

EXPLOITING URBAN PHYSICS

The Role of Urban Form as an Energy Management Parameter

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THE ISSUES

THE CITY OF LONDON AS THE CASE STUDY AREA

THE IMPORTANCE OF FORM & FUNCTION

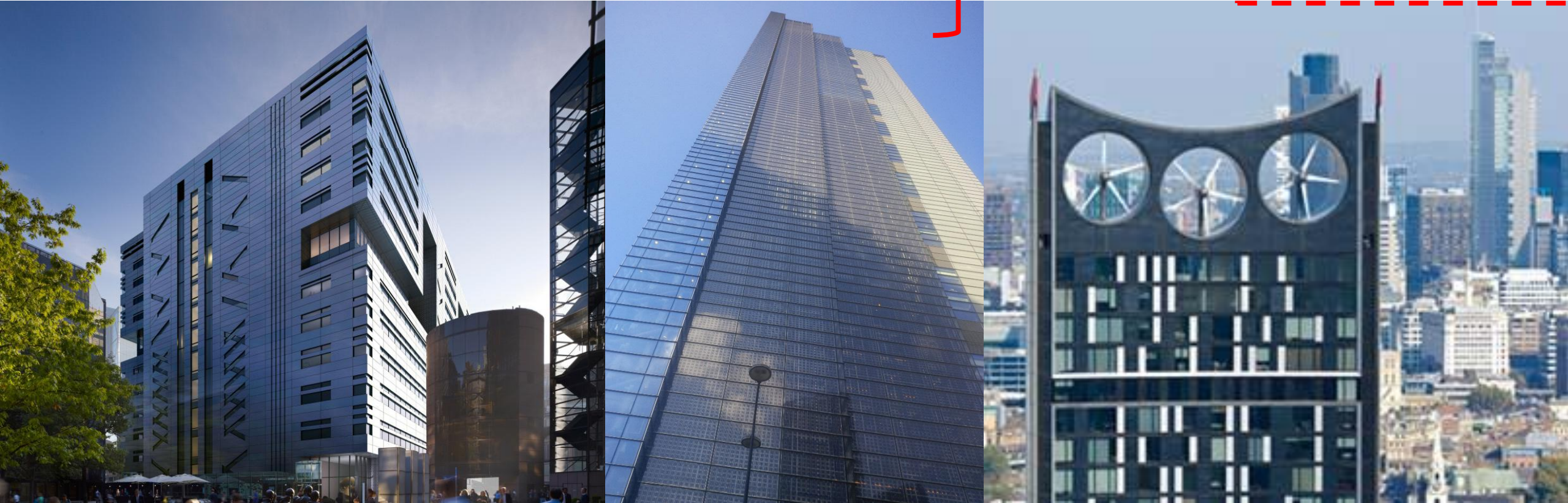
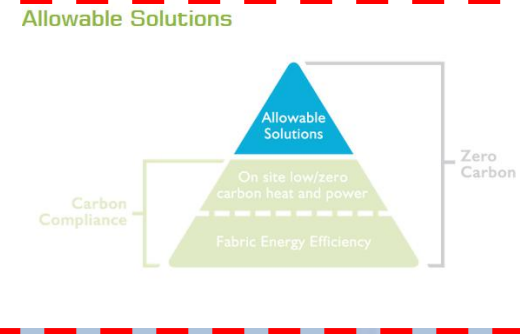
COMMENTS & QUESTIONS



Current UK BUILDING ENERGY MANAGEMENT Measures

- Energy supply from both on and off site renewables (*Limited Resource – often limited to the individual building*)
- Optimising the building fabric and the efficiency of energy demanding systems (*regulated*)
- Change behaviour patterns towards energy efficient measures (*operational*)

Limited to the individual building



50% of all energy is taken by buildings / 75% of the UK 2050 building stock is already in place*/ 80% net-reductions CO₂ by 2050!! /produce 70% of global CO₂

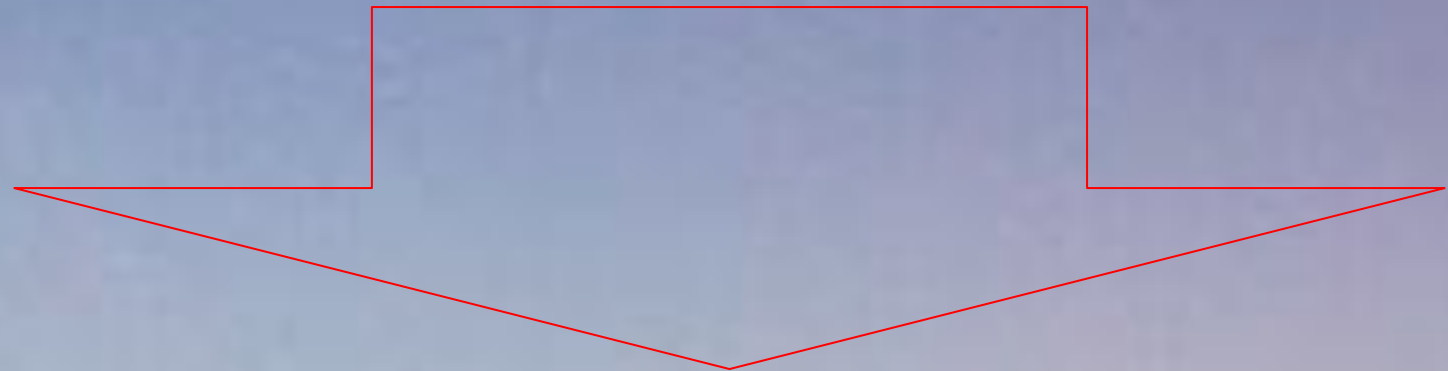
THEREFORE THESE MEASURES ALONE ARE UNLIKELY TO BE SUFFICIENT IN REACHING TARGET REDUCTIONS - SO in an attempt to address these shortfalls, our work considers an additional but often overlooked measure;

