CIBSE
Resilient Cities Group

A Wicked Collaboration

What we're NOT talking about…

Professor Darren Woolf
Chair of CIBSE Resilient Cities Group (RCG) and the
UK Urban Environmental Quality partnership (UKUEQ)

Towards Resilient and Sustainable Cities and Communities

De Montfort University, 4th September 2025

DE MONTFORT UNIVERSITY LEICESTER

INSTITUTE FOR SUSTAINABLE FUTURES

CIBSE Resilient Cities Group

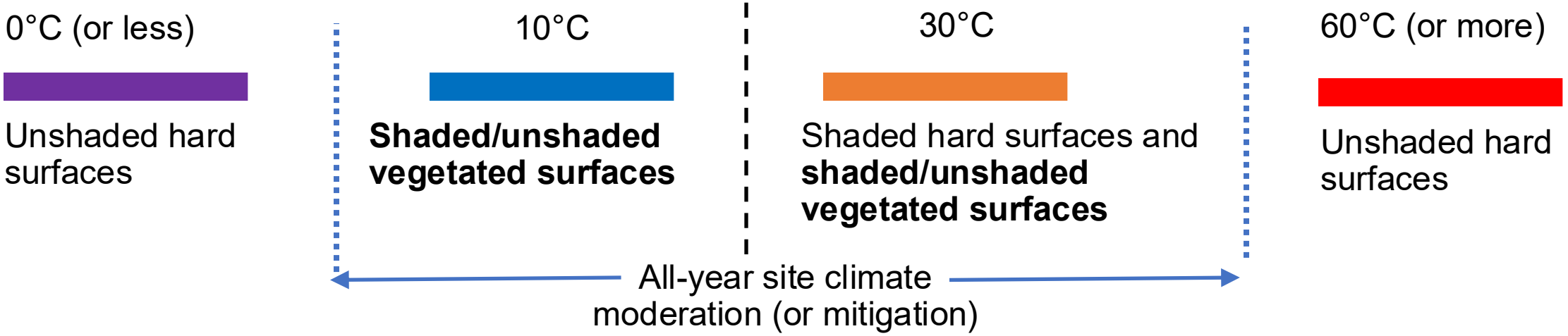
Designing for site climate moderation inc. urban morphology

COLD WINTER DAY

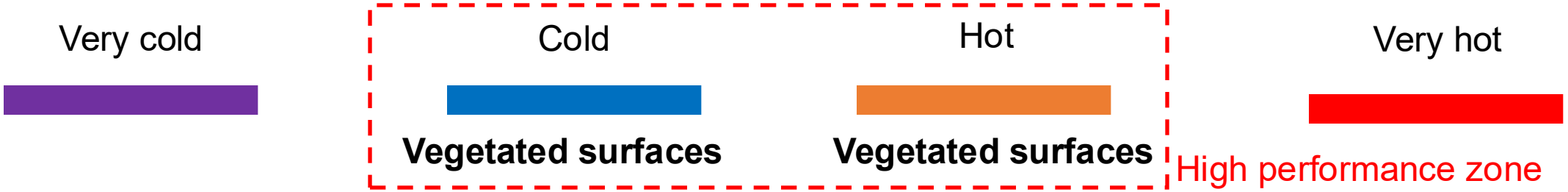
- UHI effect (cold side)

HOT SUMMER DAY

- UHI effect (hot side)



Surface design performance (should) = thermal + wind + air quality + acoustics + surface water design



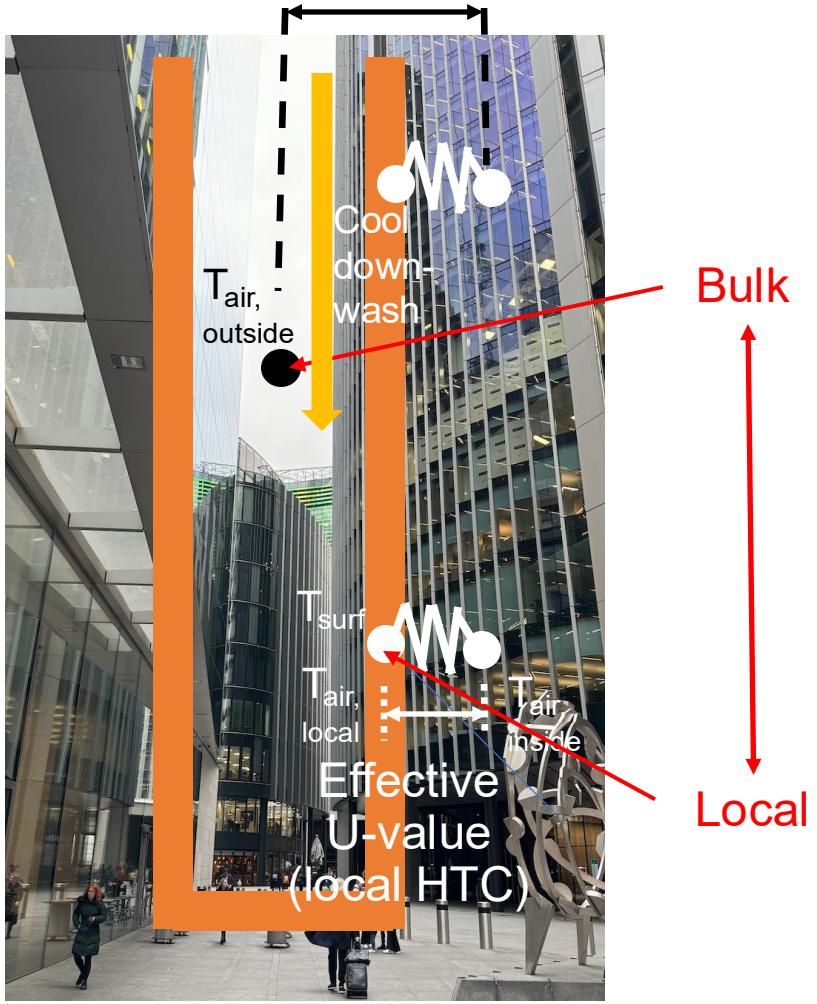
Urban cool island – Effect of buildings on urban environment

- In wind-sheltered street canyons, buoyancy more important for air movement.
- Lower façade temperatures in shaded areas could lead to downwash (negative buoyancy) cooling pedestrian areas.
- Many other urban physics and other areas of interest.

