Retrofitting existing buildings

Alice Moncaster

Cambridge Zero Policy Forum study on local priorities for investing in resilient and sustainable infrastructure

Witness session 2: Friday 10 December 2021





Background

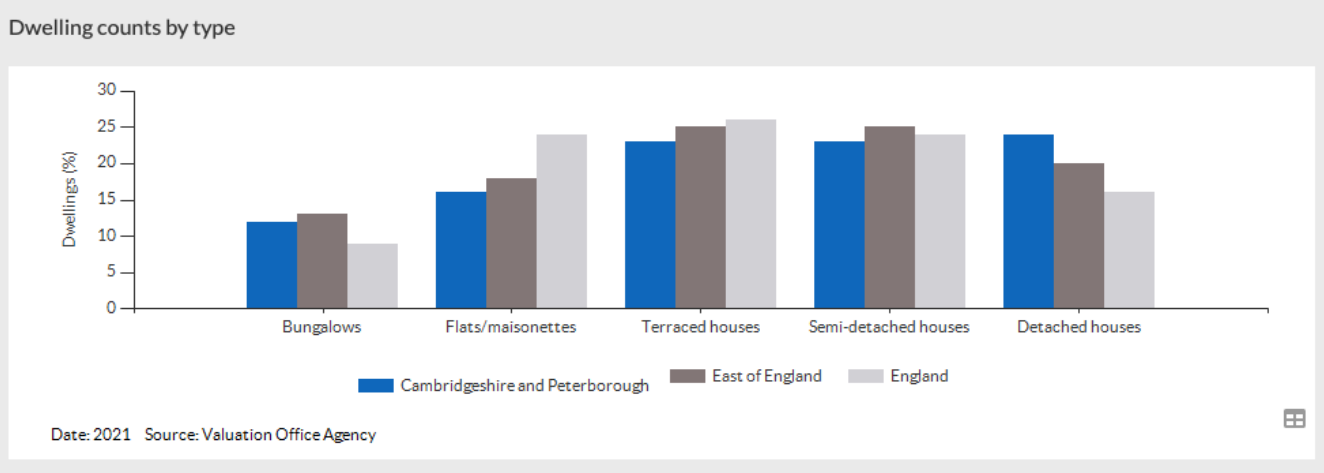
1990-2007

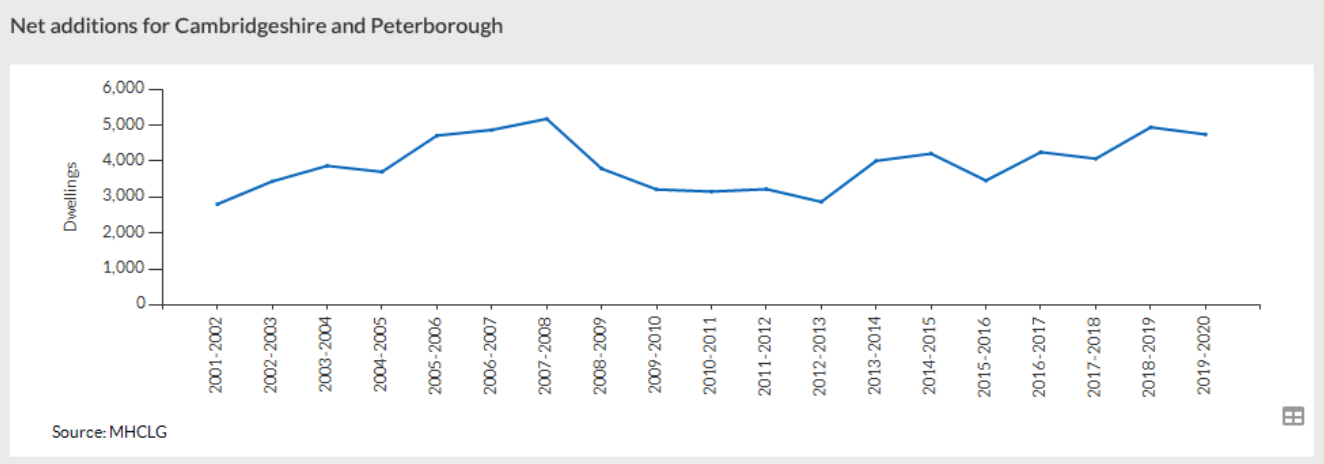
Industry – civil infrastructure then structures of buildings

