outcome. Because of GHGs, there is a huge risk of depletion in Ozone layer too, which will cause increase in UV-B radiation reaching to earth’s surface. (Fig 2a.2)

“One thing is certain: no country will be immune from the impact of Global warming and in most cases the impact will be harmful.” (Smith & Pitts, 1997)

UK faces ‘Global warming disaster’

Homes and businesses are threatened by devastating flooding as Global warming takes hold, it has been claimed. There are many deadly effects of global warming, such as:

Increased probability and intensity of droughts and heat waves, Spread of diseases, warmer waters and more hurricanes, economic consequences, polar ice cap melting etc. (fig 2b)

Warming is not only the effect of greenhouse gases in the atmosphere; they are interfering with the pH of the rain, by increasing the amount of CO₂ and Sulphur dioxide (SO₂), which are dissolving within the natural rainfall, making it more acidic. The acid rain may fall far away from the source of contamination, damaging both, the exterior materials of buildings and balanced state of ecosystems.
Residential energy consumption has increased significantly, because of the rapid growth of the number of households being formed every year and due to changes in lifestyle. This has had a huge impact on the way society now lives and has affected the composition of different communities. Rising population has direct impact in increase in number of household all around the world. Trends in UK show that the number of households increased by 5% between 1996 and 2003, while the population rise was only 2%. The number of households, each with its own lighting and set of appliances will be a key factor in future energy consumption (Environmental Change Institute, 2005).

In UK there were 26 million homes till 2004 ranging from large houses to smallest-purpose built house. Overall, these homes emitted 41.7 million tonnes of CO2 in 2004, representing more than a quarter of the UK’s emissions (152 Mt) of the main greenhouse gas driving climate change. Over the next 12 years, UK government believes, 3 million more units will be added to UK housing stock, and those have to be carbon neutral as modern technologies, techniques, government regulations etc. can make them. UK is committed to reduce carbon emissions by 60% by 2050. A reduction of that level in emissions from the housing stock would equate to about 24 million fewer tonnes of carbon, leaving emissions at about 17 million tonnes per annum. Government has agreed that individual sectors – housing, construction and transport, other buildings may contribute to achieve the target by contributing differential proportion to that total reduction. It is clear that significant contribution to the overall reduction is required from housing. However some environmentalist believe target should be as high as an 80% reduction from housing.

Whatever the level set, substantial gains can and need to be made from actions to reduce the emissions that result from our heating, our lighting, our water use and the way we manage our homes. Familiar technologies already are there that propose
Further to their efforts to promote sustainable building, the government have brought new policy in June 2007, according to which sellers compulsorily need to obtain a Home Information Pack. Essentially the pack will include a Home Condition Report and an Energy Performance Certificate which defiantly has raised the profile of quality, sustainability measures including energy efficiency and helped in promoting such dwellings.

“Each year the construction industry produces three times as much waste as all UK households combined, of which 13 million tonnes is made up of material that is delivered to site but never used.” (DCLG, 2007) the government are struggling for a more sustainable construction industry which could reduce the volume of waste by designing with regard to material efficiency.

The UK climate change programme is constantly and closely assessed to establish whether it is making positive progress as a whole and to ascertain the effectiveness of individual policies and measures. It is believed that the government have now realised that public acceptance and cooperation is the key to successfully delivering new policies at local level. Launched on January 26th 2006, the climate challenge fund is part of the government’s innovative new approach to achieve heightened awareness of both global climate challenges and individual preventative actions to combat such crisis.

Creating government policies and executing new programmes is only beneficial to the nation if the public accept them and they are put into action at local level. Decentralisation of government power has allowed individual English regions to take on greater responsibility for such actions, because they understand that disparate regions present different needs, necessitating the adaptation of policies to specific areas, town and cities.
Land Use and Ecology: Greenfield and Brownfield sites, ecological value, conservation and enhancement of the site

Pollution: Air and water pollution issues

Each environmental section covers a variety of topics and has a prescribed number of credits assigned to it. The latest credit awarding system is BREEAM 2008. The following table 4.1 describe the credits awarded using a set of environmental weightings.

<table>
<thead>
<tr>
<th>Environmental Parameter</th>
<th>BREEAM 2008, Environmental Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>0.12</td>
</tr>
<tr>
<td>Health and well-being</td>
<td>0.15</td>
</tr>
<tr>
<td>Energy</td>
<td>0.19</td>
</tr>
<tr>
<td>Transport</td>
<td>0.08</td>
</tr>
<tr>
<td>Water</td>
<td>0.06</td>
</tr>
<tr>
<td>Materials</td>
<td>0.125</td>
</tr>
<tr>
<td>Waste</td>
<td>0.075</td>
</tr>
<tr>
<td>Land use and ecology</td>
<td>0.10</td>
</tr>
<tr>
<td>Pollution</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1.000</strong></td>
</tr>
</tbody>
</table>