“Urban heat island effect is just a case of poor thermal design”

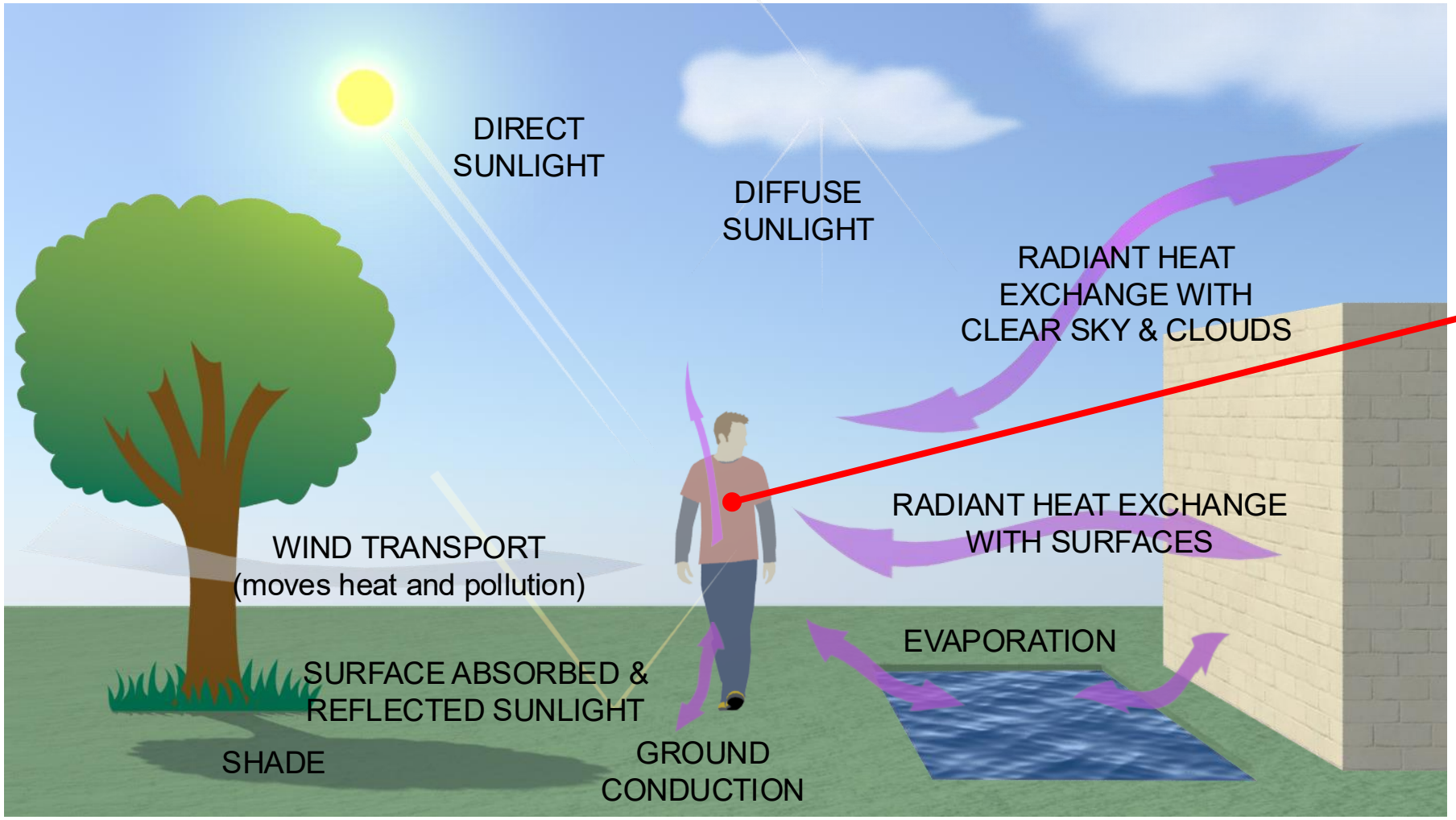
Where’s the thermography and associated measurements?
Satellite / plan view data ignores the influence of façade height / area…
Why are we almost exclusively focusing on building heat loss on cold days and not coolth loss on hot days? Two-way coupled considerations?

U-value from British Standard



Very shaded

Designing for mean radiant temperature (MRT)



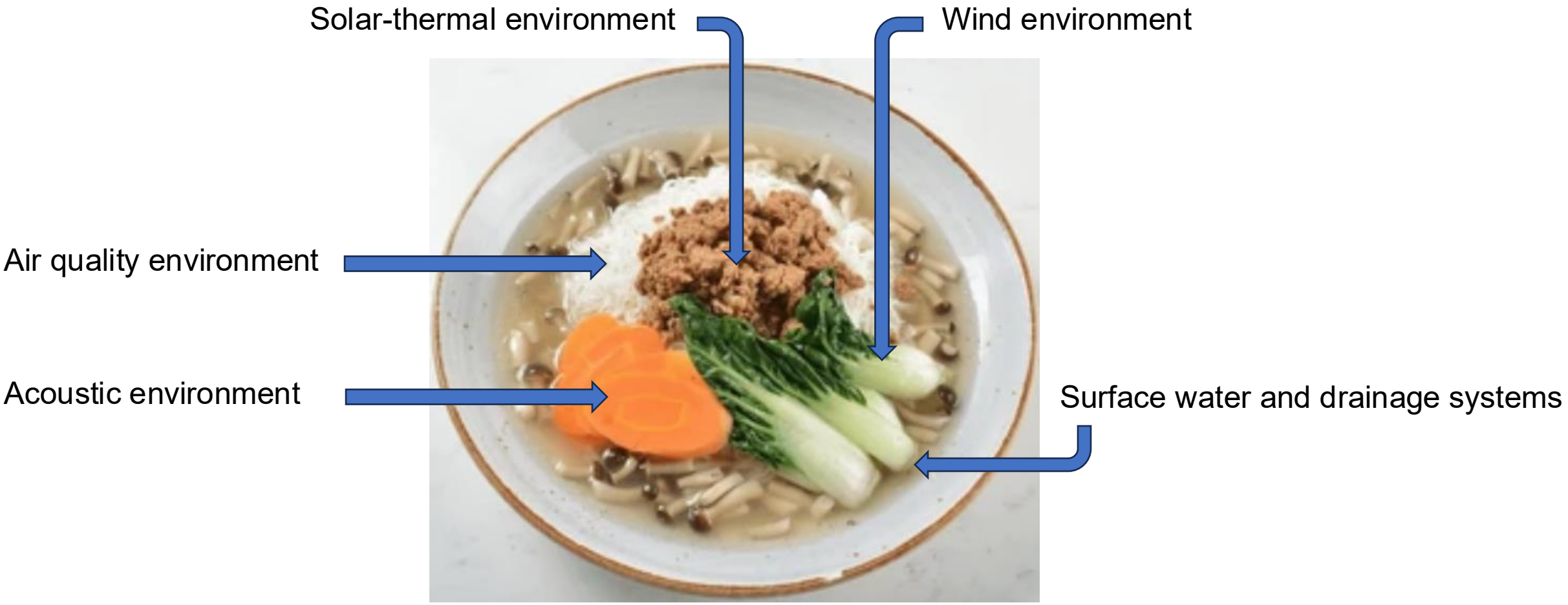
Design for MRT <u>together with</u>:

- air temperature (near & far)
- surface temperature
- surface heat transfer
- near-surface wind effects

- If an adaptation solution (e.g. concrete to grass) can only reduce air temperature by 1°C but surface temperature by 30°C and, as a result, MRT by 15°C, the 'comfort temperature' may be reduced by **8°C** (low wind speed).
- Why do we bury MRT in indices when a deeper understanding of its sensitivities may lead to more practical opportunities to improve thermal comfort than air temperature through good design?

