
Resident levy	Residents pay a small additional levy on council tax bills that is explicitly hypothecated for shading structures (and similar).	Residents	Typically treated as providing revenue funding (i.e. funding = financing) but	Could be combined with other measures intended to provide

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
			could support borrowing if revenues are stable.	cooling and wider amenity benefits i.e. urban greening.
Tourist levy funding	Tourists pay 'tourist tax' that is ringfenced for shading structure.	Tourists	Typically treated as providing revenue funding (i.e. funding = financing) but could support borrowing if revenues are stable.	Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. urban greening.
Other funding models				
Advertising Model	Public (e.g. local authority or national government) or private company (e.g. a media company) construct shading structure and sell rights to advertise on the shading space.	Companies who purchase advertising space and their customers.	Either public (local authority or national government) or private investors.	Already used extensively for bus shelters.
Solar-integrated shading	Public or (more likely) private investors invest in shading structure that also has solar PV panels and sells electricity to both retailers benefiting from shading structure and/or to the grid.	Electricity consumers, both under the shading structure and nationally.	Energy company (shareholders/lenders).	Unclear whether revenues would cover additional costs.
Corporate sponsorship	Corporates fund shading structures and gets naming rights or branding benefits (but not asset ownership).	Company CSR or marketing budgets.	Likely to be treated as revenue, no financing required.	

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
Philanthropic, charitable and community funding	Charitable funders, lottery distributors, foundations, charities and community groups provide grants, donations or fundraising support. Can include crowdfunding and volunteer-led delivery.	Lottery players, charity donors, philanthropic foundations, community fundraising.	Likely to be treated as revenue, no financing required.	

Table 27: Assessment of funding and financing models for shading structures

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Taxpayer funded models					
Central government funded model	Moderate - given potential NHS savings through reduced exposure to heat risk. However, these measures are less effective at targeting the most vulnerable populations compared to e.g. building retrofits.	Dependant on central government willingness to provide resources. Potential to be high but with wide variance, especially given current fiscal context.	Moderate–High - all would be able to benefit from the provision of shading structures and taxation system is progressive, but it is not possible to explicitly target beneficiaries.	Moderate–High - incremental impact on government budget would be low, although current fiscal context may pose a barrier to acceptability.	High - common funding model although the delivery model for disbursing funding would need to be decided and developed.
Local government funded model	Moderate–High - assuming shading structures provide benefits to all residents (taxpayers), although some benefits will also	Medium - likely lower compared to a central government funded model.	Moderate - all would be able to benefit but funding via council taxes (especially) likely to be more regressive	Medium - current fiscal context may pose a barrier to acceptability for some local authorities.	High - although delivery model for disbursing funding would need to be decided.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	accrue to non-residents i.e. tourists, commuters.		than overall tax system.[120] Not possible to explicitly target beneficiaries.		
Public-private partnership (PPP) / concession model	Moderate–High - depending on whether funding comes from local or national taxpayers.	Moderate–High - depending on whether 'availability payments' from public authorities to the contractors are made by national or local government.[121]	Moderate–High - depending on the source of availability payments. Not possible to explicitly target beneficiaries.	Low–Moderate - PPP models for urban infrastructure assets well established but there may be concerns about private sector involvement. Possible concern about value for money given historic experiences.[122]	Low - models require additional upfront transaction costs to, for example, appropriately allocate risks that may be difficult to justify given relatively low capital need.
Outcome-based / pay-for-performance PPP	High - similar to a PPP model but with the added dimension that greater payments are	Low - likely to require piloting to understand whether and how it can work, so	Moderate–High - depending on the source of payments. Not possible to explicitly target beneficiaries.	Medium–High - The fact that public funding will only be allocated if measures are	Low - as above, but will also require greater effort to set up scheme, especially

[120] Bourquin, P. and Waters, T. (2019) The Effects of Taxes and Benefits on UK inequality, IFS Briefing Note BN249
[121] In a PPP, an availability payment is a periodic payment by the public authority to the private partner for making the contracted infrastructure or service available at specified performance standards.
[122] Value for money requires that the efficiency gains from risk-transfer and private-sector delivery more than offset the higher cost of private finance. See National Audit Office (2018): PFI and PF2

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	only made when more benefits realised.	likely low in the short-term but potential to grow over time.		successful may increase acceptability.	setting KPIs, monitoring progress etc.
Existing businesses funding models					
Business Improvement District funding	High - voting means that funding only proceeds if local businesses see benefit.	Low–Medium - resources may be significant within the local areas where schemes go ahead, but will likely result in uneven funding distribution across the city as its dependent on businesses' consent.	Low–Medium – more affluent areas may be better able to secure discretionary funding to cover higher business rates, meaning investment may not always reach areas of greatest need.	High – the explicit process of requiring consent of businesses should facilitate acceptability.	Moderate–High - existing model architecture exists, but it may be challenging to convince businesses that they benefit from the measures.
Anchor investment from retail or hospitality sector	High - measures would deliver concentrated benefits for nearby businesses and their customers.	Low – few locations are likely to have suitable anchor investors.	Low - more affluent areas may be better able to secure additional discretionary spending to cover the costs of the investment. Benefits may be restricted to customers of anchor investees which may not always be areas of greatest need.	High - likely to encounter few concerns	Medium–High – for single anchor investors delivery is relatively straightforward, although it may be more challenging if the agreement must be reached across multiple investors.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Quasi - taxpayer increment financing (cf. Crossrail)	Medium–High - Funding model will capture local businesses that would benefit but, depending on how administered, could also require those who don't benefit to pay.	High - indeed, resources raised may be too much to allocate to shading structures alone.	Low - business rates do not take account of ability to pay.	Low - it may be harder to justify politically for shading alone unless done as part of larger-scale regeneration. Identifying who should pay could be challenging.	Low–Medium - for businesses, legislation already exists, such as the Business Rate Supplement Act. Challenges in identifying who should face levy increases.
Infrastructure provider model	Moderate - on average. High - for transport companies if it helps to reduce service disruption, lower for other utilities.	Low–Moderate - only likely to be relevant in select number of areas.	Moderate - depends on marginal funding source for the infrastructure provider. However, shading will be located in areas that benefit infrastructure providers that may not align with needs of vulnerable populations.	High - if restricted to cases where there are clear benefits to infrastructure users (and providers).	Moderate–High - can leverage existing infrastructure funding and financing arrangements.
Levies and mandates					
Developer funded models	Moderate–High - if there is greater interest in development because of the shading measures and/or if cost passed through to buyers/renters. Lower for CIL funding.	Low–Moderate - limited potential for scale given viability considerations and competing demands on any revenue raised through developer	Moderate - if part of s.106 agreement then likely to skew towards more affluent developments. If CIL, there is more scope for vulnerable populations to benefit. Costs would be covered by developers and tenants who are likely to be comparatively more affluent.	Medium - the main concern will be around balancing this with viability considerations.	Medium – developer contributions through s.106 or CIL are broadly a proven model, however any expansion of their use for these measures may

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
		contributions. Scale also depends on pipeline of new development. Will not cover ongoing maintenance costs.			require public consultation, stakeholder support, and local government and/or government approval.
Resident levy	Medium–High - residents are key beneficiary but compared with urban greening measures, residents will only benefit when directly under shading. Non-residents will also benefit.	High - depending on the scale of the levy but potentially significant.	Moderate - per household levy likely to be regressive but funding can be allocated to focus on vulnerable populations/localities	Low - additional levy for residents are unlikely to be favourable among residents.	Low - a 'climate-resilience' precept would require new legislation and consultation.
Tourist levy	Low–Medium – many tourists likely to benefit directly from the measures when visiting, although they only account for small proportion of total beneficiaries.	Moderate - there will likely be competing demands for these revenues raised.	Moderate - high Funding could be allocated to most vulnerable localities. More affluent are likely to be tourists, although within this group, flat-rate structure means likely to be regressive.	Medium **-** tourism levy may be more acceptable than residential levy but still with some pushback from hospitality sector.	Low–Medium - it would require new legislative powers.
Other models					

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Advertising Model	Low–Moderate - advertisers are likely to only pay if they perceive they benefit from the measures. Key beneficiaries not required to fund.	Medium–High - high in some locations but variable across the city.	Low - shareholders of companies advertising will be affluent, but the model is likely skew development to more affluent areas of city with high footfall.	Medium–High - recognised and accepted as a model elsewhere e.g. bus-stops (although possible concerns over visual clutter).	High - no significant challenges foreseen at this stage.
Solar-integrated shading	Moderate –High - electricity customers are one beneficiary. Alignment will be high if power sales contribute to cost recovery, but only moderate if they cover all costs.	Low–Moderate - only some sites will be suitable for solar PV and likely to only partially contribute to cost recovery.	Moderate - additional electricity generated displaces existing (more expensive) electricity, but sites will be determined by insolation rather than vulnerable population need.	High – as this will allow for lower electricity costs for businesses on the local network connected to the solar PV.	Low–Medium – there may be additional engineering challenges in adding and ensuring security of solar PV.
Corporate sponsorship	Low–Moderate - corporations are only likely to participate if they perceive benefit. Key beneficiaries not required to fund.	Moderate - significant variance across the city is expected, with greatest potential and interest in high footfall areas.	Moderate - sponsorship ultimately paid for by shareholders of companies who have high incomes, but shading measures are likely to favour the most affluent parts of the city.	High – potential concerns about 'privatisation' of public spaces, but likely to be limited given experience in other contexts for urban greening.	High - relatively straightforward (and seen in other urban cooling interventions e.g. Trees for Cities[123])

[123] See Corporate Partnerships | Trees for Cities

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Charity and community organisations	High - as community organisations/charities, internalise benefits accruing to others.	Low–Moderate - can support specific projects but unlikely to meet city-wide needs alone.	High - most likely to focus on vulnerable populations/localities.	High - unlikely to be controversial.	High - relatively straightforward (and seen in other urban cooling interventions e.g. Trees for Streets)[124]

Deep dive: Maintaining, raising awareness of and, where possible, expanding public drinking water points and public toilets

Table 28: Indicative benefits register

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Increased comfort, dignity and welfare for users	Water fountains and public toilets make hot weather journeys and time spent outdoors safer and more tolerable, supporting comfort, dignity and confidence to	• All users of public space (residents, visitors, tourists) but especially vulnerable groups such as older people, people with disabilities, carers with children • Retailers and other service providers	• Wider benefits to UK society (monetisable if WtP estimate can be generated)[125]	High - key motivation for action, all users receive benefit.	Ongoing after provision is expanded and awareness increased, with greatest benefits in hot weather.

