

European Climate Change Programme

**Working Group II
Impacts and Adaptation**

**Urban Planning and Construction
Sectoral Report**



Legal notice: The report has been compiled for the European Commission by Ecofys BV under contract number 070501/2006/432780/MAR/C2. The publication does not necessarily reflect the official position of the European Commission or of the Commission's Environment Directorate-General.

The EU's Adaptation Programme

Adaptation is a new policy area for the European Climate Change Policy. The Impacts and Adaptation Workgroup has been set up as part of European Climate Change Programme (ECCP II). The main objective of the workgroup is to explore options to improve Europe's resilience to climate change impacts, to encourage the integration of climate change adaptation into other policy areas at the European, national, regional and local level and to define the role of EU-wide policies complementing action by Member States.

The aim of this initial programme of work is to identify good practice in the development of adaptation policy and foster learning from different sectoral experiences and explore a possible EU role in adaptation policies.

The Commission has led a series of 10 sectoral meetings looking at adaptation issues for different sectors. One of these meetings looked at the impacts on urban planning and infrastructure in particular. This report summarises the state of play in the urban planning sector in relation to adaptation to climate change on the basis of the information gathered at the stakeholder meeting. Some of the other stakeholder meetings, such as the meeting on human health, have a strong connection with the urban planning agenda. Therefore, some actions in the sector report on adaptation and human health relate to urban planning and infrastructure considerations.

Key impacts of climate change on urban planning and infrastructure

The global urban population has doubled over the last 50 years and it is estimated that two-thirds of the world's population will be living in cities by 2030.

Urban planning is differentiated from other types of planning here because of its unique characteristics. Urban planning has to be designed in a way that copes with the unique qualities of the urban environment, including increased density of development, increased number of people, different cost dynamics and lifetimes of development, more civil infrastructure, broader ethnic diversity, a greater proportion of gross domestic product generated and urban microclimates.

Looking at cost dynamics in particular, the economic value of urban sites is much higher than sub-urban/rural sites, making the development economics different. Because of the high value of these sites, the lifetime of buildings in the urban environment, particularly at very high value sites is much shorter than in other locations.

These unique characteristics mean that the climate change impacts will be different in an urban setting, and urban planning approaches should incorporate these factors appropriately.

Urban planning, construction and design of infrastructure play a key role in the minimisation of climate related risks in the human environment. The key impacts of climate change on urban areas and building infrastructure within Europe relate, in particular, to all extreme event impacts (such as heat, heavy snow burden on buildings, hail, storm, flooding in low-lying areas, increase in erosion and decrease in slope stability and impact on other geotechnical properties), as well as sea rises in coastal area.

This section aims to give an overview of the key areas of impacts in relation to the urban environment and construction.

- Overheating

The urban heat island effect means that urban areas can experience higher temperatures than more rural counterparts, making overheating more pronounced in cities, which is intensified further by reducing green zones in cities. This can have several effects, including:

- a) an increase in the number of excess deaths, particularly of vulnerable people,
- b) a reduction in the comfort of urban residents (with knock-on effects on their productiveness and the urban economy),
- c) an increased demand for air conditioners, thus increasing energy requirement and further exacerbating climate change.

In addition, losing the evaporative transpiration cooling benefits of green spaces further intensifies overheating.

More detrimental to social and health conditions than a gradual increase in average temperature is the increase of extreme events of overheating and subsequent particularly affects on the indoor environment. For example, the summer heat wave in 2003 led to the death of in excess of 30,000 people across Europe (many of them in their own homes). Overheating also has implications for outdoor thermal comfort and transport systems.

Impacts on the construction industry from overheating include difficulty with concrete curing (which is harder in hot, dry weather), or damage to construction materials from increased combined heat and UV exposure. In particular in large-scale residential and office developments the use of low quality building materials or cost saving in 'non-visible' areas further make the ambient temperature in buildings uncomfortable, leading to overheating in summer – this includes limited use of insulation for roofs and walls, as well as incorrect glazing. Improved building regulations can lead to vast improvements in this area.

Building regulations should include clear benchmarks for optimising solar gain in summer while maximising it in winter. For instance, sunspaces are becoming a source of overheating in homes in the UK.

