



Climate Change and the Historic Environment



ENGLISH HERITAGE



English Heritage is the Government's adviser on the historic environment. Our responsibilities include archaeology on land and underwater; historic buildings, sites and areas; designed landscapes and the historic aspects of the wider landscape. We also manage an estate of over 400 historic properties.

This statement sets out current thinking on the implications of climate change for the historic environment. It is aimed at all those involved in the scientific and technical aspects of climate change and those undertaking impact, risk and adaptation studies.

Alongside this statement, English Heritage has sponsored a scoping study on the implications of climate change for the historic environment and published guidance on flooding and historic buildings, and on coastal defence. We are also producing guidance on renewable energy technologies and the historic environment. These publications are available at the *Historic Environment – Local Management* website: www.helm.org.uk.

ENGLISH HERITAGE AND SUSTAINABLE DEVELOPMENT

Sustainable development is defined in the 1987 report by The World Commission on Environment and Development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland 1987). The historic environment – the evidence of people's interaction in the past with their physical surroundings – is a finite resource and, like other valuable environmental resources, deserves to be sustained for the benefit of people in the future.

English Heritage has a three-fold responsibility, set out in our Sustainable Development Strategy:

- To ensure that the historic environment is recognised as a finite and non-renewable environmental resource in its own right.
- To ensure that the value of the other environmental capital embodied in the historic environment is not wasted.
- To ensure that our own activities, actions and advice are fully sustainable.

Our climate change policy forms an important part of this wider Sustainable Development Strategy.

CLIMATE CHANGE: THE SCIENTIFIC BACKGROUND

The Earth's climate has changed in the past and is continuing to change. The geological and archaeological record provides evidence of past climate change and human adaptation that can help in understanding and assessing the possible impact of current changes.

The average global temperature has risen by 0.6°C since the beginning of the 20th century, taking the northern hemisphere outside the range of average temperatures it has experienced over the last thousand years. Globally, the ten warmest years in the past 200–300 years have all occurred since the beginning of the 1990s. There is a strong scientific consensus that the current increase in average temperatures results mainly from increasing atmospheric concentrations of carbon dioxide and other 'greenhouse gases', and that these increasing concentrations are at least partly the result of human influences. Climate change scenarios for the UK, published for Defra in April 2002 (Hulme *et al* 2002), suggest that:

- Average annual temperatures across the UK may rise by between 2°C and 3.5°C by the 2080s, depending on the future scale of global emissions of greenhouse gases; in general, there will be greater warming in the south-east, where temperatures may rise by up to 5°C in summer by the 2080s; high summer temperatures will become more frequent and cold winters increasingly rare.

Increased likelihood of flooding will put historic settlements at risk and threaten heritage visitor attractions.

1 Flooding at Tewksbury, 2000. NMR 21025-01 © English Heritage.NMR

2 Flooding at Rievaulx Abbey, 2005. © Durham Police Air Ambulance Support

Increased likelihood of soil erosion may threaten the integrity of archaeological sites.

3 Severe gulley erosion, Flitwick, Bedfordshire, in the autumn of 2000, one of the wettest on record. © Cranfield University

- Winters will become wetter and summers may become drier across the UK, with the biggest relative changes in the south and east; summer precipitation may decrease by 50 per cent by the 2080s in the south-east, while heavy winter precipitation will become more frequent.
- Relative sea level will continue to rise around most of England, in line with global changes but with local variations due to land movement; in south-east England, sea level may rise between 26cm and 86cm by the 2080s.

THE POLICY BACKGROUND

Under the Kyoto Protocol, the UK is pledged to reduce greenhouse gas emissions by 12.5 per cent below 1990 levels by 2008–12, with a further undertaking to reduce carbon dioxide emissions by 20 per cent by 2010. The European Union has also endorsed the need to reduce carbon dioxide levels in order to limit future temperature rise to 2°C.

The need to respond effectively to climate change is expressed most strongly in the new UK Sustainable Development Strategy (HM Government 2005). The implications had previously been spelled out in *Climate Change: The UK Programme* (DETR 2000); the 2003 Energy White Paper, *Our Energy Future – Creating a Low Carbon Economy* (DTI 2003); *Planning Policy Statement 22: Renewable Energy* (ODPM 2004a) and *The Planning Response to Climate Change* (ODPM 2004b). *Planning Policy Statement 1: Delivering Sustainable Development* (ODPM 2005) includes the need to address, on the basis of sound science, the causes and impacts of climate change. *The Sustainable and Secure Buildings Act 2004* will enable building regulations designed to improve energy efficiency (Part L) to be applied more effectively to the existing building stock, while remaining sensitive to impacts on the historic environment.