2007-date

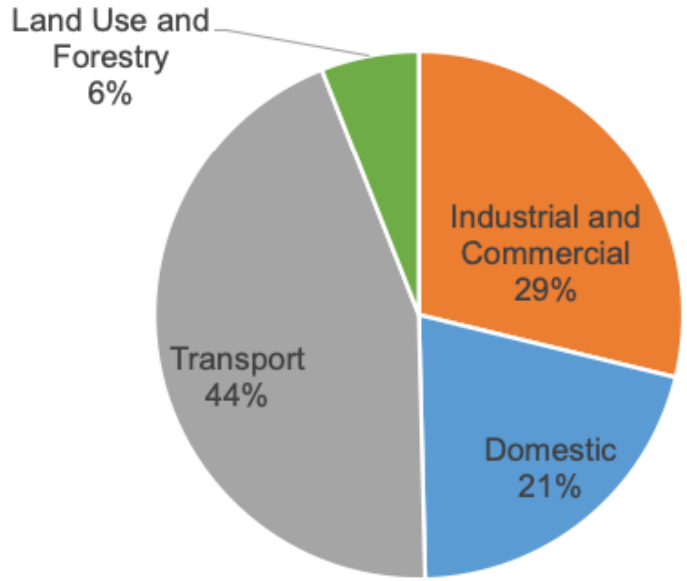
Research - Sustainability of the built environment

Dwellings in Cambridgeshire and Peterborough





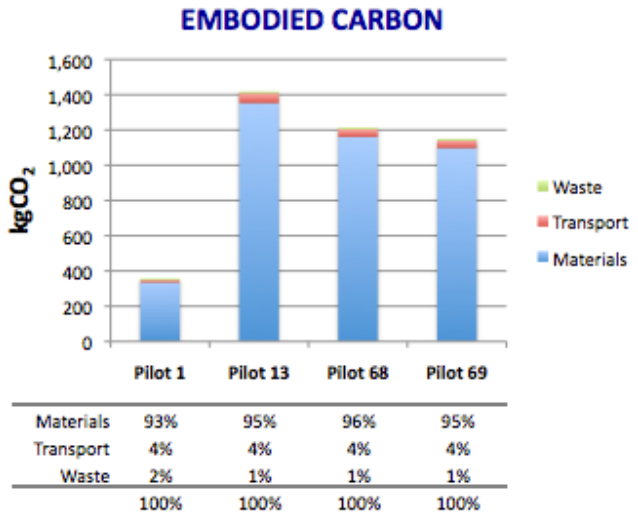
380,000 dwellings in 2021, growing by 3-5,000 per year



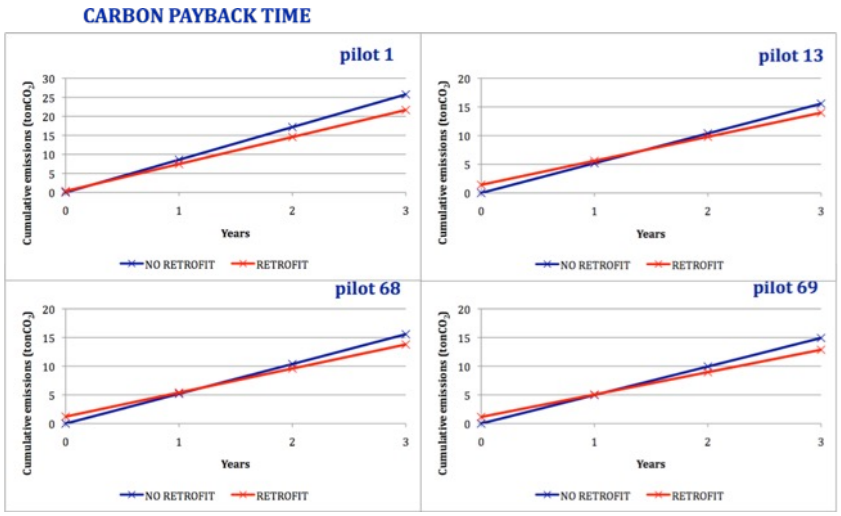
Residential buildings emit 21% of carbon emissions in the region, 1.28Mt CO_2e

