

# Adapting to climate change

## Consequences of global warming

The Intergovernmental Panel on Climate Change (IPCC) is an independent international group of climate scientists who have summarised the state of the art knowledge on climate change in their IPCC Fifth Assessment Report.

[Climate models](#) demonstrate the associated global temperature changes we can expect, depending on how successful we are at reducing emissions. However, regardless of our efforts to reduce greenhouse-gas emissions, there will be some unavoidable climate change from now until the 2040s, due to the [influence of our past emissions](#) on the climate system.

The report states that climate change is already happening and that for “the next two decades a warming of about 0.2°C per decade is projected for a range of [...] emission scenarios”.

We can group the effects of climate change on our climate systems into three categories.

### 1. Temperature-related phenomena:

- Higher daily summer temperatures
- Longer and more frequent hot spells in the summer
- Warmer night temperatures
- Less frequent sub-zero temperatures

### 2. Water-related phenomena:

- Variation of precipitation distribution and quantity
- Increased periods of consecutive dry days
- Sea-level rise

### 3. Extreme weather events:

- Changes in frequency of occurrence
- Increased intensity of events
- Geographical concentration of events might change

## Climate change in the UK

The [UK Climate Impacts Programme](#) (UKCIP) was established to provide information on climate-change impacts and help businesses adapt to these unavoidable impacts. [Based on current climate projections](#), the UK can expect the following impacts.

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Temperature-related impacts:

- Annual warming of between 0.5° and 1.5° C by 2020 – all regions are already experiencing an increase in average annual temperatures.
- By 2050, annual warming of up to 3° C
- Regional disparity in warming patterns - greater summer warming in the South

Water-related impacts:

- Wetter winters, by up to 15 per cent by 2020 and up to 25 per cent by 2050
- Drier summers, by up to 20 per cent by 2020 and up to 40 per cent by 2050
- Sea-level rise of between 4cm and 14cm by 2020 and between 7cm and 30cm by 2050
- Larger storm surges and higher waves

The extent and nature of these impacts will vary [across the UK](#). The English regions as well as Scotland, Wales and Northern Ireland have carried out scoping studies to identify the key impacts to prepare for. Flooding constitutes the most frequently cited impact of climate change across all regions.

## Climate Change Risks

More recently, in January 2012, the UK government published a detailed Climate Change Risk assessment (CCRA), which reviewed a comprehensive list of potential impacts identified based on climate projections.

The outcomes of the analysis have been tailored to different sectors' specific risks, delivering 11 individual sector reports:

- Agriculture
- Biodiversity and Ecosystem Services
- Built Environment
- Business, Industry and Services
- Energy
- Floods and Coastal Erosion
- Forestry
- Health
- Marine and Fisheries
- Transport
- Water

# Adapting to climate change

## Adapting to climate change in the UK

The Environment Agency's Climate Ready service provides support for businesses, public sector and other organisations to adapt to changing climate by giving information on how to adapt successfully.

Building upon the results of the CCRA (see above), it has tailored its support to some specific sectors:

- Agriculture and forestry
- Built environment
- Business and services
- Health and wellbeing
- Infrastructure
- Local government
- Natural environment

## International impacts of climate change

Changes in climate systems vary across regions of the world. The climate science presented in the [IPCC Fifth Assessment Report](#) (PDF) indicates that these changes are happening already and are likely to continue in the future

# Legal profession and adaptation

## Adapting to climate change

### Mitigation and adaptation

- Mitigation involves actions to reduce greenhouse-gas emissions, thus reducing the severity of the long-term impacts of climate change.
- Adaptation focuses on reducing vulnerability to the impacts of unavoidable climate change. The [Intergovernmental Panel on Climate Change](#) (IPCC) defines adaptation as 'the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities'.

### Key issues for the profession

- Is enough known, with a sufficient degree of certainty, to establish legal liability should there be a failure to act against the impacts of climate change?
- *'As the financial impacts of climate change and adaptation begin to be recognised, we are likely to see the use of litigation as a means to recover costs ... courts will examine claims and may decide it was reasonable, at the time the decision was made or advice given, to have foreseen the impacts of climate change, based on the information available in the public domain.'* (The forecast predicts legal liabilities, Dowden M (2005), Estates Gazette)
- Preparing for extreme weather events 'help[s] compliance with regulatory requirements such as the Occupier's Liability Act 1984' which affirms the common duty of care which holds occupants liable for damages if they know that danger exists - which may be the case in light of climate change scenarios which predict events with high probability.
- Litigation is already occurring:
  - in Australia, where Council decisions relating to a failure to adapt and permit development in coastal zones and flood plains highly susceptible to climate change have been challenged and overturned
  - in the USA, where climate-change litigation has already been brought on several occasions over the last years. For example, in 2012, a court in Louisiana has held the designers of a shipping channel liable for not having taken necessary precautions which could have reduced the impact of the hurricane Katrina. This ruling is directly relevant to architects, infrastructure planners and engineers active in the US, illustrating the importance of integrating resilience measures throughout the lifetime of infrastructure.
- A report by the [United Nations Environment Programme Finance Initiative](#) (PDF) identifies the impact of climate change as a risk that may affect any investment. Failure to assess climate-related risk more fully could result in beneficiaries making claims of neglect of fiduciary duty.

### Further information

- [IPCC Fifth Assessment Report](#)
- [EU Adaptation White Paper](#)
- [UKCIP02](#) Future climate scenarios for the UK and the forthcoming, more detailed UK Climate Projections
- [Defra Adaptation Policy Framework](#)
- Series of nine Legal Sector Alliance adaptation briefing notes

# Legal profession and adaptation

- A survey by the [Carbon Disclosure Project](#) (PDF) reported a growing acknowledgement within the legal profession that there is now sufficient information available to take climate change into account both in short and long-term planning, and that failure to do so might result in legal action.

## UK national adaptation policy

Adaptation to climate change is increasingly featuring at the forefront of international and national policy. This trend will continue as more verified climate science becomes available to decision makers. *'If businesses do not introduce adaptation policies themselves, the government is increasingly likely to resort to prescriptive regulation'* (The Adaptation Tipping Point: Are UK Businesses Climate Proof?, Firth, J, and Colley, M (2006), Acclimatise and UKCIP, Oxford)

**National:** [Climate Change Act 2008](#) includes a UK-wide climate-change risk assessment, the provision of a national adaptation programme, and a variety of reporting requirements for local authorities and utilities about climate-change risk assessment and adaptation.