One of the Government's main objectives is to reduce the demand for energy, or at least to moderate the rate of increase, while at the same time increasing the supply of energy from sources other than fossil fuel. This, while necessary to reduce greenhouse gas emissions, will also have the benefit of reducing the country's dependence



on imported fossil fuels and create a more secure and resilient energy supply. The security of UK and global energy supplies is one of the Government's international priorities over the next five to ten years.

THE IMPACT OF CLIMATE CHANGE ON THE HISTORIC ENVIRONMENT

Many aspects of the historic environment are potentially at risk from climate change. Threats to historic assets include not only the direct impacts of climate change but also the impact of adaptive responses, policies to increase renewable energy supplies and policies to reduce the demand for energy. These are considered in more detail below.

Direct impacts

Direct impacts of climate change on the historic environment include:

- The effect of rising sea levels, especially in the south-east, where these will be added to by down-warping of the North Sea basin, which will cause coastal erosion and endanger historic maritime landscapes, structures, buildings and archaeology.
- Ground subsidence, which could pose a threat to some historic buildings.
- More frequent and severe flooding, which may damage some historic buildings (and create difficulties in obtaining insurance, which may make others uneconomic to occupy and maintain).
- Changes in hydrology, which may put buried archaeological remains at risk.
- Fewer frosts and drier summers, and the northward migration of pests and diseases, which may make it difficult to maintain traditional planting schemes in some historic gardens.
- A warming climate, which may mean that some historically authentic tree plantings may not be viable by the time they reach maturity.
- Alteration of agricultural practices, resulting from changes in crop or stock viability, which could pose a risk to some archaeological landscapes and buried archaeological sites.
- A possible increase in the frequency of extreme weather, or a change in its geographical distribution, which could pose an increased risk of damage to some historic landscapes and buildings.

The impact of adaptive responses

Some adaptive responses to climate change may themselves have an impact on the historic environment:

- 'Hard' coastal defence is seen as increasingly untenable and has led to a new policy of selective managed realignment and a greater emphasis on 'soft' defence, which can pose a risk to archaeology, buildings and landscapes.
- New flood defences, particularly in historic towns, can cause major archaeological damage along historic waterfronts and may impair the character of historic quaysides and waterside buildings and gardens.
- The architectural integrity of some historic buildings could be damaged by the need to provide new and more effective rainwater disposal systems.

The impact of policies to increase renewable energy supplies

Developments designed to generate renewable energy, like any other infrastructure developments, can have a wide variety of impacts, both positive and negative, and varying from the insignificant to the unacceptable. It is always important to evaluate these impacts on a case-by-case basis, but examples of typical issues will include:

- The construction of new renewable energy infrastructure, including hydro-electric and tidal plants and onshore and offshore wind farms, may have a direct archaeological impact, although, in the case of wind farms (unlike other more conventional forms of development), the extent of physical disturbance within the overall footprint of the site may be comparatively small.
- Wind farms (like any other prominent developments) need to be carefully sited to avoid compromising significant landscapes, or the visual setting of important sites or buildings where the integrity of that setting is an important part of their significance.
- The introduction of new biomass crops (like other changes in agricultural practice) may pose a risk to buried archaeology through deeper disturbance and lowered water tables, or it may radically change the appearance of historically significant landscapes, while the impact of other initiatives, such as the re-use of existing coppiced woodland, may be entirely positive.
- Some micro-renewables, such as mini wind turbines, or micro combined heat and power plants, are unlikely to present problems if sensitively located; others, such as visually intrusive photo-voltaic arrays, may be more difficult to accommodate on a historic building.



Increased storminess could result in serious damage to historic landscapes and structures.

4 and 5 Stonewall Park and Chilham Castle in Kent following storms in 1987. Copyright © English Heritage



ENERGY EFFICIENCY AND HISTORIC BUILDINGS

Since high energy use is a relatively modern phenomenon, it is perhaps not surprising that there is a great deal of synergy between the conservation of the historic environment and reducing the demand for energy.

Much of the historic environment was constructed at a time when far less energy was consumed than in the last 50 years. Many historic towns and villages as well as individual buildings were designed for a low-energy economy. Historic mixed-use neighbourhoods, built to a high density and providing a wide range of essential services within walking distance, provide a model of sustainable development and of lifestyles that require less traffic movement and fewer building services.

Many traditional historic buildings perform well in energy terms. The thick walls and small windows of many pre-1900 vernacular buildings provide them with a high thermal mass, or capacitance, compared to 20th-century construction, which means that they can stay warmer in winter and cooler in summer. Thatch in particular has a very high thermal insulation value compared with other forms of construction. Terraces can also be more energy-efficient than detached houses which lose more heat through their larger surface area. In addition, the natural ventilation of many historic structures – and their often high ceilings and generous proportions – may make energy-consuming air conditioning less necessary in a hotter climate than would be the case in more recent structures. Historic building materials are also often more durable than their modern replacements and can be more cost-effective in energy terms. While traditional softwood window frames can have an almost indefinite life if properly maintained, no PVCu windows are guaranteed for more than 10 to 15 years, far less than the time needed to repay any energy savings at current energy prices.

