Reducing carbon emissions from residential heritage buildings while retaining their heritage values

The Problem: We must urgently reduce carbon emissions to help mitigate the effects of climate change. The building sector accounts for over a third of UK emissions each year, the majority from existing buildings. Up to 20% of UK buildings are heritage buildings. They shape the character of our urban and rural areas but because of their historic values and traditional construction techniques they are particularly challenging buildings for carbon reduction.

Research Aims: I'm exploring ways to reduce carbon and retain history, investigating three poorly understood but key areas:

- 1. Residents opinions of the heritage values of their buildings and what changes they would find acceptable
- 2. The energy behaviours of residents
- 3. The carbon savings of different options and the carbon cost (embodied carbon) to manufacture, transport and install them

I'm focussing on Cumbria and the Lake District National Park which have a high proportion of heritage buildings. An example of a Cumbrian Heritage Building There is a robust debate around whether visible renewables like solar and wind should be permitted in protected areas like National Parks Because the best local 'Westmorland green' or 'Borrowdale flags' slate were saved for export Cumbrian roofs used progressively smaller slates towards the ridge. This household has re-slated part of Round chimneys are their roof with homogeneously sized dark slates from Brazil or China. a distinctive feature in the Lake District. Flat 'crow steps' at the gables and Internal features like original door and floorboards interlocking 'wrostler may still be present. They are often much higher slates' at the ridge quality wood than modern equivalents. are traditional features This house has a small utility extension and they Cumbrian buildings have installed a ground were often lime source heat pump, if the washed on the front electricity comes from the elevation but left as solar panels this could be bare stone on the very sustainable. However less exposed sides. they had to replace the A layer of 'through suspended timber ground stones' gives the floor to install the walls added underfloor heating strength Window replacement is a contentious issue for heritage buildings. This household has replaced some of An intricately carved spice cupboard with a date plaque their single glazed beside the fireplace is another traditional feature. timber sashes with In traditional slate External insulation is double glazed UVPC. buildings sandstone a carbon saving Residents' energy behaviours can be a significant opportunity was often imported option for solid for carbon savings. efficient management of heating, effective for door and window walled buildings but use of thick curtains and increased personal insulation (ie

Image from original painting by Freya Wise

Methods: Online survey of Cumbrian heritage building residents

has clear heritage

implications for original stonework.

Case studies involving; interviews, building walkthroughs and energy diaries.

surrounds as it was

easier to carve

• Energy modelling of case study buildings and lifecycle analysis to explore the carbon costs and savings of different options.

slippers!) can have a substantial impact.

Results so far:

- 1. Residents value the traditional construction, local materials and character of their heritage buildings in the landscape. They dislike changes effecting the building's exterior but are more positive on renewable energy technologies such as solar panels.
- 2. Most heritage building residents engage in positive energy behaviours such as wearing slippers, putting on more layers rather than turning up the heating and only heating actively used areas of their houses.
- 3. Embodied carbon must be considered and can effect whether an option actually saves carbon or not, UVPC window replacements are particularly dubious for both carbon savings and heritage values.

Implications: This research will help identify appropriate ways to reduce carbon while retaining history and will inform policy.

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