Domestic adaptation measure results using IES VE

Developing adaptation measures

Adaptation measure	DECoRuM-Adapt	IES VE	Individual Effectiveness
Internal wall insulation		✓	-
Cavity wall insulation	✓ (No differentiation)	✓	o
External insulation		✓	+
Roof insulation	✓	✓	o
High albedo roof and wall		✓	++
Exposed thermal mass		✓	+/++
Low-e glazing / low-e film	✓	✓	+
Insulate primary pipework and tank	✓		++
External shading on glazing	✓	✓	+++

Increasing insulation standards in many cases can have an adverse impact when trying to mitigate overheating; however,

(1) increased insulation standards are essential for meeting the carbon reduction goal and

(2) the UK climate is projected to remain a heating dominated climate.

Packaging adaptation measures for IES VE

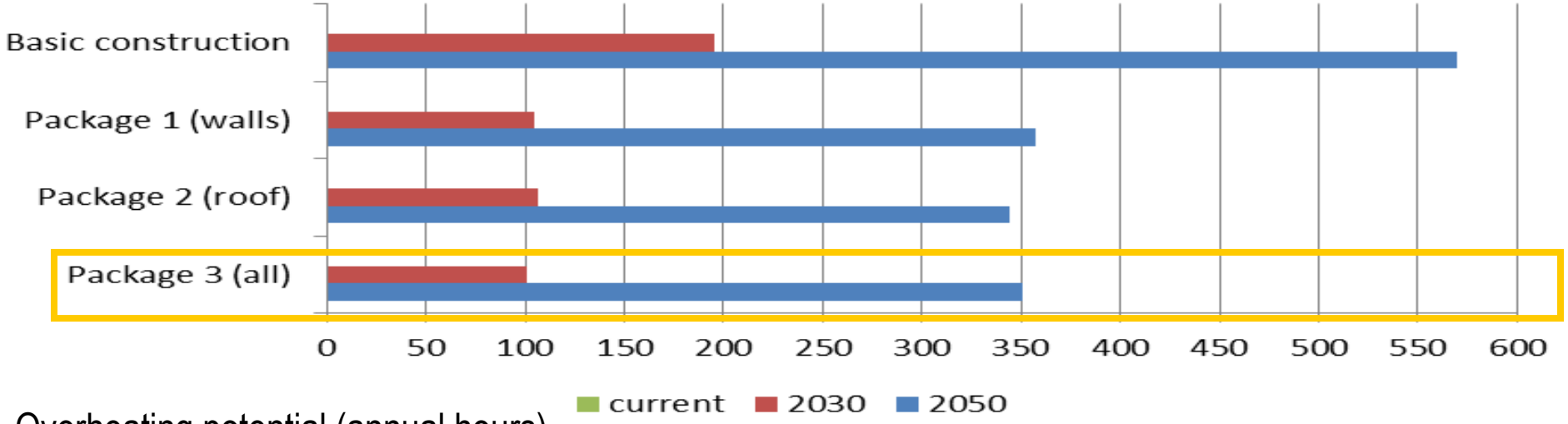
Package 1 (walls): High albedo external wall insulation, solar selective low-e double glazing and user controlled shading

Package 2 (roof): High albedo roof, roof insulation and shading on existing single glazing

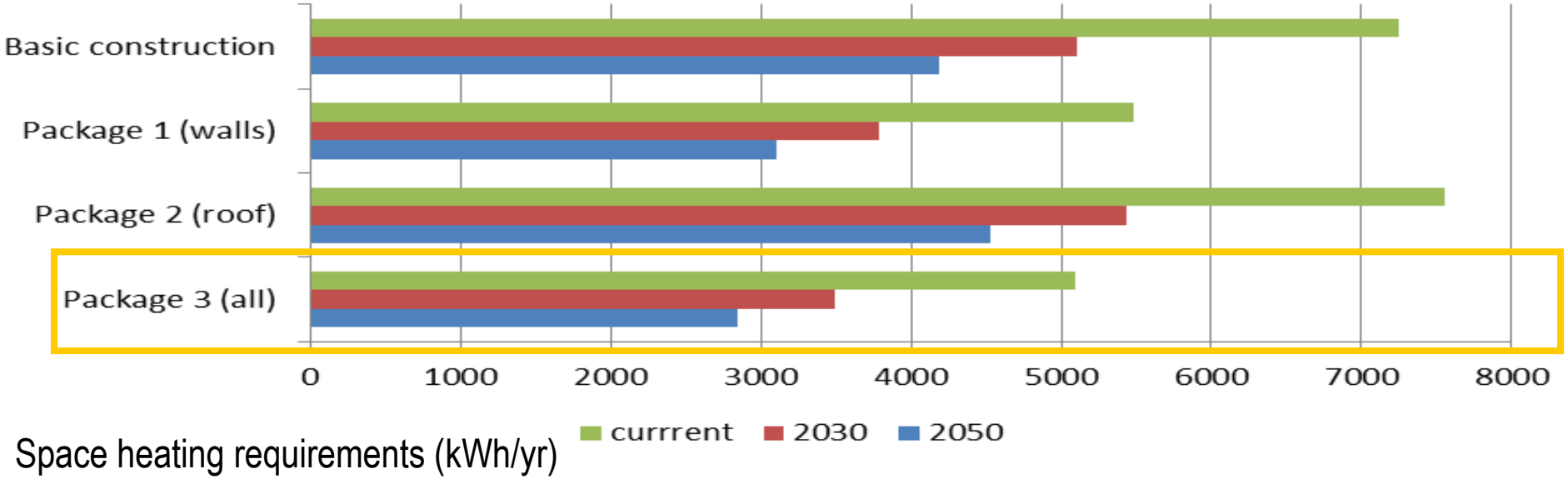
Package 3 (all): Combines packages 1 and 2

* All packages assume a moderate level of natural ventilation during occupancy

Packaging adaptation options: mid-terraced home example



Overheating potential (annual hours)



Space heating requirements (kWh/yr)