- Impacts of changes in rainfall patterns and flooding on infrastructure

Convective thunderstorms are influenced by microclimatic conditions, and increased flooding can be due in part to changes in rainfall patterns. Very acute flash flooding is caused by extreme rainfall events. There are five types of flooding: tidal, fluvial, pluvial, sewer and groundwater; the probability of all of these being expected to increase as a result of climate change.

Cities are often the backbone of a nation's economy and are often more susceptible to extreme weather. Low permeability of urban ground is a major factor in how a city responds to such events; and many urban catchments are vulnerable to flash flooding, with water levels moving from 'low level' to 'out-of-channel' flooding in less than an hour. As well as the damage to property described above, impacts on other urban infrastructure such as transport and power generation and transmission are possible from flooding and from storms and wind damage. For example, in London, the underground transport system is substantially exposed to flood risk; with 75 stations located in the 'high' flood risk zone area. Under these conditions, Zone 3 of

the underground would be flooded in 1 in 100 year freshwater and 1 in 200 year tidal event.

A further potentially hazardous impact of floods is the risk of chemical leakages from industrial sites upon flooding. Hazardous chemicals can pollute natural waters, get into drinking water systems and water treatment facilities.

In areas with increase in precipitation the risk of erosion and undermining in urban watercourses will increase. Erosion along coastal areas and harbours may increase due to rise in the sea level and more frequent storm events.

Sea level rise and larger variation in ground water levels may influence the mobility of contaminants and thereby indirectly influence the water quality

- Changes in Water availability

Successive years of drought in some regions could mean less water is available, both for drinking and for other uses. Extracting more water for human consumption reduces the volumes of water that remain available for natural ecosystems. In addition decreased water availability, changes in water quality and demand are anticipated also.

- Direct impacts on the built environment and construction practices

Impacts on the built environment include structural damage due to wind storms and floods and differential settlement (subsidence, heave). In construction there could be impacts from project delays and requirements for more durable materials. For example, in the UK, the total estimated worth of properties at risk is £214bn (2 million residential and 185,000 commercial).

Subsidence and heave risks exist in some soils, such as clay, that are prone to expanding and contracting as their moisture content varies. Increased seasonality in rainfall will cause soil moisture to fluctuate more dramatically than before, causing increased subsidence and heave. Buildings with shallow foundations, utility service pipes and tunnels may all be affected. Dry clays shrink, whilst wet clays expand. Although existing buildings can be underpinned, new buildings on clay soil should have improved foundation design.

For example, in France, the shrinking and swelling of clay soils were a key influence in property damage that amounted to €3.3bn for data available up to 2002. In regions where climate change results in increased precipitation (e.g. North EU, but also elsewhere during periods with more intense precipitation) the stability of slopes and coastal zones will decrease due to raise in groundwater and pore pressure. Buildings and infrastructure at these locations may be endangered.

In the UK, the insurance industry faced £2.1bn property claims as a result of the 2002 flooding events during which 10,000 properties were flooded over 700 locations. Flooding of property causes damage to the building fabric, including fixtures and fittings, as well as the building structure itself in extreme events. Some people may not be able to obtain flood risk insurance in the UK and therefore cannot get an affordable mortgage. It is anticipated that eventually mortgage providers and insurers may lobby government to influence construction standards because existing building regulations and planning guidance will not encourage development that is sustainable in a changing climate, leaving properties that may be uninsurable and unmortgageable.

Many cities are reliant upon aged infrastructure (e.g. London's Victorian water and sewer systems), many of which are at capacity and the cost of enhancing them in the confines of the city will be high.

Project delays may impact on the construction sector, due to site flooding or other extreme weather conditions, albeit with some small reductions in lost days due to snow and frost.

Although there is a growing movement towards modern methods of construction (MMC) as a realistic means of improving quality, reducing time spent on-site, and improving on-site safety, the insurance industry has limited information about the long-term resilience of MMC to the range of perils that affect buildings, including flooding, driving rain, fire, subsidence and windstorm. This needs to be examined further.

Existing/Relevant policies at the EU level

There are very few directly relevant EU legislative instruments relating to cities and buildings and none of them include explicitly requirements for improved climate impact resilience or adaptation. The key policies of importance are:

- the EU Energy Performance in Buildings Directive (EUPBD),
- the EU Thematic Strategy on the Urban Environment,
- the Strategic Environmental Assessment Directive,
- structural funding (to a certain extent).