Example (all in °C): AirT1=30, AirT2=29, MRT1=45, MRT2=30, Operative T=0.5(AirT+MRT), OperT1=37.5, OperT2=29.5, OperT[2-1]=**8**

Urban soup concept



Many ingredients: Little understanding on **“best recipe”** and **“preferred taste”**

Better working practices for improved climate & air quality resilience

Typical working practices: Limited cost-benefit basis

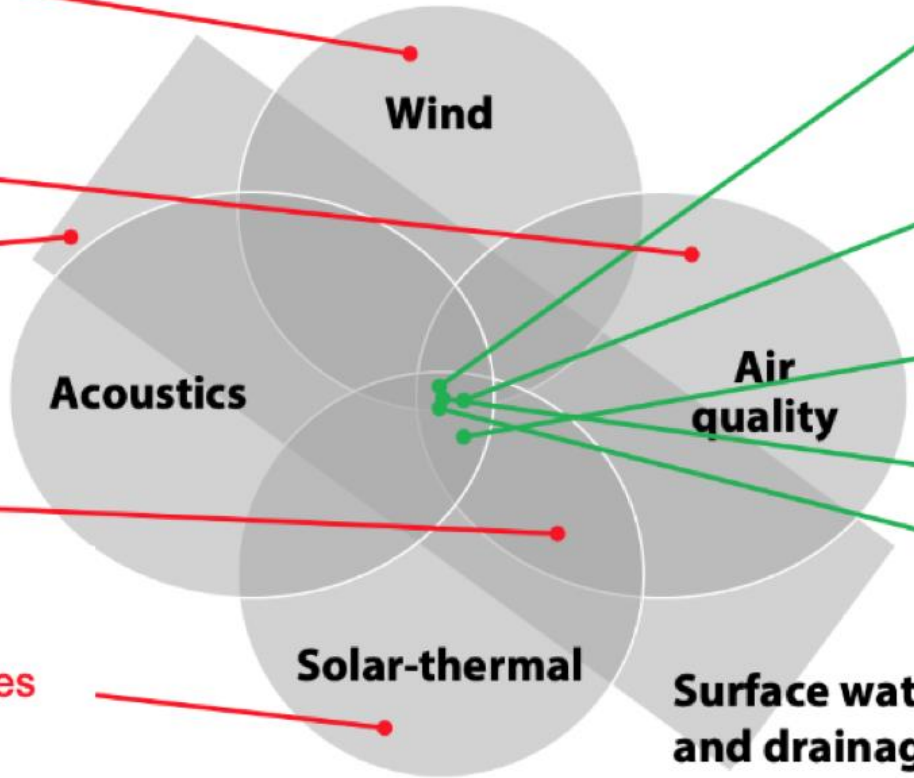
Building massing then trees & hard landscaping

Transport

Sustainable drainage systems (SuDS)

Urban greening factor – London Plan (area-based application)

Thermal comfort using solar irradiance (City of London compliance measure that excludes surface temperature effects)



Interdependencies: Improved performance & increased value

Urban vegetation (trees, bushes, green walls, green roofs & grasses)

Hard landscaping (screens, canopies & balustrades) – wind impacts thermal & air quality environments

Water systems (SuDS, ponds & fountains)

Health, wellbeing & productivity
Energy demand (insulating green surfaces, rainwater harvesting, climate moderation)

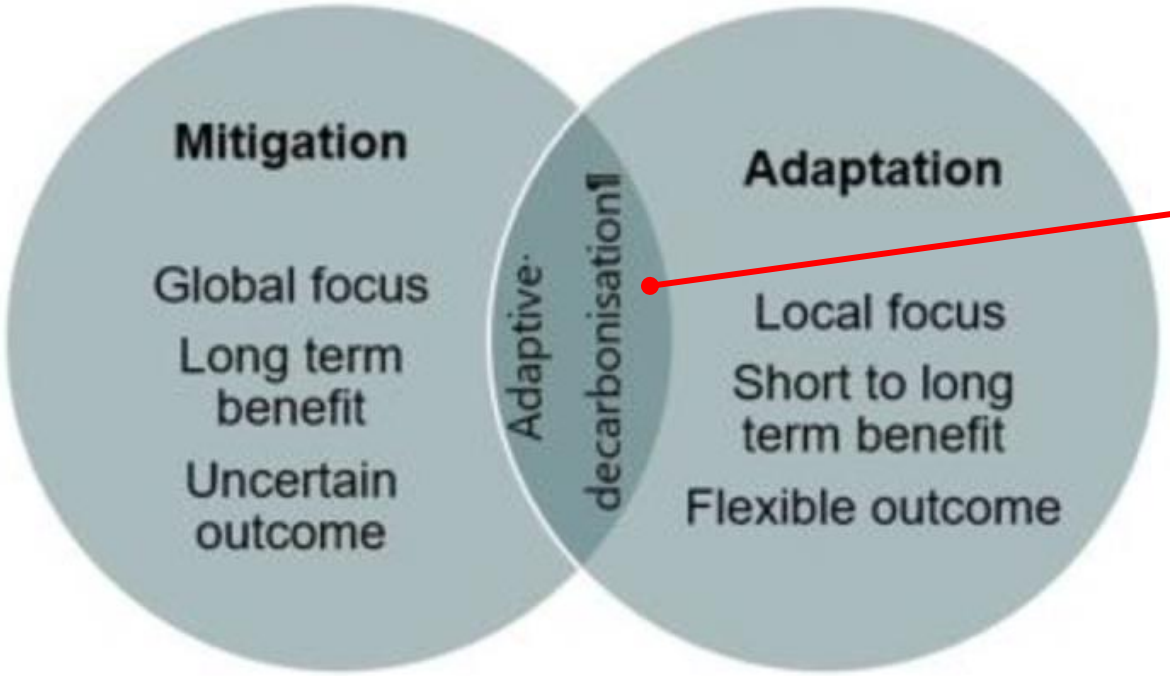
CIBSE
Resilient Cities Group

Extending the design language *including* monetization

- Free cooling
- Air quality
- Noise
- Flood
- Drought
- Crime
- Jobs
- Biodiversity
- Nat vent
- Health
- Wellbeing
- Productivity
- ++ gearing

https://www.arup.com/perspectives/publications/research/section/cities-alive-green-building-envelope

Improved adaptation *whilst* mitigating against climate change



What's the increased investment gearing through adopting a holistic approach?

Could understanding this significantly increase uptake of proposed design interventions?

Optimal, high-value solutions include **adaptive decarbonisation** *by design*.