### **Adaptation Reporting Power – explicit adaptation requirement for critical infrastructure**

Based upon the Climate Change Act the UK government introduced the Adaptation Reporting Power for all critical infrastructure organisations. They are obliged to submit reports on their activities to adapt to climate change. The first round of a five year cycle ended in November 2011. It is a first explicit adaptation requirement for all critical infrastructure organisations in the UK.

### **UK Climate Change Risk Assessment (CCRA) 2012**

The first UK Climate Change Risk Assessment (CCRA) was published by the UK Government in early 2012. It provides comprehensive information looking at over 700 climate risks for 11 different sectors based on future climate projections and sector specific analyses.

### **National Adaptation Programme (2013)**

Building upon the CCRA, the Department for Environment, Food and Rural Affairs (Defra) has developed the first National Adaptation Programme in 2013 together with businesses, local authorities and civil society in order to help them become more climate resilient. The NAP looks at national policies relevant in the context of the risks identified in the CCRA (see above) but also emphasises the role of local authorities. It will be reviewed every 5 years.

**Regional:** [Regional Spatial Strategies](#) (RSSs) across the UK will integrate specific adaptation requirements into regional spatial planning.

#### **Further information**

- [IPCC Fifth Assessment Report](#)
- [EU Adaptation White Paper](#)
- [UKCIP02](#) Future climate scenarios for the UK and the forthcoming, more detailed UK Climate Projections
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**Local:** [National Indicator 188](#) (PDF) (NI 188), a performance indicator, introduced in 2008 to assess how prepared local governments are for the risks and opportunities of climate change. Local authorities choosing to commit to NI 188 are obliged to take into account climate-change adaptations in their decisions, plans and measures. Central government will then assess the relevant authority's performance against the goals of NI 188.

## European Union (EU) adaptation policy

### EU Adaptation White Paper 2009

In 2009 the European Commission (EC) published an EU Adaptation White Paper. The paper contains proposals for Community action in climate-change adaptation, stressing the need to mainstream adaptation into existing and future policies. Key sectors mentioned in the White Paper include health, agriculture, coastal areas and infrastructure as well as the relevance of adaptation financing and the collaboration between Member States.

### EU Adaptation Strategy to be published in 2013

The White Paper will be followed by the EU Adaptation Strategy which is to be launched in March 2013. It is planned to have four priority areas of action:

1. Enhancing the knowledgebase and widening access to information
2. Mainstreaming adaptation into policies, strategies and programmes at EU level
3. Capturing the potential of the market, market-based instruments and the private sector
4. Support to and facilitation of collaboration, exchange of knowledge and best practice examples, etc. between Member States, regions, cities and other stakeholders

Mainstreaming, i.e. reflecting adaptation in important EU policy areas, will be a powerful tool for the European Commission to ensure that all different sectors affected by climate change tackle adaptation individually.

Some relevant sectors where mainstreaming is already happening or planned include:

- Agriculture and Forestry
- Biodiversity
- Coastal areas
- Disaster risk reduction
- Financial
- Health
- Infrastructure
- Marine and fisheries
- Water management.

#### Further information

- [IPCC Fifth Assessment Report](#)
- [EU Adaptation White Paper](#)
- [UKCIP02](#) Future climate scenarios for the UK and the forthcoming, more detailed UK Climate Projections
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# Business continuity

*'Every business continuity manager has a duty to assess the risks and to determine the threats to their organisation. Business continuity is about the long-term survival of your organisation and climate change may be one of the biggest threats you face.'*

- ([David Honour, Continuity Central](#))

## Costs of climate change

### The costs of flooding

- The year 2012 was a year of extreme weather events in the UK with droughts in spring and flooding over the summer and in late November.
- PricewaterhouseCoopers announced that the flooding in summer 2012 (excluding the November incidents) was already likely to cost insurers £500 million.
- The November rains then damaged or destroyed another 1100 homes
- according to Aon Benfield, the total annual insured loss for 2012 in the UK has thus been pushed beyond £1 billion.

### International impacts

In an increasingly global market, it is important to be aware of climate change impacts along the whole supply chain and potentially on customers, too. If climate impacts on a crucial part of the supply chain are projected with high level of probability, the failure to adapt could lead to legal liability, in addition to the likely economic losses that would be caused.

- The floods in Pakistan and Australia in 2010 did not only severely destroy local infrastructure and large amounts of cotton crops but also led to a rise in the global price of cotton, which more than doubled in the following months.
- The flooding in Thailand in 2011 damaged the local microchip industry severely which had major global knock-on effects: several computer and car manufacturers including the Honda plant in Swindon in the UK experienced supply shortages.
- Hurricane Katrina is estimated to have cost the Gulf coast states of the US \$125 billion including approx. \$60 billion of insured losses. Especially the flooding of coastal cities, most prominently the city of New Orleans had large impacts on the local industries, such as oil and sugar.

### The impacts of increasing temperatures

- In the past, heat waves in the UK have disrupted the energy-distribution infrastructure, as well as road, rail and underground networks due to excess heat.
- Increasing temperatures interrupt businesses because people suffer from heat stress when working in buildings not constructed or retrofitted to keep cool during heat-waves.
- NHS admittances due to food poisoning are shown to rise significantly with each degree of temperature rise: 4,000 extra cases when temperatures rise by 1° C, and 14,000 extra cases with a 3° C temperature rise. (Dr Verne, SW Public Health Observatory)
- Increases in average temperatures and mild winters also allow diseases (water and tick-borne) to spread at increased rates and to parts of the UK where such diseases have not been present before.



# Business continuity

## Business continuity

A business continuity plan (BCP) that takes into account climate-change impacts will become more important as these events become more frequent. If businesses ignore the impacts of climate change and the need to adapt, they run the risk of:

- Reduced productivity: from interruption of business operations, knock-on effects of disruption from essential suppliers
- Loss of reputation
- Loss of essential data and records
- Failure to meet duties and legal obligations.

