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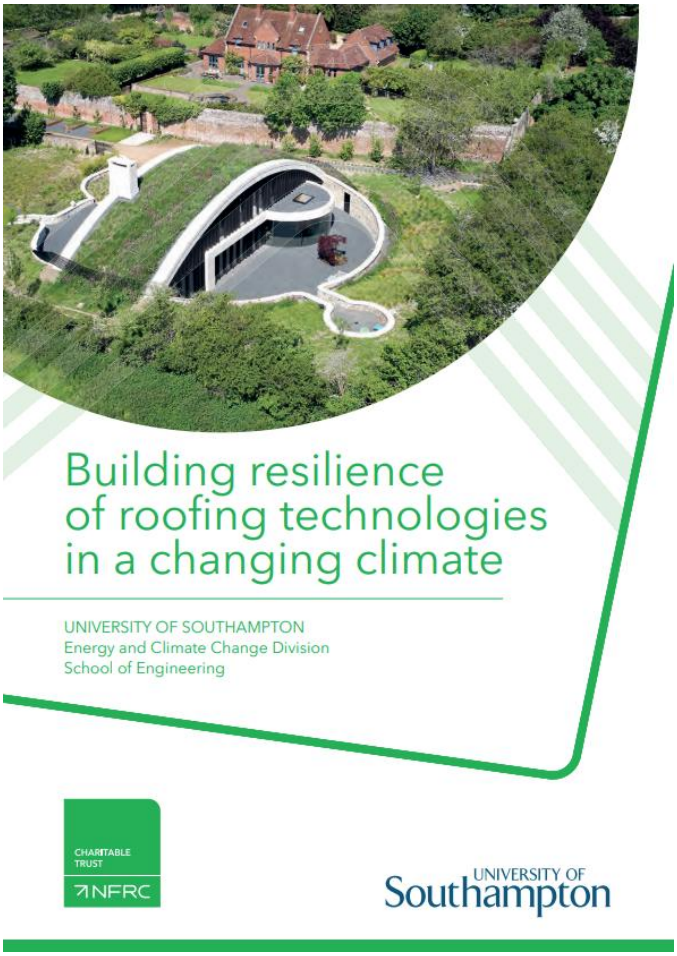
Future (P)roof: Five Years On
The Importance of Climate-Resilient Roofs as the UK Swelters

Introduction
Five years ago, the report *Future (P)roof: Building resilience of roofing technologies in a changing climate* was published, outlining the key role roofs have to play in making the UK's built environment more resilient in the face of a changing climate. The unprecedented high temperatures experienced across the UK during 2026 have provided an urgent reminder of the importance of designing and refurbishing buildings to perform well in a rapidly changing climate.

The research, which the NFRC Charitable Trust commissioned the University of Southampton to conduct, went beyond reducing carbon emissions to consider the role of the roof space in adapting the built environment to emerging challenges including warmer temperatures, more frequent and intense heatwaves, extreme rainfall and other changing climatic conditions. The research identified overheating and flooding as two of the greatest climate-related risks facing the UK built environment.

Five years later, these findings have become increasingly relevant. By August 2026, parts of the UK had experienced their fourth heatwave of the year. Temperatures of 35°C or above had been recorded during May, June and July for the first time in the UK weather record, while eight days had exceeded 34°C; more than in any previous year. This provides a critical impetus to reexamine the research to understand what progress has been made, and what needs further focus.



NFRC Future (P)roof Research (Full)
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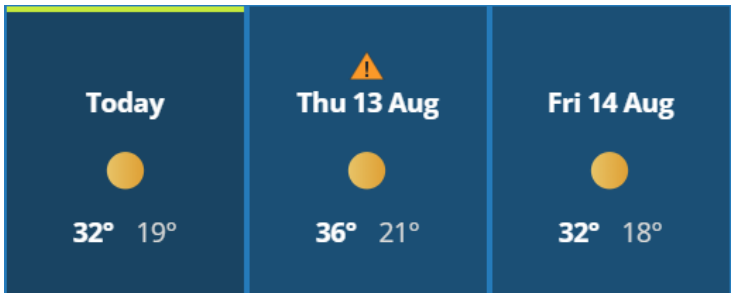

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What needs to happen
NFRC believes climate resilience should progressively become embedded within normal building and roof design practice.