The proposed directive on the assessment and management of floods does foresee management plans to be developed considering climate change and calling for measures to protect the build-up environment and its economic value.

Other examples that can also be of importance include:

- the EU Directive (2004/17/EC) of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors,
- Commission Decision of 12 September 2003 on the procedure for attesting the conformity of construction products pursuant to Article 20(2) of Council Directive 89/106/EEC as regards seven products for European technical approvals without Guideline (*notified under document number C(2003) 3247*).

Examples of existing initiatives at Member State level

Some examples of existing initiatives at Member State level are listed below:

- The French adaptation strategy for climate change is a survey of foreseeable impacts, adaptation options and current practice. It is currently in an advanced formative status. In terms of building-related impacts, the strategy is based on research conducted by the CSTB-CIB international board of research institutes in built environment. Progress in summer comfort through building design is expected for the near future by the introduction of amended construction rules. A national plan for heatwaves is activated every summer including a census of risk groups within every town that are provided with special equipment.

- In Dresden (Germany), in areas at risk of flooding, heating systems are replaced with renewable energy systems, which lead to adaptation and mitigation benefits. Green roofs improve the city's climate and provide for greater insulation and greater temperature attenuation during extreme heat events. Groundwater is used for renewable energy while groundwater management is optimised. Deep lakes are used for thermal energy. Methane emissions from groundwater are mitigated while reducing soil salinisation.
- In Sweden a national commission on climate change vulnerability has been initiated¹ parallel to other national efforts including ongoing research into climate change regional scenarios. One of the investigations of the commission has been an international comparison of ongoing activities in other countries regarding vulnerability, adaptive capacity and adaptation measures to climate change. The countries included in the investigation are Austria, Canada, Denmark, Finland, Norway, France, Germany, Italy, Netherlands, UK and USA also activities on the European Union level are included. The conclusion is that there are ongoing activities in all countries but at different levels.
- The Greater London Authority is developing an adaptation strategy. This will be the first adaptation strategy for a city. The strategy will provide policies and proposals to help London and Londoners prepare for climate change. It will recommend that all new development and infrastructure is located, designed and constructed for the climate change it will experience over its design life. The strategy will encourage Boroughs and emergency services to review climate risks through the Civil Risk Register. The strategy will encourage businesses to routinely consider climate change in their business planning and to prepare and test business contingency plans allowing for climatic risks.
- The UK Local Government Association (LGA) has signed a climate change adaptation and mitigation Protocol with the UK Environment Agency. The Protocol² is an interesting model of joint local - central government working in that it aims to establish:
 - a better understanding of local and regional impacts from climate change,
 - initiatives to collaborate in adapting to climate change, including identifying the requirements of specific sectors and ways of building resilience in infrastructure,
 - joint working on limiting greenhouse gas emissions through modern regulation, energy efficiency and renewables.
- An insurance risk premium applies for all properties to cover poor buildings in operation in Belgium.
- Land Use Consultants with Oxford Brookes University have recently completed a DEFRA-funded research study into "Adaptation responses to climate change for new development in the Growth Areas". The study identified practical climate change adaptation measures that can be taken by those involved in delivering

¹ Miljö och samhällsbyggnadsdepartementet Dir. 2005:80.

² The full protocol is online at:

http://www.lga.gov.uk/Documents/Briefing/Our_Work/Environment/workingbettertogether.pdf

the Sustainable Communities Plan Growth Area agenda at the development project scale.

- In the Netherlands, a national programme called "Adaptation Programme for Spatial Planning and Climate" is in place, which combines the collaboration of four different ministries. In 2007 there must be a "national adaptation agenda". Several research programmes also exist besides this programme. One of them is a programme called "Climate for Space". That programme does research on how climate influences area and urban planning. In several "hot-spots" there will be investigated on how this subject can be handled.

In addition to these programmes, which touch upon urban planning and construction issues particularly, some general spatial planning agendas in certain Member States also relate to climate change and the urban agenda, e.g. Germany and the Netherlands.