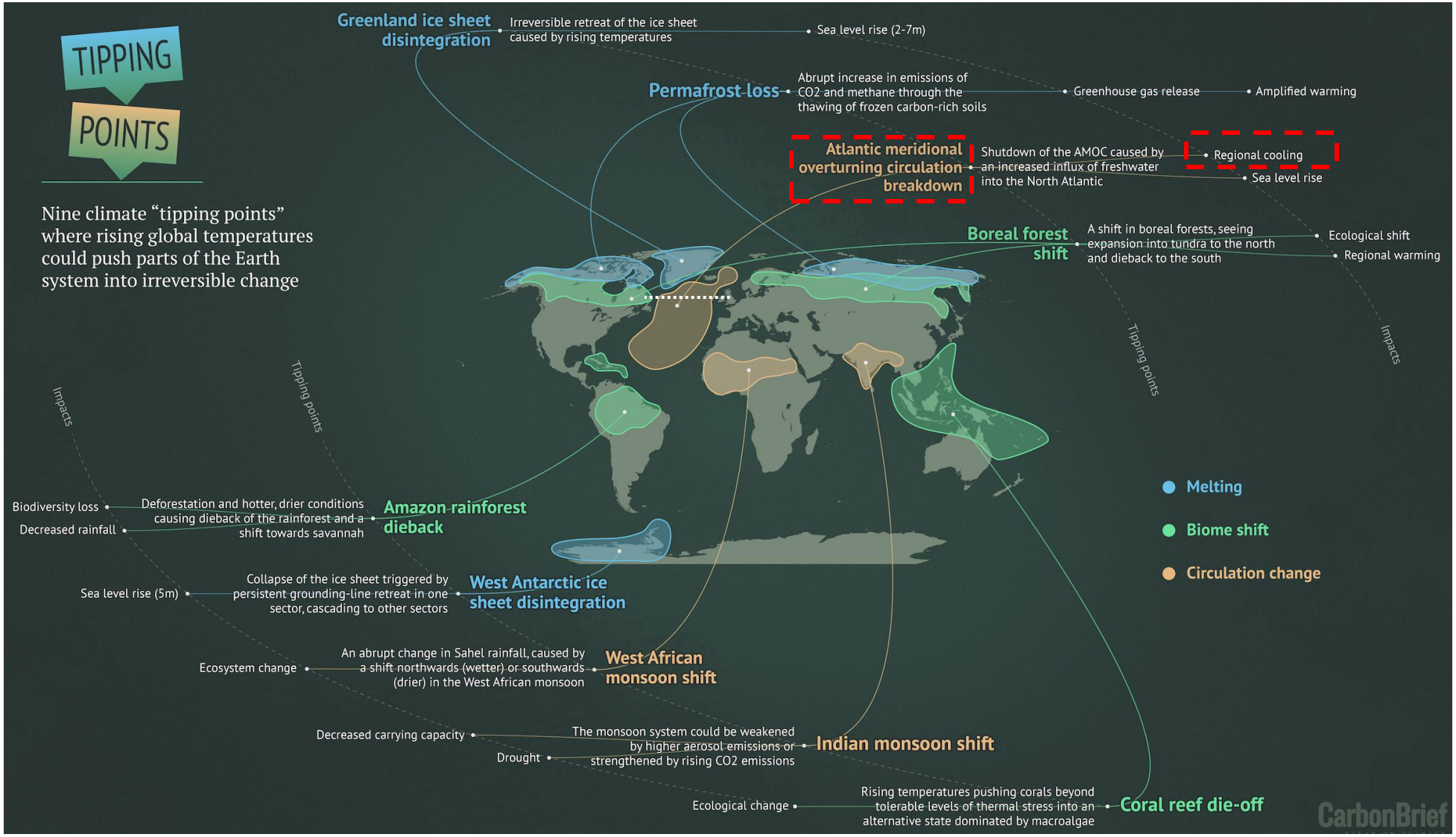
It can take over 30 years to grow a mature tree.

- When will we start having meaningful conversations about adaptation plans for the 2060's and 2070's?
- How can we do this without diminishing the efforts to meet the minimum compliance target of net zero by 2050?

https://www.cibse.org/get-involved/special-interest-groups/all-group-news-listing/supporting-improved-climate-resilience-through-decarbonisation-of-buildings-and-infrastructure/

CIBSE Resilient Cities Group

Colder UK in a warming world - climate tipping points response



AMOC slow down or collapse:

What happens if the UK climate becomes like current Northern Norway climate by the end of this century?

Implications for buildings, vegetation & ecology…+++?

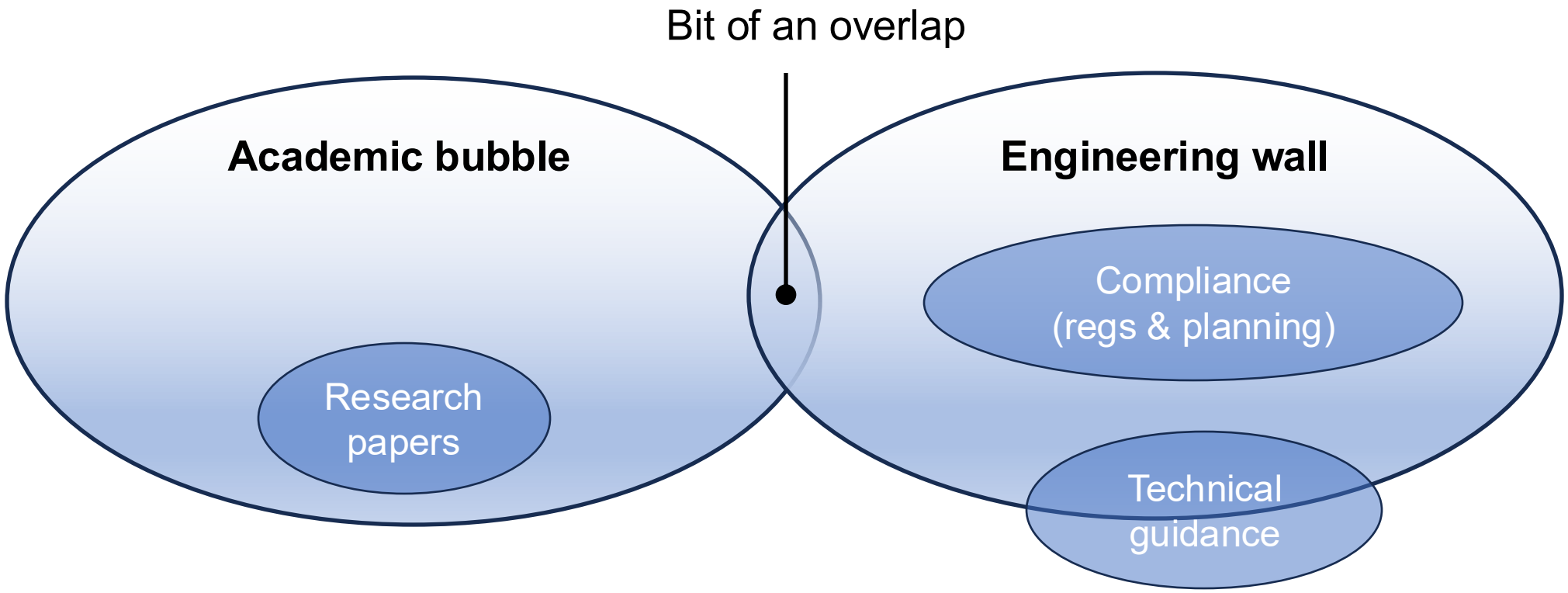
How should we balance solutions and policies with those devised for a warming UK?

A TRULY **WICKED PROBLEM!**

https://www.carbonbrief.org/explainer-nine-tipping-points-that-could-be-triggered-by-climate-change/
https://www.newscientist.com/article/mg26535264-100-is-a-broken-jet-stream-causing-extreme-weather-that-lasts-longer/
https://www.newscientist.com/article/2439295-is-a-vital-ocean-current-just-decades-away-from-catastrophic-collapse/

'difficult or impossible to solve due to its complex and interconnected nature, lack of a clear definition, and the absence of a definitive stopping point for solutions'