THE ROLE OF BUILDING & URBAN FORM

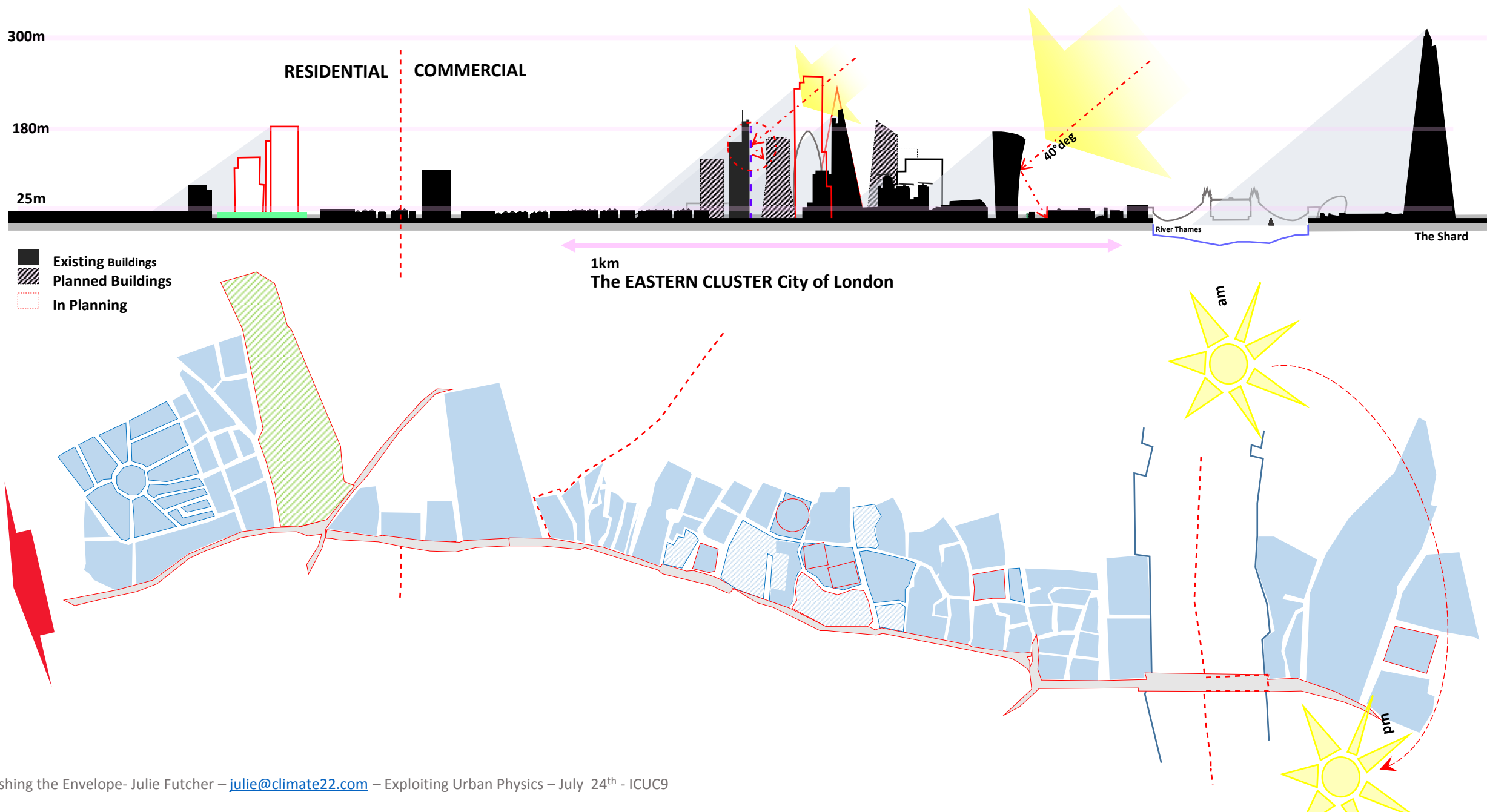
**Yet this is
what we do**



This is what we have



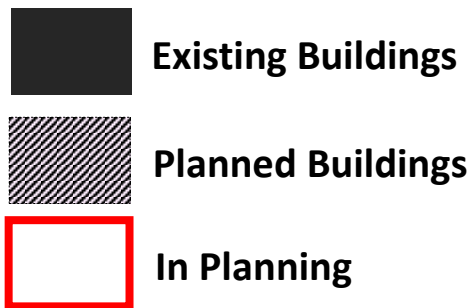






300m

The EASTERN CLUSTER City of London



180m

25m

BISHOPSGATE

Heron Plaza
(planned)

The Heron
Tower

100 Bishopsgate

30 St Marys Axe
(behind) Aka
the Gherkin

220 Bishopsgate
(behind)
Undershaft
St Helens/ the

122 Leadenhall St
Aka the cheese grater

52-54 Lime St
(behind & planned)

40 Leadenhall St
(behind & planned)

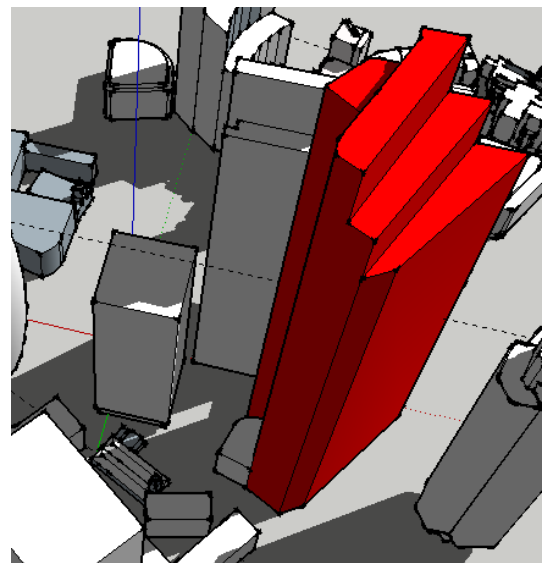
Lloyds Building
(behind)