## Interdependencies and supply chain resilience

If important infrastructure is concentrated in one geographic area only, climate impacts in this one region can have knock-on effects for the whole country. Such 'regional convergences' make a country more vulnerable to climate impacts than if they had a diversified infrastructure. With globally interdependent markets, a second kind of climate exposure interdependencies is of growing importance: 'cascade failures' describe how climate impacts in one region can affect business continuity in a very different part of the world. The flooding in Thailand mentioned above is a typical example.

## Why include adaptation in Business Continuity Planning (BCP)?

Considering the impacts of climate change and adaptation actions can reduce the risk of business interruption and associated costs.

While no single event can be attributed to climate change, the climate scenarios provided by the United Kingdom Climate Impacts Programme (UKCIP) predict similar events with increasing frequency and possibly increased intensity. Businesses and governments can use [UKCIP's projections](#) and associated probabilities to make more informed decisions about how to prepare for such events.

## Adaptation measure

Businesses need to ask themselves what climate-change impacts are most relevant and necessary for them to consider in BCP, and then assess what adaptation actions they need to take.

Larger practices should carry out a Business Area Climate Impacts Assessment (BACLIAT), which involves:

- reviewing the core areas of the business, identifying the threats and opportunities
- considering the costs of past impacts to the business, indicating priority risk areas for BCP planning.

If the practice identifies critical thresholds that, once exceeded, would result in significant interruption to its business, it should review its BCP once the forthcoming UK Climate Projections are made



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available. This may mean that certain aspects of a BCP become more important to the practice than they are currently.

## Adaptation measures businesses can take

### Flooding

- Find out whether the business is at risk of flooding. Warnings are available from the [Environment Agency](#) whenever an alert is issued in the area.
- Develop a flood plan showing:
  - key equipment
  - protective materials
  - service shut-off points.
- Check existing insurance policies and range of cover.

### Extreme temperatures

- Extremes of temperature can exacerbate existing medical conditions (for example high blood pressure, heart disease, epilepsy and diabetes). Use medical questionnaires to identify those employees at risk so that you can build this into your risk assessments and develop suitable management controls.
- Provide adequate building-cooling systems that take into consideration increased future cooling demand. Installing air-conditioning is not the ideal solution as it:
  - leads to increased energy demand
  - increases carbon emissions.

Instead, ensure employees are situated away from sources of radiant heat and investigate and implement alternative building-cooling methods such as natural ventilation and shading.

## Relevant UK policy, legislation and standards

### Adaptation Reporting Power (ARP)

Based upon the Climate Change Act the UK government introduced the Adaptation Reporting Power for all critical infrastructure organisations. They are obliged to submit reports on their activities to adapt to climate change. The first round ended in November 2011 and a new report is to be developed every 5 years. It is a first explicit adaptation requirement for all critical infrastructure organisations in the UK and is likely to be expanded to other sector companies either on a compulsory or voluntary basis.

### [UK Companies Act - Operating and Financial Review guidelines \(CA2006\):](#)

These guidelines require companies to take account of all risks to business and a legal obligation to consider the environment when taking business decisions.

### [Solicitors Regulation Authority \(SRA\) Code of Conduct 2011:](#)

Principle 8 of the Code states 'you must run your business or carry out your role in the business effectively and in accordance with proper governance and sound financial and risk management principles'.

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## **The Civil Contingencies Act 2004:**

This Act places statutory duties on local authorities to extend their civil-protection duty beyond emergency planning to address risks to local businesses.

## **Business Continuity ISO 22301:**

Issued by the British Standards Institute it aims to ensure the continued operations of a business in the event of business disruption by reducing disruption risks. It provides a foundation for developing and implementing a business continuity plan in any UK business and is a specification that can be audited against.

# Property and adaptation

## What are the risks of climate change?

*'It has become clear that the [building] industry has not yet taken account of the scale and implications of the changes in climate that we can expect this century. To create a built environment that will cope with these changes, design teams will need to consider innovative solutions to ensure buildings are robust, comfortable for people to live and work in, and that can manage water in extreme conditions such as drought and flood.'*

- Iain Gray, Chief Executive, Technology Strategy Board 2010

Residential and commercial properties (existing and new-build), are increasingly exposed to the physical impacts and consequences of climate change. According to the UK Climate Change Risk Assessment (CCRA) published in 2012, the following impacts are estimated to threaten the UK built environment with a high confidence level:

- Expected Annual Damage (EAD) to both non-residential and residential property due to flooding will already in the near future have high negative consequences.
- Exposure to significant likelihood of flooding (taking population growth into account) will affect between 1.3 million and 3.6 million people by 2050, rising to between 1.7 million and 5 million by the 2080s (current figure about 900,000)
- Summer mortality and morbidity due to higher temperatures will increase in the medium term (2050s).
- Overheating of buildings will soon increase and have high negative consequences in the far future (2080s). For that reason, also energy demand for cooling will increase and lead to high negative consequences in the long term future (2080s) according to the CCRA.

Architects and planners failing to incorporate adaptation into their construction planning may become legally liable for any damages caused by changing climate. In the US, litigation in this context is already occurring: A court in Louisiana has held the designers of a shipping channel liable for not having taken necessary precautions which could have reduced the impact of the hurricane Katrina. This ruling is directly relevant to architects, planners and engineers, illustrating the importance of integrating resilience measures throughout the lifetime of a development. According to the IPCC Report "it is likely that future tropical cyclones (typhoons and hurricanes) will become more intense" due to rising sea surface temperature.

## Main areas of impact on the UK property sector

**Flooding:** tidal, fluvial, surface and groundwater forms of flooding are projected to increase due to changing patterns of precipitation, such as more frequent heavy winter precipitation, and increased frequency of winter storms. Surface water flooding can be particularly threatening since it is difficult to predict (both the intensity and the runoff patterns) and the risk is not limited to a particular geographic position (e.g. close to rivers) but occurs anywhere. In these cases adaptation is challenging but crucial. Sea level rise will increase the probability of flooding of coastal areas.

**Droughts:** Risk of droughts and subsidence may increase as we experience longer periods of reduced precipitation in certain

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regions in the South, and at the same time demand for water will rise. If a drought is followed by an intensely wet period, this can exacerbate incidences of surface run-off and associated flooding.

