

Inquiry 2: Housing – preliminary findings

EXECUTIVE SUMMARY

To be added

BACKGROUND

1. In October 2007 the Stroud District Local Strategic Partnership (LSP) established a Global Changes Think Tank to consider the twin impacts of climate change (e.g. wetter winters, warmer winters, drier summers, hotter summers, extreme weather, sea level change) and Peak Oil (i.e. over dependence on ever scarcer carbon based energy). The aim is to identify how these twin perils will affect the key assets (Figure 1) that local people rely on and to identify what action will need to be taken by individuals, communities and organisations to increase long term resilience.

FIGURE 1: Initial List of Key Quality of Life Assets

- Social capital – people as individuals and part of community networks and organisations
- Rail network
- Infrastructure associated with public and community transport, cycling and pedestrian access
- Trunk Roads – M5 / A419 / A46
- Housing infrastructure – 48,000 existing properties
- Business infrastructure
- Biodiversity – particularly the Severn Estuary as a major south – north migration corridor
- Local food production capacity - agricultural land and infrastructure (including food processing) as well as domestic and community (e.g. allotments) growing space
- Electricity – distribution network (and a local renewable energy infrastructure as it is developed in the coming years)
- Gas – distribution network
- Water – distribution and treatment network
- Waste infrastructure – associated with collection, treatment and disposal

2. In process terms, the Think Tank considers the impacts of the twin perils on a particular asset and makes preliminary recommendations to the LSP. Once agreed by the LSP the recommendations are then issued for wider community consultation. The first inquiry looked at the role of land use planning, as this influences the development of all of the assets listed in Figure 1; the report for this is out to consultation until May 31 2008. Copies and details on how to comment can be found in the 'Further Information' section at the end of this document.

INTRODUCTION

3. The second inquiry is into Housing and associated infrastructure and the Think Tank has explored a number of key lines of inquiry:

- What is the current state of the housing stock and how is this likely to change?
- What are the main impacts of climate change and Peak Oil on housing?
- What barriers are hindering the development of future proofed housing?
- What case studies exist that help illustrate the current situation?
- What are the opportunities and risks associated with responding early to climate change and Peak Oil in terms of housing?

DRAFT: Local Strategic Partnership: Think Tank on Global Changes

Inquiry 2: Housing – preliminary findings

- In developing recommendations what questions should the Think Tank be posing to the LSP and subsequently to local people, communities and organisations?

4. It should be noted that the primary focus of the Think Tank is adaptation rather than mitigation; the latter being concerned with carbon dioxide reduction. However, in making its inquiries into housing it became clear to the Think Tank that undertaking the required mitigation activities, such as building new carbon neutral homes or reducing CO2 emissions from the existing stock, requires a sea change in the culture and practices of all those involved in planning, financing, building, regulating and buying housing. As such the Think Tank felt that mitigation should be seen as a facet of adaptation for the purposes of its inquiries.

5. Similarly, the Think Tank has focused on housing but many of the points made apply equally to other types of buildings (e.g. retail, commercial). It may be necessary for the Think Tank to return to this issue as part of its business infrastructure inquiries.

6. This report is structured to reflect the key lines of inquiry set out above, starting with a housing profile.

HOUSING PROFILE

7. The Housing Condition Survey for 2006 identified a total of 47,200 homes in the District. The tenure types and age profiles are shown in Figures 2 and 3.

FIGURE 2: Stroud District Homes by Tenure (2006)

Tenure	Dwellings	Percentage	English House Condition Survey 2004 Comparator
Owner Occupied	35,500	75%	71%
Privately rented	5,200	11%	10%
Housing Association	1,200	3%	8%
Local Authority	5,300	11%	11%
Total	47,200	100%	100%

FIGURE 3: Dwelling Age Profile (2006)

Age Category	Percentage – Stroud District (2006)	English House Condition Survey 2004 Comparator
Pre 1919	25.5%	24.3%
1919-1944	8.8%	18.8%
1945-1964	14.3%	18%
1965-1980	22.9%	20.4%
Post 1980	28.6%	18.5%

8. Current house building rates are around 300-350 units per year and by March 2008 it was estimated that there were 48,150 homes in the District. It is anticipated that about 75% of the homes built today will be around in 2050; the target date for the UK's 60% CO2 reduction target. In 'Building a Greener Future' and the supporting Code for Sustainable Homes, the Government sets out the route to 'Zero Carbon' homes via the

Inquiry 2: Housing – preliminary findings

following CO2 reduction targets, which have been enshrined in Building Regulations (Part L) (Figure 4).