Testing the adaptation options

Neighbourhood scale

Integrated improvement package (mitigation and adaptation) for DECoRuM-Adapt

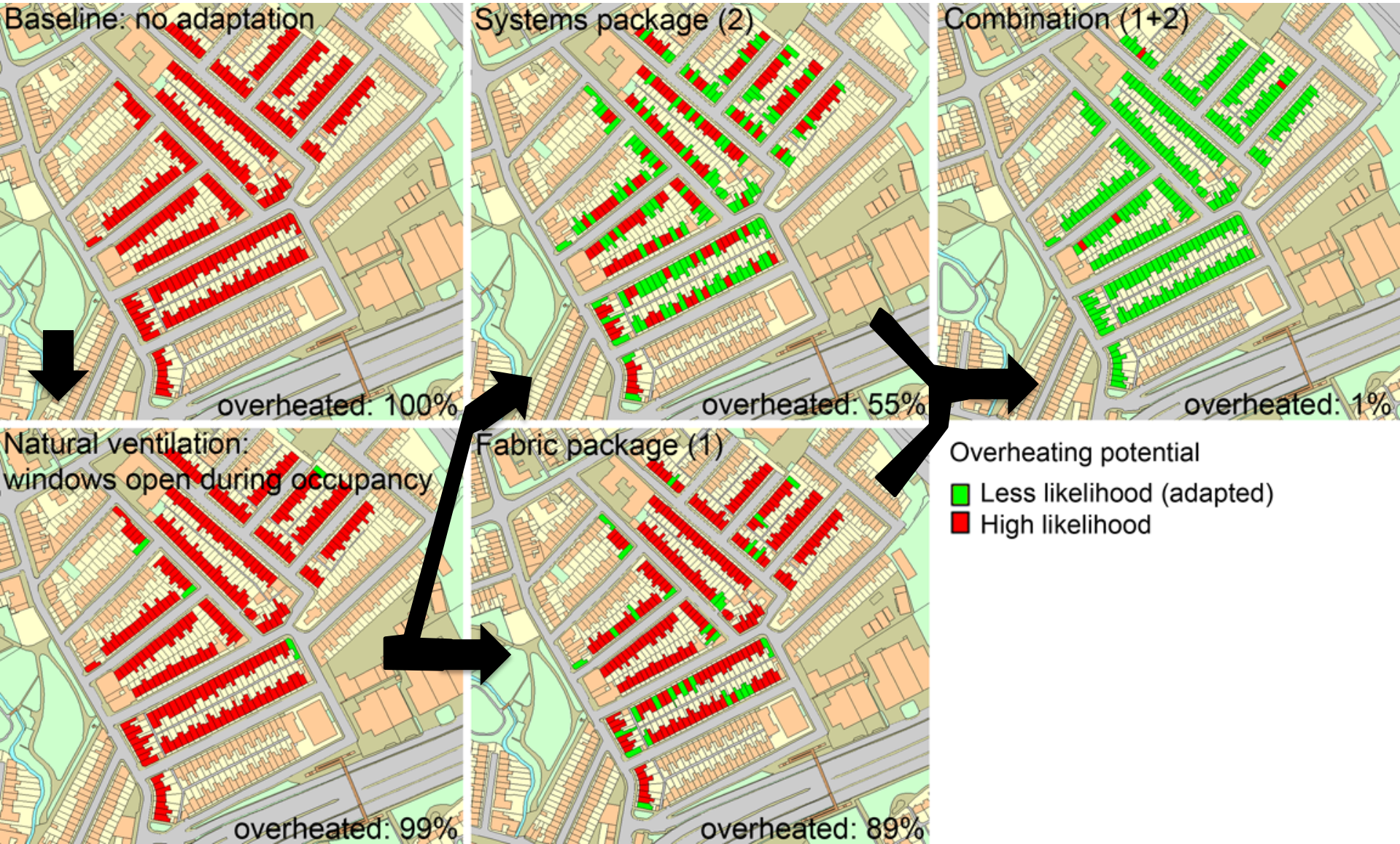
Package 1 (fabric): Insulate walls, insulate roof, provide solar selective low-e double glazing in place of single glazing or low-e solar film on existing double glazing and shading for glazing

Package 2 (Systems): Insulate primary pipework, insulate hot water tank, heating system, provide thermostat for hot water tank

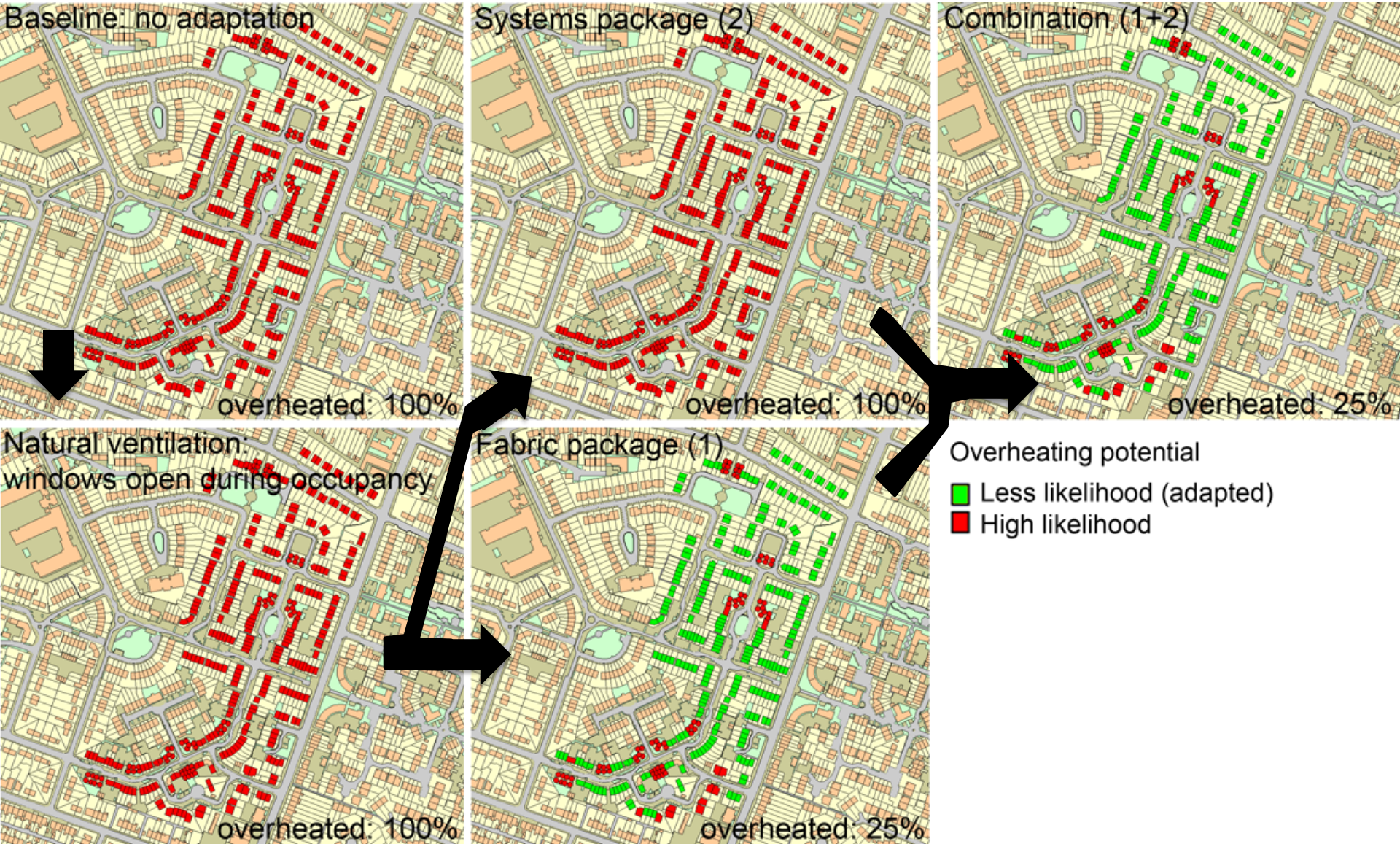
Package 3 (all): Combines packages 1 and 2