Gaps identified

There are several clear gaps in relation to adaptation and the urban agenda:

- there is no European adaptation policy in this sector,
- there are some emerging activities on the Member State level but no comprehensive overview, reporting or monitoring of activities,
- the business case for adaptation is not as well developed as mitigation, although benefits (e.g. in terms of building value, damage and quality of life) are more tangible. Both mitigation and adaptation are important and the interrelationship between these two issues needs to be highlighted – by improving mitigation actions it will reduce the need for extreme adaptation actions. Adaptation actions can cause higher greenhouse gas emissions, and such actions need to be avoided in support of mitigation,
- the construction industry (materials suppliers, contractors, architects) are largely outside of the debate, although it is essential that this sector and its trade-body representatives are included in the development of an adaptation strategy,
- security of energy supply, as linked to urban planning, also has to be considered in the context of adaptation. Strengthening the resilience of local energy provision should be regarded as a critical factor – not only on a day-to-day basis, but also in the anticipated increase of disaster situations, and considering weaknesses in current electricity supply systems. (e.g. consider collapse of German lines in 2006 due to heavy snowfall and the expected increase in storm intensity for mid-to north Europe). In this context energy utilities and local governments need to be involved,
- the 100- and 200-year disaster/storm records need to be reviewed more often, as these have repeatedly been broken in many areas in Europe. Such a review will, most likely, impact on building and infrastructure planning and regulations,
- insurance companies have no common strategy for adaptation to climate change.

Opportunities for the EU level

Urban planning is a devolved activity and hence the influence of the EU is overall limited in this area. However, the influence of local authorities is not universal, nor always satisfactory. Furthermore, in some cases urban authorities lack the mandate that they need to take action, and quite often the funds to act comprehensively are not available. Hence, there could be a role in some instances for the EU in supporting the development of standards. These standards, if deemed to be an appropriate approach, may refer to both, the planning process (on national, regional

and local level) and design of the built infrastructure (buildings, water, waste, energy). However, the issue of standards is difficult, as changes in the environment due to the climate, means that a certain standard of a building may not in the future satisfy the performance requirements, which were satisfied in the original design³.

Concrete measures for future events are easier to achieve for long term structures, such as the built environment, than for shorter-term structures. Therefore the urban planning has an extra responsibility to envisage both the problem as climate change adaptation solutions.

Climate changes are expected to show large regional variations. Very specific, detailed objectives/targets or minimum requirements in planning processes may not be appropriate in all areas. Different country and local circumstances, challenges and opportunities need to be taken into account. Capacity building is needed in the planning community to ensure that decisions are informed by the local needs of adaptation and mitigation. However, standards and minimum requirements may have a key role in awareness raising and triggering more proactive approach under the responsibility of the regional and local level.

Information and Knowledge

- a) the EU could play a large role in awareness raising, coordination and promoting continuity and to encourage cross-party consensus on climate issues,
- b) cooler countries could learn from the experience and adaptation strategies of warmer regions,
- c) best practice and successful approaches which have been used throughout Europe and elsewhere should be highlighted and disseminated to member states, e.g. how to incentivise the risk management and adaptation in planning of new infrastructure rather than disincentivise by public compensation of damages,
- d) the EU should launch a campaign for public awareness on the need to adapt at the same time as publishing the Green Paper focused on local and regional decision makers,
- e) the EU should examine its potential role as a gathering, distributing and interpreting (focal) point of information (e.g. information regarding climate change scenarios, changes in land use and specifically the development of urban areas) but in particular also monitor ongoing adaptation activities in the Member States to highlight best practice to inform and lobby the decision-making processes of regional and local government,
- f) the EU should encourage a whole life approach to planning and costing within the built environment (e.g. future-proofing) is needed. For example, one option may be to do this via the OJEC procurement procedure,
- g) the EU should develop an easy and automatic-to-implement safeguard and reporting mechanism for climate change impact assessment on released land,
- h) this could include the EU bringing forward a directive to make climate change considerations compulsory in planning and development schemes. Ensure appropriate integration of climate change impacts should be made a compulsory standard requirement in regional development. Potential common targets would have to vary between cities and member states and need further exploration in view of the principle of subsidiarity,
- i) the EU should increase current understandings of the synergies, conflicts and tradeoffs between mitigation and adaptation measures. Potential risks can make decision and policy makers more sensitive to climate issues and can stimulate

³ J. Nielsen, "On the design of buildings in relation to climate change". To be presented at the World Conference on Accelerating Excellence in the Built Environment. Birmingham 2-4 October 2006.