**Overheating:** as a result of increased incidence of heat waves, especially in the summer, overheating in buildings is already becoming a problem. Local temperatures are further increased by the 'urban heat island' effect, with buildings accumulating heat during the day and releasing it at night.

Non-residential buildings such as offices, schools and shops can have higher internal heat gains and could therefore be more affected by increased temperatures, resulting in higher cooling requirements.

**Extremes:** Extreme weather events are projected to become more frequent with climate change. Few but extremely cold winter days may make it difficult to justify super insulation but hot summer days also require better insulation. Storms increase the risk of flooding through storm surges and heavy precipitation.

## Adaptation measures

Adaptations to climate change are generally specific to a particular site and location. However, there are a range of options available, depending on whether an existing property needs retrofitting or a new one needs climate-change considerations to be integrated into its site, planning, design and construction.

### Existing properties

Existing buildings can be adapted to improve comfort, resistance and resilience, as well as energy and water efficiency. The main findings from the Case Study House (Retrofitting Existing Homes for Climate Change Impacts) are set out below.

### New properties

For new buildings, adaptation options can be found from the retrofitting options mentioned above but also by introducing improved building standards and regulations.

In the UK, the Code for Sustainable Homes was introduced in 2007. It is currently a non-mandatory standard and its objective is to improve the sustainability of new homes and the environmental standard to which they are built. In addition to improved building standards, possible adaptation measures for new building include:

- restricting new development in areas with an increased flood risk (coastal/floodplain)
- making use of thermal properties of materials to improve cooling in the summer
- reducing solar heating by using overhangs, shade and green spaces
- introducing new energy- and water-efficient technologies.

### The Code for Sustainable Homes

The Code measures the sustainability of a home against nine design categories:

- Energy and CO2 emissions

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- Water efficiency
- Materials
- Surface-water run-off
- Waste
- Pollution
- Health and well-being
- Management
- Ecology.

The Code uses a sustainability rating system based on 'stars', where one star is the lowest and six stars reflect exemplary and cutting-edge development in terms of sustainability.

## Relevant policy, legislation and standards

### UK

- Building regulations - exist to ensure the health and safety of people in and around buildings and the energy efficiency of buildings.
- Code for Sustainable Homes (CSH) - introduced in 2007, with the objective of improving the sustainability of homes. From 2010 onwards, the CSH became mandatory for private buildings too and acts as a reference point for national building regulations.
- **BREEAM** (Building Research Establishment Environmental Assessment Method) - launched in 1990 as a tool to assess the environmental performance of offices. It has since progressed to cover a number of other building types such as schools, hospitals, retail and industry.
- National Adaptation Programme (2013)  
Building upon the CCRA, the Department for Environment, Food and Rural Affairs (Defra) has developed the first National Adaptation Programme in 2013 together with businesses, local authorities and civil society. The NAP looks at national policies relevant in the context of the risks identified in the CCRA (see above) and related responsibilities. It will be reviewed every 5 years.

### Europe

#### **European Energy Performance Directive (EPBD)**

In compliance with this directive, Energy Performance Certificates have been introduced in the UK with the objective of improving the energy efficiency of buildings. By law, residential and commercial buildings that are being bought or sold require a certificate as well as a report that suggests possible energy-efficiency improvements.

The revision of the EPBD in 2010 saw a number of ambitious new requirements, including the obligation for member states to 'ensure that: (a) by 31 December 2020, all new buildings are nearly zero-energy buildings; and (b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings' (Directive 2010/31/EU, Article 9). This rigorous regulation of the building sector makes obligatory climate change adaptation actions more likely.



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## The Case Study House - Retrofitting existing homes for climate-change impacts

- Recent leading research was commissioned by the Three Regions Climate Change Group - made up of London, the East and the South East of England - and undertaken by Arup. The three UK regions referred to are projected to have the most severe climate-change impacts for buildings and their inhabitants.
- The report focuses on retrofitting existing homes to ensure their resilience, resistance and long-term sustainability, and it includes a case study that looks at adaptation measures for three distinct types of houses: a 1930s house, a 1960s flat and an entire block of flats. These types of property together represent a majority of the homes in the three regions, and in the UK as a whole.
- A range of adaptation measures was chosen for each of the three main predicted climate change impacts outlined in the briefing note, ie flooding, water scarcity and overheating. While it is important to note that each property has its own adaptive capacity and potential, we can learn valuable lessons in terms of what measures can really make a difference, and whether or not these measures are cost-effective.

A summary of the chosen measures to tackle the key climate-change risks can be found below:

### 1. Flood resistance:

- Non-return valves on drains
- Door guards
- Raise door thresholds
- Waterproof materials
- Seal gaps around pipes, cables, windows and doors

Resistance measures need to be installed in an 'all-or-nothing' manner, since every entrance/water access needs to be blocked. The report's main finding is that the cost of these measures is recuperated in one single flood event.

### 2. Flood resilience:

- Raise boiler above flood level
- Raise electrical outlets
- Replace floors with waterproof materials
- Adapted design for appliance installation

Resilience measures can be installed independently and each contributes towards the reduction of recovery costs following a flood.

### 3. Water scarcity:

- Focus on improving water efficiency of kitchen and bathroom
- Introduce low-flow toilet, taps, shower
- Install water-efficient dishwashers and washing machines

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Water-saving measures are cumulative but can be installed at the same time. The more changes you make, the more water you save. As well as saving water, you can save energy by using less hot water.

## 4. Overheating:

- External solar control
- Improved natural ventilation
- Replace carpeted floors with wood
- Improve insulation
- Replace old windows with new, low e-coating windows

As far as measures to improve indoor temperature control are concerned, there is a clear distinction between expensive measures, which require physical work done on the building or its structure, and the more clearly cost-effective measures such as improved ventilation and blinds.

As well as setting out these retrofitting measures, the report also makes a number of suggestions about how to increase the uptake of adaptation measures in the property sector as a whole. Uptake is currently low due to a number of barriers, including incomplete information and a lack of awareness about options.