* All packages assume a moderate level of natural ventilation during occupancy

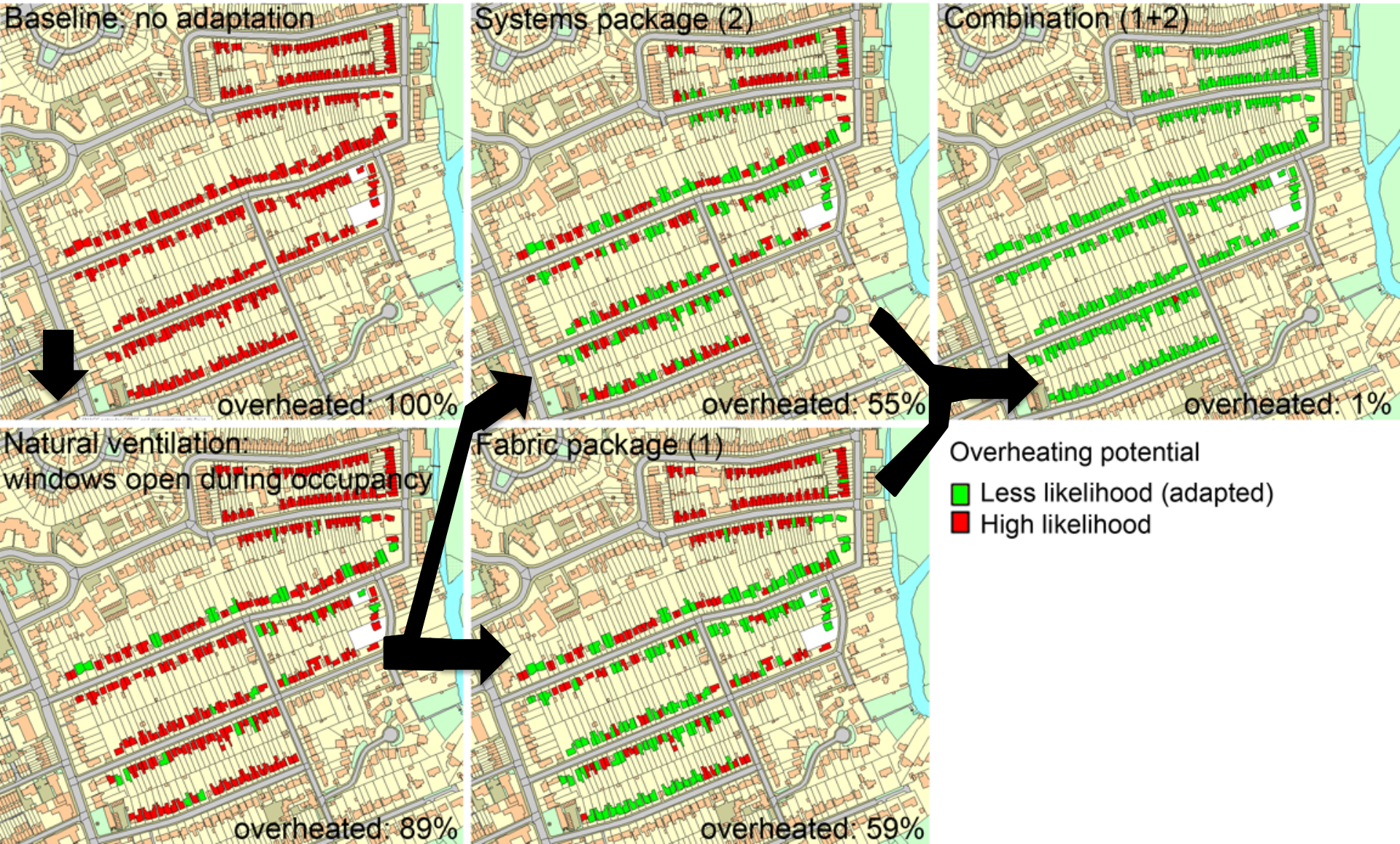
Neighbourhood scale application of the adaptation packages:
Bristol: St. Werburghs (Inner historic suburb)



Neighbourhood scale application of the adaptation packages:
Bristol: Upper Horfield (Higher density urban extension)

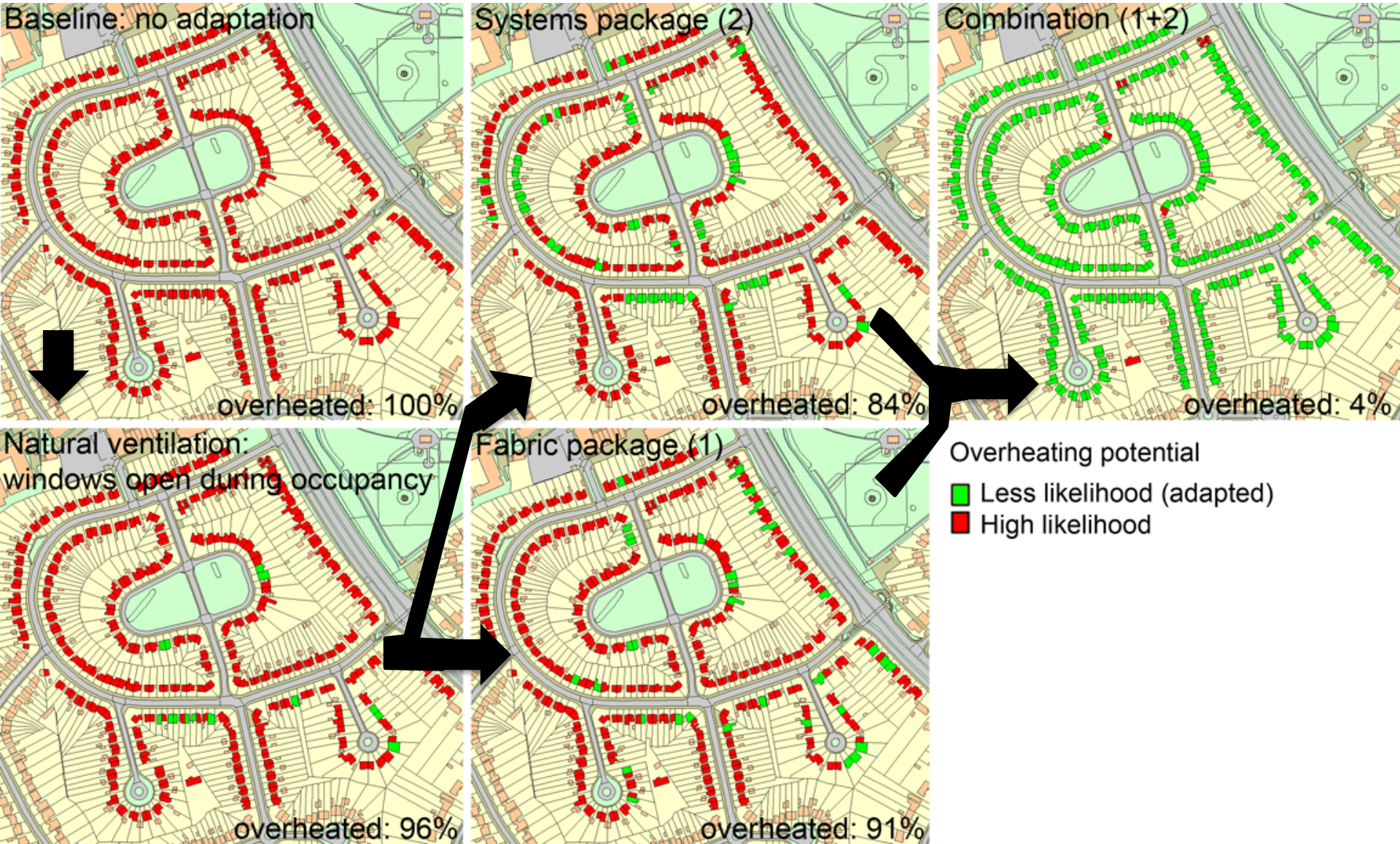


Neighbourhood scale application of the adaptation packages:
Oxford: North Oxford (Pre-war 'garden city' type suburb)