Historic buildings lend themselves to strategies to increase their energy efficiency – draft-proofing, improved roof and floor insulation, and bringing historic internal shutters back into use – which can be sympathetic to their historic character. Changing to a condensing flue gas boiler and introducing secondary glazing, for example, can significantly improve thermal performance (English Heritage 2002).

The impact of policies to reduce the demand for energy

Policies to reduce the demand for energy could have a broadly beneficial effect on the historic environment:

- Action to reduce the demand for road transport and to limit car use could have a positive impact on many historic towns and cities.
- Action to manage the demand for aviation, necessary to constrain greenhouse gas emissions, would also reduce the need to construct new or expanded airports.
- The promotion of sustainable mixed-use neighbourhoods may be more in keeping with the character of historic towns.

However, these policies could also have a detrimental impact on historic assets:

- Poorly designed or inappropriate energy-saving measures can seriously detract from the historic character and fabric of buildings, whereas well designed measures can make considerable savings with little or no damage.
- Proposals to replace historic buildings with new stock which is ostensibly more energy-efficient (for example, Boardman *et al* 2005) could result in serious losses of historic character and diversity.

Lower heating levels could be adopted in some publicly accessible historic buildings, such as churches, and the use of humidistat controls rather than thermostats may in some cases not only reduce the demand for energy but also minimise the impact of intrusive heating systems and mitigate the adverse effects on historic fabric of fluctuating temperatures and humidity.

It must always be remembered that historic buildings represent a significant investment of expended energy, timber, stone, bricks and glass. Demolishing and replacing these historic structures would also require a major reinvestment of embodied energy and other resources. The Government's Performance and Innovation Unit report, *Resource Productivity*, noted that 'energy is consumed in the production of construction materials such as bricks, cement and metals and in their distribution . . . Over 90 per cent of non-energy minerals extracted in Great Britain are used to supply the construction industry with materials . . . yet each year some 70 million tonnes of construction and demolition materials and soil end up as waste' (PIU 2000). This accounts for 24 per cent of the total waste in the UK.

Decisions to demolish historic building stock on the grounds of energy efficiency should therefore be informed by a wide range of factors including:

- The cultural and social significance of the existing stock.
- The whole-life energy costs of new stock (including energy expended in demolition and rebuilding).
- The residual-life energy costs of the existing stock (allowing for the costs of any non-damaging strategies to increase thermal efficiency).
- The sustainability of new stock in terms of both energy and materials.
- The probable lifespan and durability of new stock.

ENGLISH HERITAGE POLICY

Climate change has the potential to seriously damage the historic environment and to impair future generations' enjoyment of their cultural heritage. English Heritage therefore welcomes the Government's commitment to reduce the emissions that contribute to global warming, and we support measures to reduce fossil fuel consumption, increase fuel efficiency and exploit renewable energy sources. Nevertheless, policies for adaptation and mitigation can also have a damaging effect on historic buildings, sites and landscapes, and these impacts should be taken into account when policy is being formulated.

In 2004, English Heritage arranged for the Carbon Trust to undertake a number of assessments of our energy use. We have also sponsored a detailed scoping study of the impacts of climate change on the historic environment (Cassar 2005) and published guidance on the implications for the historic environment of coastal defence policy (English Heritage 2003), flooding (English Heritage 2004), wind energy (English Heritage 2005) and energy crops (English Heritage 2006).

We will continue to develop our policy in line with the latest thinking on the trajectory and implications of climate change, and we will continue to advise the government and others, as required, on the implications of climate change on the historic environment. In particular, we will:

- Work with partners to improve our understanding of past environmental change and human adaptation to it.
- Seek to ensure that evidence derived from archaeological and palaeoclimatological research is taken into account in climate change policy.
- Seek to protect archaeological and other sites which preserve a record of past climatic change.
- Promote further research into the direct impact of climate change on the historic environment, including the development of impact indicators and adaptation strategies.
- Work with others to ensure that significant historic sites that are at risk as a direct result of climate change are protected or, if that is not feasible, recorded.
- Ensure that appropriate emergency response procedures are in place, proportionate to the risk, to mitigate the impact of extreme weather on the historic environment.



The implications of renewable energy projects on the setting and visual amenity of historic buildings, monuments or areas should be fully evaluated at an early stage in project planning.

6 Prehistoric standing stone and wind turbines on St. Breock Down, Cornwall. © English Heritage K050101

7 Miscanthus planting near Sutton Church, Cambridgeshire. © English Heritage

Rising sea levels and increased storminess may threaten historic buildings and sites on the coast.

