UK 2012 Climate Change Risk Assessment

Built Environment

Sector Perspective

- The UK's built environment includes: 27 million homes, commercial and industrial properties, hospitals, schools, other buildings and the wider urban environment. At the current replacement rate, around 70% of buildings that will be in use in the 2050s already exist. UK-level Government Departments with core responsibilities for this sector include the Department for Communities and Local Government, the Department for Environment, Food and Rural Affairs, the Department of Energy and Climate Change and the Department for Business, Innovation and Skills. Devolved matters are the responsibility of the Scottish Government, the Welsh Government and the Northern Ireland Executive.

- Population growth and the planning system have a significant influence on the built environment and its evolution, including how it adapts to climate change. Population growth may, for example, add to pressure on water supplies and increase indoor cooling needs.

- Climate change may pose several risks to this sector. In the short term, extreme weather (e.g. flooding, storms, heatwaves and drought) may have more effect than long-term changes (e.g. increasing average temperatures and sea level rise). By mid-century, however, these long-term changes may have more of an impact.

- Most of today's buildings were designed for the climate that existed when they were built, so are not necessarily equipped to cope with current and future climates. The sector may therefore need to consider suitable approaches for adaptation to a changed climate. Air conditioning may make the Urban Heat Island effect worse; passive cooling measures for buildings are an alternative.

- As well as the direct threats posed by climate change to the built environment and people using it, the overall level of risk facing the sector may be intensified by its interdependencies with other sectors. In particular, several of the key climate-related threats to those sectors (e.g. potential interruptions to energy supplies, increasing pressure on water supplies) could have major impacts on the built environment.

Built Environment

Climate change is projected to result in changes in temperature, rainfall patterns and sea levels, as detailed in the UK Climate Projections (UKCP09) analysis. Although milder winters may significantly cut heating bills and the number of cold-related deaths, there may also be a range of negative impacts on the fabric and performance of the UK's built environment.

The Climate Change Risk Assessment (CCRA) has completed an assessment of a variety of impacts for which this sector may need to prepare. Some of the key points from this assessment are summarised here. Unless stated, the figures presented apply to the whole UK and assume no change in population numbers.

The results presented here do not take account of changes in society (e.g. population growth, economic growth and developments in new technologies); nor do they take account of responses to climate risks (e.g. future or planned Government policies or private adaptation investment plans).

Focus on… Heating and Cooling

Milder winters may reduce energy bills and cold-related deaths and hospital admissions. By the 2080s, energy demand for space heating may be 40% lower than it is today, assuming lower consumer demand and higher energy efficiency.

Warmer summers, on the other hand, may increase the risk of buildings becoming too hot and uncomfortable. In some cases, overheating may lead to illness or death. Overheating may also affect economic productivity through loss of staff hours, if workplaces become too hot. Increased temperatures may mean that energy demand for cooling rises.

Confidence

H Average number of days each year when overheating occurs (example): in London, between 22 and 51 by the 2020s, between 25 and 92 by the 2050s and between 27 and 121 by the 2080s (current figure: 18).