[124] See Trees for Streets - Let's fill our streets with trees
[125] WtP measure would also capture occupant-share of benefits from increased productivity, improved learning outcomes, reduced mortality, reduced morbidity and lower energy costs.

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
	remain in public space.				
Reduced mortality	Improved access to drinking water, and confidence to hydrate because toilet provision is available, can reduce dehydration-related risks and lower the risk of heat-related premature death, especially among vulnerable groups	• All users of public space (residents, visitors, tourists) but especially vulnerable groups such as older people, disabled, carers with children	• Wider benefits to UK society (monetisable)	Low - high value attached to each avoided death but very small attributable reduction expected.	
Reduced morbidity	Improved access to drinking water and toilets reduces dehydration, heat stress and related illness, and may reduce associated healthcare demand.	• All visitors/users (residents, visitors, tourists) especially those with underlying health conditions • NHS organisations	• Wider benefits to UK society (monetisable) • Indirect public sector benefit (cash releasing)	Moderate – potential health benefits are of high value for some exposed users in hot weather, but moderate attributable reduction on morbidity expected.	

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Enhanced productivity for outdoor workers	Access to drinking water and toilets supports safer, more comfortable and more productive work in hot weather for people spending long periods outdoors.	• Outdoor workers • Employers of outdoor workers	• Wider benefits to UK society (monetisable) • Indirect public sector benefits (monetisable non-cash releasing benefit)	Moderate - useful for exposed workers, but this group make up a relatively small number of beneficiaries when compared to e.g. retrofitting office spaces.	
More sanitary environment and reduced costs of street clear up	Better access to public toilets can reduce street fouling and associated cleaning, improving the local environment and reducing clean-up costs.	• All visitors/users (residents, visitors, tourists) of public spaces • Retailers and other service providers • Local authorities	• Direct public sector benefit (cash releasing) • Wider benefits to UK society (either monetisable or qualitative)	Moderate - likely to be locally important but only in areas with existing problems.	Ongoing after provision is expanded and awareness increased.
Reduced costs of managing plastic waste	Greater use of public drinking water fountains can reduce demand for bottled water, lowering single-use plastic waste and associated	• Local authorities • All visitors/users (less unsightly rubbish)	• Direct public sector benefit (cash releasing) • Wider benefits to UK society (either monetisable or qualitative)	Low–Moderate - likely modest relative total waste management costs.	

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
	waste management costs.				
Reduced transport service disruption	In transport hubs and other high-footfall locations, access to drinking water and toilets can reduce passenger distress and help avoid disruption associated with heat-related incidents.	• Public transport users • Public transport operators	• Wider benefits to UK society (monetisable or qualitative)	Low - limited to certain locations	Ongoing after provision is expanded and awareness increased, with greatest benefits in hot weather.

Table 29: Identification of beneficiaries from expanding coverage and raising awareness of water fountain and public toilet provision

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
Residents	Improved comfort, well-being and reduced risk of heat stress while in public places. These will likely be particularly felt by vulnerable groups	High – people across London engaging in public spaces are likely to benefit.	Economic - improved health and well-being. Financial - some financial effects if improved health and wellbeing leads to increases in productivity	High - for overall improvements to well-being[126], although attributing morbidity improvements to

[126] The Royal Society for Public Health (RSPH) found that more than half the public practice deliberate dehydration before going outside, which can seriously affect health and exacerbate existing medical problems, on account of poor public toilet provision. RSPB (2019): Taking the P: Improving public toilets in the UK

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
	including older people and those facing homelessness.		and wages or income otherwise potentially lost as a result of heat-induced health impacts.	measures may be challenging. Low - for translating benefits to financial benefit.
Outdoor workers	Improved comfort and well-being, reduced risk of heat stress while in public places.	Medium–High -especially for those with prolonged exposure. Extent to which workers can access facilities is unclear	Economic - improved wellbeing. Financial - some financial effects where gains are reflected in wages or income otherwise potentially lost as a result of heat-induced health impacts.	Moderate - clear impact of extreme heat on outdoor workers but it is unclear how much these measures will ameliorate these impacts.
Hospital management and other patients	Easy access to water will reduce likelihood and severity of heat stress, as well as sanitation benefits reducing pressures on the NHS, including reduced ambulance call outs.	Medium–High - strong evidence that heatwaves drive sharp spikes in hospital admissions. However, there is currently little evidence attributing these measures to reduced morbidity and callouts and such evidence would be challenging to develop.	Economic	Low - impact on healthcare admissions as a result of these measures are unclear.
Businesses supplying water fountains /toilets	Increases in revenues/profits from sale of fountains, toilets etc.	Medium–High -depends on roll out assumptions.	Financial	High

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
Water suppliers	Increases in revenue/profits from sale of water; meeting regulatory and/or CSR objectives.	Medium–High - high if costs covered by regulatory settlement, medium if justified by CSR and/or branding benefits. Depends on roll-out assumptions.	Financial	Low - depends on whether/how costs are recovered.
Visitors/ tourists	Improved comfort and wellbeing, reduced risk of heat stress while in public places.	Medium–High - smaller absolute numbers than for residents, same intensity of benefits but likely less access to and knowledge of other sources of water and toilet facilities.	Economic	High - for overall benefit Low - for translating benefits to financial benefit.
London Boroughs	Reduced cost from street clean ups and from managing waste of plastic bottles as well as lower pressure on emergency response coordination and public health responses.	Medium–High - all benefits could be locally material.	Fiscal	Low–Medium - cash releasing impact is unclear.
Employers of outdoor workers	Higher levels of productivity/lower levels of absenteeism and health related disruption.	Medium – productivity gains depend on worker access and employer capture.	Financial - reduced absenteeism and disruption caused by heat-induced health impacts, reflecting partial capture of productivity gains.	Low – uncertainty around extent of productivity benefit compounded by uncertainty over employer capture.

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
Central government	Lower costs from avoided and/or shorter NHS admissions.	Medium - benefits depend on reduced morbidity materialising.	Fiscal	Low–Medium - unclear how much of the benefits are cash-releasing.
Commuters	Improved comfort and well-being, reduced risk of heat stress while in public places.	Medium - large number of beneficiaries, but many will have relatively easy access to other sources of water or toilet facilities.	Economic - improved wellbeing. Financial - some financial effects where productivity gains are reflected in wages or income otherwise lost due to heat exposure and associated health impacts.	High - for overall benefit. Low - for translating benefits to financial benefit.
Retailers and other service businesses	Easy access to water fountains and toilets will result in more visitors staying for longer, increasing footfall and spending. Most likely to be felt by businesses that don't offer toilet/water provision for their customers.	Medium - as more facilities increase dwell time, increasing revenues.	Financial	Low - varies significantly by location.
Transport operators	Toilets and water provision increase customer comfort, supporting customer retention and reducing risk of service disruption linked to health incidents.	Low–Medium - only portion of toilets/fountains will be relevant for passengers.	Financial - if private operators. Fiscal - if public operators.	Medium

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
Insurers	Greater availability of fountains and toilets reduces insurance claims resulting in heat risk e.g. hospital admissions covered by travel insurance, income protection policies.	Low - only small, indirect reduction in claims.	Financial	Low – limited evidence. Further analysis needed to understand links between heat risk and insurance.

Table 30: Funding and financing archetypes for expanding coverage and raising awareness of water fountain and public toilet provision

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
Taxpayer funded models				
Local government funded/financed model	Local authorities use revenues and/or borrows (including potentially through municipal bonds) to finance provision with repayment from council tax/retained business rates.	Local authority revenue providers (mainly council tax and business rate payers).	Local authorities and their lenders.	
Community toilet schemes	Local authorities uses revenues to pay businesses to make toilets (and fountains, where available) freely accessible to all members of public.	Local authority revenue providers (mainly council tax and business rate payers).	Owners of the businesses providing access to toilets and fountains (and their finance providers in turn).	
Central government funded mode	Central government provides ringfenced funding for London boroughs (all local	National taxpayers.	National government and its lenders).	This was proposed in June 2025 by the London Assembly.

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
	authorities) in exchange for statutory duty to provide and expand provision.			
TfL Local Implementation Plan (LIP) funding	TfL provides funding to London Boroughs to implement actions that align to the Mayor's Transport Strategy.	TfL passengers, local taxpayers and other contributors to TfL budget.	TfL and its lenders.	
User funded models				
Local Authority provision with user fees	Local authorities use revenues and/or borrows (including potentially through community/municipal green bonds) to finance provision with (partial) repayment through access fees.	Customers of toilets and fountains.	Local authorities and their lenders.	
Fully private provision	Private providers of toilets and fountains provide facilities where they can get planning permission and charge for access.	Customers of toilets and fountains.	Private companies and their finance providers.	
Hybrid funding models				
Public-private partnership (PPP)	Local authority offers contract for the provision and/or upgrade of services over a defined period of time, with contractors receiving revenue from users and/or taxpayers (the latter potentially on a performance-linked basis).	Likely to be a combination of Local authority revenue providers (mainly council tax and business rate payers) and/or customers of toilets and fountains.	The successful PPP contractor and its financiers.	