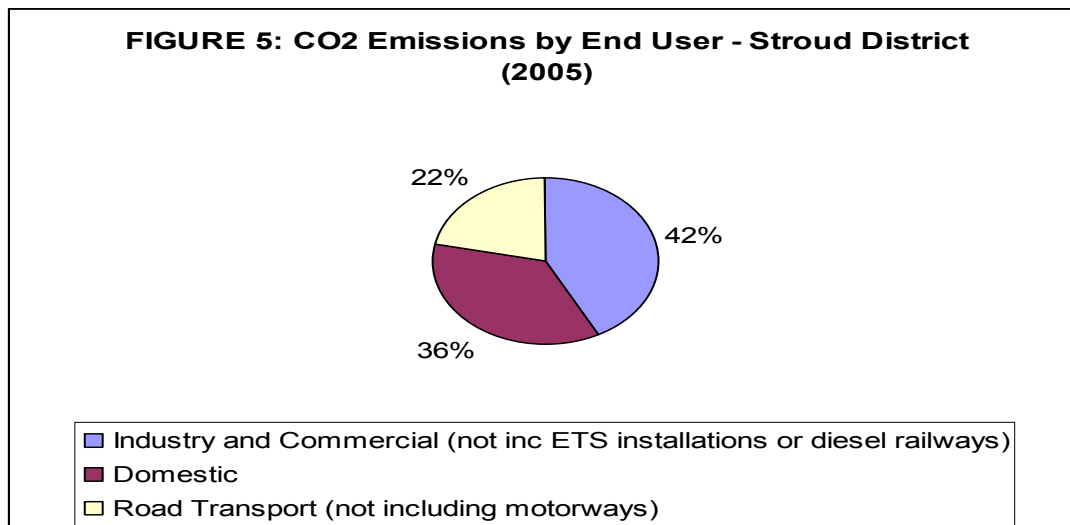
FIGURE 4: Future Building Regulation Standards

	2010	2013	2016
Energy / carbon improvement as compared to Part L (Building Regulations 2006)	25%	44%	Zero carbon
Equivalent energy / carbon standard in the Code for Sustainable Homes	Level 3	Level 4	Level 6

9. To a certain extent building new homes that have mitigation of and adaptation to climate change and Peak Oil built in will be relatively easy compared to retrofitting around 35,000 – 40,000 existing homes to achieve the same end.

IMPACTS

10. In 2005 the domestic sector was responsible for 292 kilo-tonnes (kt) of CO2, 36% of the total emissions for the District (Figure 5). The impacts of climate change are well documented and include flooding, temperature increases and sea-level change (see Inquiry 1 for more information). The detail behind the emissions figures help to illustrate the scale of the peril associated with Peak Oil as 98% of the domestic emissions were associated with energy use heavily reliant on diminishing supplies of fossil fuels; electricity (45%), gas (42%) and fuel oil (11%). There are also specific building design adaptation challenges that house holders and builders will face and some of these are summarized in Figure 6.



Inquiry 2: Housing – preliminary findings

FIGURE 6: Likely climate change impacts on building design

Climatic factors	Impacts
Soil-drying	Increase will affect water tables and could affect foundations in clay-soils
Temperature	Maximum and minimum changes will affect heating, cooling and air conditioning costs. Frequency of cycling through freezing point will affect durability. Daily maximum and minimum will affect thermal air movement.
Relative humidity	Increase will affect condensation and associated damage or mould growth
Precipitation	Increase and decrease will affect water tables (foundations and basements); cleaning costs will increase in winter, with associated redecoration requirements; durability and risk of water ingress will be affected by combination of precipitation increase and gales.
Gales	Increase will affect need for weather tightness, risk of water ingress, effectiveness of air conditioning, energy use, risk of roof failures
Radiation	Increase may affect need for solar glare control
Cloud	Increase in winter will increase the need for electric lighting; reduction in summer may reduce the need for electric lighting for certain buildings.

BARRIERS AND PERSPECTIVES

11. Having gained an understanding of the housing stock and the likely impacts of climate change and Peak Oil the Think Tank turned its attention to trying to identify the barriers that are hindering the development of future proofed housing. It did this by trying to take a number of perspectives on the challenges faced based on its own experiences. The first perspective was from the point of view of the Energy Agency.

Local Energy Agency Perspective

12. In April 2007 Severn Wye Energy Agency (SWEA) where commissioned by the District Council to undertake a study into whether it was possible for the existing housing stock in the District to meet the Government's 60% reduction target. The '40% House feasibility study' (link) was published in September 2007.

13. SWEA concluded that the target would be difficult but possible to achieve across the stock; overachievements in some house types balancing lower reductions in hard-to-treat homes. This outcome assumed that householders would be willing to invest money and time in the highest levels of insulation, at least one financially viable renewable technology (probably solar water heating), the most energy efficient appliances and behavioural change. If all of this were done then it should be possible to reduce average annual CO2 emissions from 8.93 tes per house per year down to around 2.8 tes. The estimated scale of the investment averaged out at £26,000 per household or put another way around £1.1bn needs to be spent on the existing housing stock over the next 20-30 years. The Council is working with SWEA and taking the study forward by establishing a network of 'exemplar homes' that will demonstrate to householders, in a very practical

Inquiry 2: Housing – preliminary findings

way, how the 60% reduction can be achieved. This is crucial as there is still a lot of confusion in the minds of householders about what the right thing is to do.

Energy Supply Perspective

14. The SWEA study was focused on delivering the 60% reduction at a household level as this was the brief. Investment at the household level has a degree of inefficiency built in as it ignores the potential contribution of community and commercial scale electricity and heat production. For example, combined heat and power or wind turbines may be able to reduce the costs faced by individual householders by offsetting carbon in far more cost efficient ways.

15. This will however require effective long term planning by public agencies and refocused investment by the existing utilities or the growth of new community based supply companies. This issue was examined at length in the Think Tank's first inquiry report.