20FC

Eastcheap



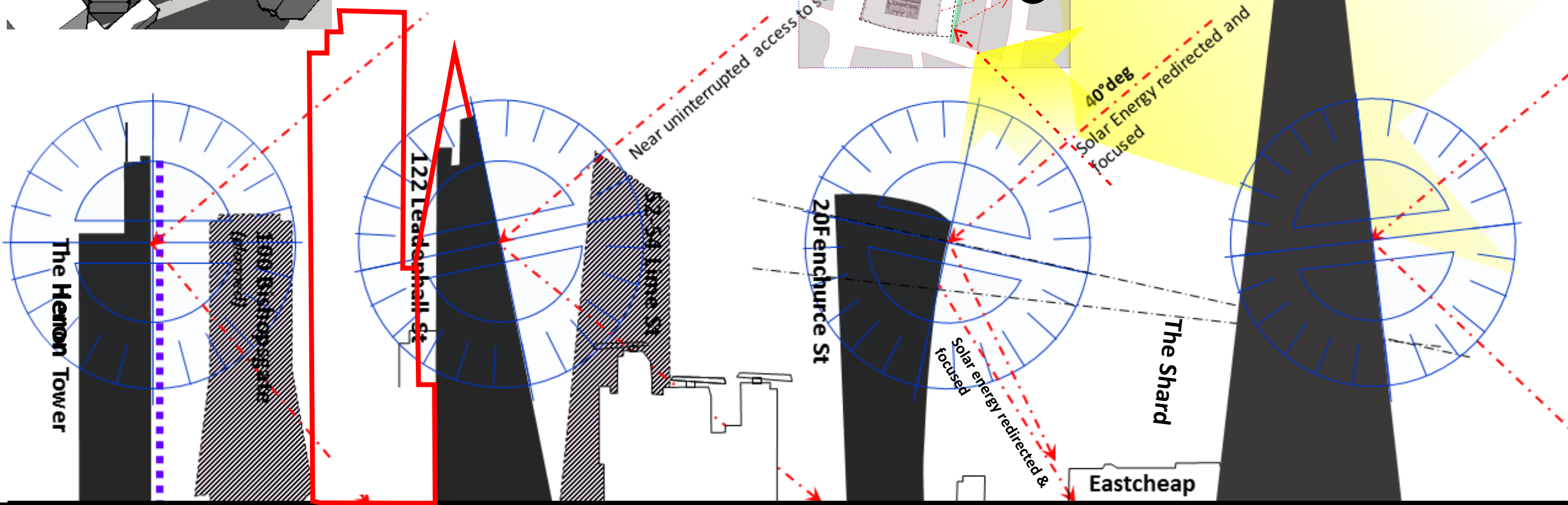
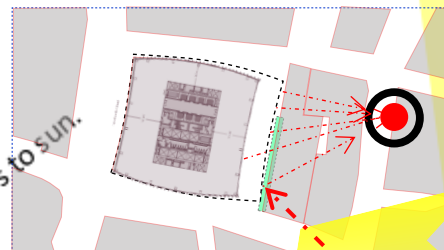
A Green wall



- 20 FC demonstrates two significant but overlooked energy management parameters relating to the role of building form,
- 1) The concave convex and cantilevered form deflects solar energy away from the interior, making the building form more efficient in terms of cooling
 - 2) The deflected beam has an energy implication of the surrounding setting

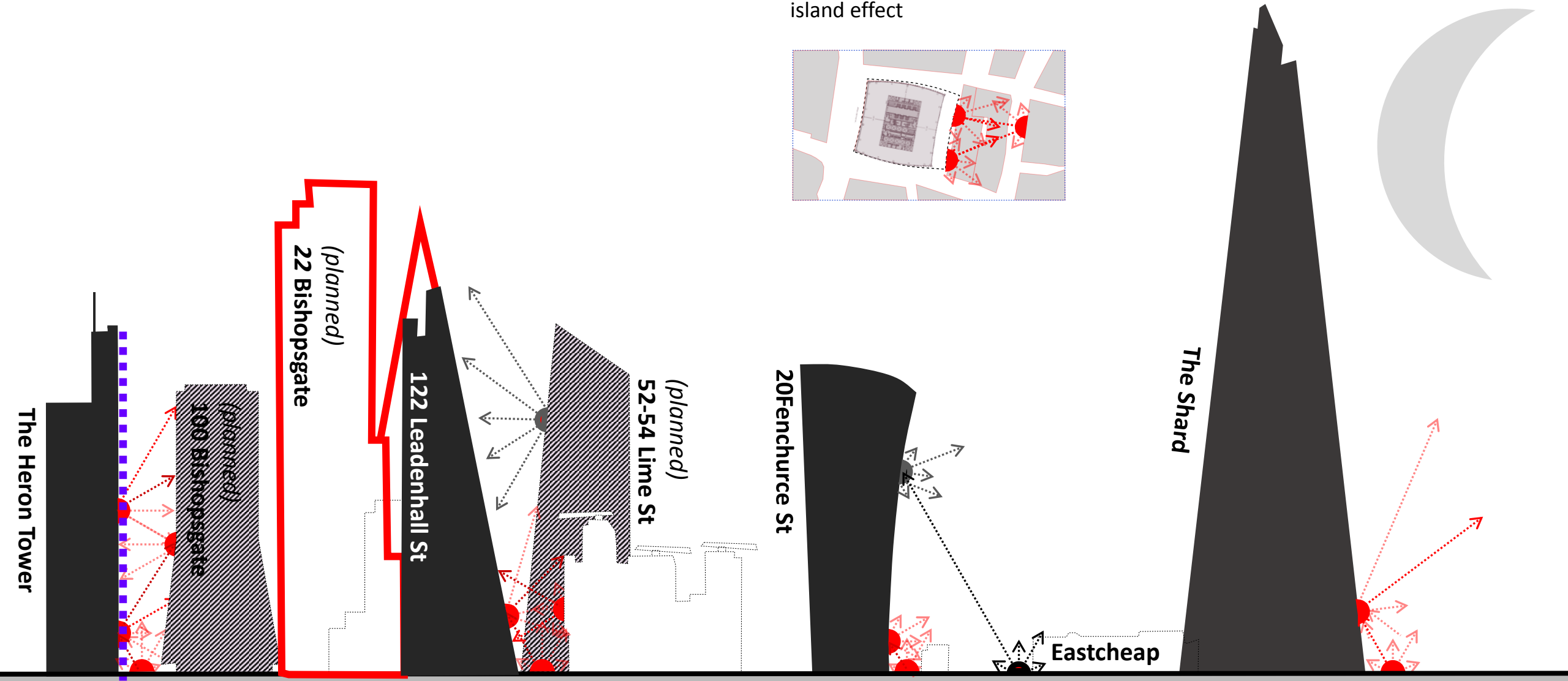
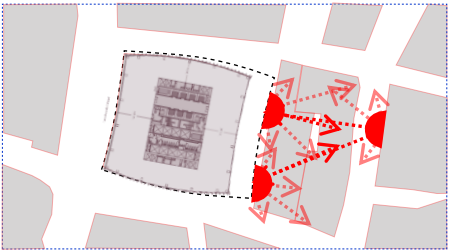