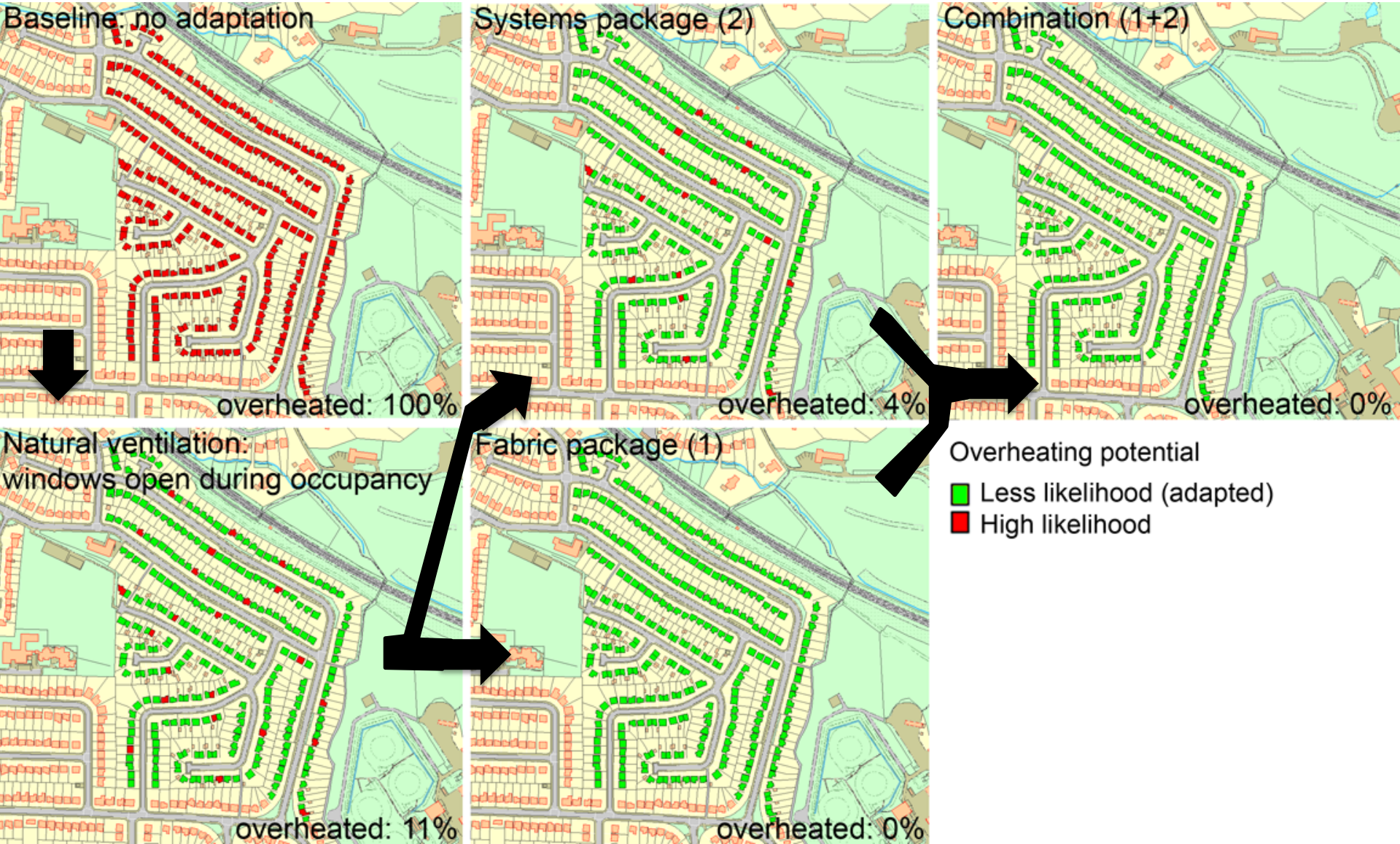


Neighbourhood scale application of the adaptation packages:

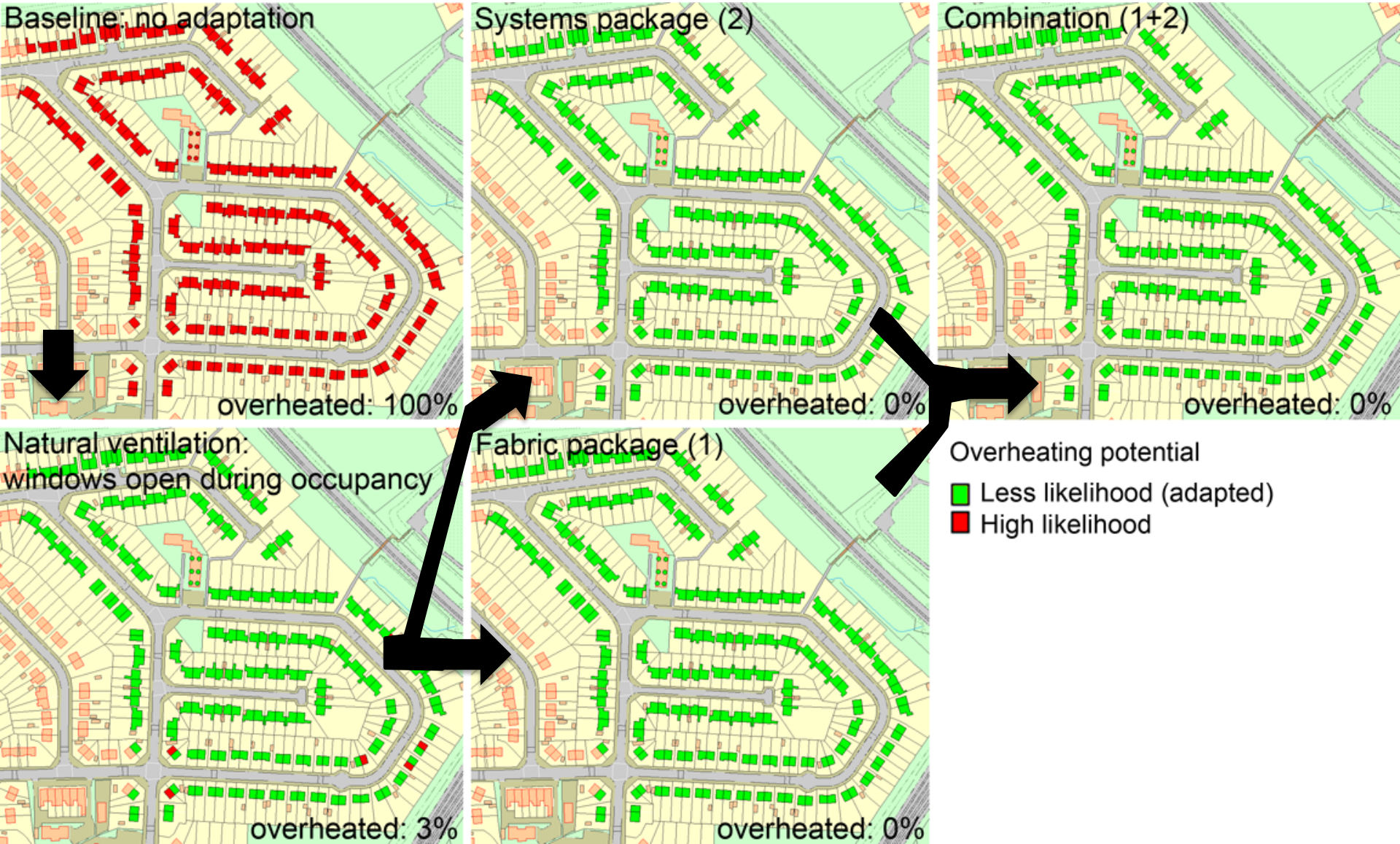
Oxford: Botley (Public transport suburb)