This means:

1. **Designers should consider future climatic conditions** where they could materially affect the performance of a roof or building.
2. **Overheating should be considered alongside winter thermal performance**, particularly for roof-level accommodation, lightweight construction and other vulnerable building types.
3. **Roof drainage design should consider future rainfall risk**, not simply historic rainfall assumptions, while inspection and maintenance requirements should be clearly established.
4. **Clients and designers should consider the wider potential of roof space**, including for delivering cooling, rainwater attenuation, biodiversity and renewable energy generation where these are technically and economically appropriate.
5. **Refurbishment should be treated as an opportunity to improve resilience.** Work to an existing roof may provide one of relatively few opportunities during a building's life to improve thermal performance, drainage, overheating resilience or accommodate future technologies in a cost-effective manner.
6. **Competence must develop alongside technology.** Designers, manufacturers, contractors and those responsible for maintenance need the knowledge and skills necessary to deal with increasingly multifunctional roof systems.
7. **Government and industry should give greater consideration to the existing building stock.** Part O represents important progress for new residential buildings, but the adaptation challenge extends far beyond new homes.

For buildings expected to remain in use for decades, climate resilience should no longer be viewed simply as an optional sustainability enhancement. It is increasingly part of good design, good asset management and ensuring that the roofs we construct and refurbish today remain fit for purpose tomorrow.

NFRC's Position
Buildings constructed or refurbished today will experience a changing climate throughout their service life. Climate resilience should therefore become a default consideration in the design, specification, refurbishment and maintenance of roofs.
Reducing operational and embodied carbon remains essential, but energy efficiency alone does not make a building climate resilient.

Roof design should also consider reasonably foreseeable risks arising from overheating, intense rainfall and changing weather patterns, while recognising the opportunities that roofs provide for cooling, water management, biodiversity and renewable energy generation. A roof that complies with today's minimum requirements is not automatically resilient to future climate challenges.

Adaptation must sit alongside decarbonisation
Much of the construction industry's response to climate change over the past decade has rightly focused on mitigation: reducing energy consumption, operational carbon and embodied carbon. However, adaptation requires us to ask a different question: Will the building continue to perform satisfactorily as the climate around it changes?

Adaptation and mitigation are complementary, but they are not interchangeable. Increasing insulation, for example, is essential to reducing winter energy consumption. However, the Southampton research warned that fabric-first improvements also need to consider that a highly insulated building can still overheat.

Similarly, reducing the carbon associated with a roof does not in itself ensure that its drainage, waterproofing, rooflights, PV systems, or other components are sufficiently resilient to future climatic conditions. NFRC believes mitigation and adaptation must be considered together throughout the design process to ensure a holistic approach.

Roofs should be designed for their service life
One of the fundamental questions posed by the 2021 research was: How can we ensure that roofs constructed or retrofitted today remain fit for purpose in 20, 30 or 50 years' time? That question is particularly important because buildings are long-lived assets. A roof installed or significantly refurbished in 2026 could reasonably be expected to still be in place in the 2050s.

The environmental conditions it experiences during that period will not necessarily reflect those contained within historical weather records. Terms such as a "1-in-100-year event" can also create unintended reassurance. A 1% annual-probability event can occur more than once within a relatively short period, and climate change may alter the probability and severity of future events. Design, therefore, should consider foreseeable future conditions rather than relying solely on historical precedent.

Overheating should become a normal roof-design consideration
The Southampton research identified particular vulnerability to overheating in loft conversions and accommodation immediately beneath roofs, especially where lightweight construction and limited ventilation are involved. Flats with restricted ventilation and some public buildings, including schools, were also identified as vulnerable. The research found that appropriate roof design can contribute materially to managing heat. Well-insulated roofs, combined with appropriate ventilation and medium or light-coloured surfaces, can reduce the risk of overheating, while modelling showed cool, green and blue roof configurations produce lower peak-summer heat gains than conventional dark roof constructions.