Area of entrance mat to barbers shop Eastcheap, scorched by beam



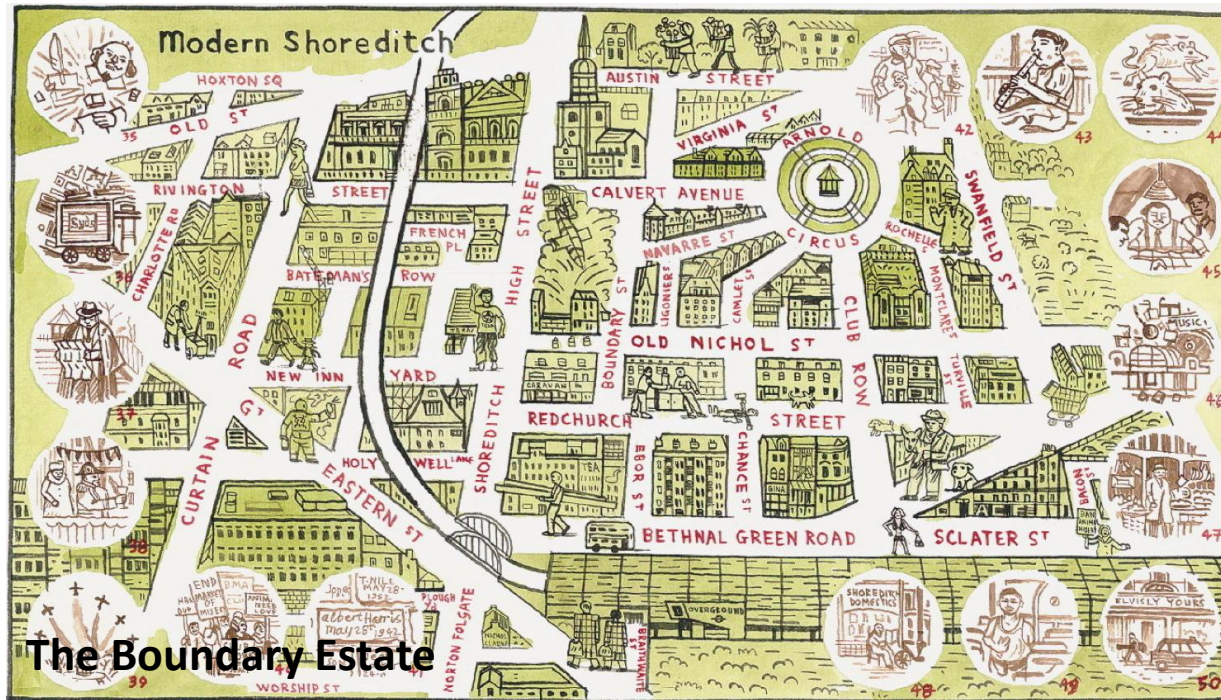
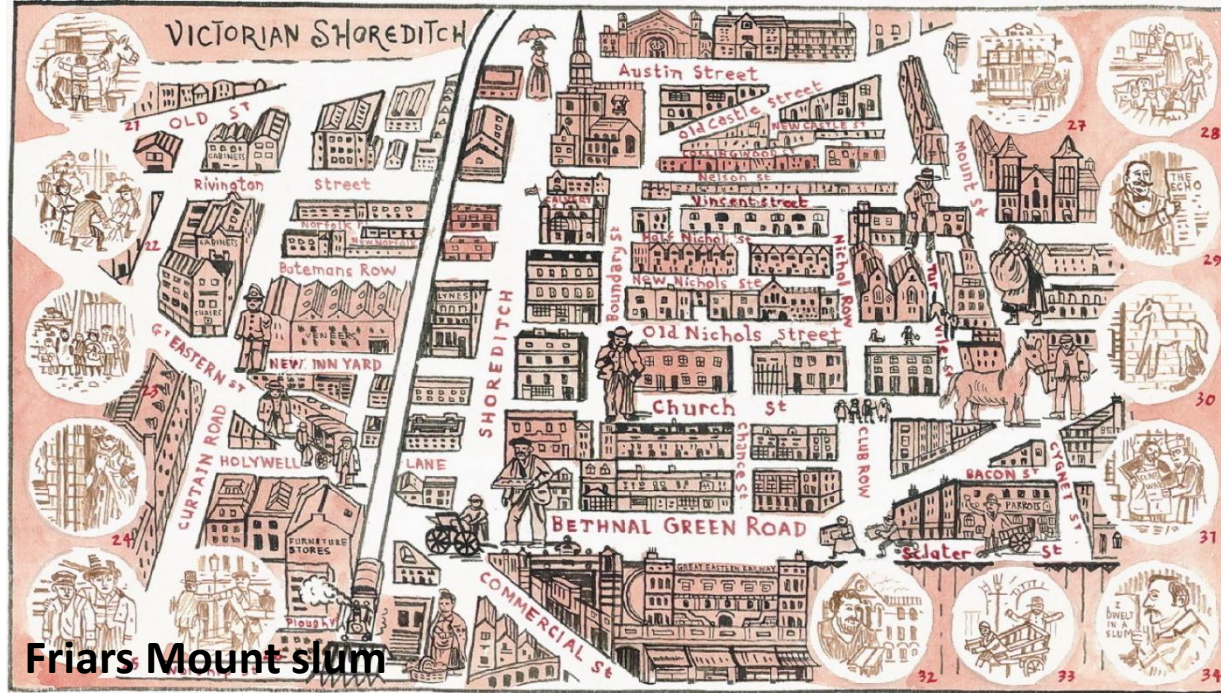
DAYTIME – incoming radiation