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
Outcome-based / pay-for-performance PPP	As above, but payments are linked to the outcomes achieved by successful contractors.	Local authority revenue providers (mainly council tax and business rate payers) and/or customers of toilets and fountains.	The successful PPP contractor and its financiers.	
Strategic co-funding				
Water company funded model	A single, or group of water companies invest in fountains and/or toilets either as a CSR initiative or as part of regulated business plans to meet its strategic objectives.	Water company customers.	Water company financiers.	Builds off previous Thames Water model (and experience in Scotland), although now concluded. Likely to work for fountains more than toilets.
Corporate sponsorship	Local authorities (London Boroughs) or regional authority (GLA) finance the provision of fountains and/or toilets but recoup a proportion of the costs through providing sponsorship opportunities (see for example Santander bike hire scheme or Thames Water model).	Company providing sponsorship (and its financiers) in addition to local authority revenue providers and users in cases where there is a residual cost to be recovered.	Local authorities and their lenders.	
Advertising funded infrastructure	A private provider installs and maintains facilities in exchange for rights to advertising revenue.	Advertisers	Private infrastructure/advertising company.	
Levies and mandates				
Developer funded model	Developer contributions via Section 106 planning	Developers (and their shareholders) as well as	Shareholders and lenders of development	Section 106 agreements typically

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
	obligations to provide fountains/public toilets and/or Community Infrastructure Levy (CIL) - either Borough and/or Mayoral - which is earmarked for provision of fountains or toilet facilities.	buyers/tenants in their development.	companies and/or through retained earnings.	fund infrastructure that is directly linked with a development, whereas Community Infrastructure Levy (CIL) receipts can generally be spent on infrastructure anywhere within the charging authority's area.
Levy/mandate on those with outdoor workers	Require companies with 'large' number of outdoor workers in London to install facilities as part of workplace safety/planning requirements and either make them available to general public or pay supplement that can help fund general public provision.	Companies with outdoor workers (and their customers/shareholders).	Finance provides and customers of those with outdoor workers.	
Resident levy	Residents pay a small additional levy on council tax bills that is explicitly hypothecated for water fountains and public toilet provision.	Residents	Typically treated as providing revenue funding (i.e. funding = financing) but could support borrowing by local authority if revenues are stable.	Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. shading structures.
Tourist levy funding	Tourists pay 'tourist tax' that is ringfenced for provision of toilets and fountains (and other heat adaptation actions).	Tourists	Typically treated as providing revenue funding (i.e. funding = financing) but could support borrowing by local	Could be combined with other measures intended to provide cooling and wider

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Other
			authority if revenues are stable.	amenity benefits i.e. urban greening.
Other				
Philanthropic, charitable and community funding	Charitable funders, lottery distributors, foundations, charities and community groups provide grants, donations or fundraising support. Can include crowdfunding and volunteer-led delivery.	Lottery players, charity donors, philanthropic foundations, community fundraising.	Likely to be treated as revenue, no financing required.	

Table 31: Assessment of funding and financing archetypes for expanding coverage and raising awareness of water fountain and public toilet provision

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Taxpayer funded models					
Local government funded/financed model	Moderate–High - both local authorities and residents (as the primary local authority taxpayers) are among beneficiaries but funding falls on general taxpayers who may not always use the	Low - local government financing is already experiencing severe funding challenges.	Moderate - benefits could be targeted towards geographies where needs are most acute, no charge for access. However, local authority funding is relatively regressive.	High - well known and broadly accepted model so long as funding for cleaning and maintenance is sufficient. 90 per cent of the public want to see more	High - model already well-established.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	facilities. Significant use expected from non-local taxpayers.			public funding for public toilets.[127]	
Community toilet schemes	Moderate–High - both local authorities and residents (as the primary local authority taxpayers) are among beneficiaries.	Moderate–High - while local authority financial resources are constrained, access payments need not cover new capital costs so coverage can be extended further (at least in relation to toilets).	Moderate - as with above model, focus can be placed on geographies where needs are most acute and ensure no charge for access. However, facilities willing to offer access may skew in a way that doesn't favour the most vulnerable. Local authority funding is also regressive comparative to national taxation.	High - already relatively well-established model and ongoing cleaning and maintenance more likely to be addressed.	High - already well-established e.g.in Richmond.[128]

[127] British Cleaning Council (2025) Nine in ten call for more funding for public toilets ahead of Autumn Budget, say results of BTA survey.
[128] See Richmond.gov.uk (2026) Toilets

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Central government funded mode	Moderate - while central government sees some benefits, this places all funding responsibility on national taxpayers.	Depends on the willingness of central government to provide resources. Potential to be high but with wide variance, especially given current fiscal context.	Potential to be high – requirement would be placed on all local authorities. Central government taxation is comparatively progressive.	Moderate - incremental impact on government budget would be low, although current fiscal may pose a barrier to acceptability.	Moderate – involvement of central government in toilet/fountain provision is currently relatively low, although no intrinsic deliverability barriers foreseen.
TfL LIP Funding	Moderate - pooled nature of TfL funding implies passengers and taxpayers across London are supporting localised schemes.	Low - can only be used for investments aligned to Mayor's transport strategy.	Low–Moderate - much LIP funding ultimately sourced from council tax (which is regressive) and passenger fares (especially for bus travel, which is likely to also be regressive). Some scope to target deprived areas, but this is limited by the need to align to transport needs.	Moderate–High – the mechanism is already widely accepted. However, while toilets and fountains are consistent with the Healthy Streets principles underpinning LIP funding, there is limited evidence of LIP being used to fund these assets to date. Possible concern that this could crowd out other active travel interventions.	High - modalities already well established.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
User-funded models					
Local authority provision with user fees	High - only those who use the facilities have to fund the facilities, assuming user fees allow full cost recovery.	Low - user fees only likely to raise significant funding in high footfall areas.	Low–Moderate - local authority ownership can influence location decisions towards more vulnerable locations but user fees will impede access to most vulnerable.	Low - broad public expectation that public toilets and fountains should be free at point of use which this model would undermine.	High - variant of already well-established model already well-established.
Fully private provision	High - only those who use the facilities have to fund the facilities, assuming user fees allow full cost recovery.	Low - user fees only likely to raise significant funding in high footfall areas.	Low - only most affluent locations likely to be selected and user fees will impede access to the most vulnerable.	Low - broad public expectation that public toilets and fountains should be free at point of consumption.	High - variant of already well-established model.
Hybrid-funding models					
Public-private partnership (PPP)	Moderate–High - depending on relative balance of user fees versus taxpayer-funded 'availability payments' from public authorities to the contractor.	Low–Moderate - removing financing obligations on local authorities should increase resource availability. This model is however till limited by funding available by local authorities and the scale of potential user fees. Spreading	Moderate - depends on the balance between user fees versus availability payments. The contract can specify locations where facilities must be provided.	Moderate – there may be some concern over the 'privatisation' of facilities otherwise expected to publicly funded and financed, but this may be limited if access broadly increases	Low - PPP contracts may have high transaction costs given assets are spread across large number of sites.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
		assets across a large number of sites may also reduce private sector interest and hence resource mobilisation.		and cleaning and security is maintained. Value for money would need to be carefully assessed.[129]	
Outcome-based / pay-for-performance PPP	High - similar to a PPP model but with the added advantage that payments scale with the magnitude of benefits provided.	Low - likely to require piloting to understand whether and how this model can work. Therefore likely low in the short-term with potential to grow over time.	Moderate – the contract can incentivise outcome delivery in locations where vulnerable populations are located. This may need some funding from user fees to be workable, however.	Medium - the fact that public funding will only be allocated if measures are successful may increase acceptability but there may still be concerns over privatisation of facilities perceived as a public good.	Low - will require greater effort to set up the scheme, including determining and monitoring outcome from toilet and fountain availability.
Strategic co-funding					
Water company funded model	Moderate - if self-funded by water company (in anticipation of	Low - if self-funded. Potentially very high - If costs are included in	Moderate - access is likely to be free at point of consumption. However, if costs	High - absence of direct user fee.	Moderate - there are existing initiatives to build on while making use of the regulatory asset base is already well-established. Willingness of water companies to engage may be limited.[130]

[129] National Audit Office (2018) PFI and PF2
[130] Based on letter from Thames Water CEO to Mayor of London on 16 February 2023, made available under a Freedom of Information Act request. https://www.london.gov.uk/media/104750/download

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	future sales/branding) Low - if socialised into the asset base and recovered across all customers.	the regulated asset base.	are recovered from water bills, then these are broadly regressive.		
Corporate sponsorship	Low–Moderate - although corporates are only likely to participate if they perceive of benefits to them. Key beneficiaries not required to fund.	Moderate - evidence from bike-hire schemes suggest there is potential to raise reasonable revenues but unclear how much interest there may be in public toilets and fountains.	Moderate–High - sponsorship can be sought for entire network including in areas where large numbers of vulnerable people. Sponsorship can help (ensure) provision is free at the point of consumption.	High – there may be some concerns about the 'privatisation' of what is perceived of as a public good, but likely to be limited, especially as it would be expected to allow access to be free at point of use.	High - Relatively straightforward.
Advertising funded infrastructure	Low–Moderate - advertisers will only pay if they perceive they of benefits to them, but it will also mean many benefit without having to pay.	Moderate–High - in some locations but variable across the city and these facilities may not be particularly attractive assets for some	Moderate - shareholders of companies advertising will be affluent, but the model could skew development to more affluent	Medium–High - recognised and accepted as a model elsewhere e.g. motorway service stations. Although there may be possible	Moderate–High - no significant challenges foreseen except possible restrictions on outdoor advertising.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
		brands (especially in the case of toilets).	areas of city with high footfall and associated advertising exposure.	concerns over visual clutter.	
Levies and mandates					
Developer funded model	Low - developers are not key beneficiaries of facilities.	Low–Moderate - limited potential for scale given viability considerations and competing demands on any revenue raised through developer contributions. Scale also depends on pipeline of new development. Will not cover ongoing maintenance costs.	Moderate - if part of s.106 agreement then likely to skew towards more affluent developments. If CIL, there is more scope for vulnerable populations to benefit. Costs covered by developers and tenants who are likely to be more affluent.	Medium - main concern will be that it is perceived as an impediment to development.	Medium - developer contributions through s.106 or CIL are broadly a proven model, however any expansion of their use for these measures may require public consultation, stakeholder support, and local government and/or government approval.
Levy/ mandate on organisations with outdoor workers	Moderate–High - firms employing outdoor workers are key beneficiaries, but they do not benefit from wider public	High - potentially significant depending on rate of any levy.	High - costs will be borne by shareholders of companies with outdoor workers who will tend to be more affluent. Levies can be	Low - likely negative reaction to new levies/taxes from organisations.	Low - the untested model would require design work would need to be undertaken.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	access to toilets/fountains.		recycled to provide facilities. where most vulnerable are located.		
Resident levy	Medium–High - residents are a key beneficiary but residents will only benefit when using facilities. Non-residents will also benefit.	High - depending on the scale of the levy but potentially significant.	Moderate - per household levy likely to be regressive but funding can be allocated to focus on locations of vulnerable populations.	Low - additional levy likely to be resented.	Low - a new precept related to help recover these costs would require new legislation.
Tourist levy funding	Moderate–High - although tourists are likely to only account for small proportion of total beneficiaries, they will likely have a high value as they are able to access facilities given their limited alternatives.	Moderate -especially as three will be competing demands for these revenues.	Moderate–High - funding could be allocated to most vulnerable localities. Tourists are more likely to be affluent, although within this group, a flat-rate structure is likely to be regressive.	Medium – a tourism levy expected to be acceptable as it supports provision of public goods, but there may still face some pushback from the hospitality sector.	Medium - despite plans, tourism levy may take a few years.
Other					

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Charity and community organisations	High - community organisations and charities internalise benefits accruing to others.	Low–Moderate - can support specific projects but unlikely to meet city-wide needs alone.	High – most likely to focus on vulnerable populations and localities.	High - unlikely to be controversial.	High - Relatively straightforward.