mitigation policies. For example, better insulation and natural ventilation and cooling as adaptation to heat has a clear synergy with mitigation (use less energy for air conditioning); densification allows for ease of mitigation responses (e.g. reductions in transport, community heating opportunities) but has implications for the urban heat island effect and urban drainage. Other examples are the range of actors involved (different policy domains and stakeholders) and the different scales of approach needed (both spatially and temporally),

- j) the EU could undertake an analysis of data needs, gaps and analysis techniques concerning integration and adaptation,
- k) the EU could develop overheating standards for homes, public buildings, workplaces and public transport, or could encourage Member States to develop such standards in a co-ordinated fashion,
- l) the EU should increase the representation of the construction industry within the EC and this policy working area, noting that this industry (including materials suppliers, contractors, architects, etc) and their trade-body representatives are currently outside the debate,
- m) the adaptation to climate change should also include an adaptation to extreme weather situations in today's climate,
- n) standards for sub-potable and water re-use (which don't exist at the current time),
- o) the EU should promote the development of an appropriate risk model, especially with respect to land use, i.e. what is an acceptable level of risk, who or how should it be defined, what land uses will be located at what level of risk and what future requirements are needed to maintain risk at an acceptable level,

Policy planning process

- p) the EU should encourage the integration of climate change adaptation into existing sustainable development dialogues, noting that climate change adaptation is fundamental to sustainable development,
- q) the EU could frame, build and drive the business case for undertaking adaptation measures, since this business case is not as well developed as the business case for mitigation,
- r) the EU should generate a vision that considers adaptive measure as creating additional wider ranging opportunities, linked to socio-economic growth and direct financial benefits. Positive local and regional side effects should always be put in context of the negative global impacts,
- s) the EU should drive a more holistic approach to the planning process (also a regional issue), since many Brownfield sites are located in areas of higher climate risk (e.g. flood risk, erosion and landslides),
- t) the EU should revise SEA and EIA Directives to make adaptation (and mitigation) explicit elements, and consider a similar revision to WFD,
- u) the EU could establish a working group on 'green areas' using indicators on the distance from green areas and impacts on quality of life. Ecological-led approaches such as those adopted in Denmark could be useful examples,
- v) the EU could set new building standards which would extend the legal requirements for energy performance to more buildings in order to minimise the need for energy consumption including air conditioning, heating and household appliances,
- w) the EU should contribute towards a better co-ordination of planning and programming measures when trans-borders issues (either because of geographical coverage, e.g. international river catchments, or because of thematic extension of the threat, e.g. continental heat waves or droughts) involve more Member States and corresponding border Regions,

Economic Stimuli

- x) the EU should 'climate-proof' EU funding for new developments, redevelopments and regeneration. This could be a quick and easy win, and essential to ensure the credibility of the EU position on adaptation issues,
- y) the EU should consider whether professionals responsible for the built environment (e.g. architects, planners, engineers) should be made liable for the performance of their buildings/cities,
- z) the EU should define and communicate the economic implications of adaptation, including the potential for positive benefits, for both new and existing buildings,
- aa) the EU should encourage financial institutions to consider the effects of climate change upon their asset portfolios,
- bb) the EU should encourage 'green mortgages' for development that is 'climate-proofed' and resource efficient,

Risk and Disaster management

- cc) provide GIS data and tools for risk assessment and management as help for decision local and regional makers (like EFAS) for planning and disaster preparedness,
- dd) provide help with remote sensing data on impacts and damages and urgent needs in case of disasters (GMES),
- ee) provide better disaster/extreme weather forecasts especially in the urban context (research need relating to regional modelling cross-linked to climate scenarios and adaptation measures).

Actions relevant at national/regional/local level

Impacts on urban planning should be analysed at the national level focussing on how they fit with local policies, e.g. with technical specifications. Noting that the influence and impact of local authorities is not consistent, changes to the law at a national level (e.g. to make local risk assessments mandatory) may be required, but also need to retain some flexibility in the policy process.

A key role for national/regional/local government will be community engagement and information dissemination. Greater public awareness of climate change issues and their impacts is a fundamental need in the short and long term. People from all sectors need to be incentivised to change their behaviour.