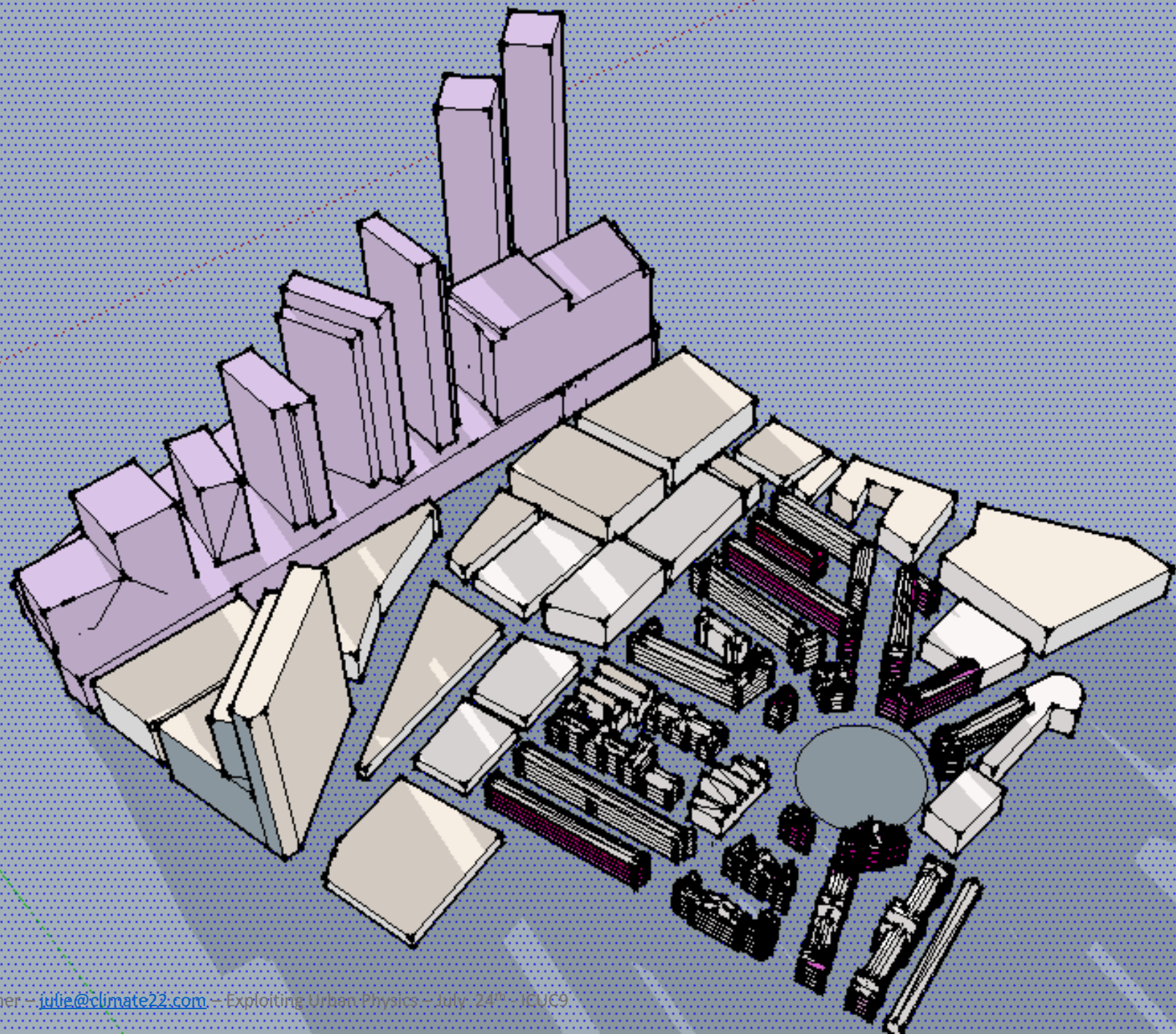
some building forms *in - situ* may be better than others at facilitating the dispersal of trapped heat, minimising the localised nocturnal urban heat island effect