Deep dive: Enhancing community cool spaces and linking them with community-led initiatives to increase awareness of heat health risk and engage communities to prepare and respond to heat

Table 32: Indicative benefits register (subject to further evidence collection in pilots)

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Increased comfort and welfare for users	Reduced exposure to high temperatures leads to measurable improvements in wellbeing and comfort while accessing the facilities, with potential benefits from greater social interaction, particularly during extreme heat events.	• All users of cool spaces, but especially vulnerable groups such as older people, people with disabilities, carers with children (so long as they can safely travel to access facilities)	• Wider benefits to UK society (monetisable if WtP estimate can be generated).[131]	High - key benefit is applicable to all users.	Benefits are ongoing during periods of hot weather after cool space provision is expanded and awareness increased,

[131] WtP measure would also capture occupant-share of benefits from increased productivity, improved learning outcomes, reduced mortality, reduced morbidity and lower energy costs.

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Reduced mortality	Provision of accessible cool spaces for those able to access them, potentially lowers excess mortality during heatwaves, although the evidence attributing these benefits to cool spaces remains thin.	• All users of cool spaces, but especially vulnerable groups such as older people, disabled, carers with children (so long as they can safely travel to access facilities)	• Wider benefits to UK society (monetisable)	Low - high valuation per avoided death, but uptake and access among high risks groups is unclear if travel is required. Facilities only provide temporary relief, meaning users return to homes that may overheat.	growing over time as periods of hotter temperatures are projected to rise.
Reduced morbidity	Provision of accessible cool spaces lowers the risk of heat stress and related illness, and may reduce associated healthcare demand, although the evidence attributing improved health outcomes to cool spaces remains limited.	• All visitors/users especially those with underlying health conditions (so long as they can safely travel to access facilities) • NHS organisations	• Wider benefits to UK society (monetisable) • Indirect public sector benefit (cash releasing)	Moderate - high valuation but moderate attributable reduction on morbidity expected.	
Enhanced productivity for outdoor workers (and indoor workers with few alternatives)	Access to cool spaces provides temporary respite for workers which can support more comfortable working conditions, with potential productivity improvements.	• Workers • Employers of workers	• Wider benefits to UK society (monetisable) • Indirect public sector benefits (monetisable non-cash releasing benefit)	Low - Relatively few people are expected to use these facilities, which may not be easily accessible from outdoor work locations. Cool spaces may offer temporary relief but do not improve outdoor workers' day-to-day working conditions.	

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Avoided costs of alternative emergency provision and reduced emergency callouts	Cool space availability can result in reduced emergency response and crisis intervention costs.[132]	• Local authorities • NHS organisations	• Direct public sector benefits (monetisable non-cash releasing benefit)	Moderate - extent to which it can replace other provision remains uncertain. Ongoing research is exploring how cool space-centred interventions may demonstrably lead to avoided emergency callout costs for local authorities and health system.[133]	
Avoided costs of household adaptation	Availability of cool spaces may mean that households choose not to invest in expensive household cooling solutions, with knock on system reduction costs i.e. lower peak electricity demand.	• Households • Energy utilities	• Wider benefits to UK society (monetisable or qualitative)	Low – cool spaces provide temporary respite but are unlikely to replace need for cooling at home, particularly during evenings and tropical nights when cool spaces do not operate. They are only likely to substitute for household cooling in a small number of cases.	Likely accumulating slowly over time after cool space provision is expanded.

[132] In a formal appraisal, this may be captured through separately assessing the costs and benefits of this alternative provision, rather than as a benefit attributable to cool spaces.
[133] Preventing avoidable demand on the healthcare system during summer heatwaves - MACC Hub

Table 33: Identification of beneficiaries from expanding provision of cool spaces

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal?	Confidence
Users (primarily residents living close to cool space)	Improved thermal comfort and wellbeing, potentially improved health outcomes and reduced risk of heat stress.	Potentially high - particularly for people without alternative access to cooling, including those experiencing homelessness and those living in poor-quality rented accommodation, provided cool spaces are well publicised and accessible.	Primarily economic (improved wellbeing), there may be some small financial benefit for the economically active or in cases. where beneficiaries can avoid cost of dwelling-level adaptation.	High - existing evidence indicate cool spaces can improve users' thermal comfort and wellbeing during use.[134] but there is limited evidence directly attributing broader improvements in health outcomes to the provision of cool spaces. Low – the benefits translating to for financial benefit.
Businesses supplying cooling technologies (e.g. air conditioning. reflective materials	Increases in profits from supply, installation and maintenance of cooling technologies used in cool spaces.	Medium - given focus on piloting intervention in the first instance.	Financial	High
NHS providers/hospital system, and existing patients	Easier access to cool spaces may reduce incidence and severity of heat stress, lowering	Low – there is strong evidence that heatwaves drive sharp spikes in hospital admissions, but there is	Economic	Low - more evidence on health benefits of cool spaces needed. Ongoing research is exploring how cool

[134] McGarr, G., Meade, R., Kenny, G. (2023) Indoor overheating influences self-reported symptoms and mood-state in older adults during a simulated heatwave: Effects of mid-day cooling centre use, *Physiology & Behaviour*, 271, 114335

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal?	Confidence
	heat-related admissions and operational pressure.	little evidence on whether cool spaces will have a material impact on reducing admissions.		spaces may be attributed to avoided emergency call out costs for local authorities and health system.[135]
Central government	Lower costs from avoided and/or shorter NHS admissions.	Medium – the per beneficiary benefit is high, even if relatively small number of cases avoided.	Fiscal	Low – as above, since improved health outcomes attributed to cool spaces remain uncertain. There is also uncertainty around how much of the benefits are cash-releasing.
London boroughs and emergency responders	Reduced need for reactive local emergency and welfare response during heat events; improved resilience of frontline services. and potentially lower costs.	Medium	Economic and fiscal	Low – as above, the impact of cool spaces on reduced callouts and emergency response remains unclear.
Family and informal carers	Reduced anxiety and caring burden associated with extreme heat affecting those for whom they have	Low–Medium - carers will benefit from greater assurance that those they have responsibilities for are	Economic - reduced mental health impacts such as stress and anxiety.	Low – although evidence on user welfare is clear, indirect benefit will vary and is less studied.

[135] Lambeth Climate Partnership (2026): Cooling Fiveways: Heat Risk Research Project

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal?	Confidence
	caring responsibilities.	more likely to remain cool.	Financial - possible financial effects if it reduces need for unpaid leave.	
Outdoor workers	Access to respite during extreme heat, reducing short-term heat strain and potentially supporting safe work continuation.	Low–Medium - not expected to be a core target for the cool spaces but impact per user could be high.	Economic, potentially some financial benefit from improved productivity or avoided loss of income.	Low - extent of use is unclear.
Visitors, commuters and tourists	Improved comfort and wellbeing, reduced risk of heat stress.	Low–Medium - not expected to be a core target for the cool spaces but impact per user could be high.	Economic	Low–Medium - extent of use is unclear.
Business/service providers offering cool spaces	Improved utilisation and community value of existing spaces; possible ancillary revenue for some providers.	Low–Medium - target users for cool spaces may have limited discretionary income, potentially greater for those offering non market services.	Financial (or economic if offering non-market services i.e. libraries).	Low–Medium - benefit depends on whether generates revenue or wider community value.
Employers of outdoor workers	Potential reduction in heat-related disruption, fatigue and absenteeism where workers make practical use of cool spaces.	Low - existing evidence suggests benefits are transitory so may not affect post-use productivity.	Financial - reduced absenteeism and disruption), reflecting partial capture of productivity gains.	Low - more evidence on productivity benefits of cool spaces needed.

Table 34: Funding and financing archetypes for expanding cool space provision

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Relevant for which types of cool space (existing function, fixed; mobile; dedicated)
Taxpayer funded models				
Local government funded/financed model	Local authorities use revenues and/or borrows (including potentially through resilience/community bonds) to finance provision including, for example, retrofit costs, with repayment from council tax/retained business rates.	Local authority revenue providers (mainly council tax and business rate payers).	Local authorities and their lenders.	All
Community cool spaces	Local authorities identify, accredit and promote existing venues that voluntarily make their space freely accessible to the public during hot weather.	Existing operators/funders of host buildings.	Usually no separate financing; costs absorbed by host organisations although, implicitly, owners of the businesses. providing access to cool spaces.	Existing function and fixed (existing schemes).
Community cool spaces with local authority payments	Local authority provides payments to encourage existing building owners to make available (or increase the availability of) cool spaces.	Local authority revenue providers (mainly council tax and business rate payers).	Local authority and its lenders.	Existing function, fixed. Potential role for reverse auction to allocate limited funding.
Central government funded model	Central government provides grants or ringfenced funding for London boroughs (all local authorities) to provide cool	National taxpayers.	National government and its lenders.	All

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Relevant for which types of cool space (existing function, fixed; mobile; dedicated)
	spaces including, for example, retrofit costs. Funding could come, for example, from Health Inequalities Fund. Evidence gaps could be addressed through funding provided by research councils.			
User funded models				
Local authority provision with user fees	Local authority uses revenues and/or borrows (including potentially through community/municipal green bonds) to finance provision with (partial) repayment through access fees.	Users of cool spaces.	Local authority and its lenders.	All, although mainly mobile or dedicated.
Commercial provider model	Private providers of cool spaces provide facilities where they can get planning permission and charge for access.	Cool space users.	Private companies and their finance providers.	All, although mainly mobile or dedicated.
Hybrid-funding models				
Public-private partnership (PPP)	Local authority offers contract for provision of cool space over a defined period of time, with contractors getting revenue from users and/or taxpayers.	Likely to be a combination of local authority revenue providers (mainly council tax and business rate payers) and/or users of cool spaces.	Successful PPP contractor and its financiers.	Mobile and/or dedicated.