Volume House Builders Perspective

16. The volume house builders have identified a number of challenges:

- Increased development costs. The Building Research establishment estimate that achieving Level 6 of the Sustainable Building Code will add 15-20% to construction costs.
- Competing planning objectives. In particular balancing the planning gains that communities may seeking (i.e. carbon reduction vs. affordable homes vs. highways improvements vs. education contributions vs. open space etc.)
- Financial pressures on developers who have agreed prices for land, which did not reflect the costs of mitigation or adaptation measures.
- Technical challenges – do the mass builders know how to build low carbon homes and if they do will the trades be willing and able to use the new materials, technologies and building techniques?
- Confusion over what is meant by Zero Carbon. Part L of the Building Regulations is only concerned with heating and lighting rather than the total energy requirement of a building.

Building Control and Enforcement Perspective

17. Paragraph 31 of Planning Policy Statement 1 notes that *“planning authorities and those responsible for implementing the building regulations should work closely to ensure integrated and timely decisions under complimentary regimes. This can be assisted by applicants preparing planning and Building Regulation applications in parallel”*. At the moment Planning and Building Control functions tend to be seen as separate functions with one operating dominantly ‘upstream’ of a development and the other ‘downstream’. In the future there will be a greater need for much closer working throughout the design and build process. For example, the orientation of a property, which is a planning matter, is crucial to thermal efficiency and the ease and cost therefore of meeting Part L of the Building Regulations.

18. However, the building control market is fragmented with services provided by ‘Approved Inspectors’ and local Councils. The contracts for providing building control services on large housing developments tend to be won by Approved Inspectors. The Inspectors tend to operate a risk based inspection regime with say 1 in 20 properties

Inquiry 2: Housing – preliminary findings

inspected, using insurance to cover the risks of developments not being built properly. Given the demands of new materials and technologies (discussed later) there is clearly a need for Approved Inspectors and Council Building Control services to understand what is required to assure the energy integrity and performance of new buildings and major renovations of existing ones.

Design Perspective

19. The move to Zero Carbon will create major challenges for designers and local people, in terms of what is visually acceptable. The ‘Poundbury’ type vernacular (Figure 7) tends to be what people demand and the volume builders provide. However, in the future there will be a need to design for environmental performance. For example the orientation of a property will be crucial to support passive heating and ventilation. On a typical ‘vernacular’ development only around 30% of properties are likely to be orientated effectively. It should be possible to achieve 90% plus but this will require much greater ‘regimentation’ (Figure 8). Similarly, new materials and technologies will require fundamentally new designs if their properties are to be maximised.

FIGURE 7: Designing for visual impact?



FIGURE 8: Designing for environmental performance?



Inquiry 2: Housing – preliminary findings

Planning Authority Perspective

20. The Planning authority will need to find ways of engaging local people in defining what is acceptable in terms of housing design. As part of the process of developing a new Local Development Framework the Council will also be producing a new House Design Guide that will address many of the mitigation and adaptation issues raised in this paper.

21. The Council has already introduced new Supplementary Planning Advice that seeks 10% on site renewable generation on major developments; the developer is required to identify the peak CO2 emissions and the 10% reduction through renewables is then calculated. If the building has been orientated effectively and is built with energy efficiency in mind then the peak emissions will be lower as will the 10% reduction target. It will also be easier to comply with Building Regulations.

Lenders and Insurers Perspective.

22. In order to create a lasting structure, designs will need to anticipate a diverse range of possible scenarios. As already indicated the ways in which these changes will impact on buildings are not yet fully understood. Lenders and Insurers typically have concerns about innovative forms of construction and it is exactly this that they will be faced with in the future. The mortgage lender will want to know that the building is of suitable build quality so that it has a good market value and is saleable. This quality of being saleable needs to be maintained throughout the period of the mortgage loan. Specific concerns identified by the Council of Mortgage Lenders are:

- ❑ Durability: achieve a life span of at least 60 years
- ❑ Whole life costs: at a level comparable to traditional construction – particularly relevant for lenders to social housing providers
- ❑ Reparability: no undue repair costs, and ability to use a range of local repair services
- ❑ Adaptability: the property should, without difficulty, support the usual range of adaptations / extensions such as a porch or conservatory
- ❑ Insurability: building maintenance should be available on normal terms

23. In addition to the above market perception will also affect saleability. How a dwelling is perceived could in turn be influenced by its appearance (i.e. Does it fit with existing design or stand out? How does the building ‘age’ physically – does it appear to be maturing or deteriorating as the years go by?) and by any adverse reputation (e.g. a systemic defect in a particular dwelling type, material or technology).

24. The insurer will wish to know that the house is constructed to a suitable standard and that in the event of damage, the construction is economically repairable. Specific issues for insurers relate to resilience and reparability. The Association of British insurers has developed a number of ‘Resilience scenarios’ whereby the resilience of new building types can be compared to the performance of conventional buildings.

25. Many of the impacts in Figure 6 would only affect the maintenance requirements, which are not normally covered by insurance policies. Others would have a direct impact on insurable perils. Maintenance is a factor in calculating whole life costs, which lenders are increasingly concerned about, and therefore all of the impacts listed are relevant to some degree.

Inquiry 2: Housing – preliminary findings

26. From these concerns the NHBC has established 5 design rules:

- ❑ Where possible stick to conventional materials, which are widely available
- ❑ Minimise the number and complexity of bespoke / specialist components
- ❑ Follow current good detailing practice, particularly for the prevention of water ingress
- ❑ Take account of solar overheating
- ❑ Avoid dark-coloured materials in areas exposed to direct sunlight.

27. These seem relatively conservative given the size of challenge faced by society but understandable given the construction and performance uncertainty surrounding delivery of new zero carbon homes and the retrofitting of the existing stock.