Table 4.1: BREEAM 2008 Environmental Weighting, Source: http://www.breeam.org

The weighted credits are then added together to create a single overall score. The building is then given a BREEAM ranking according the overall score, as listed in the following table 4.2.
and bridges. On the north side of ever housing block is an office space. The office space is placed in the shadow created by the south facing housing unit and gets mostly indirect diffuse light which is better for working. The following illustration shows the massing of the project and its relationship to the project’s solar strategy. Blue masses are housing and red masses are office space inserted behind the housing. (Image 5.1b)

The BedZED project achieves its carbon-neutral targets by using several relatively low-tech strategies. These include: highly insulated thermal envelopes, renewable materials, innovative space heating, combined heat and power generation, a green transport plan, reduced embodied energy in materials, and a well grown education and employment plan for residents. In addition to this a monitoring system is equipped for each unit so that the residents understand the energy consumption of their homes at all times. (Image 5.1c)
The following questions were qualified as a part of questionnaire:

1. What is the size (number of staff related to architecture) of your company?

2. How many members of staff in your company, do you think are aware of sustainable or carbon neutral development?

3. How often do you think your company’s work aims for absolute zero carbon developments?

4. What could be the main factor / barrier in producing carbon neutral developments?

5. In general, how interested your clients are in carbon neutral developments?

6. Are UK government policies such as ‘providing legally binding carbon targets for the whole UK economy, reducing emissions through the implementation of the Climate Change Bill’, ‘providing more support for low carbon technologies, including increased international and domestic public and private sector collaboration in the areas of research, development, demonstration and deployment’ etc. helpful in achieving the goal of a ‘carbon free UK’?

7. New UK Government proposals want all new homes in England to be carbon neutral by 2016 - to what extent you agree or disagree with the feasibility of this target?

8. How do you rate the environmental assessment method for buildings done by BREEAM?

9. According to BERR- Housing is the second largest 27% energy consuming sector of total energy consumption in UK. Do you think this energy demand can meet by renewable energy resources only?

10. Can carbon neutral housing in the UK become a reality in future?
5.2.2 Results

After conducting the survey and reaching the considerable target number of responses within due time frame of two months, the following analysis was carried out. The results of questionnaire survey gave valuable insight into housing sector and challenges facing the housing industry in UK to build carbon neutral houses. Of the 210 architects and 120 developers, 18 and 11 responses were received respectively, representing an 8.8% response rate. The respondents’ responses to the questionnaire for the research are discussed below.

1. **What is the size (number of staff) of your company?**

   ![Bar chart showing the size of companies](image)

   **Fig 5.2a: Size of the company, source: generated, 2009**

   In terms of size of the company, a breakdown of returned questionnaires is summarised in fig 5.2a. When the question was asked about the size of company to both architects and developers, it was found that many of the architects work individually or maximum of staff of 10, however the developers have big companies and staff was generally more than 10.
In response to the subsequent question about the energy requirements and renewable energy sources, more than half of the architects strongly believed that energy demands can be fulfilled by renewable energy sources, however nearly half of the developers just agreed to the statement (fig 5.2j).

10. **Can carbon neutral housing in the UK become a reality in future?**

![Chart showing architects and developers' responses](image)

*Fig 5.2k: Can carbon neutral housing in UK become a reality? Source: generated, 2009*

Finally, the question was regarding architects’ and developers’ perspective towards the future of carbon neutral housing and feasibility of the statement ‘Can carbon neutral housing in UK become a reality?’, surprisingly, the responses were quite positive. Almost all architects and developers agreed that carbon neutral housing in UK can become a reality (fig 5.2k).
economic way of achieving zero carbon homes, technical knowledge through training towards sustainable construction, optimising off-site construction techniques, community approach to building, etc.

In light of the research findings, it has become clear that there is a need for a joined up and holistic approach to the carbon neutral target, which should follow and guided by well rounded legislative measures. This should derive the implementation of carbon neutral housing agenda in a cohesive manner, ensuring that all the stakeholders in the housing building process, including architects, local planning authorities, material manufacturers, housing builders and developers are involved, committed and looking forward for the bright future and carbon free United Kingdom.
• Fig 5.2j: Feasibility of renewable energy resources to meet energy demands, source: generated, 2009
• Fig 5.2k: Can carbon neutral housing in UK become a reality?, Source: generated, 2009

List of Tables

• Table 4.1: BREEAM 2008 Environmental Weighting, Source: http://www.breeam.org
• Table 4.2: BREEAM 2008 rating scores, Source: http://www.breeam.org
• Table 4.3: Environmental impact categories, Source: http://www.breeam.org
• Table 4.4: Total Credits and weightings factors, Source: http://www.breeam.org
• Table 4.5: Total Credits and weightings factors, Source: http://www.breeam.org
• Table 4.6: Total percentage point scores and level ratings, Source: http://www.breeam.org
• Table 4.7: Example of Code of Sustainable Homes Assessment, Source: generated, 2009