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Relevant for which types of cool space (existing function, fixed; mobile; dedicated)
Pay-for-performance PPP	As above, but payments are linked to the outcomes achieved by successful contractors.	Local authority revenue providers (mainly council tax and business rate payers) and/or users of cool spaces.	Successful contractor and its financiers.	Mobile and/or dedicated.
Strategic co-funding				
Corporate sponsorship	Local authorities (London Boroughs) or regional authority (GLA) finance provision but recoup some proportion of costs through providing sponsorship opportunities (cf. Santander bike hire scheme).	Company providing sponsorship (and its financiers) plus, if there is a residual cost to be recovered, local authority revenue providers and users.	Local authority and its lenders.	Mobile and/or dedicated.
Utility sponsored resilience hubs	Private company such as a utility provides grants to community organisations to develop cool spaces (and/or directly provides facilities).	Customers and/or shareholders of sponsoring organisation.	Finance providers to the sponsoring organisation, although most likely implicitly as support. coming from CSR and/or retained earnings.	All. PG&E Corporation provides example.[136]
Advertising funded infrastructure	Local authorities (London Boroughs) or regional authority (GLA) finance provision but then sell advertising space to cover costs.	Advertisers	Local authority and its lenders.	Mobile and/or dedicated.
Levies and mandates				

[136] PG&E Corporation (2025): PG&E provides $400,000 in Resilience Hubs Grants to Help Communities Address Climate and Disaster Needs

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Relevant for which types of cool space (existing function, fixed; mobile; dedicated)
Developer funded model	Developer contributions via Section 106 planning obligations to provide cool spaces and/or Community Infrastructure Levy (CIL) - both Borough and/or Mayoral - which is earmarked to these facilities.	Developers and their shareholders, as well as buyers/tenants in their developments.	Shareholders/lenders of development companies and/or retained earnings.	Dedicated - s.106. All - CIL.
Resident levy	Residents contribute through a small additional levy or precept, or through a locally hypothecated revenue stream, to support cool space provision.	Residents	Typically treated as providing revenue funding (i.e. funding = financing) but could support borrowing by local authority if revenues are stable.	All. Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. shading structures.
BID funding	Businesses approve a levy on local business rates with revenue used to fund cool space provision (could also be used within existing BIDs, with levy income reallocated to urban greening).	Existing local businesses, and potentially their customers.	Typically treated as providing revenue funding (i.e. funding = financing) although BID income could be used to leverage further finance if predictable.	Dedicated
Other				
Philanthropic, charitable and community funding	Charitable funders, lottery distributors, foundations, charities and community groups provide grants, donations or fundraising support. This can	Lottery players, charity donors, philanthropic foundations, community fundraising.	Philanthropic, charitable and community funding.	All, although most likely to be existing function, fixed.

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	Relevant for which types of cool space (existing function, fixed; mobile; dedicated)
	include crowdfunding and volunteer-led delivery.			

Table 35: Assessment of funding and financing archetypes for expanding coverage and raising awareness of cool spaces

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Taxpayer funded models					
Local government funded/financed model	Moderate - both local authority and residents (as among most important local authority taxpayers) are among beneficiaries but funding falls on general taxpayers who may not often use facilities.	Low–Moderate - local government financing is already experiencing funding challenges but potential to leverage existing local authority-owned assets e.g. libraries, leisure centres.	Moderate - benefits could be targeted towards geographies and users where needs are most acute, with no charge for access. However, local authority funding is relatively regressive.	Moderate - well known and broadly accepted model but local authorities may be concerned by fiscal impact.	High - model already well-established for similar facilities.
Community cool spaces	Low–Moderate - providers effectively internalising the needs of the direct users, but other beneficiaries do not contribute.	Low–Moderate - focusing on existing facilities increases reach/effectiveness, but reliance on voluntary support limits scale.	Moderate–High - as with above model, focus can be placed on geographies where needs are most acute with no charge for access.	High - already well-established model.	Moderate - already well-established, although some concerns over whether spaces that have been identified offer sufficient cooling benefit. Also, expansion

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
			However, facilities willing to offer access may skew in a way that does not favour most vulnerable.		depends on identifying appropriate spaces.
Community cool spaces with local authority payments	Moderate - both local authority and residents (as among most important local authority taxpayers) are among beneficiaries but funding falls on general taxpayers who may not often use facilities.	Moderate–High - as with current cool spaces scheme, focus on existing assets increases reach while payment to providers increases the likelihood of take up.	Moderate–High - additional public funding compared to above model increases scope for targeting the most vulnerable, but funding source is regressive.	Moderate–High - likely to be acceptable where payments are clearly linked to public access and coverage gaps, though some concern may arise over value for money or subsidising venues already operating.	Moderate–High - builds on existing scheme with additional local authority funding potentially making it easier to assess facilities. Reverse auction mechanism would increase complexity.
Central government funded model	Moderate - while central government sees some benefits, this places all funding	Depends on willingness of central government to provide resources. Potential to be high	High - relatively easy to introduce geographic targeting and central	Moderate - incremental impact on government budget would	Moderate - involvement of central government in cool space provision is currently relatively low, although no intrinsic

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	responsibility on national taxpayers.	but with wide variance, especially given current fiscal context.	government taxation is progressive	be low, although current fiscal context may pose a barrier to acceptability.	deliverability barriers (and already involved in warm room funding).
User-funded models					
Local authority provision with user fees	High - only those who use the facilities have to fund, assuming user fees allow full cost recovery.	Low - funding potential is likely to be limited because the groups most likely to need cool spaces have low ability to pay and charging would suppress demand.	Low - local authority ownership can influence location decisions towards more vulnerable locations, but user fees will impede access to most vulnerable.	Low - a user fee model likely to be resented and with very little political appetite. There is no international precedent.	High – relatively simple model to deliver.
Commercial provision	High - only those who use the facilities have to fund, assuming user fees allow full cost recovery.	Low - funding potential is likely to be limited because the groups most likely to need cool spaces have low ability to pay and charging would suppress demand.	(Very) low - only most affluent locations likely to be selected and user fees will impede access to most vulnerable.	Low - user fee model likely to be resented. There is no international precedent.	High – relatively simple model to deliver.
Hybrid-funding models					

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Public-private partnership (PPP)	Moderate–High - depending on relative balance of user fees versus taxpayer-funded 'availability payments' from public authorities to the contractors are made by national or local government.	Low–Moderate - removing financing obligations on local authorities should increase resource availability, but it is still limited by funding that can be made available by local authorities and any user fees.	Moderate - depends on balance between user fees versus availability payments. Contract can specify locations where facilities must be provided.	Low - likely to be a concern over 'privatisation' of facilities that are expected to target the needs of the most vulnerable.	Low - PPP contracts may have high transaction costs given assets may be spread across multiple sites, increasing transaction costs relative to single-site infrastructure. May become more feasible after pilot phase.
Pay-for-performance PPP	Moderate–High - in principle, this model aligns funding with realised benefits, but practical alignment is weakened by the current difficulty in specifying, measuring and attributing outcomes from cool spaces.	(Very) low - limited evidence on the effectiveness of cool spaces is likely to make it difficult to allocate this risk to private financiers.	Moderate - contract can incentivise outcome delivery in locations where vulnerable populations are located. May need some funding from user fees to be workable.	Low–Moderate - the fact that public funding will only be allocated if measures are successful may increase acceptability but may still be concerns over privatisation of facilities used by most vulnerable.	(Very) Low - challenging given lack of evidence on outcomes from cool room.
Strategic co-funding					

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Corporate sponsorship (local authority financed)	Low–Moderate - although utilities or other corporates only likely to participate if they perceive of the benefits. Key beneficiaries are not required to fund.	Moderate - extent to which companies will wish to associate their brand with cool spaces would need to be tested.	Moderate–High - sponsorship can be sought for the entire network including in areas where large numbers of vulnerable people. Sponsorship can help ensure provision is free at point of consumption.	High - maybe some concerns about 'privatisation' of public spaces, but likely to be limited.	High - relatively straightforward.
Utility sponsored resilience hubs (Utility provides finance)	Low–Moderate - although corporates only likely to participate if they perceive benefit. Key beneficiaries not required to fund.	Moderate - potential to link to existing programmes supporting vulnerable customers.	Moderate - supports free access but utilities may prioritise areas linked to network risk, customer vulnerability programmes or brand considerations rather than heat vulnerability alone.	High - absence of direct user fee.	Moderate–High - relatively straightforward. The existing PG&E initiative[137] shows how it could work – but no existing UK-based precedent.
Advertising funded infrastructure	Low–Moderate - advertisers will only pay if they perceive they benefit, but will mean many benefit without having to pay.	Low - given expected low discretionary income of many users.	Moderate - shareholders of companies advertising will be affluent, but reliance on advertising could skew provision	Moderate–High - recognised and accepted as a model elsewhere, although	High - no significant challenges foreseen.

[137] Ibid.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
			towards high footfall locations.	possible concern about visual clutter.	
Levies and mandates					
Developer funded model	Low - developers and their tenants are not key beneficiaries of facilities.	Low–Moderate - limited potential for scale given viability considerations and competing demands on any revenue raised through developer contributions. Scale also depends on pipeline of new development. Will not cover ongoing maintenance costs	Moderate - distributional outcomes depend on the mechanism: s106 is likely to tie provision to development locations, while CIL offers more scope to direct resources toward wider need.	Medium - main concern will be that it is perceived as an impediment to development.	Medium - developer contributions through s.106 or CIL are broadly a proven model, however any expansion of their use for these measures may require public consultation, stakeholder support, and local government and/or government approval.
Resident levy	Medium–High - residents are key beneficiary but residents will only benefit when using facilities. Non-residents will also benefit.	High – depending on the scale of the levy but potentially significant.	Moderate – per household levy likely to be regressive but funding can be allocated to focus on locations where vulnerable populations/localities.	Low - additional levy likely to be resented.	Low - a 'climate-resilience' precept to fund cool spaces would likely require new legislation.
BID funding	High - schemes will only proceed if local	Low–Medium - depending on who	Low– Moderate - while access could	High - explicit process of	Moderate - existing model architecture

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	businesses can be convinced that they will benefit.	cool spaces target, businesses may not see strong commercial benefit from cool spaces (cf. urban greening).	remain free, plausible that only more affluent areas that can most easily attract additional discretionary spending to cover the costs of the higher business rates will take forward.	requiring consent of businesses should facilitate acceptability.	exists but it may be difficult to convince businesses that they will benefit.
Other					
Charities and community organisations	High - as community organisations/charities, internalise benefits accruing to others.	Low–Moderate - can support specific projects but unlikely to meet city-wide needs alone.	High - most likely to focus on vulnerable populations/localities.	High - unlikely to be controversial.	High - relatively straightforward.

