



BUILD WITH CaRe. ENERGY SAVING BUILDINGS.

# Build with CaRe

## A baseline review of standards



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## Summary of key findings

This baseline study describes standards, findings and procedures that describe a current position across Europe regarding energy efficiency in buildings and current developments.

- The project requires to ensure that its external profile is maximized. This can be achieved through having a presence at **events** including the EU Energy Week, and through the establishment of a **project ambassador**.
- The work package team should specifically develop a **position statement** regarding aims for policy, practice and future development.
- The **EPBD** has been published and generally welcomed by professional bodies within construction and the built environment. Nevertheless, the manner in which its recommendations are realised requires guidance and continued pressure, and the position statement and follow up activities can help to do this.
- A final outcome from the work package should be to develop a strategy for **influence** at the EU and National levels. This baseline study has identified existing situations in constituent countries, and existing plans and agendas for change within construction. The work package strategy should reflect this, and tie in with opportunities to influence positive change.
- The importance of developing a coordinated approach to the issues of energy use and carbon emissions from buildings across Europe has been recognised as a key priority for the whole region.
- Addressing these needs will require action from all parties including those in industry and academia, as well as building users themselves.
- It is recommended that there should be an EU led policy as individual governments are hard to persuade to change.
- Variation currently exists between nation states, which stems from different histories of policy development, perceived needs and recent developments in the state of the art.
- There is also considerable variation in terms of the manner in which issues of carbon and energy use in construction are debated at the national level. Whilst this is understandable due to the manner in which national policies and building standards have developed, it is also important to consider how change can be enacted across Europe.
- The baseline study indicates that there is broad agreement regarding the need for inclusion of climate change mitigation within policy. The project consortium is well placed to influence policy and practice through instigation of best practice work in their countries, and through the championing of best practice.
- Whilst it may well be possible to develop a single strategy for the region, it is likely that implementation will vary depending on building type, condition, industry and economic factors and political will.
- The Build with CaRe project provides a strong forum within which Local Authorities from across NW Europe can help to establish a common approach.
- Such a strategy will require political support at both national and local level, but requires implementation quickly to help address targets for energy use and CO<sub>2</sub> emission reductions.

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## 1. Introduction

This review is intended to support a number of aims. The review of literature in itself provides some detail of the policy, research and practice which has influenced European directions in buildings and energy to date. However, the main purpose of the document is to inform the Build with CaRe project regarding the development of their own strategy. To that end, the report places the current situation within a suitable context, and outlines various directions which can be planned for in the future. The current existence of ‘roadmaps’ to determine the future of European policy and support in the area of energy and buildings is suggested as a potentially fruitful starting point, as there is a clear link between participants from practice, academia and wider industry and policy.

Therefore, the report takes a structure from these themes, and deals with issues of wider EU policy, relevant research findings, standards across the EU, historical and cultural issues, and relevant case study material.

## 2. Policy

Current policy at the European level is embodied with in a number of plans and strategies, all of which relate to the current legislation and current research programmes. A relationship between economic performance, social sustainability and environmental conditions has been recognised and central to European commission policy since 2000. The Lisbon strategy (2000) identified what was termed an environmental “pillar”, which specifically recognises the need for economic growth to not be at the expense of natural resources. The strategic energy technology plan (SET Plan<sup>1</sup>), for example, has been introduced in an attempt to accelerate both the development of new technology and its deployment with in practice. Of particular relevance to the current study is the European economic recovery plan (November 2008<sup>2</sup>), which in addition to noting the importance of accelerating key construction projects to facilitate an economic recovery across the region, specifically identifies an improvement in the energy efficiency of buildings as being central to the economic recovery of Europe as a whole. The plan states that member state should, “*set demanding targets for ensuring that public buildings and both private and social housing meet the highest European energy efficiency standards and make them subject to energy certification on a regular basis*”. The plan also suggests that member state should direct structural funds towards energy efficiency investments, and to work towards the development of innovative methods of supporting the finance was required to implement energy efficient technologies with both new and existing buildings.

Perhaps of most immediate relevance to the current study have been the recent further developments of a European energy efficient buildings initiative, which will support and promote green technologies and the development of energy efficient systems and materials in both new and existing buildings. The aim is to radically reduce energy consumption and CO<sub>2</sub> emissions. Part of this initiative has been the instigation of specific academic and industrial research programmes which will come out shortly. The overall budget for this initiative is €1bn, and it extends the existing energy performance of buildings directive<sup>3</sup>, which came into force in Europe in 2002.

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<sup>1</sup> [http://ec.europa.eu/energy/technology/set\\_plan/set\\_plan\\_en.htm](http://ec.europa.eu/energy/technology/set_plan/set_plan_en.htm)

<sup>2</sup> [http://ec.europa.eu/commission\\_barroso/president/pdf/Comm\\_20081126.pdf](http://ec.europa.eu/commission_barroso/president/pdf/Comm_20081126.pdf)

<sup>3</sup> <http://www.dfpni.gov.uk/index/law-and-regulation/energy-performance-of-buildings/epb-directive.htm>

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That policy was introduced to help meet EU carbon emission reduction targets from the Kyoto protocol and the energy policy for Europe.

It is important the study recognises that the nature of research undertaken within Europe is typically driven by agendas which will be defined at both national (including local) and European levels. At the European level, which is arguably the most relevant to the current study, research work for many years has been funded through the framework programme. The current framework, framework seven, is arranged in such a way that issues pertaining to climate change, energy and sustainability are dealt with mainly through the environment theme.

Regarding European research, the influence of a range of technology platforms cannot be underestimated. Of most relevance to the study is the European construction technology platform, or the ECTP<sup>4</sup>. The ECTP was established by Europe to help coordinate research across the EU and to help develop future strategies for research and development work which should be funded by the commission. What is interesting about the ECTP is the interest of stakeholders from across industry academia and political spheres. One development which emerged directly from the ECTP was part of the energy efficiency and buildings initiative, or E to be. That initiative will be referred to later in this document, as one of their most prominent contributions to debate since being established has been the development of a series of roadmap documents. The contents and direction of the roadmaps are important to the study, as they signpost that building design moves away from mitigation of harm, towards the production of buildings which arguably and demonstrably make a positive contribution to the environment.