Neighbourhood scale application of the adaptation packages:
Stockport: Bramhall (Car suburb)



Neighbourhood scale application of the adaptation packages:
Stockport: Cheadle (Social-housing suburb)



Summary: Whole neighbourhood overheating potential after adaptation

Suburb	Type	Baseline (no adaptation)	Baseline (naturally ventilated)	Fabric package (1)	Systems Package (2)	Combination package (3)
Bristol – St. Werburghs	Inner historic suburb	100%	99%	89%	55%	1%
Bristol – Upper Horfield	Higher density urban extension	100%	100%	25%	100%*	25%
Oxford – Summertown	Pre-war 'garden city' type suburb	100%	89%	59%	55%	1%
Oxford – Botley	Public transport suburb	100%	96%	91%	84%	4%
Stockport – Bramhall	Car suburb	100%	11%	0%	4%	0%
Stockport – Cheadle	Social Housing Suburb	100%	3%	0%	0%	0%

*majority already 'adapted' for systems package

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Conclusions

- 'Adaptive retrofitting' should be combined with 'low-carbon retrofitting' of UK housing to avoid lock-in effect and sub-optimal retrofitting
- Creating adaptation packages is more effective than installing individual measures.
- Package 3 (all measures) was most effective in reducing overheating hours and space heating demand.
- Reduction of internal gains in older homes is hugely beneficial for both reduction of overheating and energy use.
- Single storey homes with smaller exposed external areas, flats, densely packed homes and homes with large roof light areas tend to continue to overheat the most.
- As an individual measure, shading (externally!) the glazing from incident solar radiation is most effective in reducing overheating hours.
- More effective adaptations in reducing overheating risk (e.g. shading and insulation of primary pipework) can cost less than the typical mitigation measures (wall insulation) and may be considered relatively simple 'do-it-yourself' measures.
- Impact of insulation and thermal mass depend significantly on the position of these measures and type of home. Results can differ greatly.

Testing the acceptability of adaptations

Resident workshops

home and garden:mitigation

summer

winter

street/public space

mitigation

Mitigation measures

Photovoltaic and solar panels

Roof insulation

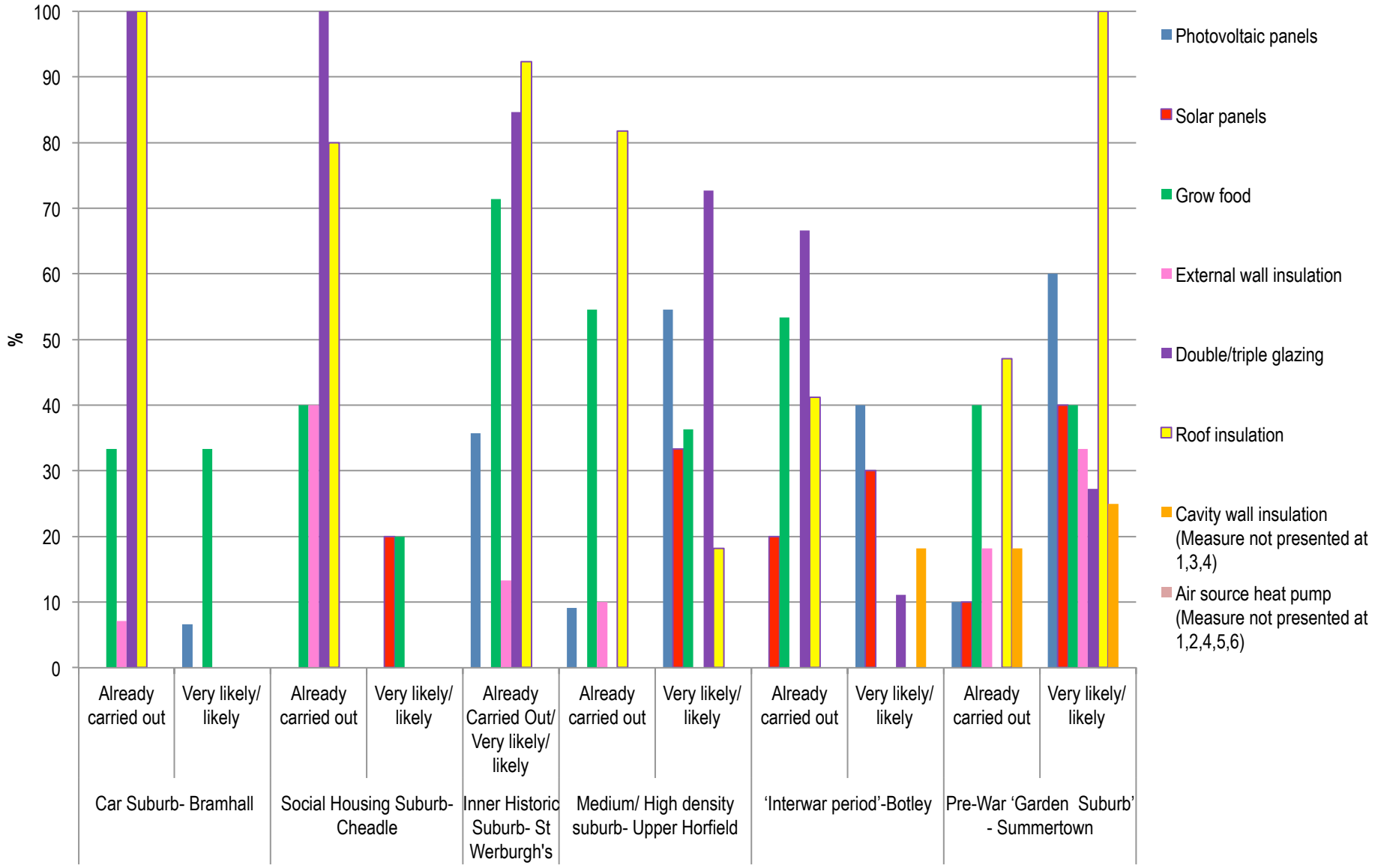
Triple or Double glazing

External wall insulation

Air source heat pumps

Growing food

Mitigation measures- All Typologies



Response on the Options by Suburban Type/ Area

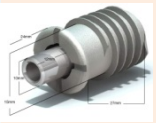
Mitigation findings (home and garden)