Local government is in a very powerful position to influence climate change issues and responses by citizens. There is considerable difficulty in communicating uncertainty in risk-based decision-making, and clarifying the key messages on adaptation is crucial. In addition, communications need to be targeted at different groups such as the public, financial or insurance institutions, political institutions etc, and so a multi-faceted communication strategy may be required.

In addition, other actions identified at a national/regional/local level are:

Urban planning

- urban planning and land use need to be considered in the long term, considering the timeframes over which climate change will impact on the urban environment,
- impacts should be analysed at all levels (national, regional and local), but adaptation responses should seek to fit with local policies,
- privatisation of public open space should be carefully managed, as under certain socio-economic scenarios, this could place restrictions on open access to green spaces and have a negative impact on equality of opportunity of developing or benefiting from adaptive capacity,

- urban planning regulations/policy should, as far as possible, specify good practice in particular regions, including avoidance of building on flood plains, maintaining and upgrading flood defences and drainage systems, promoting SUDS and rules for building on clay zones. A risk-based approach is needed to determine good practice in different areas,
- dense developments provide opportunities for mitigation, e.g. district cooling and district heating to become more viable, but also some adaptation, for example improvement of facilities for pedestrians and cyclists under extreme weather conditions and grey water recycling. It can also act against adaptation, for example in lack of green spaces,
- urban planning policies should include consideration to all the adaptation implications to all aspects of the urban environment including transport and energy supply (noting that secure decentralised local energy supply, using renewables, should be preferred) and other urban infrastructure,

Overheating

- minimising the risks and impacts to urban areas of the urban heat island effect is of key importance:
 - providing urban green space is critical and can help to moderate summer temperatures expected with climate change in residential areas and town centres,
 - shade provided by appropriate mature trees and the presence of water surfaces which remain cool, will help under drought conditions when grass may dry out and stop the provision of evaporative cooling,
 - irrigation measures should be considered to ensure that vegetation continues to have an adequate water supply during these periods,
 - external cooling of buildings e.g. shading, shutters, etc.,
 - making cities more permeable through more green spaces, green roofs and permeable pavings increases evaporative cooling (hence reducing the urban heat island effect), as well helping to manage flood risk,

Built environment

- building regulations and construction rules (both quality and design standards) need to fit better with, and complement, the planning system. Amendments should be made to improve the quality of buildings and address summer comfort. For example, adaptive considerations for the spaces between buildings include providing shelter from wind in cold weather and rain, providing a choice of exposures to the sun (which should be linked to wind exposure) and reducing the urban heat island effect,
- avoid built forms which are unsustainable i.e. require air conditioning,
- local authorities should lead by example by improving the adaptive qualities of their own buildings,
- provide training for professionals involved in the built environment, including policy-makers, planning officers, architects and engineers,

Construction sector

- low-energy building materials should be provided,
- shading and water supply in hot weather should be provided, as well as protection of sites from flooding and appropriate storage facilities,
- project planning should account for the possibility that working may have to be restricted in adverse weather,
- awareness raising of health and safety issues,

Water management

- improved catchment management/planning, using an integrated water management approach, to ensure that future water demand of both the rural and urban environment can be met in the future,
- to protect surface waters from polluted flood waters, petrol and oil should be properly banded or ideally replaced by renewable energy sources as the preferred energy medium. Closed groundwater energy systems could ensure that groundwater is not contaminated. Changes in temperature and hydrology will impact on pollution mobility in ground water,
- non-potable water, subject to suitable standards, should be used for industrial and non-consumptive processes, wherever possible,
- a water consumption hierarchy of "waste less, use less and recycle more" is useful, noting that water is energy intensive to source, purify and supply. Rainwater harvesting (adds to supply and helps manage flood risk), grey water recycling and water conservation are all relevant measures to manage water consumption,
- risk-based changes to flood protection need to be implemented, including changes in levels of dykes, plus new infrastructure designed for higher floods and different forms of floods will be needed,
- soils with a high infiltration rate should be preferred where rain falls, to help regulate surface runoff,
- investment should be made in water-saving and water re-use technologies,
- invest in R&D which aims to develop resilience in systems,
- develop public awareness, as well as implement emergency response and recovery planning, to ensure appropriate actions are taken in response to flooding incidents.