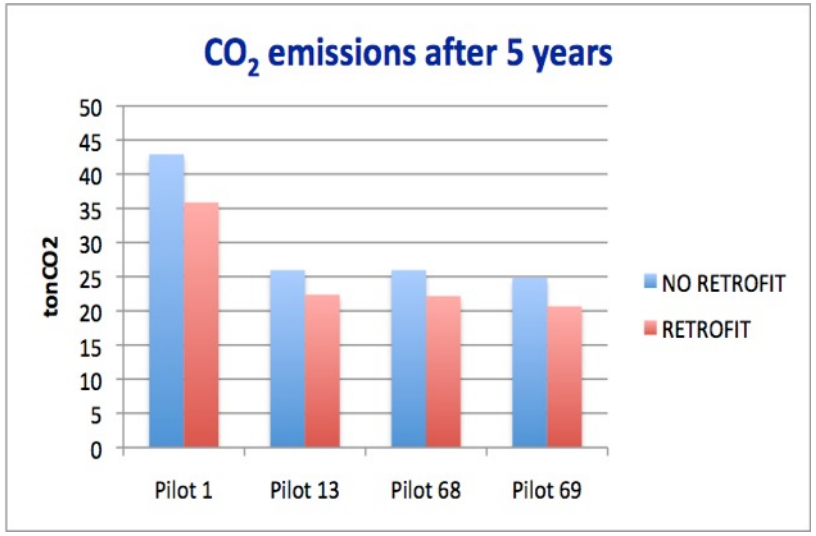
= **3.37t CO_2e per dwelling, per year**

Rampton Drift (Northstowe)



	Pilot 1	Pilot 13	Pilot 68	Pilot 69
Materials	93%	95%	96%	95%
Transport	4%	4%	4%	4%
Waste	2%	1%	1%	1%
	100%	100%	100%	100%