The primacy of industry in future funded research is clear, and it is vital that the strategy emerging from the Build with CaRe project take this into account. The strategy itself is likely to include methods and approaches which come together to transform the manner in which we build, including input from academic research, industry, applied case studies and other mechanisms. Perhaps what is more important in the current study is that the roadmap or strategy which eventually develops from the project is able to identify clear and measurable milestones and objectives.

For this current project it is clearly vital that the research team aims towards identifying a series of industrial and research challenges which can be pursued both within the current project and beyond through later activities. Key challenges which regularly appear across the European research agenda include the refurbishment of existing buildings, neutral and energy positive new buildings (including passive housing), the district level energy strategies and a range of technological and organisational challenges. The structure was certainly recognised by the JTI<sup>5</sup> and it is interesting for the Build with CaRe project, perhaps, to consider how there can be a strategic match between a need for technological change and how this relates to social or managerial aspects of the subject area.

As stated and referenced elsewhere in this document there is a clear relationship which must be explored and recognised between the user of a building and the energy which that building will ultimately consume. That is, the building itself will tend to consume energy only when required to do so by its users. An associated aspect of the project which may be worth consideration by the team is that of the building life cycle. Life cycle costing and life cycle assessment have been developed as methods

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<sup>4</sup> <http://www.ectp.org/>

<sup>5</sup> <http://www.e2b-ei.eu/>

to understand the costs, resources and demands of the built environment over the whole buildings life cycle, including the planning, design, construction and occupancy stages. Most life-cycle costing studies have tended to conclude that the vast majority of resources, perhaps as much as 90%, are likely to be consumed after construction has taken place. A useful deliverable from this project, or from following work, would be to track how the case studies explored within the project have developed once the buildings have been occupied, and once the buildings have therefore been subject to an inevitable change over time. For example changes could include a change of occupant, a change of intended use, a change of use patterns, or a combination of these.

An aspect related to this of course refers to the issue of incentives for participants in the building and built environment and development processes to actively engage with the process of life cycle costing, and an attempt to make this out to the end user. Although a significant amount of work over many years (Gluch and Baumann 2004, Kishk *et al* 2003, Kneifel 2010, Laing *et al* 2006, Soronis 1992) has demonstrated the applicability of life cycle costing in construction, a failure to engage with life cycle costing across the construction sector has perhaps emerged as a result of a lack of awareness, a disconnection between the design and construction teams and the end user, and an over emphasis on original construction cost, as opposed to full life-cycle cost of the building. It is likely, across Europe in fact, that legislation and practice within the industry begins to reflect the need to address the demands of climate change, that end-users may in fact by necessity become far more aware of the implications of technical design decisions taken at the earliest stage. As an aside, the UK processes developed since the 1990s including PFI and PPP tended to place an emphasis on the management of the building and its fabric becoming part of a management contract, intrinsically linked to the original design and construction stages. Whilst such processes are quite rightly subject to regular debate regarding the actual value for money which can be demonstrated to have emerged from them, they have nevertheless set a precedent for a genuine incorporation of maintenance, running and energy costs, included as a central part of the technical and aesthetic design processes.

One very positive aspect of the current project, Build with CaRe, is that it actively encourages the sharing of information across the constituent partners. Such an approach to knowledge transfer between organisations is however not necessarily the norm within the construction industry or the built environment generally, and this has certainly been identified by the JTI (2009) who state that, *“there is a need to encourage the transfer of good practices, technologies and methodologies, including cross-sectoral Cooperation, the setup of a communication infrastructure and the organisation of a number of coaching events”*. Although it is certainly not the case that Build with CaRe should follow the specific activities suggested by the JTI, there would appear to be some value in attempting to prolong and develop the life of the group well beyond the initial funded period.

It is important that the Build with CaRe project properly recognises the existence of previously developed roadmaps and strategies, which were devised to take the entire construction industry towards a more environmentally responsible position. In particular, recent initiatives including those by the JTI have tried to identify how buildings can move from being in a position of being energy consumers to a position where they can be regarded as positive energy contributors within the next 10 to 15 years. Existing roadmaps such as that prepared by the EU recognise that there is a need for both vertical and horizontal change. That is, changing behaviour and design, but also a compatible change in the decision-making and policy-making structures which exist across Europe.

It appears clear that whatever strategies eventually adopted by the Build with CaRe project, there is a need to fit within existing European initiatives, and to recognise a number of real challenges which will face the construction industry in relation to energy efficiency and carbon emissions. The JTI, for example, have identified a large number of existing technology platforms (for example, construction, steel, electricity, wind energy, sustainable mineral resources, forestry) and other initiatives which together have contributed over 1700 outputs<sup>6</sup> which are of relevance to the subject of energy efficiency in buildings. As will be explored in following sections of this report, it is clear that issues including energy efficiency in existing buildings, user behaviour and acceptability of technical solutions to users, and a willingness by the market to embrace new technology will become key factors in the success or otherwise of whatever strategy may emerge from the current project.

### **3. Current research and future directions**

#### **Existing buildings**

A great deal of current emphasis, from industry and academia with regards to the energy performance of buildings, relates to that of buildings which already exist. It is recognised across Europe that the great majority of buildings which will exist in 20 years time have already been built. Therefore it is vital that methods were developed which allow us to address this issue and effectively either retrofit existing buildings so that they meet current and future standards for energy performance, and associated with this, a need to change the behaviour of occupants. It has been recognised for many years that there is a strong relationship between the technical design of buildings and the manner in which they will actually perform once built. Recent studies (Al-Mumin *et al* 2003, Hondo 2010, Lindén *et al* 2006) have shown that the behaviour of occupants and organisations can have a far greater impact on the actual energy utilised within a building than was perhaps envisaged at the design stage. Nevertheless, when dealing with existing buildings, particularly buildings which were constructed some time ago, there is a need for the development of new technical solutions which at least give the buildings the potential to perform at an acceptable environmental level.