Further references and weblinks

- "Adapting to climate change: A checklist for developers" available using the following link:
<http://www.climatesoutheast.org.uk/downloads/TRCCG%20Checklist%20for%20Development%20Nov%202005.pdf>
- Climate change impacts and adaptation: Cross-Regional Research Programme.
<http://www.defra.gov.uk/environment/climatechange/uk/adapt/crossreg.htm>
- <http://www.eurocities.org/> Eurocities is a network of 129 cities in 32 European countries, with a focus on enhancing links and promoting cooperation between cities. There are seven working groups, from which one is on adaptation and climate change. The website includes 30 case studies from the EU.
- Energie-Cites - www.energie-cites.org - the association of 500 local authorities promoting local sustainable energy policies. The Energie-Cites website contains more than 500 case studies in local energy management.
- Display® European Climate Campaign for Energy Efficiency in Public Buildings: www.display-campaign.org. Display® is a voluntary scheme to publicly display the energy and environmental performance of a public building. To date, almost 200 local authorities and more than 4.000 public buildings are involved in this European-wide buildings climate campaign.
- AMICA project www.amica-climate.net (Adaptation and Mitigation: an Integrated Climate Policy approach).

- Construction Industry Research and Information Association www.ciria.org
- London Climate Change Partnership
www.london.gov.uk/climatechangepartnership
- www.iclei-europe.org: ICLEI – Local Governments for Sustainability is a local government association that addresses all issues impacting on sustainability. One of ICLEI's major international campaigns is the Cities for Climate Protection (CCP) Campaign – for the European CCP adaptation has recently been added, in addition to mitigation. New support is being planned for Europe, in particular the HEAT tool (Harmonised Emissions Analysis Tool). Further information on ICLEI and the CCP can be found on the following website: www.iclei-europe.org/ccp
- 5th Sustainable Cities and Towns conference in Seville, Spain in March 2007
<http://www.sevilla2007.org/>.
- <http://www.sed.manchester.ac.uk/research/cure/projects/current/asccue.htm>
Adaptation Strategies for Climate Change in the Urban Environment project is due for completion at the end of 2006 and information will be disseminated on this website. This project is part of a wider 'Building Knowledge for a Changing Climate' (BKCC) programme, which operates as a network focusing on the impacts of and adaptation to climate change
http://www.ukcip.org.uk/resources/sector/projectsdets.asp?sector=1&project_ref=5
- Later in 2006, will be a special edition journal on cities and climate change by the Built Environment journal.
- Nottingham Action Pack (includes mitigation and adaptation action planning)
<http://www.est.org.uk/housingbuildings/localauthorities/NottinghamDeclaration/>
- ESPACE (European Spatial Planning: Adapting to Climate Events)
<http://www.espace-project.org/index.htm>
- ADAM (Adaptation and Mitigation Strategies) – funded by the EC.
<http://www.adamproject.eu/>
- A special edition journal on cities and climate change by the Built Environment journal will be published late 2006. Issues covered include impacts, risk assessment, urban drainage and the urban heat island, adaptation (urban green space), and decision making under uncertainty.
- A special edition journal on climate change (Municipal Engineer) will also be published late in 2006. Papers include synergies and conflicts between mitigation and adaptation, transport issues, air quality, risk assessment, and urban greenery.
- A risk based approach has been adopted by the UK Environment Agency and is being encouraged within planning guidance for development and flood risk in the UK (Draft PPS25). Details regarding a risk screening methodology developed for the urban environment by the ASCCUE project can be found in:
 - Lindley S.J., J.F. Handley, N. Theuray, E. Peet & D. McEvoy (2006) Adaptation Strategies for Climate Change in the Urban Environment:

Assessing Climate Change Related Risk in UK Urban Areas *Journal of Risk Research*, vol 9, no 5, 1-26.

- Lindley S.J., J.F. Handley, D. McEvoy, E. Peet & N. Theuray (forthcoming) *Built environment special edition on cities and climate change, due late 2006.*
- http://natural-hazards.jrc.it/activities_modeldevelop.html - Research Activities carried out at the Joint Research Centre of the European Commission on integrated modeling related to climate scenarios.
- Urban drainage - <http://www.eng.brad.ac.uk/audacious>
- Finnish example (FINADAPT)
<http://www.ymparisto.fi/download.asp?contentid=25178&lan=en>