- Some ‘divides’: north south/wealthy less wealthy
- Cost savings and environmental concerns are drivers (vary according to case study)
- Most likely adaptations: double glazing, roof insulation and food growing
- Less likely: air source heat pumps, external wall insulation and solar panels
- Concerns over: cost, payback period, maintenance, reduction in house value
- Mitigation actions implemented because of: grants and subsidies, hobbies (gardening), routine upgrades (new windows), environmental concern (PVs, in wealthy areas)

summer

Adaptation measures

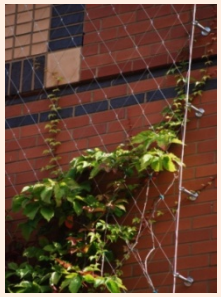
Windows that lock open



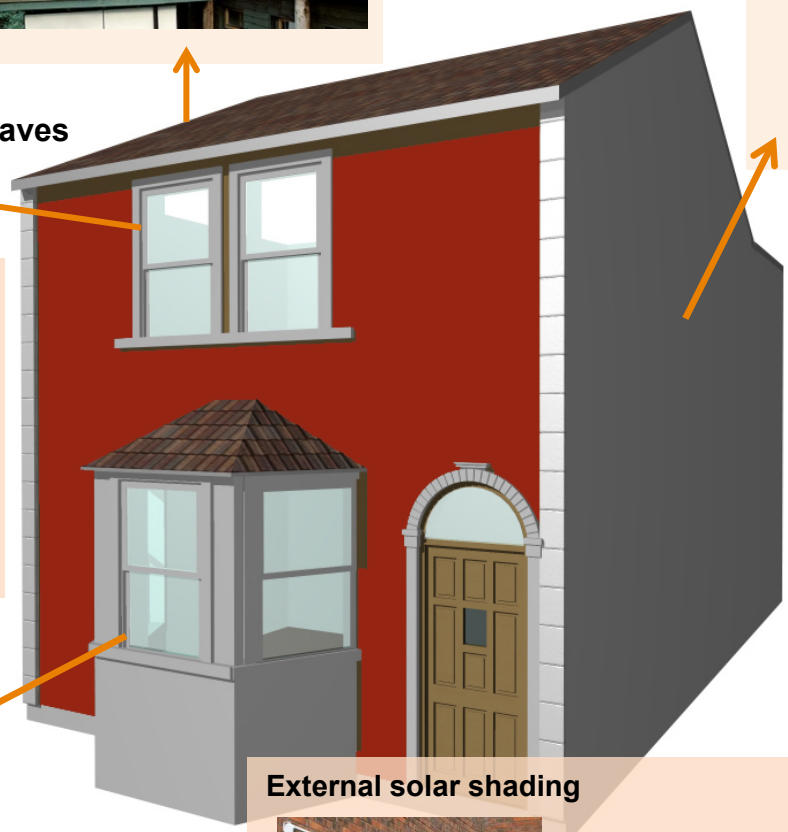
Green roof

White roof and walls

Wall greenery

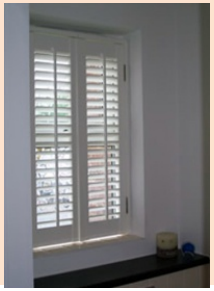


Extend eaves



Shaded outdoor space

Internal shutters



Solar Film

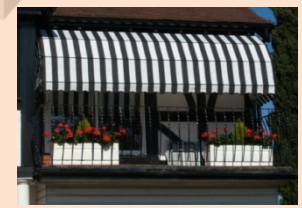
Internal thermal mass

Water butt

Timber louver shading

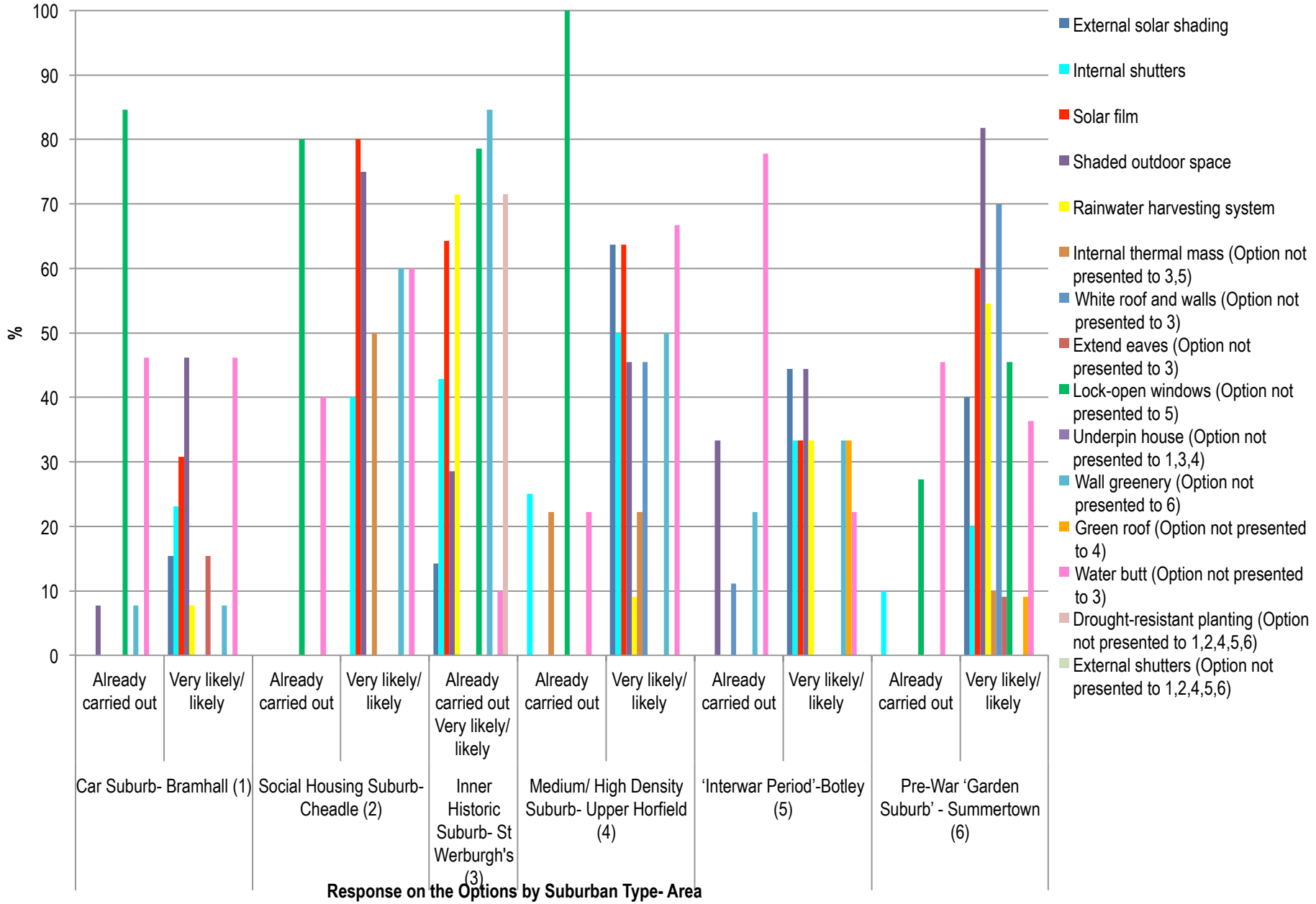
Rainwater harvesting system

External solar shading



Drought resistant planting

Summer house Adaptations- All typologies



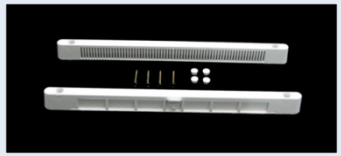
Response on the Options by Suburban Type- Area

‘Summer’ findings (home and garden)