## The main findings from the case study

### Flood resistance

Aim to prevent or minimize the entry of water into home, eg non-return valves, raised doors, waterproof walls

### Water scarcity

Introduce technological solutions that restrict water flow, eg low-flow fittings and appliances

### Flood resilience

Help reduce the time and cost of recovery from a flood, eg position sockets/appliances above flood level

### Temperature control

Use passive measures (ie not using energy) to reduce heat and improve ventilation, eg blinds, insulation, air flow, shade and vegetation

A recent study quantified the importance of green roofs in reducing the urban heat island effect. Results suggest that adding 10 per cent green surface to town centres or densely populated residential areas keeps maximum surface temperatures stable, avoiding a potential rise of up to 7.6° C by 2080, as well as improving surface-water run-off.

*(Adapting cities for climate change: the role of the green infrastructure, Gill S, et al (2007))*



# Utilities and adaptation

## Utilities and climate change

This briefing note focuses on the utilities sector - electricity, gas and water - specifically the management of large or extensive assets and infrastructure. Climate change will increase the risks and costs associated with asset design, construction, performance, maintenance and value.

The [Intergovernmental Panel on Climate Change](#) (IPCC) states that floods tend to induce more physical damage to energy and water utilities' infrastructure, whereas temperature changes affect operational aspects of utilities.

The electricity generation sector has to meet the given demand to keep the network stable and fulfil its duty to supply. Climate change will make this task more challenging in different ways:

- Power plants usually rely on cooling water from rivers. In the past years, power plants repeatedly (not only during the 2003 heat wave) had to be taken off the grid because of river water temperatures exceeding critical thresholds.
- Extreme weather events, such as storms, heat waves and intense precipitation will become more frequent with climate change. This threatens electricity, gas and water sector infrastructure alike.
- Dry periods have already challenged the UK water supply. Projections show that water stress will become more frequent and hence demand needs to be carefully managed and new resources may need to be developed.

Hence, utilities will have to adapt to changing weather conditions affecting their infrastructure as well as to changing demand patterns.

## Legal considerations

- There is a competitive energy market in the UK, which means that, ultimately, the availability of sufficient electricity and gas to meet demand is left to market forces. As a result, consumers generally have limited recourse against their supplier or the operator of the network to which they are connected in the event of disruptions to supply.
- There are, however, statutory schemes that impose guaranteed and overall standards of performance on electricity and gas distributors, gas transporters and electricity and gas suppliers, which, if not met, can lead to set compensation payments being made to affected consumers. These schemes include standards for the time taken to restore lost power supplies and avoiding supply interruptions without sufficient notice. (See: [Electricity \(Standards of Performance\) Regulations 1993](#), applying to electricity suppliers; [Electricity \(Standards of Performance\)](#)

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- [Regulations 2005](#), applying to electricity distributors; and the [Gas \(Standards of Performance\) Regulations 2005](#), applying to gas transporters and suppliers.)
- As a result of the interconnectivity of electricity and gas assets and infrastructure across the UK, industry participants are largely protected from claims against each other for consequential and most other losses following negligence and contract breach by standard limitation of liability clauses in industry documents (which generally restrict claims to property damage only).
  - Although water supplies are ultimately a natural resource, water undertakers are required (by the [Water Industry Act 1991](#)) to 'develop and maintain an efficient and economical system of water supply' and also 'to ensure that all such arrangements have been made for providing supplies of water to premises within [their] area and for making such supplies available to persons who demand them' as are necessary for ensuring continued compliance with their obligations under the relevant parts of that act. In particular, the Act places water undertakers under a duty to prepare and maintain water resource-management plans as to how they will manage and develop water resources.
  - These broad statutory obligations are given practical effect through minimum service standard protections for water consumers. Under a guaranteed service scheme, water and sewage companies are required to make compensation payments to affected consumers where specified service levels are not met, including loss of supply due to disconnection or drought, and internal and external sewage leaks due to flooding. ([Water Supply and Sewerage Services \(Customer Service Standards\) Regulations 2008](#))
  - The Floods and Water Bill (a new bill proposed in 2008) aims to create a simpler and more effective regime for flood and coastal erosion management, and to improve the sustainability of water resources.

Based upon the Climate Change Act, the UK government introduced the Adaptation Reporting Power for all critical infrastructure organisations. They are obliged to submit reports on their activities to adapt to climate change. The first round ended in November 2011 and a new report is to be developed every 5 years. It is a first explicit adaptation requirement for all critical infrastructure organisations especially targeted at both energy and water suppliers.

The reports are to be based on the statutory guidance but no particular methodology or structure is prescribed. However, the following topics should be covered:

- Functions, objectives and stakeholders impacted by climate change
- Approach to evaluation of future climate impacts and risks
- Summary of risks that affect companies' functions
- Actions proposed to address these risks
- Uncertainties, assumptions
- Barriers to adaptation actions and interdependencies
- Monitoring and evaluation

# Utilities and adaptation

The first National Adaptation Programme is being developed by Defra together with businesses, local authorities and civil society in order to help them become more climate resilient. It looks at national and local policies relevant in the context of the risks identified in the national Climate Change Risk Assessment, which features a detailed assessment both of risks for the energy and the water sector. It will be reviewed every 5 years.

The UK Water White Paper published in December 2011 calls for action in the light of future challenges such as climate change. One of the key reforms set out in the paper concerns the water abstraction regime which is to be made more resilient to climate change and population growth. Long term planning for water companies will be required, with guidance provided by the Environment Agency and Ofwat.

The Flood and Water Management Act 2010 implements the lessons learned from the 2007 floods and tries to set the framework for a more effective management of flood risk for people, homes and businesses. Duties are assigned more clearly, giving more responsibility to local authorities.

## Companies Act 2006 - Requirements on corporations regarding the environment

As corporate entities, utilities are required to take account of all risks to business and are under a legal obligation to consider the environment when taking business decisions; see section on UK Companies Act 2006 (Financial briefing note).

## Climate Change Act 2008 - Adaptation reports

The Climate Change Act 2008 gives the government the power to:

- issue statutory guidance to certain organisations regarding the assessment of the impacts that climate change will have on certain of its functions and the preparation of proposals and policies for adapting to these impacts, and
- require those organisations to prepare reports including such assessments, proposals and policies with regard to those functions.

While these measures are primarily aimed at public-sector organizations, they will also apply to gas transporters, water and sewage undertakers and those holding a licence to generate, transmit or distribute electricity.