To that end, many studies have been completed over the past 5 to 10 years, which together represent a fairly comprehensive series of technical guidelines, which can take the user and the owner of historic buildings through the process of being able to retrofit those buildings for better energy performance, without necessarily destroying the fabric which formed a basis for conservation taking place in the first instance. What is arguably true is numerous studies have been completed in recent years, including by bodies such as historic Scotland, English Heritage and troops extending across Europe. For example, work undertaken by the organisation Changeworks<sup>7</sup> suggested specific and quite detailed technical solutions which can be applied to historic properties, including those which may lie within world Heritage sites. Current work ongoing as part of publicly funded research, both within countries and as part of the European framework programme, is considering how methods can be developed to allow energy ratings of highly decorated historic properties, as well as the retrofitting of areas of towns and cities, which require environmental upgrading on a large scale. Whilst it is appreciated that the current project is tending to focus on new construction and new buildings, this must be seen within the wider context of a built

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<sup>6</sup> [http://www.e2b-ei.eu/documents/36D661v4\\_MIP.pdf](http://www.e2b-ei.eu/documents/36D661v4_MIP.pdf)

<sup>7</sup> Report available via <http://www.changeworks.org.uk/content.php?linkid=424>

environment which consists largely of buildings which were designed and constructed many years ago.

### **Framework programme**

Research funded by the European commission is supported under what has become known as the framework programme. The framework programme, currently in its seventh iteration (FP7) supports work to undertake a wide range of research activities, including large-scale research projects, research mobility funding and support for both emerging and established researchers working within Europe. A feature of the program over many years has been streaming of research underneath specified thematic areas. Of most relevance to the current project is that of the environment research area, which includes studies concerning climate change. The environment programme includes specific studies which deal with many aspects of the construction industry, including sustainable materials, existing buildings, construction and demolition waste, and associated projects which may also involve other themes including information and communication technologies. The commission define the main objective of the environment stream as being *“to promote sustainable management of both man-made and natural environment and its resources. To this end, increase knowledge on the interaction between the climate, biosphere, ecosystems and human activities assault and, new environmentally friendly technologies, tools and services are developed”*. Projects funded under the framework programme are required to involve partners from a number of European member states to ensure that research undertaken has a genuine value and is likely to be applied across a wide geographical area. Whilst it is arguable that having research undertaken in numerous countries does not necessarily lead to meeting this objective, it is certainly true that within construction the variability of construction tradition, materials and practice across Europe in itself almost dictates that research which deals with Europe regions within Europe is likely to be more representative of the wider situation than research which is very much focused on one particular member state. Projects funded under the framework programme typically have values in excess of €3M, and will normally take place across a duration of at least three years. Many corals also specify a requirement to have direct input from both industry and academia to the research, which would normally involve having industrial partners included as full partners on a project proposal (as opposed to simply being included as members of a steering group, for example).

Areas in which the commission has stated they would like to give preference for funding include studies dealing with macro level effects of climate change, conservation and sustainable management of man-made resources and the development of new environmental technologies (including those pertaining to the cultural heritage). It is suggested here that outcomes from the current project will almost certainly and by definition be of direct relevance to researchers engaged with the current framework programme. It is therefore suggested that the project team give thought to the manner in which they might be able to disseminate results, findings and best practice with a framework of events. It is also possible that recommendations from the current research can inform future calls and directions taken by the commission and its research programme in the future. It is therefore also suggested that the project team give consideration to how they might be able to interact with the European commission’s framework team over the course of the coming years.



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## **4. Standards**

### **4.1 Overview**

Partners in the Build with CaRe project are located in the UK, Sweden, Germany, Belgium and the Netherlands. The fact that there are likely to be regional variations due to the countries having different political, environmental, climatic and building traditions, it is useful to present and reflect on the commonalities and differences which exist at the present time. This of course needs to be read against the context of a stated desire to develop a common strategy or a roadmap towards the shared objective of meeting energy efficiency targets in building across the region.

This section, almost by necessity, is presented in two parts. The first part is intended to give a brief and digestible impression of data regarding the current situation across the region. This information has been gathered mainly through survey materials distributed to the project participants. A copy of the survey form itself is provided at the end of this current document, and every effort has been made to preserve references, web links and other resource information which was provided at the survey stage.

### **4.2 Summary of survey responses**

Project partners were asked to provide information regarding existing carbon emission policies in their own country. They were also asked to identify whether an existing strategy was in place covering construction. Bearing in mind that the current study is very much focused on a potential need for a change in the future, project participants were also asked to provide information regarding whether the national strategy which are in the country had changed significantly during the past decade, or whether it was likely that strategy would change or be developed in the near future. Associated with this consideration of carbon emissions with construction was an associated interest in how this may extend and potentially influence the planning system or systems associated with public debate and public participation. All partners also provided data regarding best practice Case studies, although it is recognised fully that the existing project wide website has included such case studies for some time. It is suggested that this section of the report be used to stimulate discussion and debate within the project team, although it is likely that a common strategy across the entire consortium may rely as much on method, approach, available resources and tradition as on the provision of technical standards.

<p><b>Existing carbon emission strategy</b></p>	<p><b>Belgium</b></p> <p>The Belgian government has signed a local 'Kyoto' protocol. Sustainable building and construction has been taken up in the provincial policy.</p>	<p><b>Germany</b></p> <p>Germany has a national climate protection strategy, with further policy in place at the state level.</p> <p>Germany has an established process for the calculation of CO<sub>2</sub> emissions, details of which are provided in section 4.3.</p>	<p><b>Netherlands</b></p> <p>Detailed information regarding strategy and policy in the Netherlands at a national level can be found here: <a href="http://www.pbl.nl/en/index.html">http://www.pbl.nl/en/index.html</a></p>	<p><b>Sweden</b></p> <p>Details of the Swedish energy and climate policy can be found in section 4.3. One of the main stated aims is to reduce energy consumption with reduction of 20% by 2020.</p> <p>Regarding participation in the development of such strategies, the Swedish government launched a commission for sustainable development which involved key participants from industry and academia.</p> <p>Such agendas are also typically mirrored at the local level, including the development of smart energy strategy which has led to agreements on renewable energy, energy efficient buildings and sustainable tendering.</p>	<p><b>UK</b></p> <p>Detailed strategies are in place to deal with climate change across all sectors of government. It is important to note that strategies vary between UK regions, and that mechanisms to realise change exist at the national and local levels.</p> <p>Policies are tied to economic growth, and involvement of the private sector is stressed in many practical demonstration projects.</p>
<p><b>Construction policy</b></p>	<p>The province has set itself as a goal to apply the principles of passive building into</p>	<p>Details of specific campaigns influencing construction with in Germany are</p>	<p>Construction and housing policy with regards to environmental impact is discussed within <a href="http://www.vrom.nl/pagina.html?id=37360">http://www.vrom.nl/pagina.html?id=37360</a></p>	<p>A new classification system for buildings is currently being developed within</p>	<p>Policies cover CO<sub>2</sub> emissions from new buildings, and (for example) the insulated</p>