Deep dive: Managing and expanding tree cover and green space in areas of high cooling and shading need and improving access to London's existing blue and green spaces

Table 36: Indicative benefits register

Benefit	Description	Key beneficiaries	Categorisation	Expected magnitude	Timing
Amenity/ recreational value	Expanded tree canopy and green space increase the attractiveness, usability and recreational value of parks, streets and public spaces - including scope for social interaction - especially during hot weather.	• All visitors/users (residents, visitors, tourists) • Retailers and service providers	• Wider benefits to UK society (monetisable)	High - existing natural capital account shows as a key benefit.	Ongoing after tree canopy/green space established (which may take several years depending on type).
Reduced mortality	Green and shaded environments reduce exposure to extreme heat, improve air quality and improve physical and mental wellbeing, lowering the risk	• Both visitors/users (residents, visitors, tourists) and those in the vicinity especially those with underlying health conditions • Healthcare system (especially the NHS) and life insurance providers	• Wider benefits to UK society (monetisable)	High - existing natural capital account shows as a key benefit.	Ongoing after tree canopy/green space established (which may take several years depending on type) with greatest benefits in hot weather.

	of premature death, especially among vulnerable groups.				
Reduced morbidity	Green and shaded environments reduce heat stress and related illness, support physical and mental wellbeing, and can improve local air quality, reducing illness burden and related service demand.	• Both visitors/users (residents, visitors, tourists) and those in the vicinity especially those with underlying health conditions • Patients benefiting from green social prescribing • NHS organisations and other healthcare providers	• Wider benefits to UK society (monetisable) • Indirect public sector benefit (cash releasing)	High - existing natural capital account shows as a key benefit to physical and mental health and wellbeing, although impact on reduced heat-related illness is more limited.	
Enhanced productivity for outdoor workers	Shadier and cooler local environments can reduce heat exposure and discomfort for outdoor workers, supporting safer and more productive work during hot weather. This benefit may also	• Outdoor workers and those working in adjacent buildings • Employers of the same (and their customers)	• Wider benefits to UK society (monetisable) • Indirect public sector benefits (monetisable non-cash releasing benefit)	Low–Moderate - important for exposed workers but number of beneficiaries expected to be small.	

	extend to those working in adjacent buildings.				
Carbon storage	Trees and other green infrastructure store carbon and, over time, can sequester additional carbon, contributing to climate mitigation.	• Global benefit from reduced climate change risks	• Wider benefits to UK society (monetisable)	Low - existing natural capital account shows modest benefit.	Ongoing from point at which tree canopy/green space initiated, growing over time.
Biodiversity	Expanded canopy and green space improve habitat, ecological connectivity and species resilience in the urban environment.	• All visitors/users (residents, visitors, tourists) • Wider UK/global society reflecting services (e.g. pollination) and intrinsic value	• Wider benefits to UK society (either monetisable or quantifiable but not monetisable)	Moderate - heavily dependent on design.	
Flood management, water retention and quality	Green space, soils and vegetation can intercept rainfall, increase infiltration and store water, helping to	• Local communities • Water companies • Local authorities and others involved in emergency response	• Wider benefits to UK society (either monetisable or quantifiable but not monetisable	Moderate–High – society places a high value on reducing flood risk, but the extent to which this benefit is realised will depend on green	

	manage runoff, improve water quality and reduce surface-water flood risk.			infrastructure design and context.	
Lower energy costs	Shade, green roofs and local cooling can reduce solar gains and cooling demand in nearby buildings, lowering energy use and costs where active cooling is used.	• Occupants (energy bill payers) in adjacent buildings • All energy consumers (avoided network expansion from reduced peak demand etc.)	• Wider benefits to UK society (either monetisable or qualitative)	Low - limited to buildings adjacent to green infrastructure.	Ongoing after tree canopy/ green space established (which may take several years depending on type) with greatest benefits in hot weather.
Enhanced food security	Green spaces can provide opportunities for urban growing, while green infrastructure, particularly in outer London and peri-urban areas, can help reduce heat and water stress on productive land, supporting crop resilience, yields and food availability.	• Food producers through more resilient yields • Local communities and participants • Food consumers (both in London and beyond)	• Wider benefits to UK society, with yield effects potentially monetisable and improved food availability/resilience likely quantifiable or qualitative	Low - limited to a small number of areas and pace allocated to urban farming likely to be small.	

Increased commercial activity	Shadier, cooler and more attractive public spaces can increase footfall and dwell time, supporting retail, hospitality and leisure spending. Green spaces can also provide locations for events and filming.	• Retailers and other service provider in and adjacent to areas where green infrastructure is installed • Event organisers and guests, filming/location users	• Wider benefits to UK society (monetisable)	Low–Moderate - localised gains and depends on nature of the green infrastructure and its location.	Ongoing after tree canopy/green space established (which may take several years depending on type).
Increased skills and learning	Accessible green spaces can provide outdoor learning environments for children and young people, supporting engagement and learning outcomes.	• Children and young people using green spaces for learning • Schools, teachers and youth/community organisations • Wider society/economy where improved skills and attainment enhances the productivity of others	• Wider benefits to UK society (either quantifiable but not monetisable or qualitative)	Low - secondary benefit and only small number of people benefit.	

Table 37: Identification of beneficiaries from urban greening for shade and cooling

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
Local residents	Health, productivity, learning and comfort benefits (and lower cooling costs if active cooling installed). Particularly felt by elderly, children and those with otherwise less access to cooling.	High - receive principal amenity, comfort and heat-health benefits.	Economic - improved wellbeing. Financial - some financial effects where gains are reflected in wages or income either through increased productivity and/or through avoided heat-induced health impacts.	High, evidence as reflected, for example, in GLA's Natural Capital account.[138]
Property owners *(often but not always sub-set of above)*	Increase in amenity value and reductions in flood risk leads to property value increases.	High - in London, for each hectare of green space located within a 1-kilometre radius, average house prices are 0.08 per cent higher in London[139] with ONS substantiating this finding[140]. There is also evidence that SuDS treated areas in London have property values 3.2-3.7% higher than non-treated areas, although this is driven mainly by the visibility and amenity value of the green infrastructure, not its hydraulic performance.[141]	Financial	High, given cited evidence

[138] GLA (2017): Natural capital account for London
[139] Smith, D. (2010): Valuing housing and green spaces: Understanding the local amenities, the built environment and house prices in London
[140] ONS (2019): Valuing green spaces in urban areas: a hedonic price approach using machine learning techniques
[141] Wu (2026) Sponge city and impermeable housing value: Evidence from London, Regional Science and Urban Economics, 121: 104264

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
Hospital management and other patients	Fewer hospital admissions (via reduced heat stress, increased physical activity and improved air quality) leading to reduced A&E pressure and lower ambulance demands. Less overcrowding in hospitals and reduced wait times leading to improved clinical outcomes.	Medium–High - London's natural capital account finds that the health benefits of London's public parks account for around £950m, 20% of their total economic value.[142]	Economic - health outcomes as well as fiscal if reducing pressures on health care system can reduce costs.	Medium – evidence on health outcomes is well-substantiated but evidence on how this improves hospital management less established.
Nurseries and other vendors in green infrastructure supply chain	Increased demand for products and services.	Medium–High - depends on roll-out and extent of any displacement.	Financial	High - given these organisations will supply many of the needed inputs.
Central government	Lower costs from avoided and/or shorter NHS admissions. Potential benefit from increase productivity leading to higher tax revenues. Also, possibly, lower flood response costs.	Medium–High – the per case benefit high, even if relatively small number of cases avoided, but benefits are very diffuse.	Fiscal	Medium - unclear how much of the benefits are cash-releasing.
Outdoor workers	Health, comfort/well-being and productivity benefits for those working outside	Medium - important for exposed workers, but limited population.	Economic - improved wellbeing.	Medium - impact of heat on productivity

[142] GLA (2017): Natural capital account for London

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
	e.g. construction workers, street cleaners, police officers.		Financial - some financial effects where gains are reflected in wages or income.	of outdoor workers is well-established; the number of workers likely to benefits is much less clear.
Retailers and other businesses	Increased productivity of workers and/or increased demand for services e.g. retailers, cafes, street markets as urban greening can, in some contexts, increases dwell time in public spaces.[143]	Medium - per employer benefit relatively high but geographically limited.	Financial - reduced absenteeism and disruption, reflecting partial capture of productivity gains.	Medium – some link between green spaces and dwell time especially on hot days, but uncertainty on extent of benefit to retailers.
GLA and London Boroughs	Increase in tax revenues (business rates, council tax) if urban greening measures attract businesses/residents or tourism.	Medium - as extent of benefit is spatially uneven and, by definition, will be a subset of the benefits accruing to others, depending on the size of the tax take.	Fiscal	Low - as link to future tax revenues uncertain.
Tourists/visitors	Health and comfort benefits from cooler urban environment translates into a more pleasant visitor experience.	Medium - benefit intensity is high but short duration.	Economic – economic gains, some of which will then be captured by companies offering services catering to tourists e.g. hotels, attractions.	High - amenity benefits from using green spaces is well established

[143] GLA (2023): Green Canopy Cover and Visitor Activity

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
Water companies	Urban greening can help reduce flood management costs (prior to event); improve water quality (and hence treatment costs and risk of fines for overflows); and, also, depending on design/water use, help reduce risk/management costs associated with drought.	Medium – green infrastructure can provide financial benefits to water companies by reducing flooding, overflow spills and the volume of water requiring treatment. While many green infrastructure shading interventions deliver these benefits, some green infrastructure cooling interventions may not realise these benefits, for example if runoff is not hydraulically connected to green space developed.	Financial	Medium - as scale will depend on design and context
Insurers	Reduced risk of property damage if green spaces help to reduce flood risk. Fewer insurance payouts as fewer people admitted to private health care facilities because of heat-related conditions/fewer life insurance payouts associated with mortality events.	Medium - recognising that links between green infrastructure and flood risk already established. However, for health and life insurance, benefits are likely to be smaller.	Financial	Medium–High - for flood risk. Low - for health and life insurance risk.
Employers of those who benefit from green space	Improved health of employees leads to enhanced productivity.	Low–Medium - only some who make use of green space will be employees and impacts on	Financial - reduced absenteeism and disruption, reflecting partial capture of productivity gains.	Low - due to uncertainty over how many employees will