According to [Defra](#), the statutory guidance is likely to include:

# Utilities and adaptation

- background on adaptation to climate change and national policy on adaptation
- general sources of advice and information, for example from the UK Climate Impacts Programme (UKCIP), and the Environment Agency
- information on assessing risks and vulnerabilities, developing possible adaptation responses and evaluating progress
- details about the expected scope of the report, and
- the principles of sustainable development and the need to take into account risks and opportunities from climate change for the natural environment and social and economic wellbeing.

## Water Framework Directive - Management of natural aquatic environments

The directive aims to improve and integrate the way water bodies are managed, by:

- enhancing the status and preventing further deterioration of aquatic ecosystems and associated wetlands
- promoting the sustainable use of water, and
- reducing pollution, ensuring progressive reduction of groundwater pollution.

Although the directive deals mainly with the management and protection of natural water features and groundwater, there are some requirements regarding the economic analysis of water usage, including usage related to water abstraction for domestic and industrial purposes, and the identification and monitoring of waters from which drinking water is abstracted.

## Civil Contingencies Act 2004 - Contingency planning for climate change

The Civil Contingencies Act 2004 includes provisions that certain organisations, including some utilities companies, assess possible emergencies that would affect their functions, and prepare and maintain plans to ensure that, in the case of such emergency, the organisation can continue to perform those functions.

These provisions apply to those holding licences for transmitting or distributing electricity or operating an electricity interconnector, gas transporters, water and sewage undertakers, and those providing public electronic communications networks. These utilities firms should consider the effects of climate change when formulating their plans under the Act.

# Financial sector and adaptation

## Financial sector and climate change

*'If we do not adapt, the economic costs will be extreme. Over the next 50 years, we expect to see: windstorms losses increase by two thirds to \$27 billion per annum worldwide, additional flooding costs of €100-120 billion a year in Europe and a 15-fold increase in UK flood costs to £22 billion'.*

- Stephen Haddrill, [Director General of the Association of British Insurers](#)

The banking sector potentially faces a high level of risk when investments are made in assets that are particularly vulnerable to climate change, such as property, energy and transport infrastructure.

Many pension funds in the UK operate under trust law that places a fiduciary duty on their trustees to act in the best interest of their beneficiaries. Given the major financial implications of climate change for companies, both directly through the physical impacts of climate change and indirectly through potential government action to encourage businesses to adapt, there are climate change implications for pension funds' assets. (Mercer, IIGCC and Carbon Trust. (2005) [A climate for change - A trustee's guide to understanding and addressing climate risk](#))

In fact, in the US a debate about responsible investment of cities' retirement funds and large universities' budgets has arisen. Al Gore leads a campaign to encourage divestment from fossil fuel companies which is gaining momentum. It reflects the growing recognition of the link between fossil fuels contributing to long term climate change and the concern with its impacts. The city of Seattle has reported that their pension and retirement funds *"had some 17 million dollars invested in oil and gas companies. [... In January 2013] those funds moved to create a mechanism to look into how potential divestments could take place"*.

- **Lock-in factors:** Products such as life and pension funds are based on assumptions such as mortality, morbidity and consumer behaviour, all of which could be affected by the impacts of climate change. (London Climate Change Partnership: Finance Sub-Group. 2006. [Adapting to climate change: Business as Usual?](#)) (PDF)
- **Timeframes:** Within the financial sector, corporate investment decisions made now should take into account the potential physical impacts of climate change. This is rarely the case at present.
- **Value of securities:** The impacts of climate change can have considerable effect on the value of securities that banks hold. For instance, more frequent and severe flooding can cause damage to the property market, impacting upon the value of the properties affected. As lenders of capital, banks are also increasingly at risk of borrowers defaulting on their repayments if businesses are interrupted by climate impacts.

# Financial sector and adaptation

- **Reputational risk:** Banks face potential reputational risks if the impacts of climate change are not included in their decision making.

## Insurance and climate change

*'The cost to peoples' lives and property caused by (the 2012) Atlantic Hurricane Sandy provides a timely reminder of weather related risk and the role insurance can play in facilitating recovery from extreme events. It also reminds us of the need to deepen understanding of how changes in climate might impact on our societies and customers in the years ahead.'*

- John Coomber, Chairman of ClimateWise; Member of the Board, Swiss Re

Hurricane Katrina is estimated to have cost the Gulf coast states of the US \$125 billion including approx. \$60 billion of insured losses. Especially the flooding along the coast and most prominently of the city of New Orleans had large impacts on the local industries, such as oil and sugar. According to the IPCC 2007 synthesis report "it is likely that future tropical cyclones (typhoons and hurricanes) will become more intense" due to rising sea surface temperature.

Because of the impacts of climate change on the financial sector, banks and insurers have started to develop strategies for managing them more effectively by:

- Reducing risk by engaging with governments on flood-defence funding and land zoning.
- Pricing climate risk appropriately. Incorrect calculation of risk can lead to inappropriate claims being made.
- Spreading the risk posed by climate-change impacts by diversifying products and services, for example, by opening up new markets such as weather derivatives and catastrophe bonds.

## Relevant policy, legislation and standards

Beyond the potential economic impacts of climate change, investments could be impacted by regulatory measures directed towards enforcing adaptation. In the financial sector, it is more a case of cross-compliance with regulation and legislation in sectors that are linked to finance: it is conceivable that there will be 'an increasing number of regulatory interventions outside the financial sector which will have implications for the financial sector'. ([ABI, 2007, Insuring our future climate: thinking for tomorrow, today](#) (PDF))



# Financial sector and adaptation

## UK Companies Act 2006 ([CA2006](#)):

Corporations are under a legal obligation to consider the environment when taking business decisions. The following sections of the Act are of particular relevance:

### Section 172 - Duty to promote the success of the company

(1d) 'A director of a company must act in the way he considers, in good faith, would be most likely to promote the success of the company for the benefit of its members as a whole, and in doing so have regard (amongst other matters) to ... the impact of the company's operations on the community and the environment.'

The duty to consider the company's operations on the community and the environment is not specific to adaptation but the use of the word 'environment' could include adaptation issues, eg where a company's actions have environmental consequences that directors have failed to consider and failed to implement the adaptation measures appropriate to deal with the impacts of climate change on the company.