	<p>buildings over the period 2007-2012.</p> <p>It is recognised of course that it may not be possible to upgrade or retro fit every existing building to meet ideal energy performance standards.</p> <p>It is recognised that passive construction may in some cases be more expensive to construct. Subsidies have been made available to support further development, however.</p>	<p>available, and links provided in section 4.3.</p>		<p>Sweden, which will label the energy efficiency of buildings.</p>	<p>performance of building elements has developed significantly.</p> <p>With regards to existing buildings, the introduction of energy evaluation within the property market, and initiatives to recognise the importance of historic properties and their unique characteristics, have led to extensive research and changes to heritage advice.</p>
<p><b>Developments</b></p>	<p>The past 10 years have seen great change with the problems, as the topic of energy efficiency and carbon emission has only recently become enshrined in policy.</p>	<p>Over the past 10 years, the topic of energy efficiency has become increasingly important in regulations, information campaigns and support programs at both the national and state levels.</p>	<ul style="list-style-type: none"> <li>Northern Netherlands project (Northern Energy Norm) conflicts with national policy therefore they must convince policy makers that the current national policy instruments are not relevant anymore and need to be changed.</li> <li>This is a challenge as national policy is much more difficult to change than regional policy.</li> </ul>	<p>Sweden has a strong history of investment in renewable energy, although there is a stronger focus today on climate and energy issues.</p> <p>A further policy on climate and energy is being proposed within the Swedish parliament, suggesting a target of reducing greenhouse gases by 40%.</p>	<p>The publication of the <i>Low Carbon Transition Plan</i> is the most recent change to the National Strategy and aims to transform the country through a systematic reduction in carbon emissions. Also, building standards are to be raised at set stages over the next 10 years. The UK has the most demanding, mandatory CO<sub>2</sub> emissions reduction target within Europe.</p>

						Within Scotland, changes to the building standards have been suggested which would steadily increase the energy efficiency of new buildings across a period of 5-10 years.
<b>Building standards and carbon</b>					Building codes in Sweden changed during 2008, with specific effects for buildings heated using electricity.	Recognised in the building standards, and form the basis of current consultation/debate in the development of forthcoming changes.
<b>Case studies</b>	A series of case studies from each region are indicated in section 4.3.					

### 4.3 Partnership existing standards

This section presents selected standards of relevance to the study.

Where appropriate, notes are included regarding standards in place, and also the manner in which these are applied or enforced, with brief descriptions of and links to best practice case studies and external documents. In addition, it is important that readers also refer to the annotated bibliography which provides further information available in the public domain.

Country	Summary of nationally imposed standards
<p><b>UK</b> (England)</p>	<p>Reference should be made towards <i>The UK Low Carbon Transition Plan: National Strategy for Climate &amp; Energy</i>. (15 July 2009). The document plots how the UK will meet the cut in emissions set out in the budget of 34% on 1990 levels by 2020. Chapter 4 deals specifically with transforming our homes and communities (construction). Low carbon construction is mentioned briefly on page 125.</p> <p><a href="http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx">http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx</a> <a href="http://interactive.bis.gov.uk/lowcarbon/">http://interactive.bis.gov.uk/lowcarbon/</a></p> <p><b>England:</b> Planning Policy Statements (PPS) set out the Government's national policies on different aspects of spatial planning in England. PPS1 sets out the overarching planning policies on the delivery of sustainable development through the planning system. Planning Policy Statement: Planning and Climate Change (PPS1a), supplements PPS1 by setting out how planning should contribute to reducing emissions and stabilising climate change and take into account the unavoidable consequences. A link to the document can be found here:</p> <p><a href="http://www.communities.gov.uk/publications/planningandbuilding/ppsc_limatechange">http://www.communities.gov.uk/publications/planningandbuilding/ppsc_limatechange</a></p> <p><b>England and Wales:</b> <i>Building a Greener Future – Towards Zero Carbon Development</i> is a consultation document which sought views on the Government's proposals to reduce the carbon footprint of new housing development. It set out the Government's views on the importance of moving towards zero carbon in new housing and explored the relationship between the planning system, Code for Sustainable Homes and Building Regulations in delivering our ambitions for zero carbon. It also proposed a timetable for revising the Building Regulations so as to reach zero carbon development in all new housing in England &amp; Wales.</p> <p><a href="http://www.communities.gov.uk/archived/publications/planningandbuilding/buildinggreener">http://www.communities.gov.uk/archived/publications/planningandbuilding/buildinggreener</a></p> <p>The climate Change Act 2008 aims to reduce CO<sub>2</sub> emissions by 80%</p>

	<p>below 1990 levels by 2050, with interim targets.</p> <ul style="list-style-type: none"><li>- 22% below by 2012</li><li>- 28% below by 2017</li><li>- 34% below by 2020</li></ul> <p>The code for Sustainable Homes (CSH) dictates that all new homes built after 2016 must be Carbon Zero (meaning of Carbon Zero currently being defined)</p> <p>The CSH is a set of building design principles. It does not set minimum standards for construction – that is still the role of the building regulations. It provides an important framework as the levels of performance indicate the future direction of building regulations. Its methodology is an updated version of the BRE Eco-homes tool and since April 2007, CSH has taken over as the methodology for new homes in England. It is mandatory for social housing but currently, voluntary for private housing developments.</p> <p>Home Energy Efficiency Target – all existing roofs and cavity walls to be insulated to current standards by 2015. Building Regulations (Part L) place a cap on CO<sub>2</sub> emissions for all buildings, including renovations and extensions (historic buildings are currently immune).</p> <p>The building regulations define the minimum standard that a new home in England and Wales has to be built to and Part L is the section that deals with the energy efficiency. The major emphasis is on the fabric. The regulations were last revised in 2006 and will be upgraded in 2010, 2013 and 2016.</p> <p>Carbon Emissions Reduction Target (CERT) – requirement for energy supply companies to fund energy efficiency improvements in existing houses that will reduce CO<sub>2</sub> by 185 million tonnes (over the lifetime of the home) by 2012</p> <p>Energy Performance Certificates (it should be noted that different standards apply in Scotland and Northern Ireland).</p> <p><b>Scotland:</b></p> <p>Control of building standards and the development of a distinct carbon emission policy is controlled by the Scottish Government. The Government has published wide ranging policy statements, including those concerning carbon impact assessment, carbon emission targets, and aspirations to move towards carbon neutral development across the country.</p> <p>Specific examples include a policy to stimulate 50% of Scotland's energy to come from renewables by 2020, recognition of the need for carbon assessment, emissions trading and the establishment of community protection.</p> <p>Key documents can be found online:</p> <p><a href="http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action">http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action</a></p>
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**Distinct ‘construction’ policy:**