The need for ‘more supportive’ research



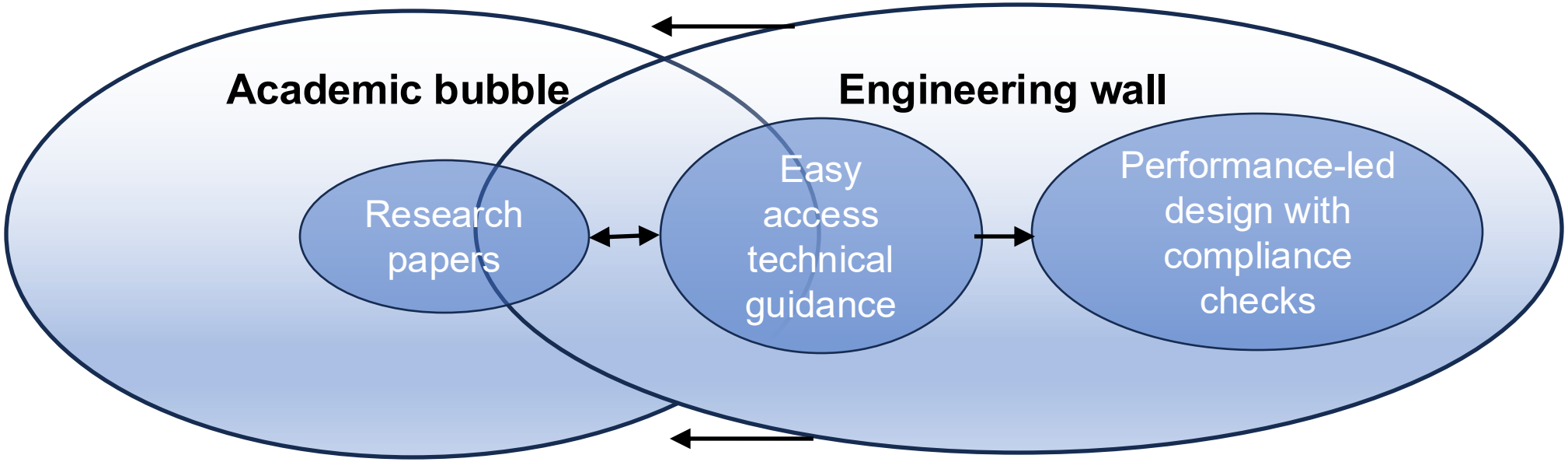
Perceptions:

Lacks relevance?
Slow?

Lacks robustness?
Poor applications?

Current (typical?) status is heavily siloed

Moving the engineering wall



Need:

- Academic-standard research with practical industrial applications defined at proposal stage
- More engineers driving research & supporting proposal scope development within wider academic team
- Better funding models with incentives for engineering practices as well as academia

CIBSE
Resilient Cities Group

A Wicked Collaboration

What we're NOT talking about…

Route to impact.

Climate change isn't waiting for us to get our house in order!

CIBSE
Resilient Cities Group

A Wicked Collaboration

What we (RCG-UKUEQ) *ARE* talking about…

RCG
[Resilient Cities Group]

Executive group
Darren Woolf: Chair
Bahareh Salehi: Vice chair
Augustine Takpor: Honorary Secretary & Social Media Manager
Paul Woodville: Events Organiser
George Adams: Adviser
[Honorary treasurer: Vacant]

UKUEQ
[UK Urban Environmental Quality partnership]

Darren Woolf: Chair

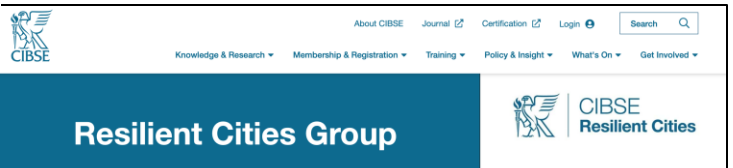
WES
[UK Wind Engineering Society]

Bernardo Vazquez: Chair

https://www.cibse.org/get-involved/special-interest-groups/resilient-cities-group/

https://www.cibse.org/ukueq

https://www.windengineering.org.uk



RCG-UKUEQ: Terms of Reference – High level

Need to align activities pointing out which SDGs, why and potential impact.

CIBSE
Resilient Cities Group

RCG-UKUEQ: Terms of Reference - Detail

RCG only

- Advanced simulations
- Building services - New build
- Building services - Retrofit / heritage
- Circular economy
- Climate change
- Daylighting / solar access
- Financial aspects
- Health & wellbeing
- Microgrids / smart grids
- Natural disasters
- Neighbourhood scale resilience
- Passive cooling and heating
- Renewable energy
- Resilient city materials
- Social and economic status
- Social equity and value
- Systems-based approaches
- Technology
- Urban density and future needs
- Urban planning
- Use of models
- Water-related issues
- Weather / climate data

UKUEQ only

- Acoustics
- Adaptive decarbonisation
- Air quality
- Blue-green / nature-based / Regenerative design
- Climate walks
- Site climate moderation
- Solar - thermal
- Surface properties
- Surface water and drainage systems
- Urban emergency
- Urban heat / cool island effect
- Urban morphology
- Urban vegetation
- Wind

RCG / WES

- Air infiltration / exfiltration / heat loads
- Air intakes / exhausts / fan pressure
- Wind loading - blue-green roofs
- Wind loading - decarbonisation / use of materials
- Wind loading - façade / solar panel / terrace paving slabs
- Wind loading - trees & vegetation / branch break

Key activities:

- Opportunities
- Resourcing
- Events
- Publications
- Sharing

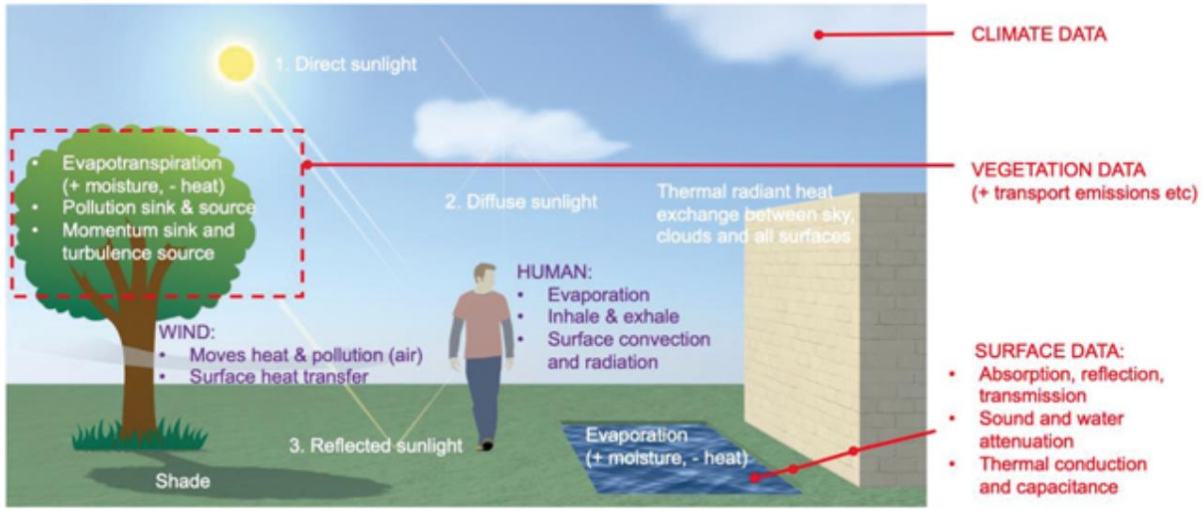
CIBSE
Resilient Cities Group

Urban Emergency – CIBSE Journal / White Papers

The urban emergency: addressing environmental quality

Designers must take a holistic approach to the urban environment, say members of the UK Urban Environmental Quality working group, who explain how elements such as wind, water and the urban form can be addressed to optimise air quality and thermal comfort