Unintended consequences perspective

28. To illustrate the uncertainty the Think Tank tried to identify a number of very practical but unintended consequences that could arise as a result of using new materials and people being faced with adaptation decisions for the first time. The first example relates to fire and the second water leakage.

29. The changes to Part L of the Building regulations mean that more insulation will be required in buildings. Improved thermal insulation may involve an increasing use of materials where the products of combustions have a high toxic yield. Additionally, low density thermal insulation may disappear early in the development of a fire leading to the creation of voids within floors and walls which may allow rapid fire spread.

30 Water shortages may prompt changes to domestic plumbing. In particular more recycling of water is likely in areas of shortage in response to the increasing use of water meters, where the consumer pays for what they use rather than a 'flat rate'. Additional pipe work and storage could be installed to collect and supply rainwater for uses that do not require potable water (dishwashers, clothes washing machines, flushing toilets) also, more dwellings are now installing solar hot water panels, but all this will increase the complexity and extent of domestic pipe work, and hence the probability of leaks. If Householders rely on recycled water or rainwater for a particular application the facility will need to be provided to top tanks up with mains water for situations when the storage tank does not have adequate supply – this may further increase the amount of pipe work needed and hence the risks of leaks.

31. Such systems may be designed and installed by the occupier and may be less robust than commercially produced systems, so increasing the likelihood of leaks. The storage facilities are more likely to be outside the main dwelling, increasing the likelihood of pipes bursting due to freezing. If such facilities were designed and installed at the time of construction then inappropriate or inadequate works by unskilled persons would be avoided, reducing the risk of leaks.

32. Increasing levels of energy efficiency mean that levels of loft insulation continue to rise. As a result, temperatures in loft spaces will drop, increasing the risk of frozen and burst pipes. Accordingly designs should avoid installing water-bearing pipes in such spaces or ensure they are fully protected from frost.

Inquiry 2: Housing – preliminary findings

CASE STUDIES

33. The Think Tank sought to test its thinking by examining a number of case studies, taking evidence directly from a local resident who is currently renovating their property with the aim of achieving / exceeding the 60% reduction target and the developer of the Stroud Co-Housing Scheme. It also indirectly took evidence from a published case study about the Stamford Brook development, a 750 unit development in Cheshire, which brought together the National Trust with Redrow and Bryant Homes to examine what was possible in terms of carbon reduction using conventional building techniques.

Local resident's perspective

34. The resident described how it was difficult to find architects, project managers and main contractors with the necessary experience and skills to effectively utilise the new building materials, technologies and techniques required. Even when they had found appropriately skilled 'professionals' the sub-contractors employed (brick layers, plumbers, electricians) very rarely understood the basic principles of low energy housing. For example, not knowing the difference between convection and conduction of heat and therefore how differing insulation materials needed to be installed to maintain the thermal integrity of the building (Figure 9). In the end the householder had to act as the 'clerk of works' to ensure that architects plans were delivered correctly.

FIGURE 9: Finding builders who use the new insulation materials effectively was a big challenge.



Stroud Co-Housing Scheme perspective

35. The development (Figure 10) was finished about 4-years ago and from a sustainability point of view it has a number of relevant features, including:

- ❑ Super insulation using recycled newspaper. Helps to keep houses warm in winter and cool in summer.
- ❑ Car sharing facilities
- ❑ The capability to generate 60% of electricity needs, exporting the surplus at times of low demand (it is the largest photovoltaic array in the UK for housing with a 49kw

Inquiry 2: Housing – preliminary findings

peak supply). As existing appliances are replaced over time with more energy efficient models more of the local demand will be met on site.

- ❑ Solar thermal water heating
- ❑ Passive solar gain design
- ❑ The largest Sustainable Urban Drainage Scheme in UK Housing, which emulates water run-off from a green field site.

FIGURE 10: Stroud Co-Housing Scheme



36. A number of problems were identified that mirrored those described above by the local resident:

- ❑ Builders wanted to continue doing what they knew. They didn't want to change and didn't want to waste time being trained as others were not asking for the same approach. They also did not understand how the new energy materials worked or the principles of Sustainable Urban Drainage (Figure 11).
- ❑ Roofers fitting PV tiles caused unnecessary costs and time delays (due to lack of expertise)
- ❑ Warmcell newspaper insulation was successfully injected by the manufacturer. However, the trades (electricians, plumbers, kitchen fitters etc) were unfamiliar and caused leakages by cutting into the super insulated shell of the building.

37. A wider point was made about the community aspect of the scheme. One of the key principles of Co-Housing (a Danish concept) is that there are self contained houses focused around a 'common house', where it possible to share meals, laundry facilities, workshops etc. In Denmark the ratio is typically 40-50 houses to one community facility. This has helped develop close community working which will be essential if more resilient communities, able to adapt to climate change and peak oil, are to be developed.

38. The Co-Housing developer was asked to identify his main learning points. The main one was that the best technology used today will be obsolete in 20-years – the important

Inquiry 2: Housing – preliminary findings

thing is to build flexibility into housing design so that it can be adapted. If they were creating the development today they would have:

- ❑ Installed a shared ground source heat pump
- ❑ Provided more common ducting for inter-cabling of electronic equipment, new generation technologies and / or shared heating
- ❑ Installed even thicker insulation
- ❑ Built basements – providing additional and naturally cooler living / working space and providing space for accommodating new technologies
- ❑ Considered combined heat and power – the technology is improving year on year – reducing pollution and noise and increasing power output.