Building Regulations (Part L) – escalating cap on CO<sub>2</sub> emissions for all buildings (all uses), including renovations and extensions (historic buildings are currently immune).

Code for Sustainable Homes – all new homes built after 2016 must be Carbon Zero (meaning of Carbon Zero currently being defined).

**How has the national strategy developed over 10 years?**

All the above measures have either been enacted or enabled in the past 10 years. Previous National Strategy was contained within ‘*Our Energy Future: Creating a Low-Carbon Economy*’ which defined a long-term strategic vision for energy policy combining environmental, security of supply, competitiveness and social goals. It built on the Performance and Innovation Unit's Energy review, published in February 2002, and on other reports which looked at major areas of energy policy.

The main development since the publication of this strategy would seem to be the shift in emphasis from inaction to action, i.e. how carbon reductions can be achieved. ‘*Our Energy Future*’ concentrated on what needs to change; ‘*The UK Low Carbon Transition Plan*’ concentrates more on how these changes can be accomplished. This is evidenced in its chapter titles - Transforming our Power Sector, Transforming our Homes and Communities, Transforming our Workplaces and Jobs, Transforming Transport - but it remains to be seen whether this resolve can be transformed into tangible results.

**If your national strategy is about to change, how do you think this will happen, and what will it involve, and when will it happen?**

The publication of the *Low Carbon Transition Plan* is the most recent change to the National Strategy and aims to transform the country through a systematic reduction in carbon emissions. Also, building standards are to be raised at set stages over the next 10 years. The UK has the most demanding, mandatory CO<sub>2</sub> emissions reduction target within Europe. Within Scotland, changes to the building standards have been suggested which would steadily increase the energy efficiency of new buildings across a period of 5-10 years. The Sullivan report on this matter is available online:

[http://www.sbsa.gov.uk/pdfs/Low Carbon Building Standards Strategy For Scotland.pdf](http://www.sbsa.gov.uk/pdfs/Low%20Carbon%20Building%20Standards%20Strategy%20For%20Scotland.pdf)

**Do your national building standards/codes specifically address carbon emission?**

See number 1 above. The most relevant document is the *Code for Sustainable Homes*. A mandatory rating against the Code was implemented for new homes on 1 May 2008. The Code measures the sustainability of a new home against categories of sustainable design, rating the ‘whole home’ as a complete package. The Code uses a 1 to 6 star rating system to communicate the overall sustainability performance of a new home. The Code sets minimum standards for

	<p>energy and water use at each level and, within England, replaces the EcoHomes scheme, developed by the Building Research Establishment (BRE).</p> <p><b>Are there methods through which carbon emissions are discussed or debated in your country? For example, committees, public participation, industrial forums, and so on?</b></p> <p>The Environmental Audit Committee is the appropriate forum for debate and discussion regarding carbon emissions at a government level. The Committee considers to what extent the policies and programmes of government departments and non-departmental public bodies contribute to environmental protection and sustainable development. It audits their performance against such targets as may be set for them by Her Majesty's Ministers and reports thereon to the House. Information about the Committee can be found at:</p> <p><a href="http://www.parliament.uk/parliamentary_committees/environmental_audit_committee.cfm">http://www.parliament.uk/parliamentary_committees/environmental_audit_committee.cfm</a></p> <p>However, organisations such as the Building Research Establishment, the Energy Saving Trust and the Carbon Trust are mandated to engage with communities on these issues and organise a wide variety of events and initiatives as a result.</p> <p><b>Useful case studies</b></p> <p>Crossway is a passive house in Kent designed by Passive House Solutions Ltd.: <a href="http://www.passivehouse.co.uk/content/view/18/91/">http://www.passivehouse.co.uk/content/view/18/91/</a>.</p> <p>A green extension to Great Ormond Street Hospital <a href="http://www.sustainablebuild.co.uk/green-architect-extension-london-hospital-case-study.html">http://www.sustainablebuild.co.uk/green-architect-extension-london-hospital-case-study.html</a></p>
<p><b>Sweden</b></p>	<p>Reference should be made to the new Energy and Climate Policy of the Swedish Government:</p> <p><a href="http://www.sweden.gov.se/sb/d/2023/a/103384">http://www.sweden.gov.se/sb/d/2023/a/103384</a>  <a href="http://www.sweden.gov.se/sb/d/2031/a/120088">http://www.sweden.gov.se/sb/d/2031/a/120088</a>  <a href="http://www.sweden.gov.se/sb/d/5745/a/19594">http://www.sweden.gov.se/sb/d/5745/a/19594</a></p> <p>More information is available via the Swedish Energy Agency website:</p> <p><a href="http://www.energimyndigheten.se/en/">http://www.energimyndigheten.se/en/</a></p> <p>“A Good Built Environment” is one of Sweden’s environmental objectives. One of the main aims is to reduce energy consumption with a reduction of 20 % to 2020 and 50 % to 2050. More info is available at Environmental Objectives Portal website:</p> <p><a href="http://www.miljomal.se/Environmental-Objectives-Portal/15-A-Good-Built-Environment">http://www.miljomal.se/Environmental-Objectives-Portal/15-A-Good-Built-Environment</a></p> <p><b>Has the national strategy in your country has developed or</b></p>



