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Future Sustainability Programme - Policy Paper

Carbon Footprint of Housing in the Leeds City Region – A Best Practice Scenario Analysis

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Commissioned by the Environment Agency

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Executive Summary

BACKGROUND

Climate change will impact, not only on the environment, but on social equity and the economy. The scientific consensus is that for the UK to play its part in limiting dangerous climate change, we must reduce our carbon emissions by 80 per cent of their 1990 levels by 2050. The Prime Minister has asked the independent Committee on Climate Change to strengthen the UK's current 60 per cent target before it is incorporated into the Climate Change Bill. This committee will advise on the first three 5-year carbon budgets for 2008-2022 and the relative contributions from different sectors of the economy.

27 per cent of the country's carbon emissions are the result of domestic energy use. Better evidence is needed on the size of carbon reductions that can be achieved by making our homes more energy efficient.

Key findings of the study

- Even with increases in population and housing, Leeds City Region can make a significant contribution to carbon emissions reduction by 2026 through the widespread adoption of domestic energy saving measures.
- Retrofitting almost all existing homes is the most effective energy efficiency measure; introduction of cavity wall and loft insulation, energy efficient glazing, draught proofing, improved boilers and low energy light bulbs could deliver over half the required reduction.
- More than 20 per cent of the reduction, by 2026, will need to come from energy saving behaviour influenced by educational campaigns and incentives to adopt technology such as smart metering.
- A further 12 per cent of the reduction can be achieved if a third of existing homes draw some heat or power from their own or community based Low and Zero Carbon technologies (LZCs). These include solar water heating, solar electricity, ground or air source heat pumps, wind turbines and combined heat and power systems.
- Ensuring new build compliance with the government's timetable for the Code for Sustainable Homes (improving to 'zero carbon' by 2016) will achieve less than 10 per cent of the required reduction.
- A policy mix of the above measures would still leave the city region slightly short of its 38 million tonne target for 2026. The shortfall could be met by fitting wall insulation to 90,000 properties without cavity walls, installing LZC technology to a further 170,000 homes, or the energy efficient rebuild of 51,000 poorly performing properties demolished under regeneration schemes.

Approach

The Stockholm Environment Institute (SEI) was commissioned by the Environment Agency to carry out a carbon footprint analysis of the housing sector, using the Leeds City Region (LCR) as an example. The aim was to determine our ability to meet the 80 per cent by 2050 challenge of energy efficiency in the housing sector. The study relates specifically to LCR but its findings will help any planning and development teams make the right decisions and gain the resources necessary to meet carbon budgets at regional and local levels.

With a growing population and an additional 263,000 housing units to be built within LCR by 2026, **the housing sector would need to reduce its expected total carbon dioxide emissions by 38 million tonnes between 2010 and 2026** to be on track for 80 per cent savings in 2050.

The report outlines the most detailed analysis to date of the required measures to deliver a growth-based regional housing strategy, alongside reducing carbon emissions. If the city region's new and existing housing is to attain the levels of energy efficiency necessary to deliver these carbon savings, big changes will be required in the way we build,

maintain and run our homes over the next 20 years. There are pockets of good practice already in the region and **the study shows that by combining innovative measures on construction standards, improvements to existing housing, low and zero carbon technologies and changing behaviour of householders, LCR can achieve the necessary savings to meet its carbon budget.**

Essential and optional measures to meet the 38 million tonne carbon emissions reduction

Other key messages

- The study has produced relevant evidence to the Leeds City Region and other UK regions.
- The study sets a total carbon budget over the medium term, assessing potential different emission reduction measures to meet that budget. This approach to local carbon accounting and performance monitoring is relevant to housing and other sectors.
- It is essential that good practice and innovation being developed in local authorities is shared regionally and nationally, including that for business models and partnership funding arrangements.
- Planners will need to make judgements on how new build, retrofit and associated LZC schemes will perform and contribute to a low carbon future, extending beyond consideration of the location and appearance of development.
- The changes required represent a significant employment opportunity and commercial rewards for early movers in the city region.
- From 2026 to 2050 there will be fewer options available as retrofit will be complete in the existing stock with all new homes being built as zero carbon. Further reductions from behavioural change and the expansion of decentralised LZC energy systems serving communities and districts will be needed.
- No matter how well we do reducing carbon emissions, some climate change is now unavoidable. There are potential benefits in combining energy efficiency plans for existing buildings and adapting the same properties to cope better with the inevitable impacts of climate change.