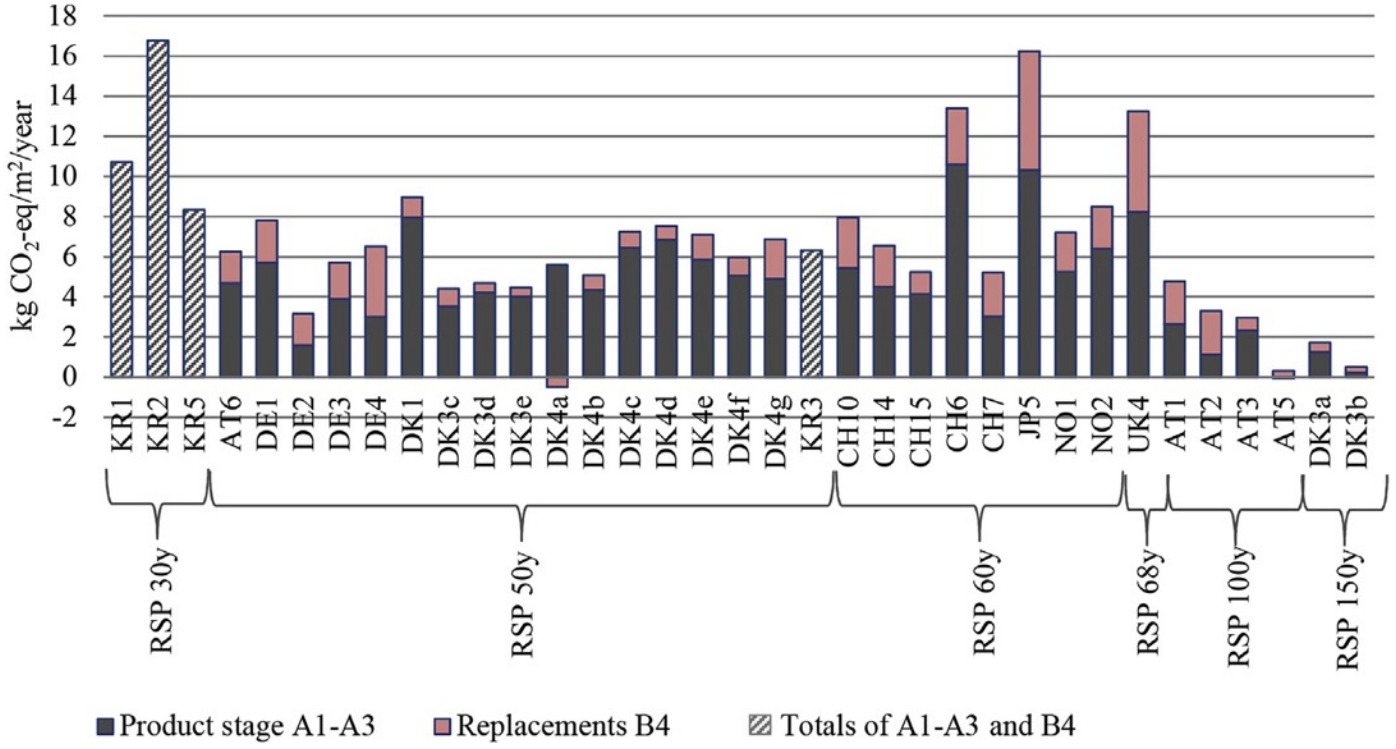


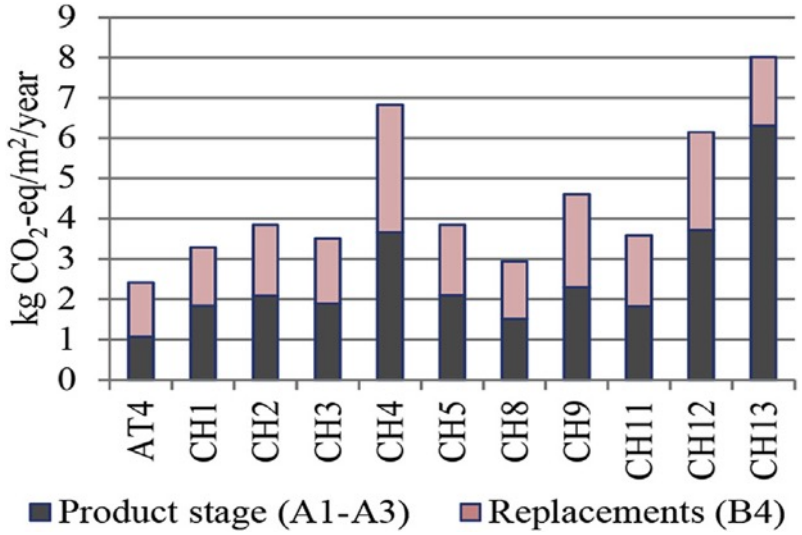


Low cost retrofit measures
Embodied carbon costs
But payback within 2 years
Savings **4t per house after 5 yrs**
- >1 year of op energy