	<p><b>changed significantly over the past 10 years?</b></p> <p>Sweden has historically invested a lot in renewable energy (such as district heating systems) but I think energy efficiency is growing more and more important.</p> <p>Compared to 10 years ago, there is a lot more focus today on climate and energy issues.</p> <p>Our buildings codes changed last year – if you have a house that is being heated by electricity there is a new maximum level.</p> <p><b>If your national strategy is about to change, how do you think this will happen, and what will it involve, and when will it happen?</b></p> <p>A new policy on climate and energy is being processed in our parliament. The new policy suggests a reduction target for greenhouse gases by 40%. This should be achieved by measures in the area of transport, energy reduction and renewable energy. A new energy classification system for buildings is currently being reviewed by experts. It is based on the EPBD (A+, A, B, C, D etc). We have not had such a labelling system for buildings in Sweden before. Hopefully it can inspire more people to aim for energy efficiency. The energy declarations (EPBD) will become more and more important.</p> <p>Swedish national building standards/codes do not specifically address carbon emissions?</p> <p><b>National debate</b></p> <p>Before suggesting the new Climate Policy the Government launched a “Commission for Sustainable Development”, involving key actors in the industry and at university level.</p> <p>Region Västra Götaland has its own regional process dealing with climate issues – Smart Energy. The process has involved hundreds of people from our municipalities, the industry, universities and research institutes. Smart Energy is now resulting in concrete action – politically signed agreements on for example solar energy, energy efficient buildings and sustainable tendering.</p> <p><b>Case studies</b></p> <p>At the Build with CaRe website you can find 35 best practise demonstration buildings, mostly from Sweden and Germany. You can also visit the website of The Swedish Passivehouse centre for Sweden’s development of Passive houses: <a href="http://www.passivhuscentrum.se/projekt.html?&amp;L=1">http://www.passivhuscentrum.se/projekt.html?&amp;L=1</a></p>
<b>Belgium</b>	<p>The Belgian government has signed a local ‘Kyoto’ protocol. Sustainable building and construction has been taken up in the provincial policy.</p>

	<p><a href="http://www.oost-vlaanderen.be/public/wonen_milieu/energie/kyotoprotocol/index.cfm">http://www.oost-vlaanderen.be/public/wonen_milieu/energie/kyotoprotocol/index.cfm</a></p> <p>The province wants to raise awareness on sustainable and energy efficient construction to citizens, schools, enterprises and local governments.</p> <p>The province set itself as a goal to apply the principles of Passive Building in two buildings (including one school) over the period 2007-2012.</p> <p><b>Has the national strategy in your country has developed or changed significantly over the past 10 years? If so, how?</b></p> <p>The past ten years has seen great change, as the topic was hardly mentioned and certainly not part of policy at that time.</p> <p><b>If your national strategy is about to change, how do you think this will happen, and what will it involve, and when will it happen?</b></p> <p>Our buildings have to be increasingly energy-efficient. It will not be possible in renovation to make every building a passive building but we are doing our best to make it as energy efficient as possible.</p> <p>A passive building is more expensive than a low energy building by giving us the subsidy we got a boost to make it passive.</p> <p><b>Case studies</b></p> <p><a href="http://www.passiefhuisplatform.be/index.php?col=/nieuws/nieuwsbrief&amp;doc=nieuwsbrief_27">http://www.passiefhuisplatform.be/index.php?col=/nieuws/nieuwsbrief&amp;doc=nieuwsbrief_27</a></p>
<p><b>Germany</b></p>	<p>The national (Germany) climate protection strategy is publicly available: <a href="http://www.bmu.de/klimaschutz/nationale_klimapolitik/doc/5698.php">http://www.bmu.de/klimaschutz/nationale_klimapolitik/doc/5698.php</a> Furthermore, information about the state level (Schleswig-Holstein) is described under: <a href="http://www.schleswig-holstein.de/UmweltLandwirtschaft/DE/ImmissionKlima/06_Klimaschutz/klimaschutz_node.html">http://www.schleswig-holstein.de/UmweltLandwirtschaft/DE/ImmissionKlima/06_Klimaschutz/klimaschutz_node.html</a></p> <p>Germany has specific information campaigns which influence construction. A good example can be found here: <a href="http://www.zukunft-haus.info/">http://www.zukunft-haus.info/</a> <a href="http://www.bmvbs.de/Bauwesen/Klimaschutz-und-Energiesparen-2823/CO2-Gebaeudesanierung.htm">http://www.bmvbs.de/Bauwesen/Klimaschutz-und-Energiesparen-2823/CO2-Gebaeudesanierung.htm</a></p> <p>There a different measures in Schleswig-Holstein. One are information campaigns or co-operation in international projects dealing with energy efficiency in building stock: <a href="http://www.schleswig-holstein.de/MWV/DE/Energie/SchwerpunkteInitiativen/Landesinitiativ_eWaermeschutz/LandesinitiativeWaermeschutz_node.html">http://www.schleswig-holstein.de/MWV/DE/Energie/SchwerpunkteInitiativen/Landesinitiativ_eWaermeschutz/LandesinitiativeWaermeschutz_node.html</a></p>