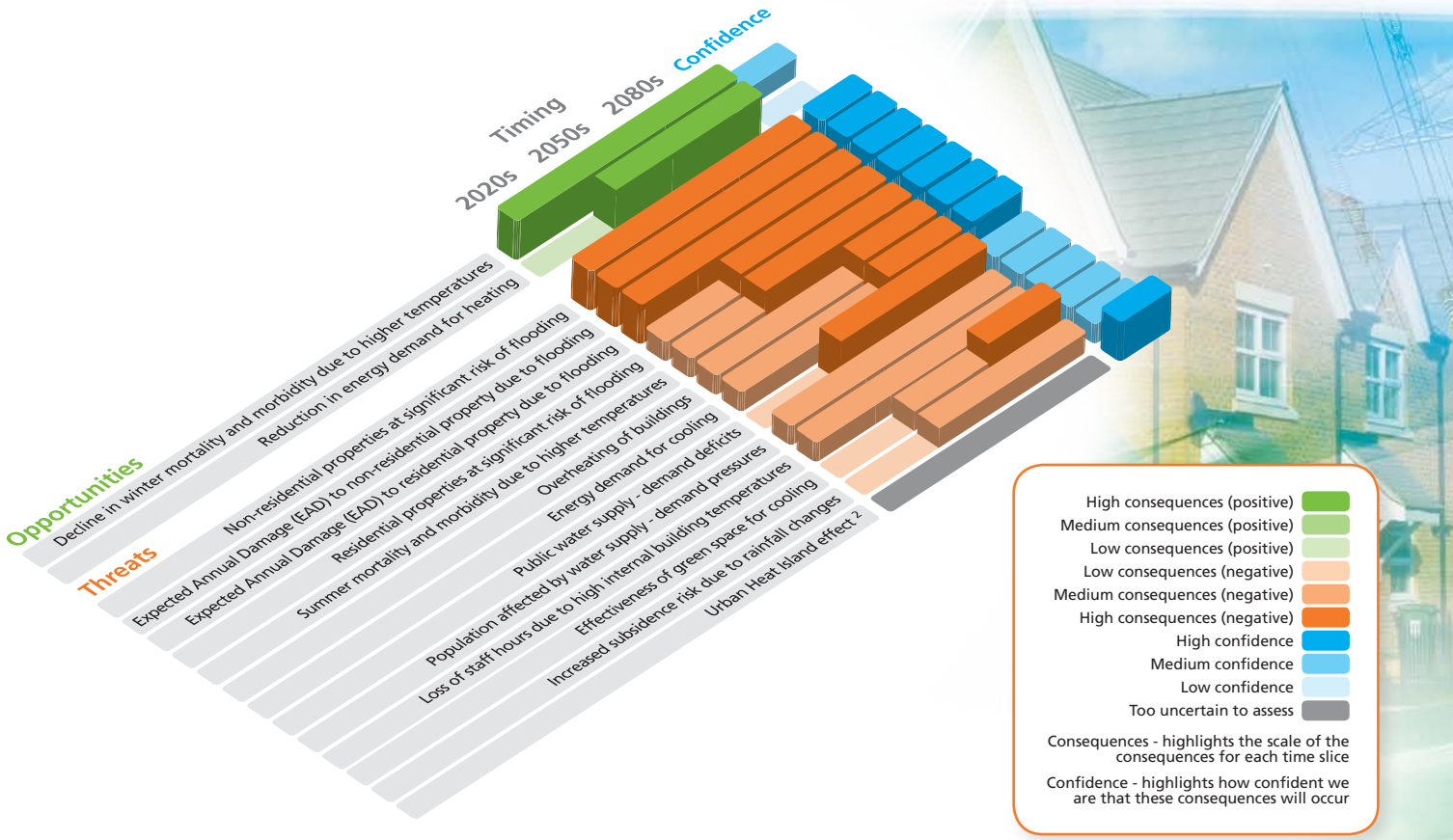
Focus on… Urban Heat Islands and Green Space

The Urban Heat Island effect occurs where the temperature at the centre of a large town or city remains several degrees higher than in surrounding rural areas. The effect is most noticeable at night: in London, an Urban Heat Island effect of 9°C was recorded during the heatwave of August 2003. Night-time temperature is recognised as a key factor in determining levels of heat stress that people experience.

By the 2050s, very hot summers may be much more frequent, occurring every 2 to 3 years. Green space and 'blue' infrastructure (e.g. rivers and ponds) can help reduce the Urban Heat Island effect and provide a climate 'refuge' where local residents can find respite from heat. More frequent and prolonged dry spells, however, may cause grass and other vegetation to dry out, reducing this benefit. Increases in urban populations and use of urban green space for buildings would increase the Urban Heat Island effect.

Confidence

H Increase in average summer night-time temperatures (example): in London, between 0.5°C and 3°C by the 2020s, between 1°C and 6°C by the 2050s and between 1°C and 9°C by the 2080s.



Focus on… Subsidence

Wetter winters, more prolonged dry periods in summer and increased temperatures may increase the risk of subsidence affecting properties. This is projected to be a particular problem in densely populated parts of south-east England where there are large areas of 'shrink-swell' clay soils. Buildings constructed after 1970 generally have better, deeper foundations than those built earlier and so are less prone to the problem, but a substantial number of older buildings will still be in use in high-risk areas in the coming decades.

In 2009, there were 29,700 subsidence-related insurance claims for domestic properties, with a total gross value of £175 million. Claims during the very dry year of 2003, however, reached around £400 million. A potential conflict of interest may occur between the need to remove urban trees to reduce subsidence risk and the need for the cooling that trees provide.

Confidence

M Subsidence cases: between a decrease of 13% and an increase of 20% by the 2020s, between a decrease of 8% and an increase of 30% by the 2050s and between a decrease of 6% and an increase of 32% by the 2080s.

Focus on… Flooding

Wetter winters and more intense downpours throughout the year may increase the risk of flooding for both residential and non-residential properties.

Confidence

H Properties with a significant likelihood of flooding:[1] between 770,000 and 1.3 million by the 2050s, rising to between 980,000 and 1.5 million by the 2080s (current figure: around 560,000).