FIGURE 11: Finding contractors who understood Sustainable Urban Drainage Schemes was not easy.



Stamford Brook

39. The Stamford Brook development in Cheshire brought together the National Trust, as landowner, with Redrow and Bryant Homes to try and identify what could be achieved in terms of carbon reduction using conventional building techniques (<http://www.nationaltrust.org.uk/main/w-stamford-brook.pdf>). The main learning points from the project were that:

- ❑ In the case of air-tightness, the levels achieved at Stamford Brook represent a considerable improvement on existing UK practice and demonstrate the capacity of masonry construction to achieve the sort of levels that will be required in the production of low and zero carbon housing.
- ❑ Stamford Brook provides some confidence that energy performance levels likely to be required by the 2010 review of Part L could be achievable by the UK housing industry now, using existing technologies and relatively standard construction techniques. However, this assumes that actions are taken to tackle the issues that have been highlighted in the project such as thermal bypassing, heating system

Inquiry 2: Housing – preliminary findings

design and typical construction faults, and also to address underlying system and process failures.

- ❑ There can be significant and quantifiable discrepancies between designed energy performance and that realised in occupational use or when tested under experimental conditions. Series of system failures in the design and construction processes at Stamford Brook highlighted the fundamental importance of design, construction and performance measurement in achieving predicted performance.
- ❑ Stamford Brook can act as a template for level 3 compliant dwellings under the Code for Sustainable Homes. However, a step-change in designed performance over that achieved at Stamford Brook would be required to reach level 4, in the absence of abundant low-carbon energy generation.
- ❑ Performance feedback through a formal production testing regime is vital to improve detailed design and the construction process.
- ❑ The research has demonstrated the significant extent to which heat is lost via party cavity walls in attached dwellings. Through relatively simple measures, this loss can be partially mitigated. If the measures developed at Stamford Brook were applied to new and existing dwellings with party wall cavities, CO2 savings to the tune of 850,000 tonnes per annum could be realised in the UK.
- ❑ Improved heating system design and installation, especially in respect of long lengths of uninsulated pipe work, together with improved user advice and control, could ensure that heating systems in occupied units achieve their full potential.
- ❑ The discrepancy between space heating consumption in use compared with modelling predictions could be accounted for by allowing for the various measured system inefficiencies, user behaviour patterns, real weather data and construction defects. **Ultimately, it has been concluded that the volume house building industry will struggle to meet enhanced energy performance standards for reasons that are deeply embedded in the culture, processes and practice at all levels in the industry.**

40. The Stamford Brook findings seem to bear out what the Think Tank was told during its inquiry. Similarly, it will be interesting in due course to reconsider whether the predicted performance of developments currently being built in the District have been achieved. For example, the 650 homes at the Littlecombe development in Dursley are predicted to achieve Level 4 through achieving the Stamford Brook levels of thermal performance and in addition providing access to district heating or other renewables technology.

OPPORTUNITIES AND RISKS FACED BY THE BUILDING INDUSTRY

41. It seemed to the Think Tank that convincing the local building industry of the need to gear itself up to deal with increasing demands for existing and new properties which are fit for the future was very important. To help stimulate the debate the Think Tank sought to summarise the opportunities and risks faced by the industry and these are set out in Appendix 1.

Inquiry 2: Housing – preliminary findings

QUESTIONS FOR THE LSP

42. In setting the scene for the LSP the Think Tank has tried to identify the long term challenges that will need to be overcome if we are to mitigate and adapt to the long term consequences of climate change and Peak Oil. With this in mind the Think Tank would like to pose a number of questions to the LSP and wider community.

43. **Question 1.** Has the think Tank provided sufficient background information on the housing stock within the District (paragraphs 7 – 9)?

44. **Question 2.** Has the Think Tank identified fully the likely climate change and Peak Oil changes that will need to be adapted to (Paragraph 10)?

45. **Question 3.** Should further evidence be gathered on any of the perspectives set out in paragraphs 11 – 40 and / or are there other perspectives that should be sought in order to inform the LSPs deliberations?

46. In paragraph 41 and Appendix 1 the Think Tank attempted to identify the opportunities and risks facing the Housing industry.

47. **Question 4.** Are the opportunities or risks listed appropriate and / or are there others that should be included. Does it help build the case for action by the local building industry?

48. In essence the Think Tank became increasingly concerned by the gap between the ever increasing expectations of society around mitigation and adaptation and the apparent lack of capacity and capability in the local building industry.

49. The Think Tank heard how SWEA has established a local network for micro-generation installers. The main aims include increasing consumer confidence and the number of installations of sustainable energy measures by providing independent advice and information and raising consumer awareness of the relevant quality and code of conduct schemes, and the assurances that these provide.

50. **Question 5.** Does a similar approach need to be taken to the wider building industry, including those developing and providing training for it (e.g. Stroud College)? How much of the likely investment in mitigation and adaptation in both existing and new housing can be kept within the local economy? Does the LSP see a role for itself in brokering the dialogue on what is possible and the way forward? Is this issue of such importance that it should be a priority within the Sustainable Community Strategy?

51. The Think Tank noted that the Council was intending to produce a Residential Design Guide (paragraph 20 & 21) that will be applied to new properties. To help in the development of this the Think Tank has drafted a checklist (Appendix 2), building on its own experiences and those of others.