### Section 260 - Derivative claims

(1a/1b) 'This Chapter applies to proceedings in England and Wales or Northern Ireland by a member of a company ... (a) in respect of a cause of action vested in the company, and (b) seeking relief on behalf of the company.'

(4) 'It is immaterial whether the cause of action arose before or after the person seeking to bring or continue the derivative claim became a member of the company.'

This provision might encourage environmental lobbyists to become shareholders in a company to challenge its previous actions, such as failing to produce and implement an adaptation policy. Where such a failure caused subsequent loss to a company, lobbyists might bring a derivative action to further their own cause by making an example of the company.

### Legal considerations

- Banks face legal liability issues when taking over ownership of an asset from a defaulting client.
- Claims for negligence could become an issue if decisions on projects, investments or funds are made with disregard to current climate science.



# Financial sector and adaptation

## European legislation

The EU Commission published the first **EU Adaptation White Paper** in April 2009, containing an official set of proposals on adaptation for public consultation. The Association of British Insurers had previously issued a [response to the consultation](#) (PDF) on the EU Adaptation Green Paper, highlighting the importance of the issue of adaptation to the insurance sector. The key points were:

- the emphasis on the role of the insurance sector in facilitating adaptation and communication of climate risks
- the need for public-private partnership to spread the risks adequately
- the importance of empowering local authorities to implement adaptation measures locally.

The European Commission is currently preparing its EU Adaptation strategy (to be published in March 2013), which will build upon the existing White Paper and formalises further mainstreaming of adaptation into existing and future EU policies.

## EU funding programmes

A large amount of EU funding is distributed through regional development, especially through the Cohesion Policy and Structural Funds. These programmes will be giving specific importance to adaptation in order to increase regional resilience throughout the EU. The EU 2020 targets also illustrate the increasing importance of integrating climate change mitigation and adaptation into all projects requiring EU funding: the overall proportion of climate related expenditure in the Multi-Annual Financial Framework is to be increased to at least 20% for climate change mitigation and adaptation measures.

# Transport and adaptation

## Impacts of climate change on the transport sector

As a source of greenhouse-gas emissions, the transport sector is a contributor to climate change. It will also be significantly affected by both the indirect and direct unavoidable impacts of climate change.

Transport is vital for both urban and rural communities and businesses in the UK and internationally, and is vulnerable to disruption from different forms of extreme weather events such as flooding, heatwaves and storms, all of which are likely to increase in severity due to climate change.

Any disruptions or delays within the transport sector impact upon business in other economic sectors, due to the interdependency of related sectors.

### Shipping

The impacts of climate change will affect the shipping industry, both in terms of possible future inclusion in some form of global trading system and in the immediate term, in relation to impacts on marine and inland waterways and port facilities.

### Rail

The impacts on the rail network relate to damage to infrastructure and health or business impacts from resulting delays, and they are already apparent.

*'In the summer of 2007, flooding affected the railway in 265 places. These floods cost Network Rail £10.5 million in infrastructural damages and a further £25.6 million in compensation to train operators for business interruption'. (Keeping an eye on the weather, 2 December 2008, [Railnews.co.uk](http://Railnews.co.uk))*

Rising sea levels and powerful sea surges may disrupt train lines which run in close proximity to the coastline. These include the South West line, Cumbrian Coastline, the Swansea-Carmarthen in South Wales and the Stomeferry to Kyle-of-Lochalsh line.

### Air

Air transport is affected directly by its inclusion in the EU Emissions Trading Scheme and by the impact of rising temperatures, flooding, excess surface run-off and prevailing wind patterns, on aircraft operation.

# Transport and adaptation

## Road

The Highways Agency is responsible for the operation, maintenance and repairs to the road network in England. The Department for Transport has recommended that the Highways Agency carry out an assessment to identify which standards will need to be revised in light of the UK Climate Impacts Programme's scenarios for climate change.

## Legal considerations and regulations

- The transport sector may experience increased claims resulting from delays, business interruption or impacts on contractor service levels. Further claims might be made by employees or third parties, such as passengers, resulting from the compromised operators' ability to meet existing Health and Safety regulations.
- Costs both to build and maintain infrastructure will increase while the life span of the infrastructure will decrease.
- Route access might have to be renegotiated should existing routes be compromised, which will have a knock-on effect on the drafting of, for example, planning agreements, easements, rights of way and negotiation of real-estate considerations.
- Sectors such as shipping, aviation and road haulage are likely to encounter increased regulation regarding the types of fuels used in commercial transport. These sectors will need to adapt to changing fuel types as a result of regulation and the availability of conventional fuel sources.

# Local government and adaptation

## Adapting to climate change

Councils have three functions that will be individually and collectively affected by the impacts of climate change:

1. **As a service provider:** local authorities (LAs), as service providers to the public, are exposed to the impacts of climate change in areas such as buildings, transport, commerce, healthcare, infrastructure, planning, natural resource management, water and sewage services.
2. **As a community leader:** LAs are well placed to take the lead on climate change at the local level, offering guidance and advice, facilitating partnerships and fostering public engagement and adaptive actions.
3. **As an estate manager:** councils are employers with physical assets (for example premises); climate-change impacts are likely to affect the working conditions of a council's staff as well as its premises.

### NI 188 Adapting to Climate Change - performance indicator

For the first time, the **Local Government Performance Framework** includes a performance indicator, NI 188, against which all LAs in England and Wales will have to report on their progress.

Given that adapting to climate change will be a continuous process, NI 188 allows LAs and their partners to measure their progress in adapting to climate change over [four levels](#) (PDF):

1. Comprehensively assessing both the risks and opportunities across an area.
2. Taking action in any identified priority areas, preferably showing evidence of having put in place mechanisms to proactively manage climate risks.
3. Developing an adaptation strategy and action plan that sets out the risk assessment, identifies where the priority areas are and what action is being taken to address them, as well as highlighting what steps will be taken to monitor and assess risks continuously in the future.
4. Implementing, assessing and monitoring the actions on an ongoing basis.

By introducing NI188, adaptation has firmly been established as a key area for local government action. To support LAs in their effort to progress, the Government has set up a Local and Regional Climate Change Adaptation Board, which includes representatives from regional and local bodies to offer targeted support.