Posted in May 2024



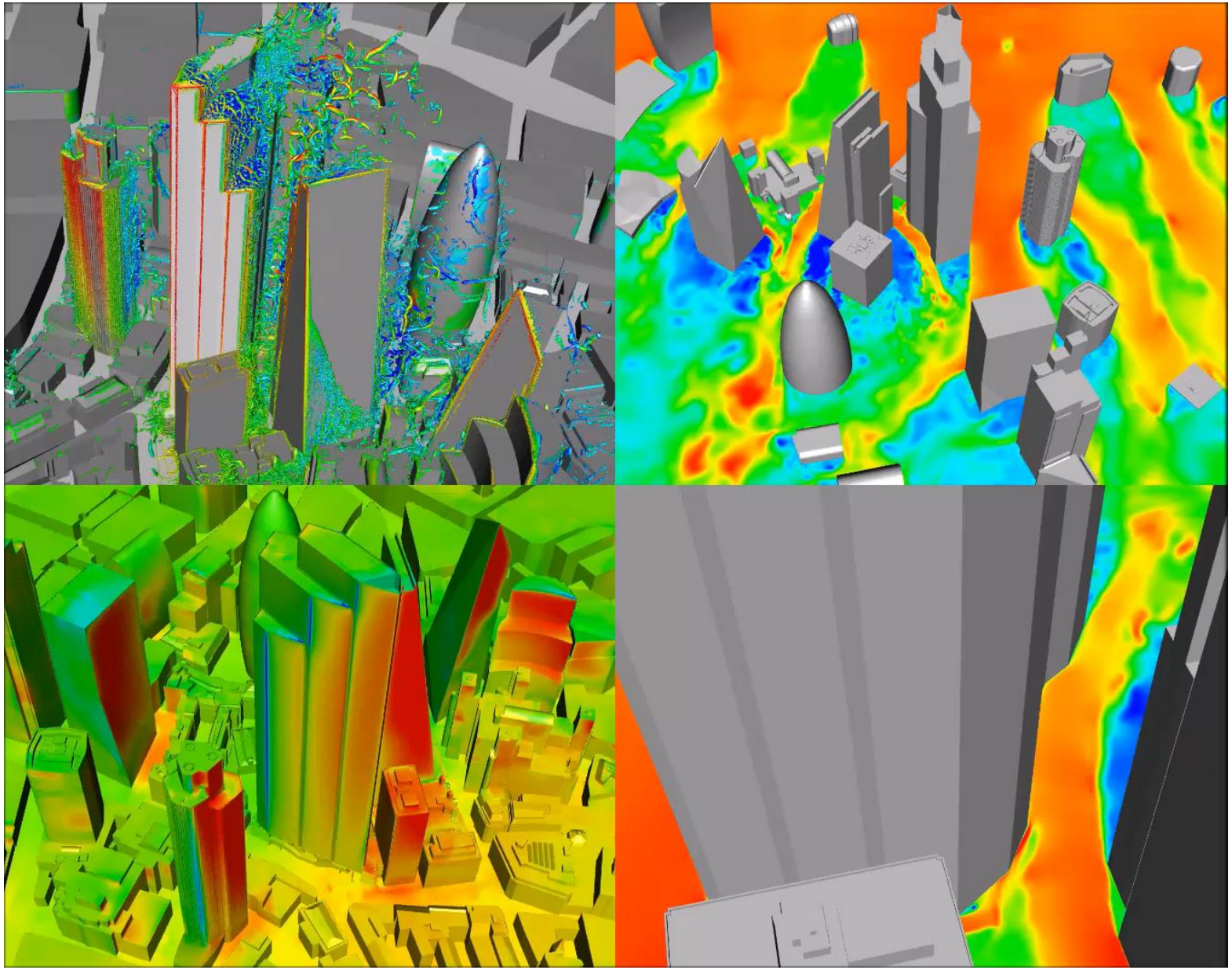
- Search ‘CIBSE Journal urban emergency’ for overview article.

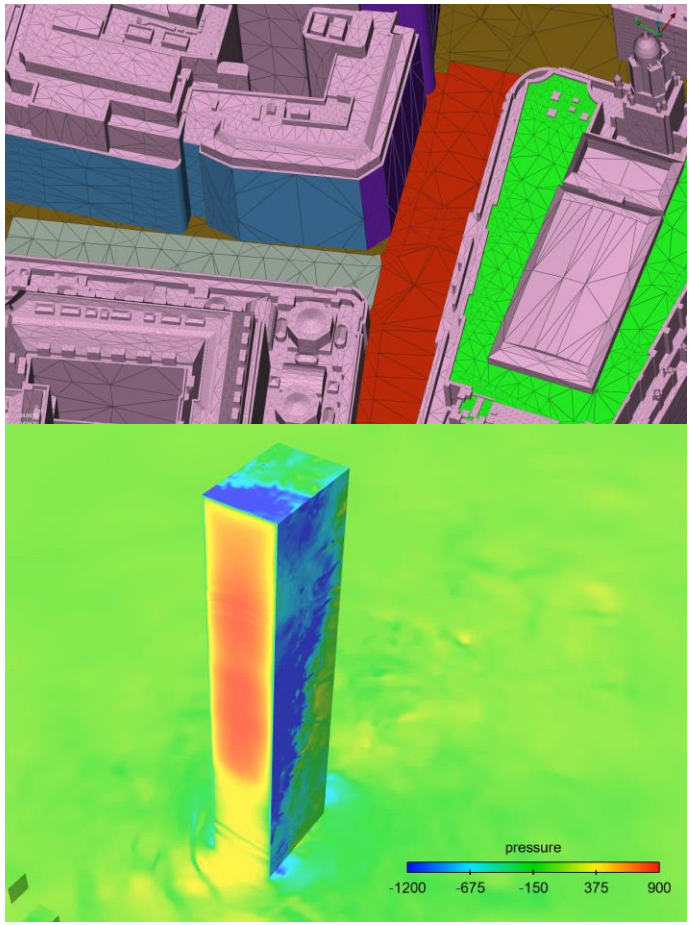
- White Papers on website: www.cibse.org/ukueq

Special features on:

- Wind
- Thermal environment
- Air quality
- Acoustics

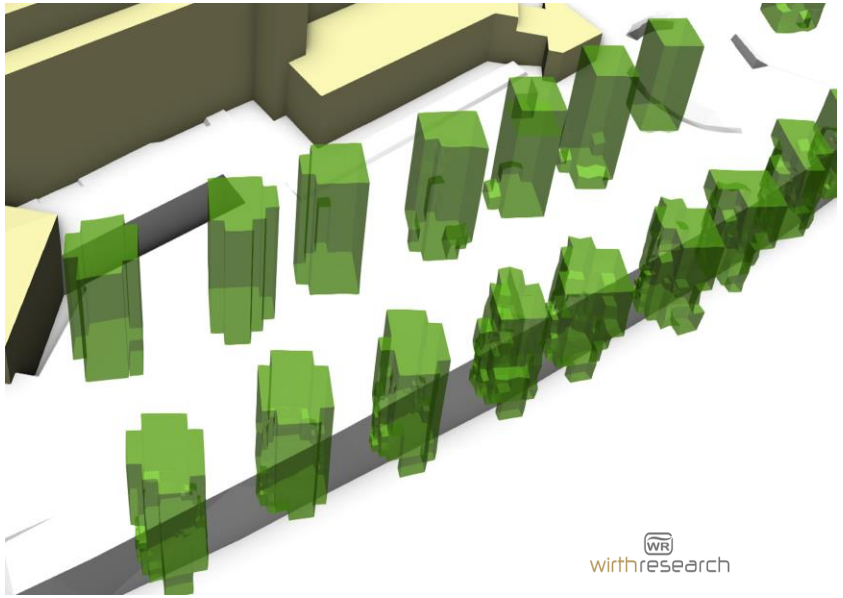
Importance of *quality* simulations





More physics = more insights

UKUEQ Publication: "CFD Modelling of Urban Vegetation Systems"