<p><a href="http://www.been-online.de/">http://www.been-online.de/</a> <a href="http://www.urbenergy.eu/10.0.html">http://www.urbenergy.eu/10.0.html</a> The other measures are part of support programmes (energetic issues in social housing programmes or in urban development projects) or the negotiated agreement between government and five housing associations_ <a href="http://www.schleswig-holstein.de/IM/DE/PlanenBauenWohnen/StaedteBauenWohnung/Wohnraumfoerderung/Foerderung_node.html">http://www.schleswig-holstein.de/IM/DE/PlanenBauenWohnen/StaedteBauenWohnung/Wohnraumfoerderung/Foerderung_node.html</a> <a href="http://www.schleswig-holstein.de/IM/DE/PlanenBauenWohnen/StaedteBauenWohnung/Staedtebau/Staedtebau_node.html">http://www.schleswig-holstein.de/IM/DE/PlanenBauenWohnen/StaedteBauenWohnung/Staedtebau/Staedtebau_node.html</a> <a href="http://www.schleswig-holstein.de/IM/DE/PlanenBauenWohnen/StaedteBauenWohnung/Wohnungswesen/Klimapakt/Klima_node.html">http://www.schleswig-holstein.de/IM/DE/PlanenBauenWohnen/StaedteBauenWohnung/Wohnungswesen/Klimapakt/Klima_node.html</a></p> <p><b>Has the national strategy in your country has developed or changed significantly over the past 10 years?</b></p> <p>The topic of energy efficiency is now more important in regulations, information campaigns or support programmes at national and state level than ten years ago.</p> <p><b>If the national strategy is about to change, how do you think this will happen, and what will it involve, and when will it happen?</b></p> <p>Germany has higher efficiency levels in the new national regulation valid from 1<sup>st</sup> of October 2009 (Energy Saving Ordinance). The next step is planned with 30% higher level to 2012. The integrated energy and climate protection programme was passed by the German government in August 2007. The action plan for climate protection of the state Schleswig-Holstein was passed by the state government in January 2008.</p> <p><b>Are there methods through which carbon emissions are discussed or debated in your country? For example, committees, public participation, industrial forums, and so on?</b></p> <p>Germany used the GEMIS method for CO<sub>2</sub> calculation. (<a href="http://www.gemis.de/en/index.htm">http://www.gemis.de/en/index.htm</a>)</p> <p><b>Case studies</b></p> <p>You can find information about CO<sub>2</sub>-reduction for all sectors under: <a href="http://ww2.bdi.eu/initiativen/klimaschutz/EN/climatestudy/Pages/climatestudy.aspx">http://ww2.bdi.eu/initiativen/klimaschutz/EN/climatestudy/Pages/climatestudy.aspx</a> or for the building sector under: <a href="http://www.zukunft-haus.info/">http://www.zukunft-haus.info/</a></p>
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## 5. Historical and cultural issues

It is estimated that demolition of the existing building stock in Europe is at a rate of around 0.5%, with the rate of growth at only 2%. Therefore, in order to meet necessary targets for energy use and emissions, it is a fact that the existing building stock will require either replacement or retro-fitting with new materials and technologies. Whilst Europe continues to support research and development in these areas, with an increasing need for industrial involvement, it is also a fact that there is no such thing as a 'typical European building'. On that basis, it is likely that strategies for, and implementation of, and work will demand significant attention be given to detail at specific locations.

However, retrofitting on a large scale is an issue, and one which will require massive financial input and both technical and political drive. The Netherlands have some examples and some research has been done on this, and retrofitting historic buildings is an issue, where retaining character is often regarded as having a higher priority than energy efficiency. Recent practical cases from the like of passivhaus have, though, attempted to demonstrate how, with a recognition and assessment of the focus of heritage values, that it should be possible to marry heritage preservation with a consideration for energy use and energy need.

Review work that deals more with local industry, social issues, developing countries, remnants of eastern block, variability of building types across the member states.

## 6. Discussion

Build with CaRe can help to further raise awareness within the community and within organisations on how to lead on policies and action to combat climate change. Build with CaRe aims to mobilise all forces in order to make energy-efficient building design the mainstream. Key to this is the development of a transnational strategy for increasing energy efficiency in buildings.

At state level in Germany, the project team discussed the higher efficient energy standard with the responsible ministries and experts. So I think we will influence the next steps for energy efficiency in the building sector.

At the local level, it may also be possible to incorporate Build with CaRe strategy into policy. For example, PPS1a states that Local Development Documents need to assess an area's potential for renewable and low carbon technologies. A Development Plan Document which specifically deals with these issues e.g. Development Management Guidelines could state that supporting documents such as Build with CaRe's strategy would be materially considered when evaluating development proposals.

## 7. Closing remarks

This document has been prepared to provide both a context for how the current project sits with in existing research and development work, and also to provide a foundation from which the project may build a strategy. It is suggested that the strategy will have the greatest chance of success in terms of actual implementation if it can be easily related to other existing initiatives happening across Europe. The report has given some space to discussing for example the existing framework programme, which funds academic and industrial research across Europe, and to the associated activities of the technology platform and the joint technology initiative.

Again it is suggested that these activities have existing (admittedly in places far from concise) strategies and directions, and Build with CaRe should and can very easily tie in with these wider activities.

It is clear that the topics contained within Build with CaRe, which are being considered largely by and within the context of local and municipal authorities are genuine and very wide interest across the whole of Europe. Therefore, it is suggested that the project outputs in themselves will have a wide resonance and deserved to be disseminated as widely as is possible.

## 8. REFERENCES

- Al-Mumin, A., Khattab, O. and G. Sridhar (2003) Occupants' behavior and activity patterns influencing the energy consumption in the Kuwaiti residences *Energy and Buildings*, **35**(6), July, pp 549-559.
- Gluch, P. and H. Baumann (2004) The life cycle costing (LCC) approach: a conceptual discussion of its usefulness for environmental decision-making, *Building and Environment*, **39**(5), May, pp 571-580.
- Hondo, H. and K. Baba (2010) Socio-psychological impacts of the introduction of energy technologies: Change in environmental behavior of households with photovoltaic systems, *Applied Energy*, **87**(1), January, pp 229-235.
- Kishk M., Al-Hajj A., Pollock R., and G. Aouad (2003) "Effective feedback of whole-life data to the design process". *Journal of Financial Management of Property and Construction*, **8**(2), 89-98.
- Kneifel, J. (2010) Life-cycle carbon and cost analysis of energy efficiency measures in new commercial buildings, *Energy and Buildings*, **42**(3), March, pp 333-340.
- Laing L, Kishk M., Scott J., and M. Edge (2006) "On the selection criteria of hospital finishes", submitted for publication, the Joint International Conference on Computing and Decision Making in Civil and Building Engineering, Montreal, Canada, June 14-16, 2006.
- Lindén, A.L., Carlsson-Kanyama, A. and B. Eriksson (2006) Efficient and inefficient aspects of residential energy behaviour: What are the policy instruments for change?, *Energy Policy*, **34**(14), September, pp 1918-1927.
- G. Soronis (1992) An approach to the selection of roofing materials for durability *Construction and Building Materials*, **6**(1), March, pp 9-14.