- Heat not seen as a serious problem (behavioural adaptations are seen as sufficient) – seen as welcome in the north: “bring it on”
- Drought and water prudence is better understood (more so in south)
- Most likely adaptations are simple water saving measures (water butts) and measures which have a shading/cooling function (wall greenery, lock-open windows, external shading, shading outdoor space)
- Least likely adaptations were internal thermal mass, green roofs and underpinning homes
- Internal shutters and solar film were not widely used now, but are likely to be taken up in the future
- Concerns were just that the measures weren’t needed.
- Adaptations had been made for aesthetic, enjoyment reasons, and to save rainwater

winter

Trickle vents



Elevated electrical sockets

Waterproof window seals

Flood skirting

Air brick covers

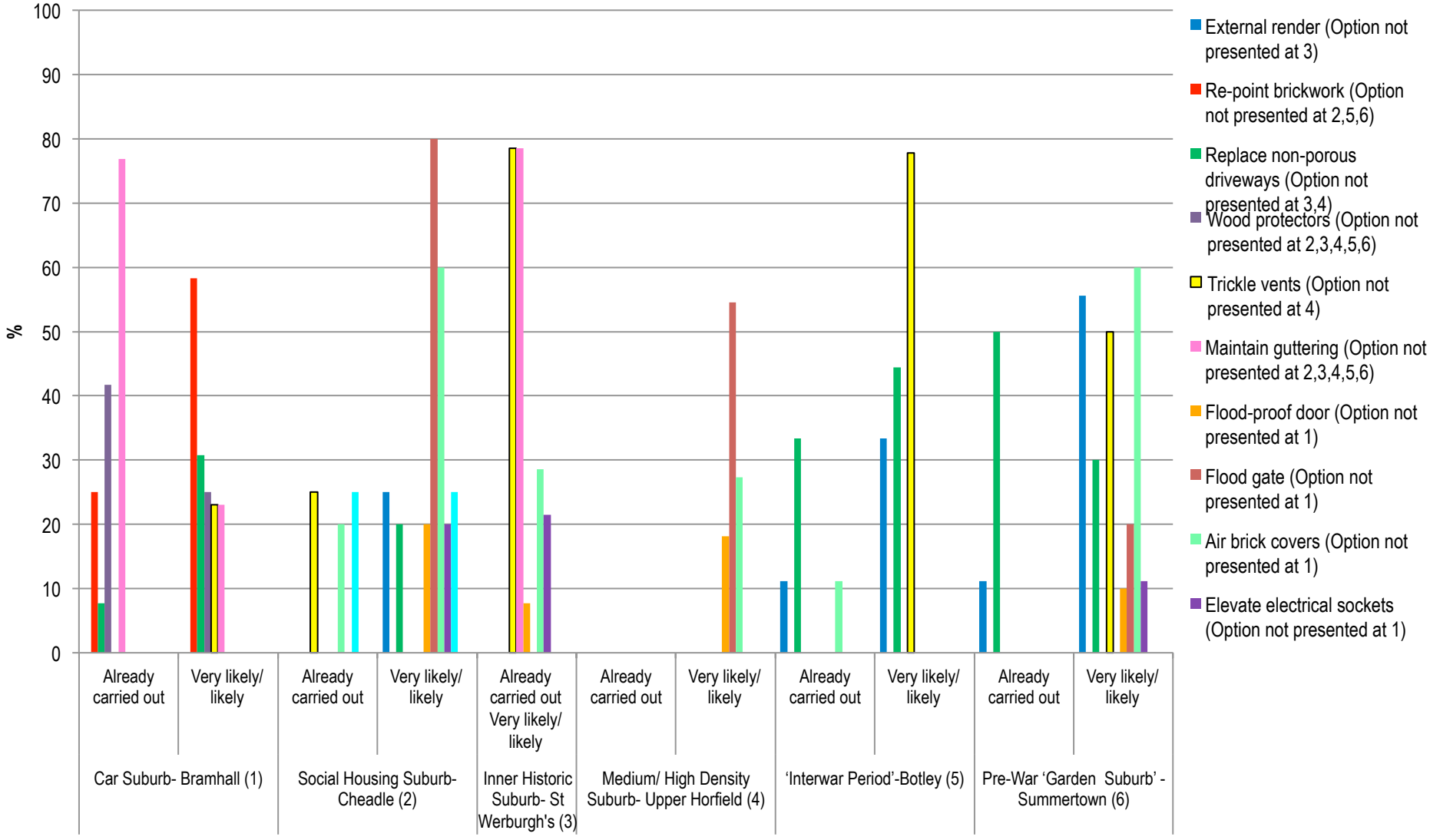
Flood proof door

Flood gate

Adaptation measures

St. Werburghs

Winter house adaptations- All typologies

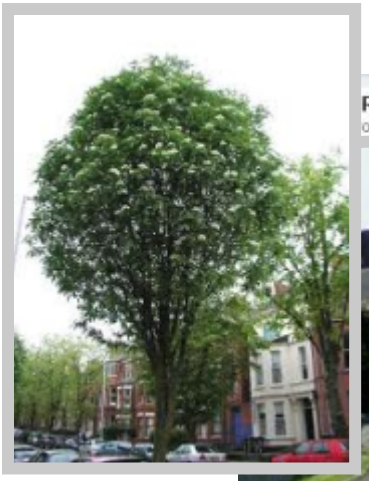


Response on the Options by Suburban Type/ Area

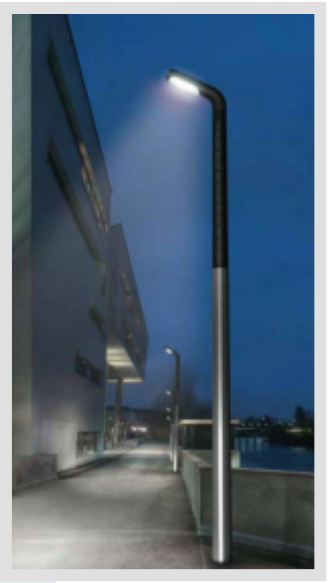
Winter findings (home and garden)

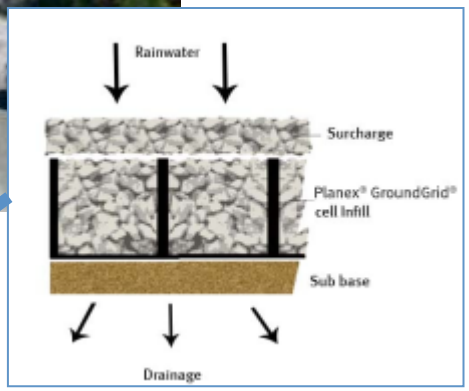
- Overall, less take up than mitigation and summer adaptations
- Even those who have experienced flooding (or nearby) are not very likely to implement flooding adaptations, although some would consider flood gates/doors and replace non-porous drives
- Likely adaptations: trickle vents, air brick covers and maintaining guttering
- Lack of knowledge of adaptation options and confusion over whether its worth protecting an individual home from flooding