Simple measures reduce carbon

IEA Annex 57 case study results





Retrofit <u>to current energy efficiency</u>

Newbuild

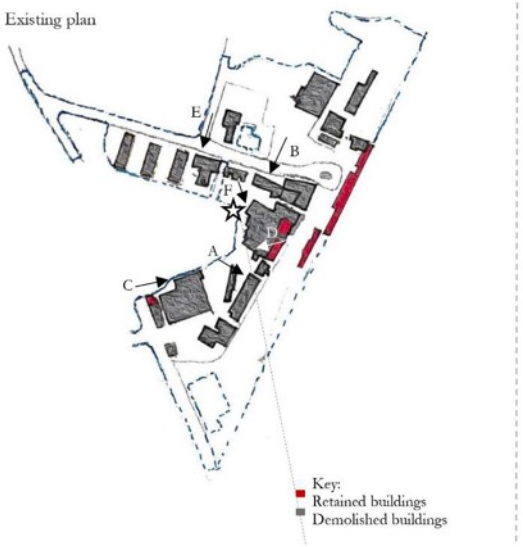
A1-3: **240** kg CO_2e/m^2

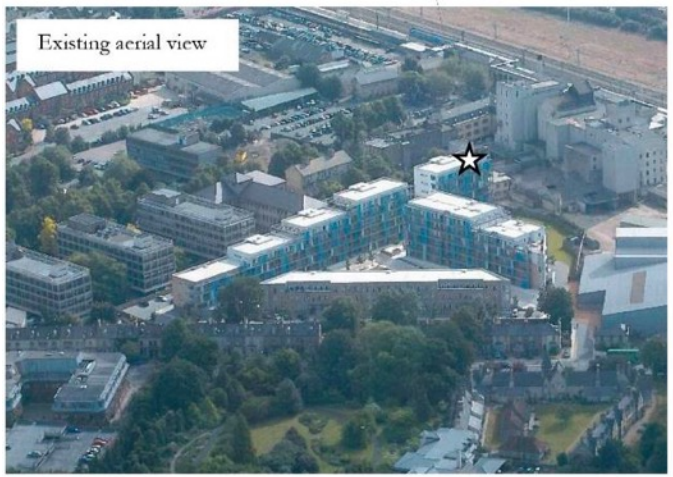
A+B: **360** kg CO_2e/m^2

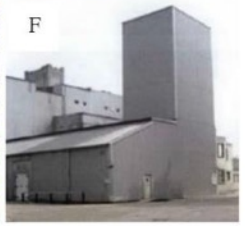
A1-3: **120** kg CO_2e/m^2

A+B: **180** kg CO_2e/m^2

Hannah Baker PhD thesis: CB1, Eindhoven & Sydney







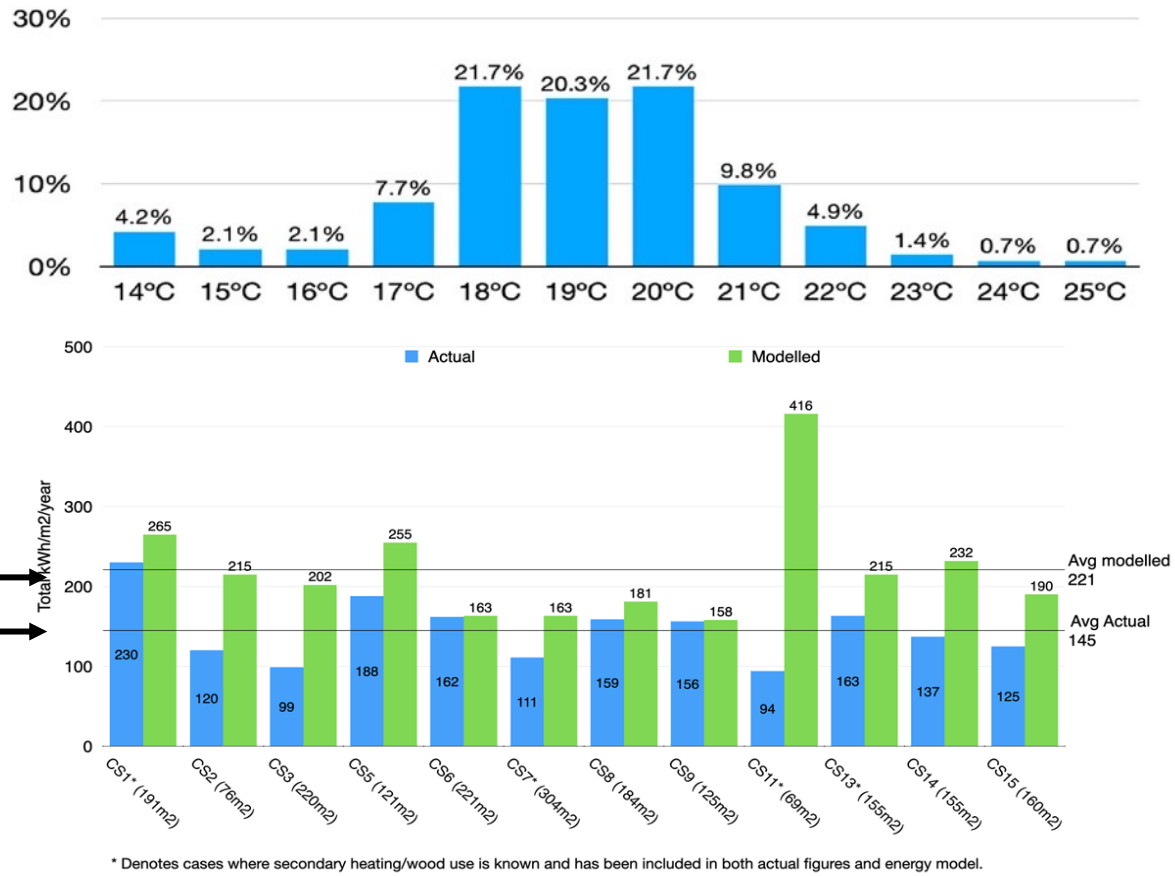
Experts KNOW demolition = higher carbon
Presumption in favour of demolition
Regs to reduce op energy used as argument
National listing is main limitation