England has made progress through Part O of the Building Regulations, which addresses overheating in new residential buildings. However, Part O applies to new residential buildings only and does not provide a general solution for the much larger existing building stock. The Climate Change Committee's 2025 assessment reinforces this concern. It rated policies and plans for ensuring buildings do not overheat as "Limited" and identified continuing gaps in monitoring overheating and adapting existing residential and non-residential buildings. NFRC therefore believes that summer performance and overheating should become part of the normal design conversation when roofs are being designed or significantly refurbished, particularly where vulnerability is foreseeable.

Roofs should increasingly be recognised as climate infrastructure
The traditional purpose of a roof remains fundamental: protecting the building and its occupants from the weather. Increasingly, however, roofs are performing several functions simultaneously. The Southampton research considered conventional, cool, green and blue roofing technologies and demonstrated that different approaches meaningfully contribute to overheating mitigation, stormwater attenuation and energy resilience.

Green and blue roofs can help manage rainfall at both individual-building and neighbourhood level. Cool and reflective surfaces can reduce solar heat gain. Roof space can accommodate renewable energy generation, while vegetated systems can contribute to biodiversity and urban cooling. NFRC's 2025 policy paper, 'Climate-Change-Ready Rooftops', recognises roofs as an underutilised environmental and climate asset capable of providing cooling, managing water and generating renewable energy, and provides a systematic analysis of the benefits each technology can provide, with real-world case studies as evidence.

NFRC is not advocating a particular roof technology for every building. The appropriate solution will depend upon the building, its use, location, structure, fire performance, drainage strategy, maintenance requirements and other design considerations. The principle is that roof space should be considered strategically rather than simply as the surface that keeps rain out.

Resilience includes drainage, inspection and maintenance
Climate resilience does not necessitate innovative or expensive technology. The 2021 *Future (P)roof* research highlighted that maintenance of roofs and their drainage systems will become increasingly important as climatic conditions change. That means basic principles remain fundamental:

- adequate drainage capacity and appropriately designed falls;
- correctly located and maintained outlets;
- effective emergency overflows where required;
- gutters and drainage paths that can be inspected and cleared;
- safe access for inspection and maintenance; and
- maintenance information that reaches those responsible for the building.

Blue and green roofs can make an important contribution to stormwater attenuation, particularly in densely developed areas, but they must be implemented alongside good roof and drainage design. The *Future (P)roof* research emphasised that the roof space's wider benefits extend beyond the building itself by reducing pressure on drainage infrastructure and contributing to neighbourhood resilience. With 6.3 million properties in England currently located in areas at risk of flooding from rivers, the sea or surface water – potentially increasing to around eight million by 2050 – adaptation must be integrated into decision-making now.

From compliance to resilience

Compliance with Building Regulations and relevant standards remains fundamental. However, regulatory compliance generally represents a minimum standard at a particular point in time. Approaches to climate resilience are strengthening, as seen with the UK Net Zero Carbon Buildings Standard. Climate resilience requires a longer view where value must be judged based on a building's whole life costs.

The roofing industry cannot control how the UK's climate changes, but it can influence how successfully buildings respond to that change. The 2021 *Future (P)roof* research concluded that roofing has a significant role to play in adapting the UK built environment to increased temperatures, heatwaves and extreme rainfall. The relentless heat and droughts of 2026 provide a timely reason to revisit that message and ensure we are taking action on lessons already learnt.

Further resources

- University of Southampton / NFRC Charitable Trust (2021), Building resilience of roofing technologies in a changing climate (Future (P)roof). link
- NFRC Charitable Trust / University of Southampton (2021), Future (P)roof: Building resilience of the UK's roofs for a changing climate – Summary. link
- Met Office (30 June 2026), June 2026 heatwave: A recap of the temperature records. link
- Met Office (1 July 2026), England's warmest June on record - the second warmest for the UK and Wales. link
- Met Office (10 July 2026), Heatwave continues as UK records unprecedented run of 35°C days. link
- Met Office (15 July 2026), State of the UK Climate 2025 - highlights. link
- Climate Change Committee (2025), Progress in adapting to climate change: 2025 report to Parliament. link
- UK Government, Flood risk and coastal change - Planning Practice Guidance: definition of a design flood and climate change allowance. link

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