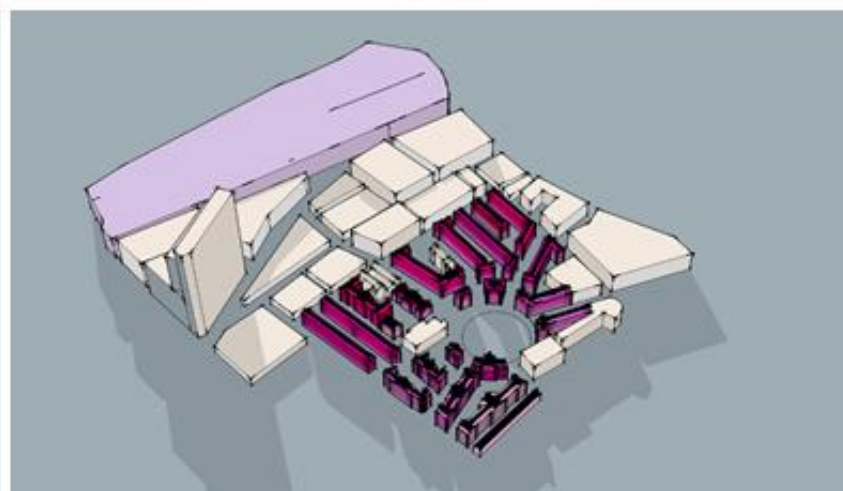
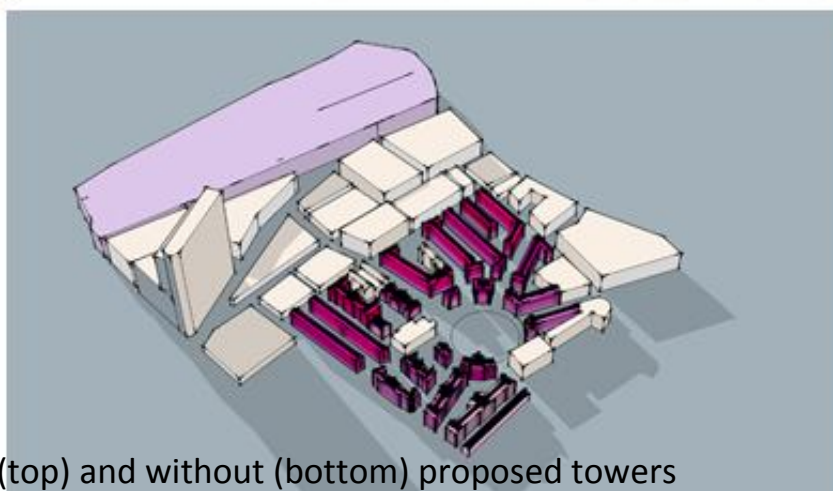
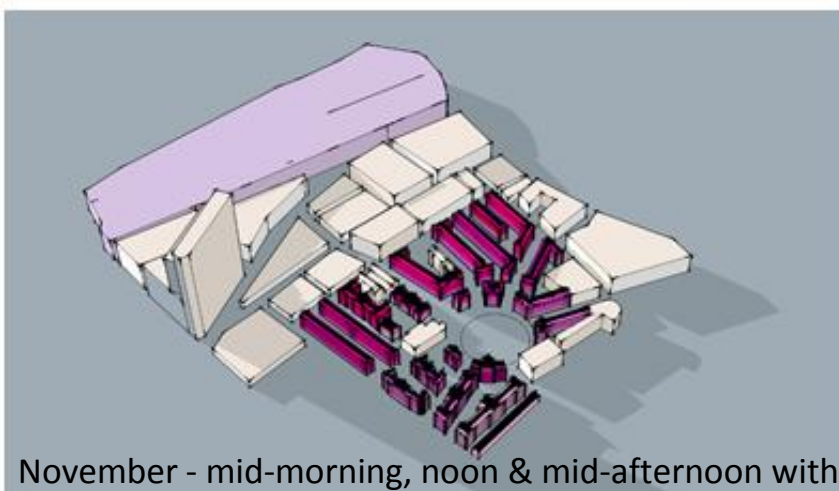
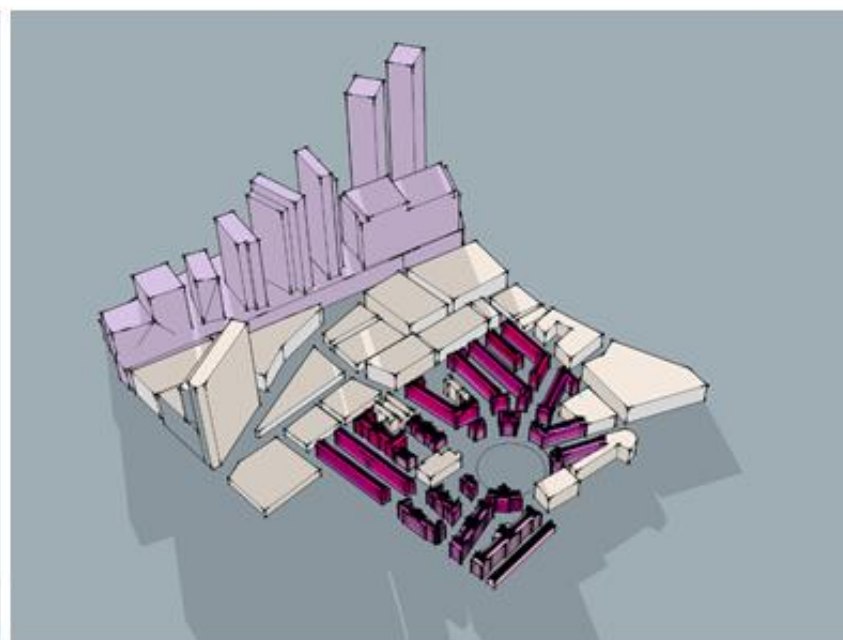
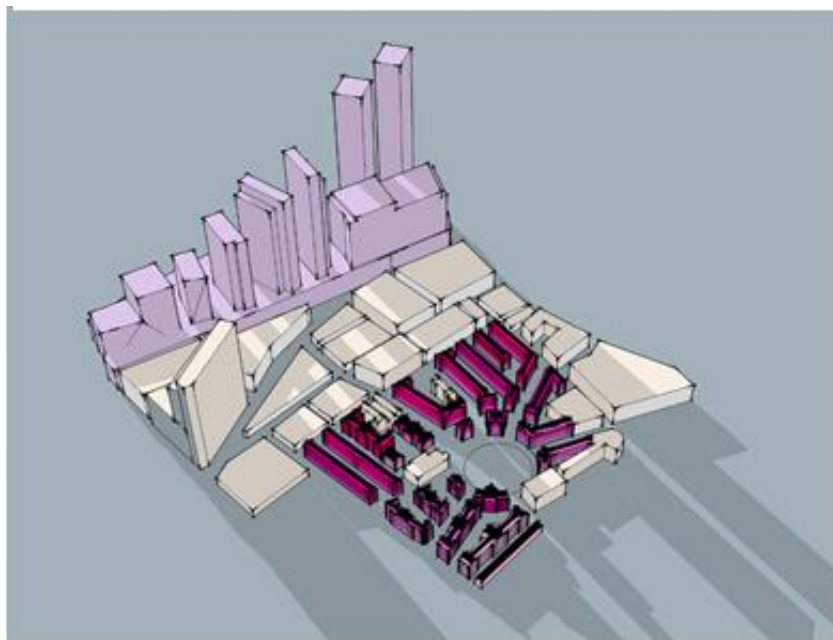
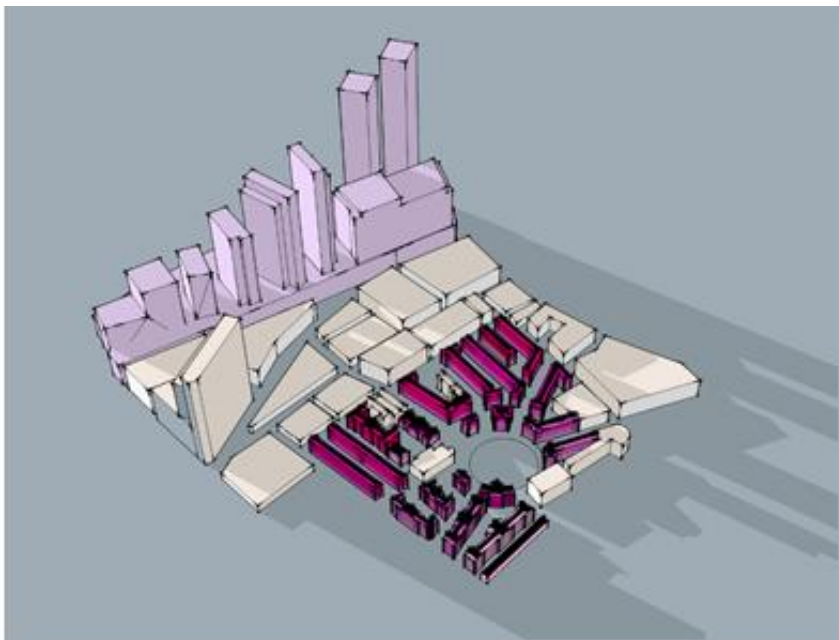
NIGHT TIME – outgoing radiation