Beneficiary	Key benefits	Indicative magnitude	Economic/financial/fiscal	Confidence
		health/productivity expected to be moderate and employers only realising a share of that benefit.		benefit and what share will be captured by employers
Education providers	Green spaces provide alternative learning environments and cooling benefits may allow schools to remain open during extreme heat events.	Low - represents only small proportion of total green space users and benefit of keeping schools open will only apply if adjacent to green space.	Economic	Low - uncertain relationship between green space and learning outcomes.[144]
Energy suppliers	Cooling effect reduces need for active cooling in nearby buildings, lowering peak electricity demand and reduced risk of stress on the network.	Low - will depend on the extent of active cooling and limited to adjacent buildings.	Financial	Low–Medium - depends on current and future extent of active cooling.
Global	Enhanced biodiversity, and if cooling measures sequester greenhouse gases, also lower climate change risks.	Low - for biodiversity, benefit depends on nature of greening and extent of connectivity. Low - for greenhouse gases, all benefit but the sequestration potential is relatively small.	Partly economic, partly financial.	High

[144] Browning, M. and Rigolon, A, (2019) School Green Space and Its Impact on Academic Performance: A Systematic Literature Review, Int J Environ Res Public Health, 16 (3):429

Table 38: Funding and financing archetypes for urban greening

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
Taxpayer funded models					
Central government funded model	Central government grants to local authorities or delivery organisations to fund urban greening.	National taxpayers.	HMG and its lenders.	In principle either, but central govt grants tend to be focused on new urban greening assets.	Examples that could be harnessed and/or provide inspiration include England Woodland Creation Offer, Environment Agency grant funding e.g. Water Environment Improvement Fund, or Natural England and Forestry Commission funding.
Local government funded model	Local authorities (London Boroughs) or regional authority (GLA) use existing revenues and/or borrows (e.g. PWLB, municipal/green bond or extension of Green Finance Fund) repaid through council tax, retained business rates or other revenues.	Borough taxpayers, or other providers of local authority revenue.	Local authorities and their lenders.	Both	Eligibility of the Green Finance Fund could be expanded to allow boroughs to access low-cost finance for cooling retrofit, but this depends on boroughs willingness to borrow for this, which has not been clearly expressed to

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
					date. For this reason, this is not something actively explored.
TfL Local Implementation Plan (LIP) funding	TfL provides funding to London Boroughs to implement actions that align to Mayor's Transport Strategy.	TfL passengers, local taxpayers and other contributors to TfL budget.	TfL and its lenders.	Both	
Public-private partnership (PPP) / concession model	Public sector grants concession to private partner who designs and invests in urban greening and receives return from 'availability payments' made by local or national government.	Local or national taxpayers.	Private company or consortium of investors.	Contract would build in maintenance requirements but would typically be applied to new urban greening assets.	
Outcome-based / pay-for-performance PPP	As above, but some or all of the payments are made according to the performance of the greening measures in reducing urban heat islands.	Local or national taxpayers.	Private company or consortium of investors.	Contract would build in maintenance requirements but would typically be	Could be based on either outputs (e.g. trees planted) or outcomes (e.g. reduction in urban heat island). Latter

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
				applied to new assets.	requires careful measurement.
Existing businesses and property owner funding models					
Business Improvement District funding	Businesses approve a levy on local business rates with revenue used to fund urban greening (could also be used within existing BIDs, with levy income reallocated to urban greening).	Existing local businesses (and - potentially - their customers).	Typically treated as providing revenue funding (i.e. funding = financing) although BID income could be used to leverage further finance if predictable.	Both - existing BIDs could be re-allocated to support maintenance of ongoing green asset; new BIDs would likely focus first on developing (and then maintaining assets).	Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. shading structures.
Commercial anchor investment	One or more businesses operating in or adjacent to the area collectively agree to pool resources to invest in urban greening.	Existing local businesses (and - potentially - their customers).	Local businesses.	Both - although may be easier to get investment when new green urban greening is	Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. shading structures.

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
				being developed.	
Quasi - taxpayer increment financing (cf. Crossrail)	Businesses required to pay additional business rates (and/or property owners) when urban greening is complete. Local authorities can borrow on expectation of future increases (cf. Crossrail).	Existing local businesses (and – potentially - their customers).	Local Authorities and their lenders.	New - logic implies that taxpayers pay more once additional assets have been developed.	Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. shading structures.
Infrastructure provider model	Infrastructure providers (water companies, transport providers, energy distribution companies) are mandated to support urban greening measures in recognition of the benefits these measures will bring to their users/customers.	Customers/users of the infrastructure.	Depends on how the infrastructure company is financed.	Both	
Levies and mandates					
Developer contribution models	Developer-led planning and regulatory requirements, including Section 106 planning obligations,Requirement,	Developers (and their shareholders) as well as buyers/tenants in their development.	Shareholders/lenders of development companies and/or retained earnings.	Both - new assets would work as per standard s106 or CIL	Section 106 agreements typically fund infrastructure that is directly linked with a development,

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
	Biodiversity Net Gain obligations, Community Infrastructure Levy (CIL) – both Borough and/or Mayoral - earmarked for urban greening. A further potential future source of revenue could be to include levy on new buildings/developments that don't meet ambitious cooling thresholds that are then recycled to urban greening (and other heat risk measures).			contributions. Maintenance could be supported by pooling developer funds into endowment fund (see below).	whereas Community Infrastructure Levy (CIL) receipts can generally be spent on infrastructure anywhere within the charging authority's area. Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. shading structures.
Resident levy	Residents pay a small additional levy on council tax bills that is explicitly hypothecated for urban greening measures (and similar).	Residents	Typically treated as providing revenue funding (i.e. funding = financing) but could support borrowing by local authority if revenues are stable.	Both	Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. shading structures.

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
Tourist levy	Tourists pay 'tourist tax' that is ringfenced for urban greening.	Tourists	Typically treated as providing revenue funding (i.e. funding = financing) but could support borrowing by local authority if revenues are stable.	Both	Could be combined with other measures intended to provide cooling and wider amenity benefits i.e. shading structures.
Other funding models					
Carbon, biodiversity and/or flood reduction crediting (RFC)	Credit buyers purchase units from green infrastructure projects that reflect the quantified benefit they provide towards either of these objectives. This provides a funding stream of these projects that allows finance to be raised.	Actors purchasing credits and their shareholders/customers. For carbon credits, could be any corporate. For biodiversity, likely to be those needing to deliver Biodiversity Net Gain (BNG). For FRC, likely to be water companies, insurers, businesses at risk of flooding or Environment Agency.	Funding model could support either public or private finance of the measures (or a blend). Public investment could be directed to early-stage activities. If credits are pre-purchased, then funding = financing.	Both	Public finance could be structured through London Nature Investment Vehicle or equivalent as proposed by Finance Earth. Buyer interest in 'credit stacking' i.e. selling multiple environmental attribute certificates from same GI would need to be established Relies on synergy between green infrastructure for cooling and green

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
					infrastructure for biodiversity/flood reduction.
Outcome bond to leverage crediting potential	GLA (or other highly-rated entity) issues principal-protected bonds without guaranteed interest payments (to impact investors). Expected interest payments are capitalised and passed to project development company that invests in urban greening projects with crediting potential. Successful credit generation allows investor to receive interest payments.	Combination of actors purchasing credits (and their shareholders/ customers) but with additional risk absorbed by impact investors.	Impact investors.	Either, but possible bias towards new. Requirement for crediting revenue to demonstrate additionality is likely to be easier for new assets.	Already used by World Bank in various transactions including to support ecosystem restoration in South Africa.[145]
Blended finance endowment fund	Endowment fund capitalised by public and private finance established and invests	Diversified portfolio of fixed income security issuers and any finance providers who are willing	Blend of public finance (GLA, London Boroughs, s106 contributions	Explicitly targeted at maintenance.	Some similarities for Tropical Forest Forever Facility.[146]

[145] World Bank (2026): World Bank Prices 14-Year Spekboom Restoration Outcome Bond in South Africa
[146] TFFF - Tropical Forest Forever Facility

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
	in fixed income securities. Returns from investments partially meet maintenance needs and partially provide return to investors.	to accept below risk-adjusted market returns (could be either public or private).	from developers) – taking 1st loss position – and private investors.		If independent governance arrangements established, then payments to boroughs could be made on a results basis. Potential to be integrated into agenda for local investing (although this may narrow investment potential for fund too much).
Social value investment through public authorities	Public bodies, utilities, NHS trusts, universities etc. commit to delivering social value as part of contracts, regeneration schemes or estate strategies. GI is included because it contributes to wellbeing, climate resilience, biodiversity, amenity, skills and/or community outcomes.	Depends on the institution undertaking the investment. Could be taxpayers (public bodies, NHS Trusts), utility customers (utilities), students/taxpayers (universities).	Depends on the institution undertaking the investment but often public sector and its lenders.	Either, but possible bias towards new given link to new development.	

Model	How does it work?	Who is ultimately funding?	Who is providing the finance?	New assets or maintaining existing assets?	Other
Corporate sponsorship	Corporates fund urban greening measures and gets branding/naming rights (no ownership).	Company CSR or marketing budgets.	Likely to be treated as revenue, no financing required.	Either, but potential sponsors may be easier to find for new assets.	
Philanthropic, charitable and community funding	Charitable funders, lottery distributors, foundations, charities and community groups provide grants, donations or fundraising support for urban greening, restoration and stewardship. Can include crowdfunding and volunteer-led delivery.	Lottery players, charity donors, philanthropic foundations, community fundraising.	Likely to be treated as revenue, no financing required.	Both, although possible bias towards new assets or major refurbishment.	Includes National Lottery Heritage Fund and National Lottery Community Fund/ Support could be aggregated into a GLA-backed fund which then facilitates other funding models e.g. GMEF. Could be organised through Community Improvement Districts.