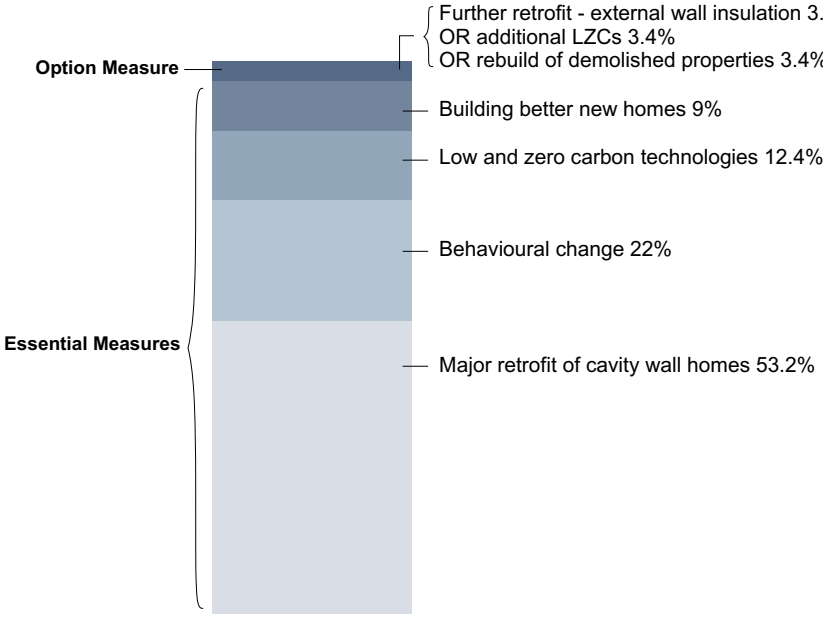


Figure 1: Contribution of measures to the 38 million tonne reduction target

Table 1: Scale of implementation and effectiveness of essential and option measures

Essential measures	CO_2 saving (m. tonnes)	% of 38mt required	Scale of implementation over period 2010 to 2026
Major retrofit	20.2	53.2%	50,000 per year (90-95% take-up by 2026)
Behavioural change	8.3	22%	0.6% energy consumption reduction per year
Low and zero carbon technologies	4.7	12.4%	30,000 per year (35% of all homes by 2026)
Building better new homes	3.5	9%	All new homes (14,000 per year) to Code for Sustainable Homes timetable
Total	36.7	96.6%	
Option Measures	CO_2 saving (m. tonnes)	% of 38mt required	Scale of implementation over period 2010 to 2026
Further retrofit to non-cavity wall homes	1.3	3.4%	5,000 per year (22% of all non-cavity wall homes by 2026)
OR Further LZC technologies	1.3	3.4%	Additional 10,000 per year (increasing coverage to 47% of all homes by 2026)
OR Rebuild of demolished properties	1.3	3.4%	3,000 homes per year or 51,000 by 2026
Total	38	100%	

Introduction

The political momentum to address the adverse effects of climate change through both mitigation and adaptation is mounting. At a national level the Sterne Review has focused attention on the issue with the clear message that we need to act now, or literally pay the price at a later stage stating that the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP per year, now and forever. More importantly, climate change potentially threatens the livelihoods of millions of vulnerable people.

There is clear acknowledgement that responsibility for mitigation lies with the developed countries as they all have disproportionately higher carbon emissions on a per capita basis. The UK has a legally binding commitment under the Kyoto protocol to reduce greenhouse gas emissions (GHG) by 12.5% below base-year level (1990), over the first commitment period 2008-2012. The UK also has a domestic target to reduce carbon dioxide emissions by 20% below 1990 levels by 2010 and the Energy White Paper sets a longer term goal of reducing carbon dioxide emissions by 60% by 2050 with real progress to be achieved by 2020. There is also further discussion that suggests the required reduction is nearer 80% to avoid some of the more extreme effects of climate change. There is also a case for moving early, i.e. achieving a reduction sooner rather than later. The longer we wait for climate change policy to be implemented the greater the accumulated emissions are in the atmosphere.

A greenhouse gas emissions target is established for the Yorkshire and the Humber region[1] which is broadly aligned with the 2006 UK Climate Change Action Plan target. The most recent iteration of the Yorkshire and Humber greenhouse gas emission target as set out in the 2006 Regional Economic Strategy is focused on reducing consumption related emissions.

The emissions caused due to the direct energy requirements of homes have also been a significant contributor. Any climate change strategy has to consider how we can heat our homes, provide hot water, and power our appliances in a way that significantly reduces carbon dioxide emissions.

1 ' Reduce greenhouse gas emissions (CO_2 equivalent) by 20-25% over 1990 baseline, based on modelling of energy/resources consumption attributable to Y&H', The Regional Economic Strategy for Yorkshire and the Humber 2006-2015.

Scope of this report

This report focuses on the direct and indirect CO_2e (carbon dioxide equivalent)[2] emissions of the housing sector in the Leeds City Region and documents the results of a workshop undertaken with local authority representatives. In particular, the report concentrates on what local authorities can do to contribute to a reduction in CO_2e emission in the housing sector. This does not just cover the houses under the control or ownership of the local authority but all houses within the area of the local authority.