52. **Question 6.** Is the Checklist set out in Appendix 2 below comprehensive? Does it cover all of the issues relevant to the District? Does the LSP wish to recommend such an approach to the Council? Should something similar be produced for people renovating existing property?

DRAFT: Local Strategic Partnership: Think Tank on Global Changes

Inquiry 2: Housing – preliminary findings

53. Finally, the think tank noted the work of SWEA, on behalf of the Council, and the Transition Town Groups active in the District. Both are helping existing householders to adapt to change. It was felt that the exemplar homes project (paragraph 13) will provide practical insights into how best to engage local people, helping them to be confident about the mitigation and adaptation decisions that they will need to make. It noted that the focus was currently on mitigation but that the approach could be broadened, potentially involving the local Transition Town groups, to cover the full range of mitigation and adaptation issues likely to be faced. Appendix 3 contains a range of possible and practical adaptation measures that could inform a future Design Guide and /or wider marketing campaign targeting local people.

54. **Question 7.** Would the LSP like SWEA and Transition Towns representatives to report back their experiences to a future meeting? In doing so should they bring forward ideas on how the exemplar home project and other initiatives can be broadened to cover the full range of advice and support for householders wanting to mitigate and adapt to climate change and Peak Oil? Should the Think Tank undertake a separate inquiry into behavioural change?

FURTHER INFORMATION

55. If you want further information on the work of the Think Tank or wish to offer feedback on this inquiry, or previous ones, then please contact:

Nigel Riglar
Strategic Director
Stroud District Council
Ebley Mill
Stroud
GL5 4UB
01453 754300
nigel.riglar@stroud.gov.uk

Inquiry 2: Housing – preliminary findings

APPENDIX 1: Opportunities and Risks Faced by the Local Building Industry

Opportunities

Financial:

- ❑ Local building industry has the opportunity to benefit from the significant mitigation and adaptation investment in retrofitting and new build.
- ❑ Higher future asset values due to lower long term running costs, e.g. insurance and heating and cooling costs, by climate proofing a building / development.
- ❑ Good financial sense for long term investors taking a long-term view at the design stage, especially to those considering corporate social responsibility (CSR).
- ❑ In addition, investors with climate vulnerable assets may start to offload these assets and invest in climate proofed assets instead.

Market differentiation:

- ❑ Properties are easier to sell or let at a higher price as clients are attracted to well designed buildings, properly protected from climate change risks.
- ❑ Opportunity to position the organisation as a market leader on climate proofed buildings and highlight the organisation's "sustainability credentials", attract new customers, and gain a competitive edge over competitors by being able to demonstrate clearly the organisation's CSR credentials.

Better risk management:

- ❑ Reduce the potential risks and liabilities through pro-active risk management of climate change issues.
- ❑ This will also help to "mainstream" climate impacts and adaptation into conventional business strategies. The ABI agree "it is time to bring planning for climate change into the mainstream of business life".

Assist innovation, creativity:

- ❑ Find new innovative solutions to building long-term sustainable developments in a changing climate and helping to gain a competitive edge.

Risks

Operational/financial:

- ❑ Failure to adapt to climate change may mean that a development proves too expensive to run, too uncomfortable to live or work in, and even uninsurable later in its life.
- ❑ This will have serious implications when attempting to sell or let property as the asset value will be less in the future, making it a less attractive investment now.

Consumer expectations:

- ❑ Built environment stock in the UK is generally expected to last between 20 and 100 years. It is therefore important to recognise that there will be an expectation among buyers and tenants that developments designed and built now will withstand the impacts of climate change within the lifetime of the development.

Legislation:

DRAFT: Local Strategic Partnership: Think Tank on Global Changes

Inquiry 2: Housing – preliminary findings

- ❑ Building regulations and standards will change. By failing to take measures now (that anticipate future requirements), there is a risk that more expensive remedial measures may need to be taken at a later date to ensure compliance as tighter legislation comes into force.

Funding:

- ❑ Public subsidy may not be available to developers that have not incorporated climate change into the location and design of their development, or investing bodies may not want to invest in non-climate proofed developments.

Reputation risks:

- ❑ There is a threat to the organisation's reputation and brand if a failure to address climate change threatens the sustainability of a building, development and/or land by, for example, flooding or high temperatures that make the building undesirable.
- ❑ There might also be a negative impact on reputation if property insurance cannot be provided in areas of increasing risk e.g. due to high subsidence risk and/or flood risk.

Increased weather risks:

- ❑ Increased insurance premiums could add to running costs, affecting the value of the development. Insurance claims from increased weather risks are already increasing by 2-4% per year on household and property accounts due to changing weather. Claims for storm and flood damages in the UK have doubled to over £6 billion over the period 1998-2003, compared to the previous five years, with the prospect of a further tripling by 2050.

Delaying action:

- ❑ Although fewer delays on-site through snow and frosts, workers will be more likely to suffer heat stress in summer and flooding on site is expected to become more common adding cost to construction.

Inquiry 2: Housing – preliminary findings

APPENDIX 2: Checklist for adapting to climate change

This checklist summarises the key issues that need to be considered when climate proofing your development against the impacts of climate change.

Pre Application Advice

Ensure early discussions are held with the planning authority and that all climate change mitigation and adaptation policies are understood.