December - noon

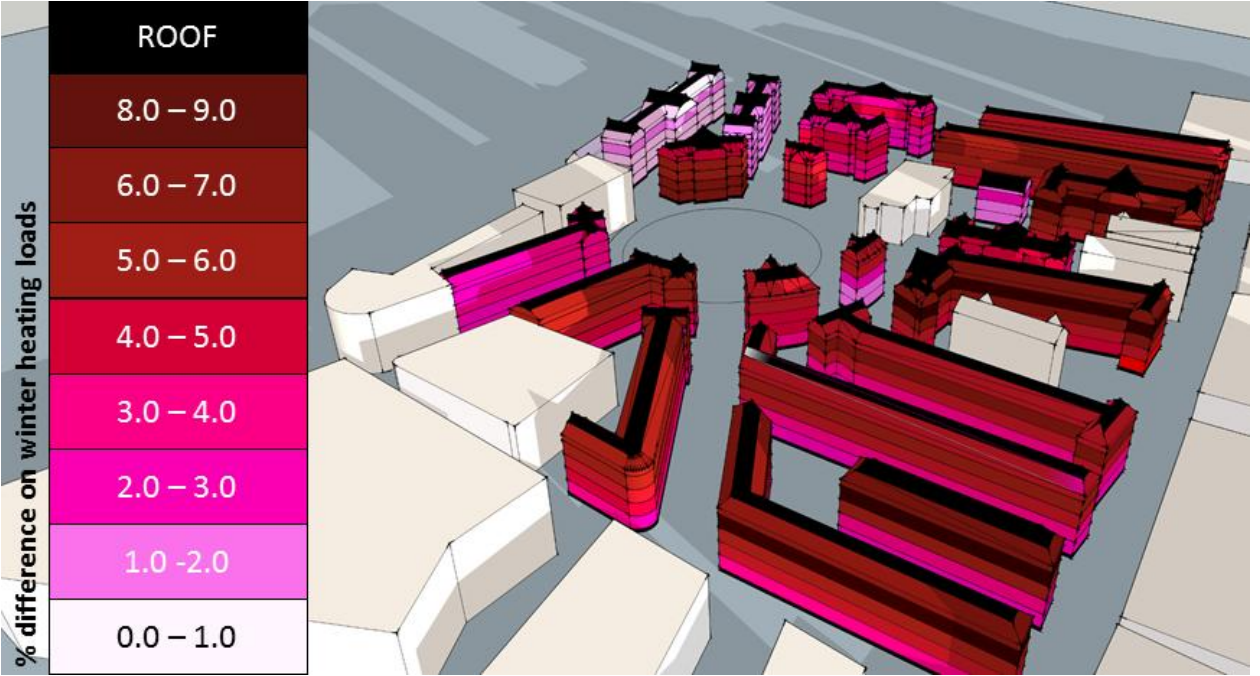
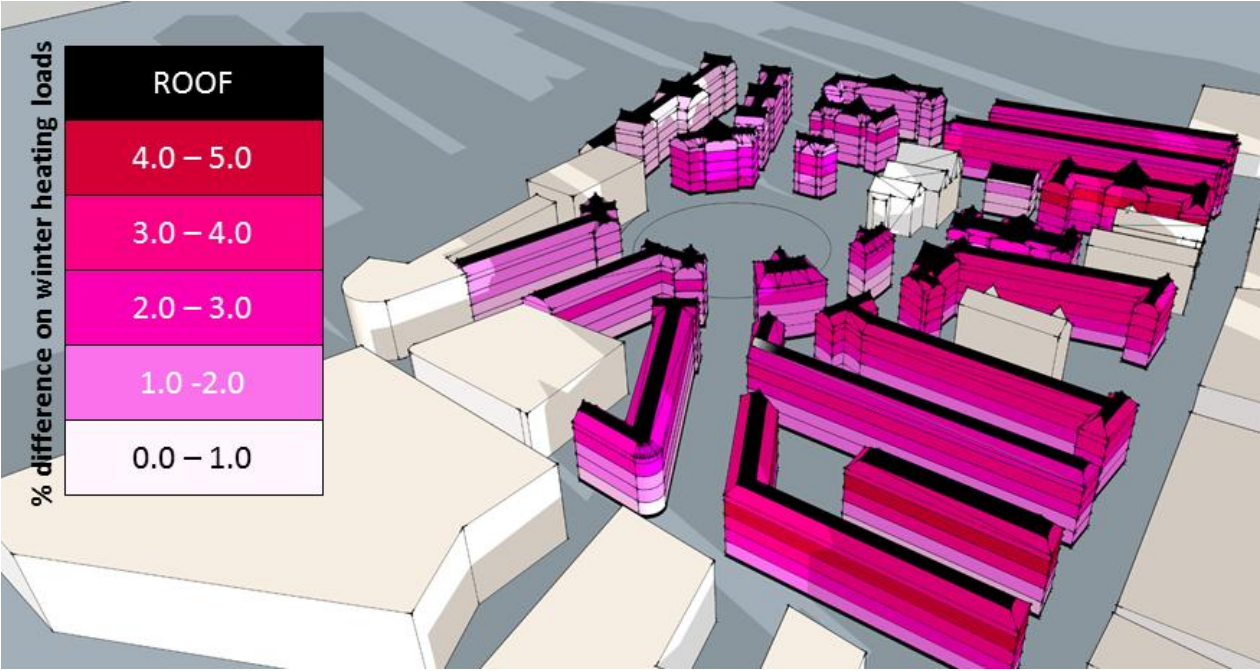


November - mid-morning, noon & mid-afternoon with (top) and without (bottom) proposed towers