8 Coastal defence work adjacent to the Martello Tower at Slaughden, Suffolk, which has already suffered erosion of its seaward facing defences. NMR 21836-01 © English Heritage.NMR

- Support any moves by the UK government to raise international awareness of the threats of climate change to cultural heritage.
- Provide further guidance on the historic environment and renewable energy technology.
- Publish updated and detailed advice on improvements that can be made to the thermal performance of the historic building stock, having already published an Interim Guidance Note on the application of Part L of the Building Regulations to historic buildings (English Heritage 2002).
- Publish updated advice on insuring historic buildings.

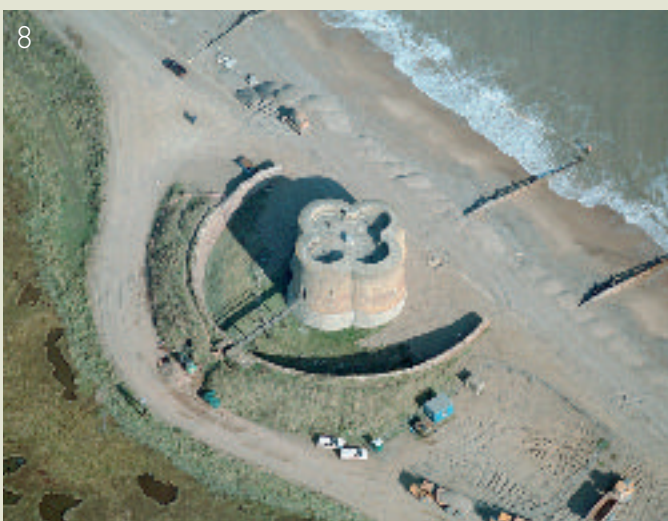


We will also continue to review the management of our own estate in terms of climate change and will:

- Investigate low carbon and alternative energy systems that can be used in historic buildings to reduce carbon emissions.
- Ensure that buildings occupied or used by English Heritage are maintained and operated to optimise their environmental performance.
- Ensure that any new buildings constructed on our estate achieve 'excellent' energy performance ratings.

In order to support this approach, and to assist decision makers in their appraisal of the available options, we plan to issue a number of more detailed guidance notes.

These will be available on the *Historic Environment – Local Management* website: www.helm.org.uk.



KEY SOURCES

Cassar, M 2005: *Climate Change and the Historic Environment*. London: University College London, Centre for Sustainable Heritage
(www.ucl.ac.uk/sustainableheritage/climatechange/climatechangeandthehistoricenvironment.pdf)
ISBN 0-9544830-6-5

Boardman, B, Darby, S, Killip, G, Hinnells, M, Jardine, C N, Palmer, J and Sinden, G 2005: *40% House*. Oxford: University of Oxford, Environmental Change Institute
(www.eci.ox.ac.uk/lowercf/40house.html#report)
ISBN 1-874370-39-7

Bruntland, G (ed) 1987: *Our Common Future: World Commission on Environment and Development*. Oxford: Oxford University Press ISBN 0-19-282080-X

DETR 2000: *Climate Change: The UK Programme*. London: Department for Environment Transport and the Regions

DTI 2003: *Our Energy Future – Creating a Low Carbon Economy*. London: Department for Trade and Industry

English Heritage 2002: *Building Regulations and Historic Buildings*. London: English Heritage (Product Code 50675)

English Heritage 2003: *Coastal Defence and the Historic Environment: English Heritage Guidance*. London: English Heritage (Product Code 50756)

English Heritage 2004: *Flooding and Historic Buildings: Technical Advice Note*. London: English Heritage (Product Code 50776)

English Heritage 2005: *Wind Energy and the Historic Environment*. London: English Heritage (Product Code 51099)

English Heritage 2006: *Biomass Energy and the Historic Environment*. London: English Heritage (Product Code 51100)

HM Government 2005: *Securing the Future: UK Sustainable Development Strategy*. London: HM Government

Hulme, M, Jenkins, G J and Turnpenny, J R 2002: *Climate Change Scenarios for the United Kingdom: the UKCIP02 Briefing Report*. Norwich: Tyndall Centre, University of East Anglia

ODPM 2004a: *Planning Policy Statement 22: Renewable Energy*. London: Office of the Deputy Prime Minister

ODPM 2004b: *The Planning Response to Climate Change*. London: Office of the Deputy Prime Minister

ODPM 2005: *Planning Policy Statement 1: Delivering Sustainable Development*. London: Office of the Deputy Prime Minister

PIU 2000: *Resource Productivity: Making More with Less*. London: Performance and Innovation Unit

The Sustainable and Secure Buildings Act 2004. London: The Stationery Office Limited

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