Table 39: Assessment of funding and financing archetypes for urban greening

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Taxpayer funded models					

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Central government funded model	Moderate - given NHS savings, although intervention is less effective at targeting most vulnerable populations (that are responsible for greatest health care costs) than, e.g. retrofits.	Depends on willingness of central government to provide resources. Potential to be high but with wide variance, especially given current fiscal context.	High - all would be able to benefit from greening and taxation system is strongly progressive.	Moderate–High - incremental impact on government budget would be low, although current fiscal context may pose a barrier to acceptability. Acceptability likely to be highest when integrated within existing funding structures for development and regeneration.	High - although delivery model for disbursing funding would need to be decided.
Local government funded model	High - assuming urban greening provides benefits to all (tax-paying) residents, although some benefits will accrue to non-residents i.e. tourists, commuters. Some benefits will accrue to local taxpayers even if they do not directly make use of urban	Medium - likely to be lower than for central government funded model.	Moderate - all would be able to benefit but funding via council taxes (especially) likely to more regressive than overall tax system.[147]	Medium - current fiscal context may pose a barrier to acceptability for some local authorities.	High - although delivery model for disbursing funding would need to be decided.

[147] Bourquin, P. and Waters, T. (2019) The Effects of Taxes and Benefits on UK inequality, IFS Briefing Note BN249

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	shading i.e. air pollution benefits.				
TfL LIP funding	Moderate - pooled nature of TfL funding implies passengers and taxpayers across London are supporting localised schemes.	Low - can only be used for investments aligned to Mayor's transport strategy.	Low–Moderate - much LIP funding ultimately sourced from council tax (regressive) and passenger fares (especially for bus travel, likely to be regressive). Some scope to target deprived areas, but limited by need to align to transport needs.	Moderate–High - already established and widely accepted. However, LIP has not been used to deliver green infrastructure consistently to date and faces competing priorities for its use.	Moderate–High - this mechanism is already operating, however it does not consistently deliver green infrastructure.
Public-private partnership (PPP) / concession model	Moderate–High - depending on whether funding comes from local or national taxpayers.	Moderate–(potentially) High - depending on whether availability payments made by national or local government.	Moderate–High - depending on source of availability payments.	Low - may be concerns about the 'privatisation' of green space (expected to be higher than for other 'concrete' assets) and, based on historic experience, concerns over whether	Low - PPP models require additional upfront transaction costs to, for example, appropriately allocate risks

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
				it offers value for money.	that may be difficult to justify given relatively low capital need.
Outcome-based / pay-for-performance PPP	Moderate–High - depending on whether funding comes from local or national taxpayers.	Low - likely to require piloting to understand whether and how it can work, so likely low in the short-term but potential to grow over time.	Moderate–High - depending on source of payments.	Medium - the fact that public funding will only be allocated if measures are successful may increase acceptability but may still be concerns over privatisation of green space.	Low - as above but will also require greater effort to set up scheme, with particular challenge around determining heat reduction KPIs and monitoring progress.
Existing businesses funding models					
Business Improvement District funding	High - schemes will only proceed if local businesses can be convinced that they will benefit)	Medium (on average) - within local areas where schemes go ahead then resources may be significant, but likely to result in uneven distribution of funding across the city (as unlikely to get consent from businesses in some areas).	Low–Medium - plausible that only more affluent areas that can most easily attract additional discretionary spending to cover the costs of the higher business rates will take forward. These may not be the areas of greatest need.	High - explicit process of requiring consent of businesses should facilitate acceptability. This will be reinforced if the BID is able to then attract new businesses into the area.	Moderate–High - Existing model architecture exists but may be difficult to convince businesses that they will benefit.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Anchor investment	Moderate - costs would be covered by specific companies and its customers, rather than all beneficiaries of greening measures.	Low - likely to be few sites where single/small number of anchor investees can be found.	Low - plausible that only more affluent areas that can most easily attract additional discretionary spending to cover the costs of the investment will take forward. Benefits may be restricted to customers of anchor investees.	Low–Moderate - may be concerns about the 'privatisation' of green space.	Medium–High - if single anchor investor then relatively straightforward, more challenging if agreement has to be reached across multiple investors.
Quasi - taxpayer increment financing (cf. Crossrail)	Medium–High - funding model will capture local businesses that would benefit but, depending on how administered, could also require those who don't benefit to pay.	Potentially very high - indeed, resources raised may be too much to allocate to urban greening alone.	Low - business rates do not take account of ability to pay.	Low–Medium - may be harder to justify politically for greening alone unless linked to wider regeneration. Identifying who should pay could be politically contentious.	Low–Medium - for businesses, legislation already exists (Business Rate Supplement Act). No mechanism to capture houses. Challenges in identifying who should face levy increases.
Infrastructure provider model	Moderate (on average) - could be high for water companies if greening provides	Moderate - only partial intersection between infrastructure user needs and that needed for cooling could mean that	Low - in general these costs account for larger share of low-income spending than for more	High - if restricted to cases where there are clear benefits to infrastructure users (and providers).	Moderate–High - can leverage existing infrastructure funding and

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	water supply/quality co-benefits and for greening at transport hubs. Less for energy utilities. May be tension between designs that maximise cooling and that deliver other benefits.	some cooling needs overlooked.	affluent. Furthermore, greening will be located in areas that benefit infrastructure provider that may not align with needs of vulnerable populations.		financing arrangements. Regulatory processes could be quite slow and bureaucratic.
Levies and mandates					
Developer funded models	Moderate–High - if there is greater interest in development because of the greening measures and/or if cost passed through to buyers/renters. Lower for CIL funding.	Low–Moderate - limited potential for scale given viability considerations and competing demands on any revenue raised through developer contributions. Scale also depends on pipeline of new development. Will not cover ongoing maintenance costs	Moderate - if part of s.106 agreement then likely to skew towards more affluent developments. If Community Infrastructure Levy then more scope for vulnerable populations to benefits Costs covered by developers and tenants who are likely to be more affluent.	Medium - main concern will be that it is perceived as an impediment to development.	Medium - developer contributions through s.106 or CIL are established mechanisms, but their use to expand green infrastructure further depend on local authority priorities and compete with other potential uses of these funding streams.

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
Resident levy	High - residents are key beneficiaries of urban greening and can generate benefits even when not directly accessing 'greened' locations.	High - depending on the scale of the levy but potentially significant.	Moderate - per household levy likely to be regressive but funding can be allocated to focus on vulnerable populations/localities.	Low - additional levy likely to be resented.	Low - a 'climate-resilience' precept would require new legislation.
Tourist levy	Moderate–High - tourists will benefit while in city, but only one of a wide number of beneficiary groups.	Moderate - especially as there will be competing demands for these revenues.	Moderate–High - Funding could be allocated to most vulnerable localities. More affluent are likely to be tourists, although within this group, flat-rate structure means likely to be regressive.	Medium - tourism levy may be more acceptable mechanism for green infrastructure than resident levy but still with some pushback from hospitality sector.	Medium–High - despite plans, tourism levy is not yet certain and implementation will take a few years.
Other funding models					
Carbon, biodiversity and/or flood reduction crediting	Moderate (on average) - generally strong overlap but may be tension between designs that maximise cooling benefits and those that generate these other benefits. Key beneficiaries	Low–Moderate - only partial intersection between carbon/biodiversity/flood reduction and interventions needed for cooling could mean that some cooling needs are overlooked. Further challenges as only some	Moderate - it will depend on the organisation purchasing the credits and how they recover their costs. Location of greening will be targeted toward ecosystem benefits that may not	Moderate–High - assuming crediting schemes are considered credible.	Low–Moderate - flood reduction credits not well established, stronger for biodiversity and highest of all for carbon, although carbon crediting can still be

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
	not required to support.	projects will be a good match for crediting programmes and there are currently not a lot of opportunities identified in London, while voluntary nature of many credit purchases will limit funding scale.	align with needs of vulnerable.		difficult to urban green infrastructure projects. Further work required on exploring potential for credit stacking and possible need for aggregation vehicles.
Outcome bond to leverage crediting potential	Low–Moderate - same as above, with extra implicit funding provided by (impact) investors being willing to accept risk of non-interest repayment (despite not being beneficiaries).	High - by separating issuer and project risk, it is easier to attract capital for high-risk crediting projects. 10 -year bond of £50m at 5 per cent coupon → PV of foregone interest of around £20m.	Moderate–High - same as above but additional risks being absorbed by impact investors.	Moderate–High - in principle attractive but may be seen as complicated. Requires impact investors willing to purchase bonds.	Low - significant transaction costs.
Blended finance endowment fund	High - assuming that it is local government taxpayers who implicitly fund by accepting below market returns.	Moderate–High - would depend on whether private investors can be successfully leveraged.	Moderate - assuming implicit funding is from local govt given their tax base is regressive. However, no direct charge on residents/taxpayers.	Moderate–High - biggest be some concerns around volatility of returns from investment portfolio.	Low - would require significant transaction costs to set up. Would need to be of sufficient size to offset transaction

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
					costs in establishing.
Social value investment funding	Moderate - depends on the ultimate source of funding within this model. High if funding ultimately comes from local taxpayers or students (in campus), lower if national taxpayers or utility customers.	Moderate - can mobilise resources across a number of sites and developer-types, but GI is likely to be one component of wider social value commitments rather than the sole focus.	Moderate - can be targeted towards local communities, disadvantaged groups. Different funding sources will be more or less progressive.	High - likely to be acceptable where GI is delivered as part of wider public, institutional or community benefit commitments.	High - well-established model.
Corporate sponsorship	Moderate - low, although corporates only likely to participate if they perceive benefit. Key beneficiaries not required to fund.	Low - varying significantly across the city, with focus in high-visibility areas.	Moderate - sponsorship ultimately paid for by shareholders of companies who have high incomes, but greening may be focused in most affluent parts of the city.	Medium - maybe some concerns about 'privatisation' of public spaces, but likely to be limited.	High - relatively straightforward.
Philanthropic, charitable and community funding	High - as community organisations/charities, internalise benefits accruing to others.	Low–Moderate - can support specific projects, restoration, stewardship and community-led greening, especially where lottery/foundation grants are secured, but	Moderate–High - most likely to focus on vulnerable populations/localities, although depends on local capacity to apply for and manage funding.	High - unlikely to be controversial.	Moderate–High - straightforward for established organisations, but competitive applications, match-funding, reporting and

Model	Alignment with who benefits	Expected scale of resources mobilised	Distributional implications	Acceptability	Deliverability
		unlikely to meet city-wide needs alone.			long-term maintenance requirements can constrain delivery.

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