Freya Wise PhD thesis: Cumbrian heritage dwellings

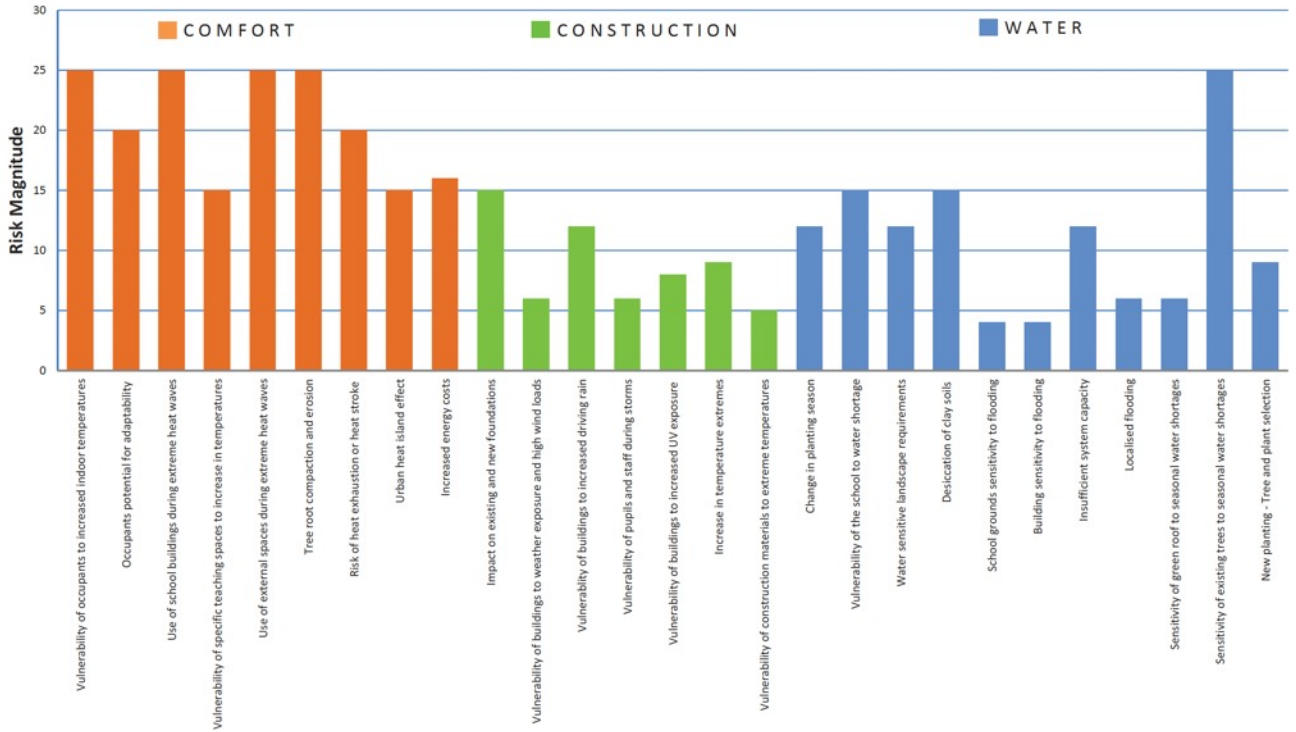
Occupants:
…care about heritage value & won't implement retrofits which lose this
…have low energy behaviours

Buildings:
….are <u>not</u> accurately represented in models
- RdSAP estimates 50% higher energy use

Energy:
… can be reduced significantly through low emb carbon measures – 'soft retrofits'



Design for future climates (D4FC): St Faith's School



Retrofit needs to consider future climate risks

- Expected significant increased temperatures, indoors and outdoors
- Tree root compaction and erosion, & sensitivity to drought, leading to tree loss
- Loss of trees = even greater heat

New battle ground for BAU lobby?