H Annual damage to properties due to flooding: between £1.7 and £4.5 billion by the 2050s, rising to between £2.1 and £6.2 billion by the 2080s (current figure: £1.2 billion).

The assessment of flood risk for the CCRA has assumed that there are no changes in existing flood and coastal erosion risk management measures; the analysis takes account of current flood defences and protection against coastal erosion, but does not include any future changes as a result of adaptation policies or deterioration of existing flood defences and coastal protection measures. ***The figures here apply to river and tidal flooding in England and Wales only.***

Focus on… Water Supplies

Changes in water availability, particularly reductions in the summer, may lead to less reliable supplies, more frequent restrictions and potential water shortages in the longer term, unless more measures are taken to reduce demands and develop supplies.

Confidence

M Number of people in the UK living in areas affected by water supply-demand deficits: between 27 million and 59 million by the 2050s.

[1] Significant flood risk is defined here as an annual flood probability of 1 in 75 or greater.

[2] The Urban Heat Island effect is too uncertain to assess UK-wide, but has high confidence at the site specific scale.

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The Challenge of Adaptation

A more resilient built environment will be a key element in the creation of places and communities that are more resilient to the effects of climate change, and in the protection of the people living in and using them. A programme for increased resilience will need to look at the existing built environment, at new buildings and at opportunities for change within existing communities.

It will need to consider both public and private action, as most of the built environment is privately owned. It will also have to consider both barriers to and opportunities for early action, e.g. where decisions need to be made now on new build and refurbishment. Although buildings can be modified later to help them withstand changing climatic conditions, their location, the way they are built and the way in which structural changes are carried out can make this easier or more difficult to accomplish.

Currently, many existing buildings are maladapted. In other words, the way they have been built increases their potential vulnerability to the effects of climate change. Moreover, in some cases it is not considered cost-effective to modify existing buildings so that they can cope with a changing climate.

Current initiatives to increase the ability of this sector to adapt to climate change include:

- Departmental Adaptation Plans for every UK Government Department, setting out priorities and plans for climate change adaptation (many of which relate directly to the built environment).
- A strong emphasis on climate mitigation and adaptation in planning policy, including action on coastal change, water resources and green infrastructure.
- Building regulations, which set minimum water efficiency standards, ensure structural stability and limit heat gain.
- Continuing investment in community-wide and property-level flood protection, and steps to improve management of local flood risk.
- The Technology Strategy Board's Design for Future Climate competition, which has to date invested around £5 million in design strategies for new and existing buildings.

Planning policy has been successful in directing most new development away from locations where it might flood. Where new building has been necessary in flood risk areas, policy has required it to be safe and resilient to flooding. Action to tackle other risks such as heat stress has been on a smaller scale.

Uncertainty with respect to how extremes of temperature may change in future, as well as the extent of future population growth, will add to the challenge of adapting the built environment to climate change in an appropriate and timely way. Important gaps in current knowledge also include:

- How specific building types and locations affect their occupants' thermal comfort and health.
- Trees and plants most suitable for use in green space to support cooling, drought resilience and drainage.
- The potential risks to buildings and communities posed by surface water flooding in the future.

Where to Get Further Information

For copies of the CCRA Built Environment Sector Report, the CCRA Evidence Report and Devolved Administration Reports, please visit www.defra.gov.uk/environment/climate/government/.

How the CCRA was conducted

The CCRA reviewed the evidence for more than 700 potential climate impacts on the UK economy, society and environment. Over 100 of these impacts across 11 sectors were taken forward for more detailed analysis, having been selected on the basis of likelihood, potential consequences and how urgently adaptation action may be needed to address them.

A plausible range of climate change scenarios was used in the analysis. Some aspects of socio-economic change (e.g. population growth) were also taken into consideration. Adaptation policies that are planned for the future were not considered, so that the underlying level of risk could first be compared across sectors.

The results presented here are based on the UKCP09 Medium emissions scenario for the 2020s (2010-2039) and the Low, Medium and High emissions scenarios for the 2050s (2040-2069) and the 2080s (2070-2099). A range of climate projections representing lower, central and upper estimates were considered within each emissions scenario.

Risks are categorised as low, medium or high based on their economic, social and environmental consequences.

The CCRA findings are also categorised as having low, medium or high confidence. The level of confidence is the degree to which the findings are considered valid, based on the type, amount, quality and consistency of the evidence studied.

Further information on how the CCRA results should be interpreted is presented in the CCRA Evidence Report. www.defra.gov.uk/environment/climate/government/

Llywodraeth Cymru Welsh Government
DOE Department of the Environment www.doeni.gov.uk
The Scottish Government
defra Department for Environment Food and Rural Affairs