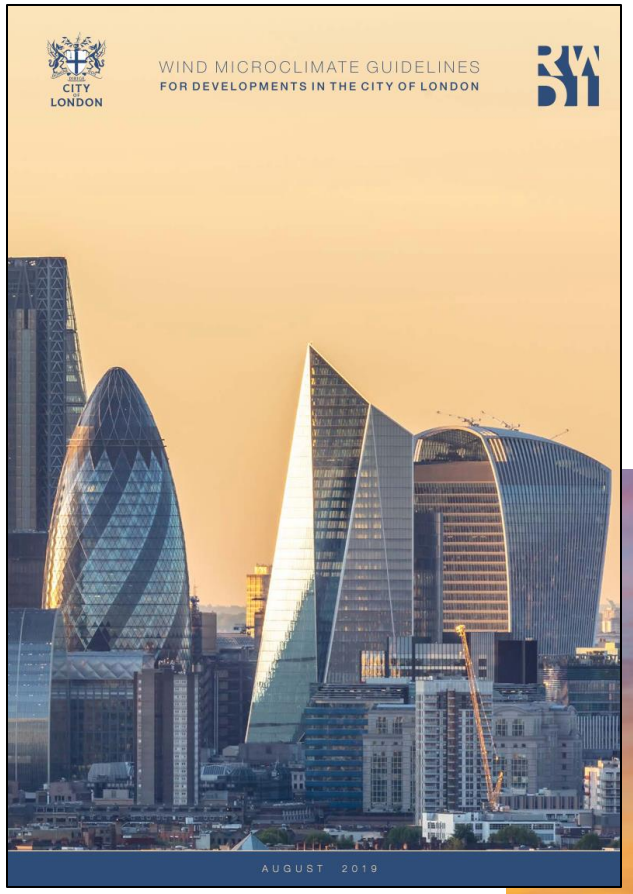


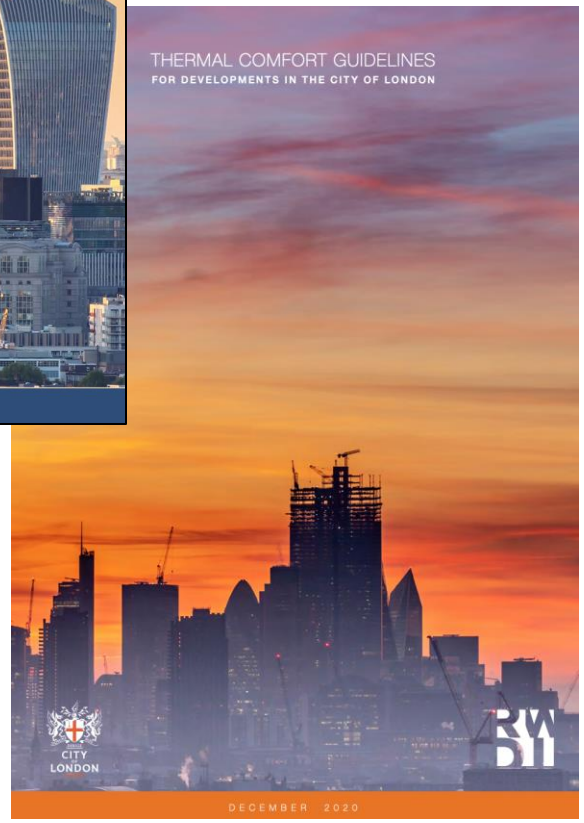
- Urban environmental quality being challenged by climate and air quality emergency.
- Complex multi-factored ecosystem with many interdependencies.
- Urban vegetation systems – multi-physics including wind, thermal, air quality and acoustics - typically applied at or near surfaces.
- Little to no standards and/or guidance on modelling *holistically* – siloed approaches.
- CFD modelling can include many elements – need evidence-based guidance (BATNEEC good practice) to improve confidence and uptake.
- Guidance will support good practice industrial modelling leading to better designs for improving urban environmental quality, health and productivity.
- Current status: Nearing completion of first draft.

Authoring Team:

- Darren Woolf (Wirth Research)
- Maarten van Reeuwijk (Imperial College London)
- Giulio Vita (Ramboll)
- Nina Glover (WSP)
- Rubina Ramponi (Arup)
- Hua Zhong (UCL, LSBU)
- Bernardo Vazquez (BuroHappold)
- Nihit Borpujari (SLA)
- Simone van de Wiel (SLA)

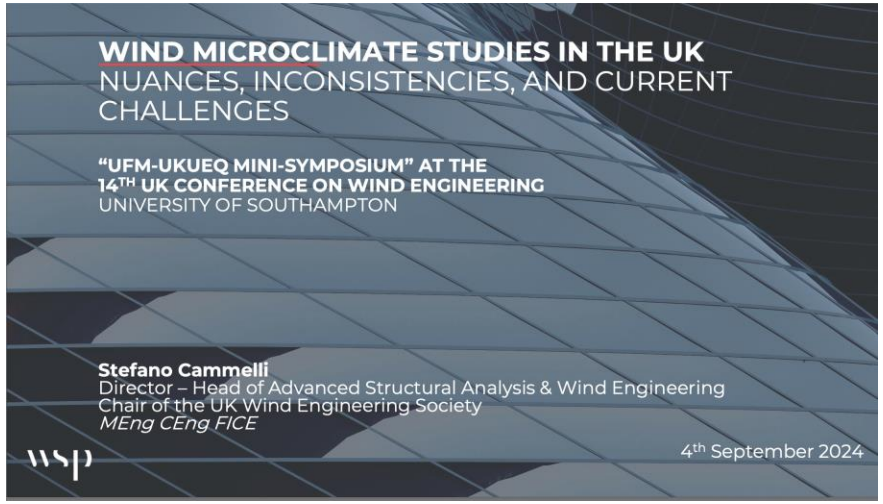
Additional UKUEQ Publications: Proposals under development





- UK City Wind Microclimate Guidelines – led by Rob Rowsell
- Modelling outdoor air quality with a focus on interfacing with the Gaussian plume techniques used in planning – led by Jenny Stocker
- Computational Modelling of Outdoor Thermal Comfort – led by Rubina Ramponi

If you would like to support, contact:
Rob Rowsell rob.rowsell@wirthresearch.com
Jenny Stocker jenny.stocker@cerc.co.uk
Rubina Ramponi Rubina.Ramponi@arup.com



RCG News: Driving the Urban Environmental Quality Agenda at UK Wind Engineering Society Conference - September 2024

[in collaboration with Urban Fluid Mechanics SIG]

Presentations:

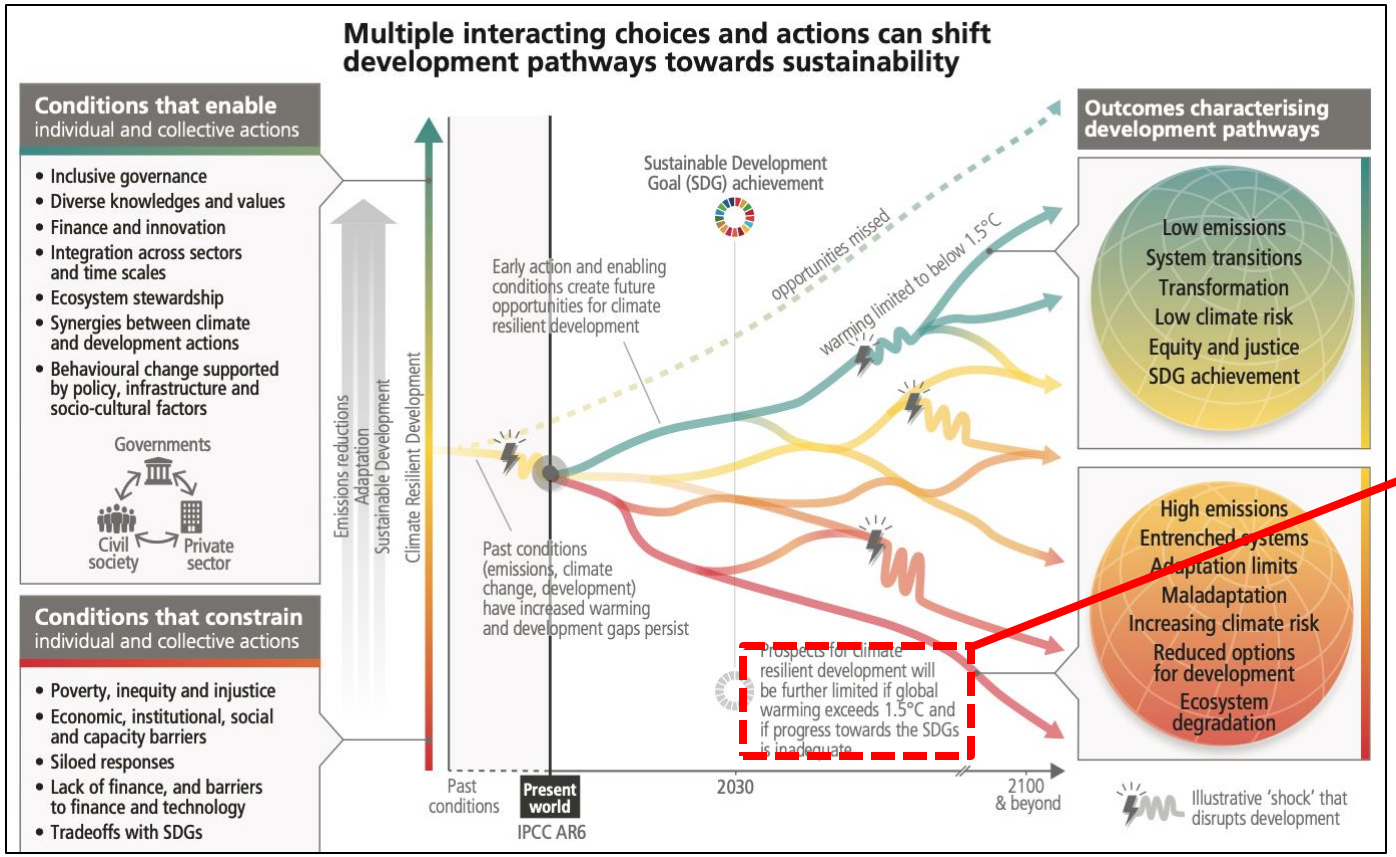
- Urban Environmental Quality: Challenging Knowledge. Darren Woolf (Wirth Research)
- Integrating Urban Environmental Quality in urban design. Marialena Nikolopoulou (University of Kent)
- Estimating UEQ in practice. Rubina Ramponi (Arup)
- Urban Air Quality and planning. Steve Moorcroft (AQ consultants)
- Wind microclimate studies in the UK: nuances, inconsistencies, and current challenges. Stefano Cammelli (WSP)
- Using wind compliance to improve UEQ. Giulio Vita (Ramboll)

https://www.cibse.org/get-involved/special-interest-groups/all-group-news-listing/driving-the-urban-environmental-quality-agenda-at-wes-conference-2024/

CIBSE
Resilient Cities Group

RCG News: Supporting improved climate resilience through decarbonisation of buildings and infrastructure - The case for adaptive decarbonisation: January 2025

C.1 Climate change is a threat to human well-being and planetary health (*very high confidence*). There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all (*very high confidence*). Climate resilient development integrates adaptation and mitigation to advance sustainable development for all, and is enabled by increased international cooperation including improved access to adequate financial resources, particularly for vulnerable regions, sectors and groups, and inclusive governance and coordinated policies (*high confidence*). The choices and actions implemented in this decade will have impacts now and for thousands of years (*high confidence*).



Prospects for climate resilient development will be further limited if global warming exceeds 1.5°C and if progress towards the SDGs is inadequate

Note: 2024 was first year global temperatures were greater than 1.5°C above pre-industrial levels.

Challenge evidence-first mindset?

IPCC (2023). "Climate Change 2023 Synthesis Report: Summary for Policymakers". (Link)

CIBSE
Resilient Cities Group

RCG News: Beyond Awareness - Embedding Climate Resilience in the Built Environment: July 2025

- Climate crisis now impacting our most vulnerable systems – ageing buildings, outdated infrastructure, and underprepared communities.
- At the same time, tightening budgets, growing retrofit needs and critical facilities (e.g. hospitals, schools, and housing stock) under strain with limited capacity to adapt to tomorrow's climate.
- Urgent need to shift from assessing climate risks to embedding measurable resilience into the way we plan, design, and operate our buildings and infrastructure.
- Financial and insurance mechanisms are becoming unexpected but powerful drivers of climate adaptation - some areas increasingly uninsurable.
- More strategic and integrated approaches to resilience needing more interdisciplinary collaboration for truly adaptive, future-ready solutions.
- Defining challenge of our time needing more innovation and sharing for better practical and measurable outcomes.

Speakers and host (all WSP): Christine Wissink, Michjael Trousdell & Dr Bahareh Salehi

Recordings and presentations on website.

RCG News: A Wicked Collaboration – What we're NOT talking about

Blog with recording and presentation coming soon on RCG News site!

"Climate change is here. We're in trouble. Are we asking *all* the right questions?"

CIBSE
Resilient Cities Group

Proposed RCG Event @ Build2Perform: Regenerative Design & Resilient Cities (Nov 19th or 20th 2025)

Including Julie Futcher (Anglia Ruskin University) on ”how **built form operates as active climate infrastructure”**

Need more speakers! Contact Paul Woodville @ PWo@hrtb.no

https://www.build2perform.co.uk https://elementallondon.show

CIBSE
Resilient Cities Group

A Wicked Collaboration

Professor Darren Woolf
Chair of CIBSE Resilient Cities Group (RCG) and the
UK Urban Environmental Quality partnership (UKUEQ)

Towards Resilient and Sustainable Cities and Communities

De Montfort University, 4th September 2025

DE MONTFORT UNIVERSITY LEICESTER

INSTITUTE FOR SUSTAINABLE FUTURES