Strong arguments <u>against</u> retrofit:

- To reduce operational energy
- To increase density of cities to reduce transport
- To reduce fuel poverty

Real reasons (I suspect):

- More profit for developers
- Sexier buildings for architects?
- Vested trade interests, eg cement
- Regulations don’t include embodied carbon

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tects Competition wins RetroFirst Climate change Opinion AJ Architecture Awards RIBA Grenfell Tow

M&S needs to reject ‘fast architecture’ in the same way it’s rejecting fast fashion

9 DECEMBER 2021 . BY MARTIN PRINCE-PARROTT

Marks & Spencer store at Marble Arch on 458 Oxford Street
Source: andersphoto/shutterstock

AJ Architects’ Journal

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ects Competition wins RetroFirst Climate change Opinion AJ Architecture Awards RIBA

Row breaks out after Centre for Cities analyst advocates demolition

2 DECEMBER 2021 . BY WILL HURST

Dr Alice Moncaster @AMoncaster · Dec 3

So, err, have you heard of #retrofit?

And if you want evidence that even deep retrofit is less than 50% of the carbon cost of new build, please do look up our peer reviewed papers from the @IEA Annex 57 and indeed elsewhere.

Tim Worstall @worstall · Dec 3

So, err, how do we get rid of all the old leaky buildings that we can't have any more if we can't demolish them?

2 13 49

Importance of retrofit for Cambs & Peterborough:

- … essential to reduce carbon emissions from existing buildings (incl 1.28Mt CO_2e resi)
- … and to cope with future climates – hot and dry in East of England

Residential:

- … poorly modelled (partic heritage buildings)
- … carbon savings are dependent on occupants as well as buildings
- … industry skills are limited

Non-residential and mixed:

- … brownfield development sites: definitely lower carbon, materials & waste to retain
- … however complex, high risk & time, therefore expensive (partic for non-resi)
- … many in industry want business to continue as usual
- … currently disincentivised by lack of policy & regulation for embodied carbon, & lack of skills

Rampton Drift, Cambridgeshire (Daniela Sahagun, MSc)

Sahagun D and **Moncaster A.M.** (2012) How much do we spend to save? Calculating the embodied carbon costs of retrofit *Proceedings of Retrofit 2012*, 24-26 January 2012, Salford, UK

St Faith's School, Cambridge

Verve Architects (2012) St Faith's Masterplan D4FC Final report

Moncaster A.M., Cheng, V, Littlewood E and Muscat, D (2012) Climate resilience of schools: a case study, 1st International Conference of Urban Sustainability and Resilience, 5-6 November 2012, UCL, London, UK

IEA Annex 57

IEA EBC report: Birgisdottir H., Houlihan Wiberg A., Malmqvist T., Moncaster A., and Nygaard Rasmussen F. (2016) Evaluation of Embodied Energy and CO2eq for Building Construction: Subtask 4 - Case Studies Demonstrating Embodied Energy and Embodied Greenhouse Gas Emissions in Buildings

Moncaster, A. M., Nygaard Rasmussen F., Malmqvist T., Houlihan Wiberg A. and Birgisdottir H. (2019) Widening understanding of low embodied impact buildings: results and recommendations from 80 multi-national quantitative and qualitative case studies, Journal of Cleaner Production 235, 378-393

Adaptation or demolition on masterplan sites (Hannah Baker PhD)

Baker, H., Moncaster, A.M., Remøy, H. and Wilkinson, S. (2021) Retaining buildings is better for the environment: how heritage thinking could support a reduction in carbon from all existing buildings, Journal of Architectural Conservation doi: 10.1080/13556207.2021.1948239

Baker H. E., Moncaster A.M. and Al Tabbaa A. (2017) The decision to demolish or adapt on brownfield sites Proc. Inst. Civil Engineers – Forensic Engineering 170 FE3, 144–156

Reducing carbon while retaining heritage: retrofit of vernacular buildings, Cumbria (Freya Wise, PhD)

Wise, F., Jones, D. and Moncaster, A.M. (2021) Reducing carbon from heritage buildings: the importance of residents' views, values and behaviours, Journal of Architectural Conservation

Wise, F., Moncaster, A., & Jones, D. (2021). Rethinking retrofit of residential heritage buildings. Buildings and Cities, 2(1), pp. 495–517.