Location

Establish the Environment Agency flood risk designation(s) for the site and ensure that the design of the development accords with it. Check the Environment Agency's Flood Map resource at www.environment-agency.gov.uk/subjects/flood/826674/829803

Check with the Local Planning Authority to review any strategic flood risk assessments.

Undertake an appropriate flood risk assessment and evaluate the flood risk over the design life of the development. Demonstrate that this is acceptable for the proposed use(s) and, at a minimum, that there will be no overall increase in flood risk (likelihood and negative impact).

(If relevant) Consult the insurance industry guidance *Strategic Planning for Flood Risk in the Growth Areas – Insurance Considerations* about the viability of the development for insurance purposes.

(If relevant) Help reduce the urban heat island (i) effect e.g. by planning green space and using appropriate shade when locating your development.

Undertake a fire risk assessment. Hotter- drier summers coupled with the possibility of more frequent lightning strikes, are likely to mean an increase in the risk of field and forest fires and it would be wise to have a suitable fire break between these and housing estates. The action required to minimise the risk of fire damage is to ensure there is a gap between the whole estate and the surrounding countryside. For example, communal space could be placed between dwellings and areas of dense vegetation.

Consider the implications of coastal erosion or estuary inundation when planning a development.

Site layout

Ensure the overall layout and massing of the development:

- Does not increase the flood risk and where possible reduces risk;
- Minimises solar gain in summer;
- Maximises natural ventilation;
- Maximises natural vegetation;
- Takes account of the increased risk of subsidence;
- Provides homes and other appropriate uses with a private outdoor space wherever possible.

Inquiry 2: Housing – preliminary findings

Buildings

A: Structure

Demonstrate the structure is:

- ❑ Strong enough or able to be strengthened if wind speeds increase in the future due to climate change;
- ❑ Strong enough to avoid movement due to expected future levels of subsidence and heave;
- ❑ Able to incorporate appropriate ventilation and cooling techniques/ mechanisms;
- ❑ Of an appropriate thermal mass for the intended use and occupancy.

B: Physical envelope of structures

Demonstrate the envelope of the building is designed so that:

- ❑ Drainage systems and entrance thresholds can cope with more intense rainfall;
- ❑ There are opportunities for incorporating green roofs or walls;
- ❑ The exterior of buildings reduces heat gain in summer;
- ❑ The overall envelope avoids infiltration from increased wind and temperatures;
- ❑ Cladding materials are able to cope with higher wind speeds.

C: Materials

Ensure the materials specified will perform adequately in the climate throughout the lifetime of the development.

Ensure the construction methods to be used are suitable for the weather conditions at the time of construction.

D: Choice of Inspector

Ensure that the approved inspector or Council Building control Service has staff skilled in climate change mitigation and adaptation.

Ventilation and cooling

Ensure that ventilation brings clean pollution-free air into the building and does not compromise noise levels or security.

Demonstrate the building has or is capable of having installed a ventilation system which will deliver comfortable temperatures (i.e. exceeding 28°C for less than 1% of the time and exceeding 25°C for less than 5% of the time) for the expected climate throughout the design life of the development.

Cooling and ventilation systems, where necessary, should be designed to use as little carbon-based energy as possible by utilising renewable energies and being as energy efficient as practicable.

Drainage

Carry out a site survey to determine which SUDS techniques will be appropriate for use on the site. For example, ground conditions will determine the suitability of infiltration systems. Consider rainwater harvesting, green roof systems and opportunities for permeable paving if soil permeability is low.

DRAFT: Local Strategic Partnership: Think Tank on Global Changes

Inquiry 2: Housing – preliminary findings

Ensure, in consultation with the Environment Agency, that the requirements of the Groundwater Regulations are complied with (you should though note that shallow, extensive infiltration systems will minimise risks to groundwater).

Demonstrate consideration is given to future maintenance requirements of Sustainable Urban Drainage Schemes (SUDS) including the need, where necessary, for the removal of silt which will be treated as a controlled waste, and that space requirements for this purpose are allowed for in the design.

Ensure that responsibility for maintaining SUDS is clear at the planning application stage (iii).

Consider using permeable paving anywhere that loadings will not cause structural failure. In practice, all pavements, driveways, footpaths, car parking areas and access roads could have permeable surfaces.

In developing the drainage plan for the site, ensure that the design standard takes account of climate change and that carriageways, paths and other features of the site are designed to convey this excess flow safely.

Water

Estimate the net water consumption of the development under normal use and under water conservation conditions (i.e. during a drought), both initially and during the lifetime of the development in consultation with the relevant water company.

Discuss existing sewerage infrastructure and sewage treatment capacity with the local sewerage provider.

Regarding water use, for housing, achieve a target of 30 cubic metres per person per year under typical use and for offices, 1.05 cubic metres per person per year.

Minimise water use in buildings, consider the use of rainwater collection/re-use systems and consider the environmental impact (in terms of water consumption) of products, materials and building methods.

Outdoor spaces

Incorporate an appropriate range of public and private outdoor spaces in developments, with appropriate shade, vegetation and water features.

Ensure the design of surfaces take account of more intense use, permeability, potential for causing dust and for soil erosion.

Ensure the selection of vegetation with longer life (over 10 years) takes account of future climate change.

Ensure water features have minimal net water use.

Provide a rainwater collection system/grey-water recycling for watering gardens and landscaped areas.

DRAFT: Local Strategic Partnership: Think Tank on Global Changes

Inquiry 2: Housing – preliminary findings

Ensure there are arrangements for storing waste which allow for separation and prevent excessive smell in hotter conditions. Storage could either be at the level of individual households or communal serving a number of properties.