Street



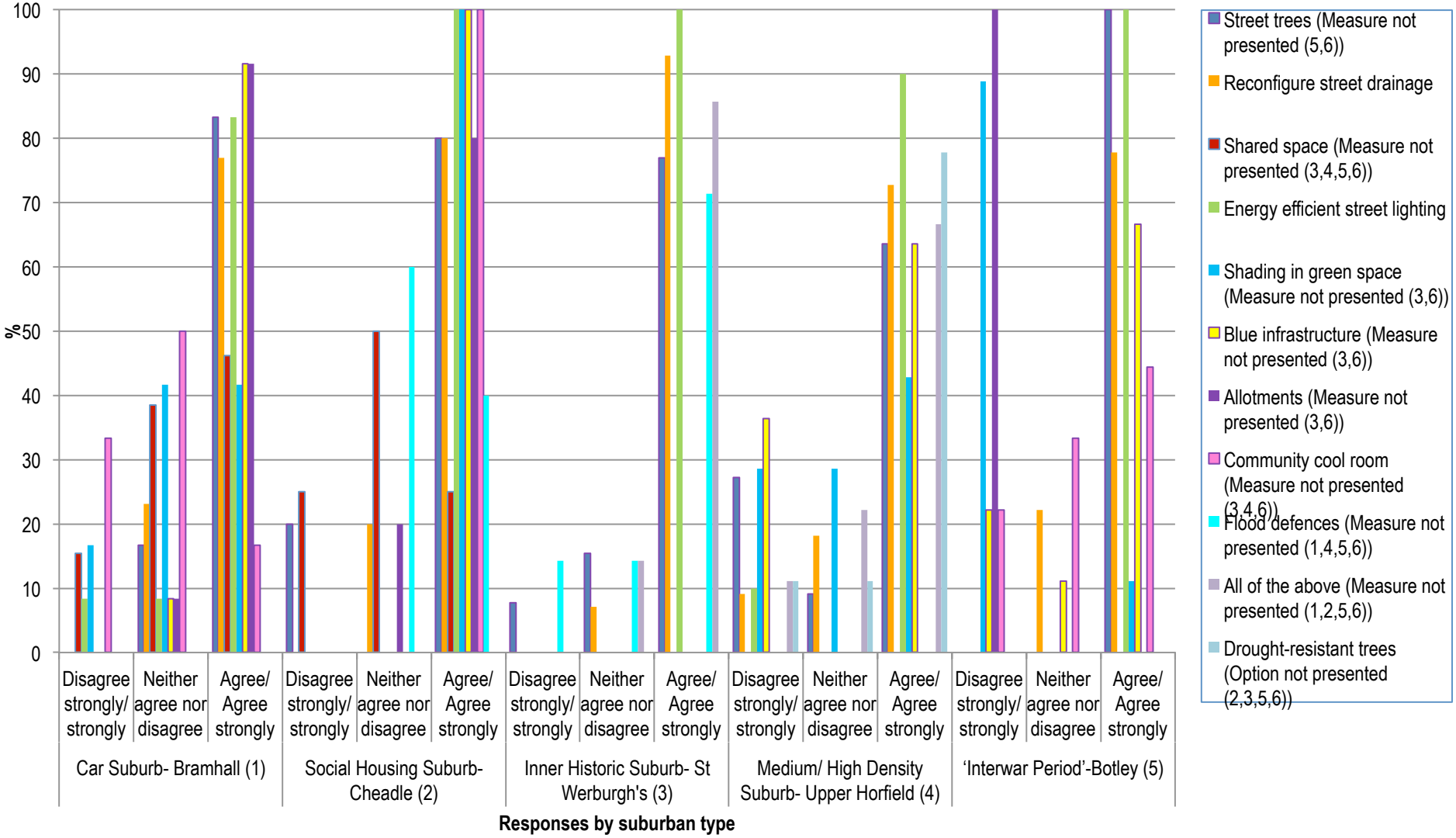

Road, Oxford, England, United Kingdom
Montagu Rd




Rainwater
Surcharge
Planex® GroundGrid® cell Infill
Sub base
Drainage

Green space

Neighbourhood adaptations- All typologies



No neighbourhood measures were presented in Summertown (6)

Neighbourhood findings (mitigation and adaptation)

- Overall, people largely positive about schemes to adapt their neighbourhood
- Most positive about: street trees, energy efficient street lighting, reconfiguring street to improve drainage, blue infrastructure
- Mixed views on community cool rooms
- Concerns over who pays, who is responsible for maintenance, non-climate change impacts (anti-social behaviour), protecting existing assets

Overall: key decision-making factors

- Financial resources
- Convenience
- Built form practicality
- Visual appearance
- Climate comfort
- Environmental benefits
- Non-climate impacts
- Familiarity of options
- Perception of effectiveness of options
- Relationship to home renovations
- Longevity in place of residence
- Behavioural alternatives
- Authority to implement

Testing the feasibility of adaptations

Stakeholder workshops

Stakeholder workshops

- How can local stakeholders facilitate or deliver suburban adaptation:

  Environment Agency, Climate South East, Oxfordshire County Council (Env & CC), LGA Councillors, LGA staff (development control, climate change, strategic housing, drainage management), NHS (public health), United Utilities (water), NGOs (London Flooding Alliance, Bristol Green Doors), Bristol Housing Foundation, Federation of Master Builders, Ridge Architects, White Design Architects.

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Policy response

- Adaptation is not an ‘urgent’ policy issue, it is an ‘emergent’ issue
- Vicious policy/political circle: public not interested, so politicians don’t prioritise it.
- Responsibility for addressing adaptation for flooding particularly unclear
- Multiple stakeholders involved, neighbourhood protection means that individual householder action not as important

Local level may not be the most effective scale for facilitating implementation

- Many policy levers are central government mechanisms – grants and subsidies and pricing mechanisms (e.g. water) outside local control.
- Local mechanisms focus on promotion initiatives and advice, and capacity building.
- Statutory local planning system 'limited' capacity to encourage homeowners to adapt.
- Retrofitting powers limited, new build has greater influence.

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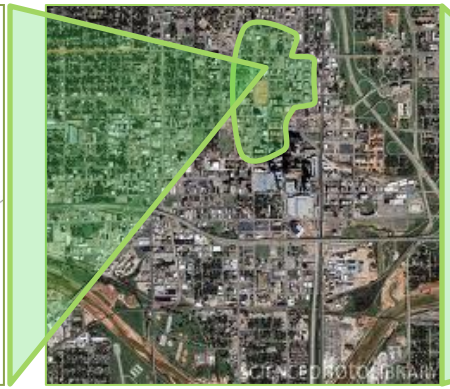

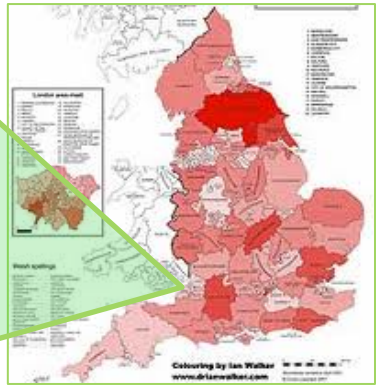

Challenges and opportunities for the implementation of adaptation measures

- Implementing adaptation measures could draw attention to potential problems.
- Problematic that insurance only replaces like with like.
- People are also likely to make changes that make problems worse: paving over drives, new patios, poorly designed conservatories
- Renovation and routine house maintenance is the time to make changes
- Builders, DIY stores and estate agents (most likely to make changes in first 12 months) are key opportunities for influence
- Mechanisms such as the Green Deal might have the potential to incorporate adaptation measures, and needs to ensure mitigation measures don't exacerbate overheating vulnerability.

Overall findings

- **‘Climate change’ is not a driver for change to homes and neighbourhoods**
- **Yet change is needed if suburbs are to be liveable 2050+**
- **Adaptation and mitigation** need to be considered together – overheating vulnerability has not been considered enough – importance of shading.
- There **is real confusion and little action over flooding measures**.
- **Overheating is not an issue**, with most thinking behavioural responses will suffice.
- **Some measures are effective for all areas while others are only suitable for specific types of suburb (next piece of work)**
- **Some measures are prohibitively costly** or not desirable for a range of other reasons – aesthetics, non-climate impacts.
- **Householders are most receptive to adaptation and mitigation measures as part of DIY, routine upgrade projects** – there is scope for improved interventions
- People are generally **accepting of neighbourhood measures** but there is **no clear delivery mechanism** so they are not already being nor are likely to be done.

Next steps

- Suburb specific packages
- Governance/action scenarios for different types of threat and response