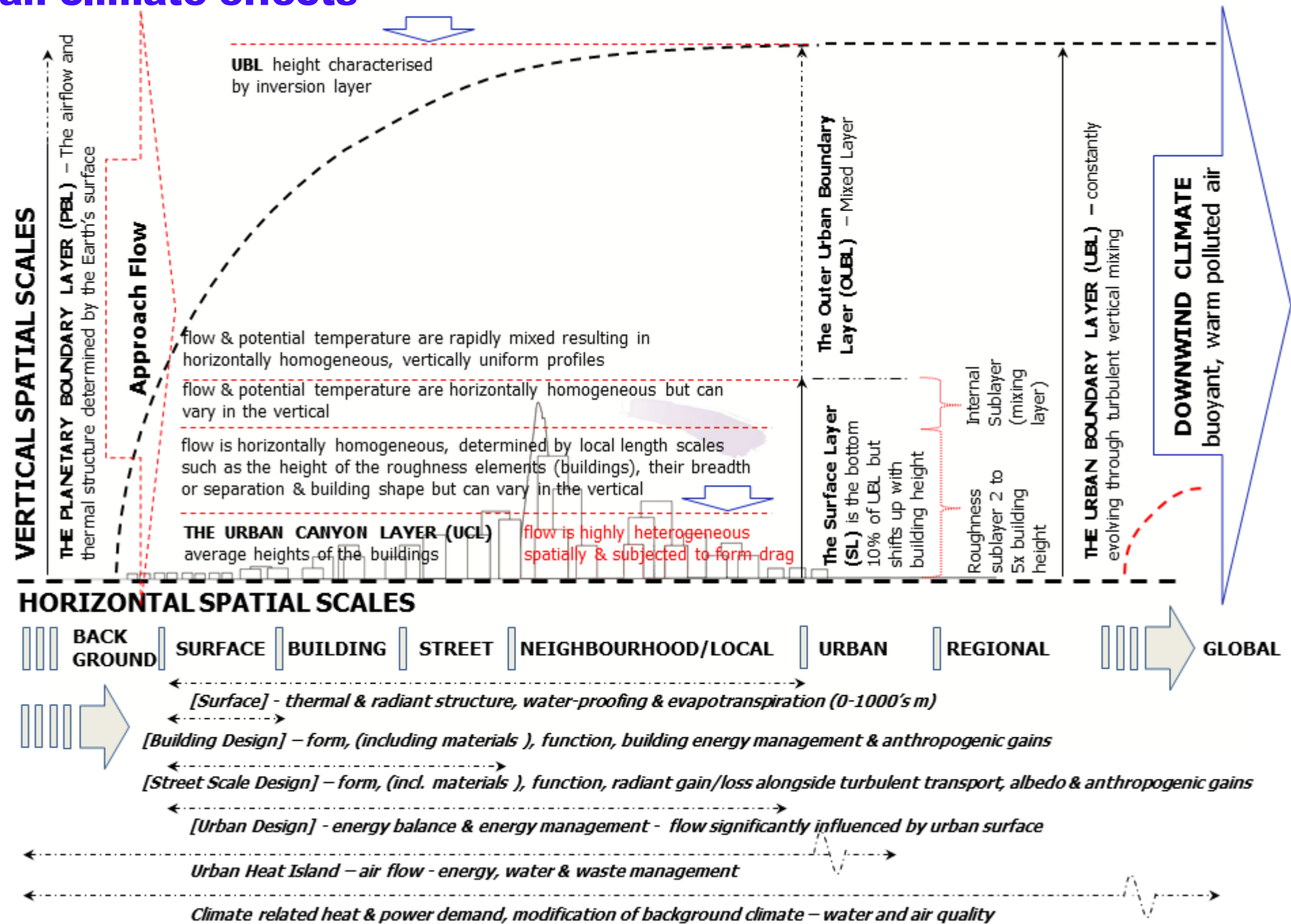
		U-Values	
Building Element	Current construction	Existing	proposed
external walls	15" Brick wall without cavity or insulation	1.583	0.28
Roof	Wooden rafters	2.823	0.303
	Welsh Slate and/or Terracotta tiles		
	No or limited roof insulation		
Windows	single transparent 4mm glass	5.871 Solar Heat Gain Coefficient: 0.847 Visible transmittance: 0.892	1.946 12mm air cavity, 4mm Low-E clear inner pane Solar Heat Gain Coefficient: 0.628 Visible transmittance: 0.761
	casement, sash and pivot		
Ground floor	foundation of vaulted arches in-filled with rubble	1.378	0.273
	damp proof course around the base of the ground floor flats		
Internal floors	concrete	Temperature setpoints: C	
	one block still has wooden floors	occupied time:	during unoccupied time:
Dividing walls	modified original layout	Bedrooms 19	12C
	Brick or block work	Living rooms 21	
Heating	original coal fires replaced with gas heating system	Light + Equipment gains:	
	Occupancy parameter	Bedrooms: 9W/m2	
Occupied time	Bedrooms: 10pm - 8am	Living rooms: 11.5W/m2	
	Living rooms working family:	Infiltration (constant):	
	Weekends: 8am - 10pm	existing fabric: 0.5 ach	upgraded fabric: 0.25 ach
	Weekdays: 5pm - 10pm	Occupancy density	
	Living rooms constantly occupied: 8am - 10pm	Bedrooms: 8m2/person	Living rooms: 10m2/person

Using energy + evaluated current heating for the six-month winter (September to March) period, neglecting the energy demand other than heating, the average heating demand was 90kWh/m2/yr

When building fabric was upgraded under the same conditions the consumption was lowered to 27kWh/m2/yr



FORM DRIVEN urban climate effects



Related Publications

RICS June 2015 Good Neighbours - page 12

http://www.rics.org/Global/Building_Control_Journal_June_July_2015.pdf#page=12

CIBSE – April 2015 Pushing the Envelope

<http://portfolio.cpl.co.uk/CIBSE/201504/opinion-futcher/>

CIBSE – Feb 2015 Walking among Giants

<http://portfolio.cpl.co.uk/CIBSE/201502/tall-buildings/>

Architects Journal (AJ) - August 2014 We Cannot Assess Skyscrapers in Isolation

<http://www.architectsjournal.co.uk/news/julie-futcher-we-cannot-assess-skyscrapers-in-isolation/8668340.article>

CIBSE – July 2014 ‘Shadowlands’

<http://portfolio.cpl.co.uk/CIBSE/201407/modelling-tall-buildings/>

CIBSE – Feb 2015 ‘The Selfish Giants’

<http://portfolio.cpl.co.uk/CIBSE/201402/opinion-julie-futcher-gerald-mills/>

IAUC – Sep 2013 ‘No Building is an Energy Island, The cautionary tale of the fryscraper

urban-climate.org/newsletters/IAUC049.pdf