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## 9. Annotated bibliography

### Selected national and local developed standards and guidance available online

#### Belgium

National planning system

<http://www.bondbeterleefmilieu.be/lokaalkyotoprotocol/index.php/>

[http://www.oost-vlaanderen.be/public/wonen\\_milieu/energie/kyotoprotocol/index.cfm](http://www.oost-vlaanderen.be/public/wonen_milieu/energie/kyotoprotocol/index.cfm)

Building standards

<http://www.energiesparen.be/epb/energieprestatieregelgeving>

*Specific mention of carbon emissions*

#### Germany

Hamburg climate action

*"climate action in Hamburg" - framework conditions - fields of action - tools. It is the "update of the Hamburg Climate action policy 2007-2012" and includes an overview about the climate policy of the federal government (see Annex 1) and special information on the climate action in Hamburg (see Annex 2).*

Support programmes by KfW.

*Building:*

[http://www.kfw-foerderbank.de/DE\\_Home/Bauen\\_Wohnen\\_Energiesparen/index.jsp](http://www.kfw-foerderbank.de/DE_Home/Bauen_Wohnen_Energiesparen/index.jsp)

*Renewable energies:*

[http://www.bafa.de/bafa/de/energie/erneuerbare\\_energien/index.html](http://www.bafa.de/bafa/de/energie/erneuerbare_energien/index.html)

*CHP:*

[http://www.bafa.de/bafa/de/energie/kraft\\_waerme\\_kopplung/index.html](http://www.bafa.de/bafa/de/energie/kraft_waerme_kopplung/index.html)

*The new building standard (EnEV, Energy Saving Ordinance)*

[http://www.bmvbs.de/Bauwesen/Gesetze-und-Verordnungen-1537.7567/Energieeinsparverordnung-EnEV.htm?global.back=/Bauwesen/-%2c1537%2c0/Gesetze-und-Verordnungen.htm%3flink%3dbmv\\_liste%26link.sKategorie%3d](http://www.bmvbs.de/Bauwesen/Gesetze-und-Verordnungen-1537.7567/Energieeinsparverordnung-EnEV.htm?global.back=/Bauwesen/-%2c1537%2c0/Gesetze-und-Verordnungen.htm%3flink%3dbmv_liste%26link.sKategorie%3d)

Climate protection strategy

[http://www.bmu.de/klimaschutz/nationale\\_klimapolitik/doc/5698.php](http://www.bmu.de/klimaschutz/nationale_klimapolitik/doc/5698.php)

<http://www.bundesregierung.de/Webs/Breg/DE/lekp/iekp.html>

National building standard (EnEV)

[http://www.bmvbs.de/Anlage/original\\_1088019/EnEV-2009-Lesefassung-nicht-amtliche-Fassung.pdf](http://www.bmvbs.de/Anlage/original_1088019/EnEV-2009-Lesefassung-nicht-amtliche-Fassung.pdf)

*Addresses primary energy demand*

#### Sweden

Building regulations

<http://www.boverket.se/Om-Boverket/Webbokhandel/Publikationer/2008/Building-Regulations-BBR/>

[http://www.boverket.se/Global/Webbokhandel/Dokument/2008/BBR\\_English/9\\_Energy\\_management.pdf](http://www.boverket.se/Global/Webbokhandel/Dokument/2008/BBR_English/9_Energy_management.pdf)

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*Provides information on allowed energy usage in new dwellings and non residential buildings, see “Building regulations/ Energy management”*

## UK

The Building Regulations Part L (2006)

[http://www.building-regs.org.uk/part\\_l.html](http://www.building-regs.org.uk/part_l.html)

*Deals with “Conservation of Fuel and Power” and sets a minimum reduction in carbon emissions relative to 2002 levels (typically 20% for dwellings) Interestingly, PPS1a seeks greater integration between planning control and Part L. A consultation on the next revision of this regulation is due to begin this year.*

Communities and Local Government 'Green Commercial Buildings Task Group'

<http://www.communities.gov.uk/documents/planningandbuilding/pdf/carbonreductionsreport.pdf>

Commissioned the UK Green Building Council (UK-GBC) to investigate the costs and benefits of raising the energy performance standards in new non-domestic buildings above those currently set out in the Building Regulations all the way to zero carbon. The report prepared by UK-GBC investigates the opportunities for achieving zero carbon in new non domestic buildings. Following on from the targets set out in the Code for Sustainable Homes to achieve radical emissions reductions in new homes; this report aims to add to the understanding of whether similar targets in the commercial sector can be set and achieved and in what timescale.

Local Authority Performance Framework

<http://www.defra.gov.uk/environment/localgovindicators/index.htm>

*With a reporting suite of 198 Defra National Indicator inc: NI185 (CO<sub>2</sub> from own estate); NI186 (CO<sub>2</sub> emissions from LA district); NI188 (CC Adaptation); NI 194 (Air Quality – NO<sub>x</sub> & PM10s).*

PPS1: Delivering Sustainable Development

<http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/pps1/>

PPS22: Renewable Energy

<http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/pps22/>

*A key Principle 13 [ii] of PPS1 seeks to ensure that development plan address the causes and potential impacts of climate change, while PPS22 sets regional and local targets to be met.*

Planning Portal

<http://www.planningportal.gov.uk/england/genpub/en/1115315124405.html>

*The initial port of call for information regarding the planning system in England. The guide available at this address looks at the main domestic microgeneration technologies and for the different ways to make more efficient use of energy in the home.*



*See also:*

<http://www.defra.gov.uk/environment/climatechange/pubs/eac/pdf/cc-govres.pdf>  
<http://www.defra.gov.uk/environment/climatechange/uk/ukccp/pdf/ukccp06-all.pdf>  
[http://www.opsi.gov.uk/acts/acts2008/pdf/ukpga\\_20080027\\_en.pdf](http://www.opsi.gov.uk/acts/acts2008/pdf/ukpga_20080027_en.pdf)  
<http://www.defra.gov.uk/environment/climatechange/uk/legislation/provisions.htm>  
<http://www.communities.gov.uk/documents/planningandbuilding/pdf/ppscimatechange.pdf>  
<http://www.communities.gov.uk/publications/planningandbuilding/building-a-greener>  
<http://www.communities.gov.uk/publications/planningandbuilding/zerocarbondefinition>  
<http://www.communities.gov.uk/statements/corporate/ecozerohomes>  
<http://www.communities.gov.uk/publications/planningandbuilding/part1f2010consultation>  
<http://www.communities.gov.uk/publications/planningandbuilding/codesustainabilitystandards>