Incorporate space for the local production of food (e.g. allotments)

Connectivity

A: Infrastructure Resilience

Ensure there are safe access routes above the likely flood levels and the routes are clearly marked (e.g. by a series of poles) during the design life of the development.

Negotiate with utilities and others over the resilience of services and infrastructure to the development (including public transport)

B: Impact on Neighbours

Identify immediate neighbour impacts as well as the cumulative impacts and the increased demands on services.

i www.metoffice.com/education/secondary/students/microclimates.html *Microclimates, The Met Office,*

iii *Interim Code of Practice for SUDS, National SUDS Working Group 2004,*
www.environment-agency.gov.uk/business/444304/502508/464710/465036/466851/?land=_e

Inquiry 2: Housing – preliminary findings

APPENDIX 3: SOME POTENTIAL MITIGATION MEASURES

Cost bands:

Free

L Low (£1 - £100)

M Medium (£101 - £1000)

H High (£1001+)

Flooding – adaptation options and costs

Measure	Cost
Check the Environment Agency Flood Map	Free
Register with Environment Agency flood warning scheme	Free
Drainage bungs for drains, sinks and toilets	L
Install air brick covers	L
Seal gaps around pipe and cable entries	L
Fit non-return valves on main drains	M-H
Install demountable door guards	M-H
Move meters and electrical sockets above flood levels	M-H
Install a 'sump and pump' below ground level	H
Raise door thresholds	H
Repoint brickwork on external walls	H
Apply waterproof render to walls	H
Install waterproof membrane on external walls	H

Typical resilience measures include

Measure	Cost
Check the Environment Agency Flood Map	Free
Register with Environment Agency flood warning scheme	Free
Store valuables and paperwork upstairs	Free
Turn off gas, water and electricity mains	Free
Fit rising hinges so doors can be removed	L
Use dry-bags to protect soft furnishings	L
Use water-resistant paint for the lower portions of internal walls	L-M
Rewire, raising electrical points above flood level (with wiring drops from above)	M
Relocate meters and boiler above flood level	M
Relocate white goods on a plinth above flood level	M
Replace carpets with vinyl and ceramic tiles and/or rugs	M-H
Replace timber floors with solid concrete	H

Inquiry 2: Housing – preliminary findings

Water Stress – adaptation options and costs

Water-saving device	Cost band	Potential water saved, per person per year (l)	Metered value of water saved, per year (£)	Water-saving - elemental
Low flow shower or shower head	L-M	8176	16	Reducing flow from 10.8l/min to 8l/min
Ultra low flush toilet replacement	M	7884	15	Reducing from 9l to 4.5l per flush
Cistern displacement device	Free from water companies	Up to 5256	10	Reducing flush volume by up to 3l
Variable flush retrofit kit	L	Up to 7884	15	Reducing flush volume by up to 4.5l
Low flow bathroom taps (1.7l flow)	L	5087	10	Reducing flow from 6.5l to 1.7l
Repair dripping taps	L	4745	9	Saving 90l/week
Garden watering	L	5000	10	Water garden using water from water butts. 5.3l/butt/day
Car washing	L	15643	31	Filling bucket from water butt eliminates use of 300l mains water/wash
Low flow kitchen tap adapter	L	7727	15	From 12 to 6l/min
Water-efficient dishwasher	M	1205	2	Reducing from 25l/load to 14l/load
Water-efficient washing machine	M	4592	9	Reducing from 80l/load to 43l/load

DRAFT: Local Strategic Partnership: Think Tank on Global Changes

Inquiry 2: Housing – preliminary findings

Overheating – adaptation options and costs

Adaptation measure and benefits	Limitations	Approx. Costs
Switch off unused appliances, reducing internal heat gains and saving on running costs		Free-L
Open windows at night to introduce cool air, providing natural ventilation	Security may be an issue. Possible outdoor noise and poor air quality	Free
Use ceiling or desk fans to create a local cooling effect	Noise (but usually quieter than air conditioning)	L-M
Install a reflecting blind, ventilated by open window, to provide protection from the sun and reduce glare	Security may be an issue	L-M-H
Awning – protects rooms from the sun while allowing light, window ventilation and view		H
Shutters – protect rooms from the sun and may increase security	Reduced ability to ventilate via windows at the same time as shading	L-M
Replace carpets with wooden floors or tiles to expose the cooling effect of the ground. Use rugs for colder periods	Only relevant in ground floor rooms with solid floor construction	H
Improve roof insulation standard to reduce heat penetration, particularly for slate roofs. This also reduces winter heat loss/energy bills		L-M
Increase reflectivity through light-coloured painting/coatings on walls and roof, preventing heat being absorbed into the fabric	Alters appearance of facade	L-M
Cavity wall insulation (where wall cavities are present) to reduce penetration of heat through walls	In flood risk areas, use closed cell insulation	M-H
Double glazing, with low-e-coatings to reduce heat gain in summer and heat loss in winter	Will increase overheating if ventilation provision is inadequate	M-H
Install secondary double glazing behind existing glazing ('climate window') to create triple glazing, with external ventilation of outer cavity, that can greatly reduce solar heat gain provided inner pane remains closed	Suitable only where window has deep set. Reduced ability to ventilate while also shading. May be lower cost and is more reversible than replacement window	H