### Local Climate Impacts Profile

The UK Climate Impacts Programme (UKCIP) has developed a tool - the Local Climate Impacts Profile (LCLIP) - to enable LAs to understand how their council services have been

# Local government and adaptation

affected by past weather events and learn from the experience, to establish critical thresholds and to proactively adapt to a future climate.

## Statutory guidance

The Climate Change Act 2008 gives the Government the power to produce statutory guidance on adaptation. In summer 2009, the Government will consult on draft guidance. This guidance is likely to set out the processes that organisations need to follow to assess the risks from climate change and draw up adaptation plans. It is primarily aimed at public-sector organisations such as LAs. According to [Defra](#), the guidance is likely to include:

- background and national policy on adaptation to climate change
- general sources of advice and information, for example from UKCIP and the Environment Agency
- information on assessing risks and vulnerabilities, developing possible adaptation responses and evaluating progress
- details about the expected scope of the report
- the principles of sustainable development and the need to take into account risks and opportunities from climate change for the natural environment, and for social and economic wellbeing.

## Relevant policy, legislation and standards

All of the information noted above increases the duty of local government to act. Failure to do so may result in claims for **breach of statutory duties** and claims at common law of **nuisance and negligence**.

Negotiations over the cost of infrastructure building, maintenance and operation will need to factor in the decreased lifespan of that infrastructure and the increased cost of construction and maintenance. If not done, councils will be left with a hefty bill to fund themselves.

### Civil Contingencies Act 2004

- LAs have a responsibility to undertake local risk assessments taking a multi-agency approach. This could take place via the Local Resilience Forum to plan for emergencies, including extreme weather events.
- Following the risk assessments, LAs have to produce actions plans on how to reduce the impacts of these risks.
- LAs have an obligation to deliver business continuity plans for the local area, covering a variety of threats including extreme weather events

# Agriculture and adaptation

## Adapting to climate change

*'Farmers, like other businesses, are beginning to realise that adapting to climate change is crucial to the success of their business. Reluctance to adapt could become a concern as the impacts of climate change become more pronounced, so it's important to remember that actions to combat climate change also reduce on-farm costs.'* ([Jonathan Porritt, Founder of Forum for the Future](#))

The [Stern Report](#) (PDF) quantified the reductions in cost as well as the avoided climate damages in the agricultural sector, based on a collection of existing studies. Adaptation measures could range from low-cost, farm-level changes such as crop variety and changes in planting times, to policy-driven measures such as improved irrigation infrastructure and regional shifts in crop choices. The main findings are that:

- Introduction of different crops, improved irrigation and using more drought-resistant crops could reduce yield losses by between thirty per cent and sixty per cent.
- Small shifts in planting dates, crop choice and additional irrigation could reduce the impacts of climate change on production by at least 24 per cent in developed countries.

## Adaptation measures

There are adaptation measures that address the risks of climate change and others that allow the exploitation of opportunities related to climate change.

- Crop production: the agriculture sector could adapt their cultivation practices or diversify into different crops and varieties in response to climate change. This could include the development and use of drought- and/or pest-resistant varieties of crops.
- Livestock farming: while there might be less need for livestock shelter as a result of increasing average temperatures, there might instead be a shift towards prevention of heat stress and disease. Adaptation measures could include increased vaccination or improved ventilation of existing shelters. ([Climate change and the European countryside](#) (PDF), 2006)
- Soil management: one way to control soil erosion is to maintain soil vegetation cover. The [Environment Agency](#) recommends winter barley to improve the stability of the soil and thereby prevent nutrient leaching. Other recommended practices include changes to cultivation times to reduce soil run-off.
- Water management: farmers face the prospects of flood risks and water shortages. Water-management strategies will become ever more important to face these challenges. The [Environment Agency](#) recommends using stored water collected during the winter and rainfall collected by reservoirs for irrigation. In addition, improvements can be made in how water is used, for example by changing the washing regimes for equipment and livestock.

# Agriculture and adaptation

- Adoption of organic farming methods: using the International Federation of Organic Agriculture Movements [International Basic Standards](#), it is possible for farmers to facilitate adaptation to climate change. Organic farming methods conserve and grow soil, maintain water quality and use water efficiently and responsibly.

In September 2008, the Environment Agency published an extensive report on [Best Farming Practices](#). This includes information and case studies highlighting how farmers can benefit from best practice to tackle climate change, pollution, water management and flooding. Some farmers report that by following these guidelines, the cost of crop cultivation can be reduced by up to twenty per cent, coupled with the survival of beneficial insects that contribute to natural pest control.

## Policy and legislative context

Adaptation to climate change is increasingly at the forefront of national policy development and consequently also in related legislation and regulation. If proactive adaptation is not undertaken within the agricultural sector, the following existing regulations and their inherent aims and objectives will be compromised by the impacts of climate change, so there may be cross-compliance issues.

- [The Nitrates Directive](#): aims to reduce water pollution by nitrogen as a result of agricultural activity. The extent of Nitrate Vulnerable Zones (NVZs) and the effectiveness of the Action Programmes to tackle nitrate loss will be affected by the impacts of climate change. It is therefore recommended that reviews of the NVZs and action programmes should take into account future impacts and the benefits of adaptation.
- [The Water Framework Directive](#): aims to improve and integrate the way water bodies are managed, thereby:
  - enhancing the status of, and preventing further deterioration of, aquatic ecosystems and associated wetlands
  - promoting the sustainable use of water
  - reducing pollution, especially by 'priority' and 'priority hazardous' substances
  - ensuring progressive reduction of groundwater pollution.
- [EU Common Agricultural Policy](#) (CAP): climate change in the context of the CAP is a relatively recent consideration. Given the importance of the CAP for the UK's agricultural sector, any changes or amendments to take more significant consideration of climate-change scenarios and the need to adapt could have knock-on effects for the sector. The CAP could play a significant role in guiding the process of adaptation in agriculture by providing farmers with the mechanisms and resources needed to facilitate the change. Adjustments to the CAP through the '[Health Check](#)' of 2008 could provide opportunities to examine how to integrate adaptation into agricultural support programmes as well as incentivising farmers to adapt.