The policy levers available for local authorities within this sector are growing and there is considerable diversity in the package of policies to tackle the issue. This suggests significant room for improvement, especially if each local authority was to adopt the "best practice" examples from other local authorities. This report documents current best practice within the Leeds City Region taking examples from the 10 local authorities that make up the city region. To do this, the policy options available have been divided into five key categories:

- Building New Homes
- Retrofitting Old Homes
- Behavioural Change Programmes
- Low / Zero Carbon Technologies
- Selective Demolition and Rebuild

Finally, the report constructs a set of scenarios that quantify the potential reduction in CO_2e emissions if all of the 10 local authorities adopted the best practice in the region under these five policy areas. In addition to this, a more progressive set of policy packages have been calculated that demonstrate the various options available to be on course for an 80% reduction in 2026. Both these scenarios are compared with the "Continuing Trends", in essence "do nothing" scenario. All of the scenarios have been calculated using the Resources and Energy Analysis Programme (REAP), developed by SEI[3].

The pricing of policies is beyond the scope of this report. Many of the policy options put forward have never been implemented on such a wide scale and providing an economic costing could be misleading. Continuing with the "do nothing" scenario could have both economic and social cost implications; particularly for the most vulnerable in society. This report does not consider the economic costs of implementing policies, but recognises the potential economic and social costs of not taking any action.

2 Includes all six major greenhouse gases regulated by the Kyoto Protocol. Emissions of greenhouse gases are converted into carbon dioxide equivalent (CO_2e) based on their 100 year global warming potential. This allows a single figure for the total impact of all emissions sources to be produced in one standard unit.

3 For further information on the methodology of REAP please visit www.sei.se/reap and click on "Publications".

Policy Targets for GHG Reduction

A growing number of Greenhouse Gas Emission (GHG) targets are appearing, either suggested by the European Union or the UK Government. The UK Government has already admitted that it will fail to achieve its target of a 20% reduction by 2010 in emissions. This is despite the warning seven years ago from the Royal Commission on Pollution that the UK would fail to reach this target. In reality, from a territorial emission perspective, there has been a 5% reduction in GHG emissions between 1990 and 2007 and no further reduction by 2010 is predicted. This highlights a major concern, that a target is easy to announce but very difficult to achieve.

However, this has not stopped further targets being announced. At the European level the EU Strategic Energy Review introduced a legally binding target of 20% reduction in emissions by 2020, from a 1990 baseline. The Energy White Paper for the UK[4] suggests an even more ambitious target of 26% by 2020. This would equate to an annual reduction of 1.8% a year between 2008 and 2020 (so far only a 0.3% per year reduction has been achieved between 1990 and 2007).

Aspirational targets for 2050 have also been put in place. In 2003, the Energy White Paper suggested a reduction of 60% by 2050. This would equate to an annual reduction of 1.3% per year. However, the Climate Change Bill[5] highlights that the likely reduction needs to be in the region of 80% of 1990 levels by 2050. Increasingly robust scientific evidence suggests that this target needs to be achieved even earlier to ensure that some of the worst consequences of climate change will be avoided. An 80% reduction by 2050 would require the equivalent of an annual reduction of 1.8% a year, which is aligned with the UK Government's 2020 target.

It is not simply an 80% by 2050 target at all. In reality, it is a 2050 target combined with an assumed straight line trajectory of progressive reduction from 1990 levels to that target. In other words, it is an accumulated emissions total for the period 1990-2050 that has to be met (a stated annual reduction could achieve the same effect). If progress ensured that emissions are over the straight line, as has been the case for UK carbon emissions between 1990 and 2007, then the extra emissions have to be compensated for later on.

The reason why this is so important is because carbon dioxide does not gradually dilute or disperse once it reaches the earth's atmosphere; it stays there and continues to have a "greenhouse" warming effect. That is why any targets to limit damaging climate change, such as those from the IPCC adopted by the UK government, must be viewed as total accumulated emissions over a given time period. That is the basis of the calculations and modelling carried out for this study.

Therefore, based on an annual percentage reduction of 1.8% a year, this report adopts a total carbon budget approach and tests a range of policies to ensure that the housing sector in Leeds City Region achieves this. The earlier climate change policies are implemented the easier it will be to achieve this target.

4 Energy White Paper 2003: Our Energy Future - Creating a Low Carbon Economy

5 March 2007

Profile of Leeds City Region

City regions have recently been adopted as a mainstream geographical unit by central government and regional agencies. There is consensus that they better reflect an area's economic geography than the sub-regional system. A map of the city regions in Yorkshire and the Humber is shown below. The Local Authorities in Yorkshire and the Humber belong to either one of four city regions or to a rural and coastal group. The Leeds City Region is the largest of the four and includes Barnsley, Bradford, Calderdale, Craven, Harrogate, Kirklees, Leeds, Selby, Wakefield and York. It contains 2.7 million people, which is over half of the total population in Yorkshire and the Humber. The Leeds City Region contains 47% of the region's total rural population. (Yorkshire and Humber Rural Evidence Base, 2007).

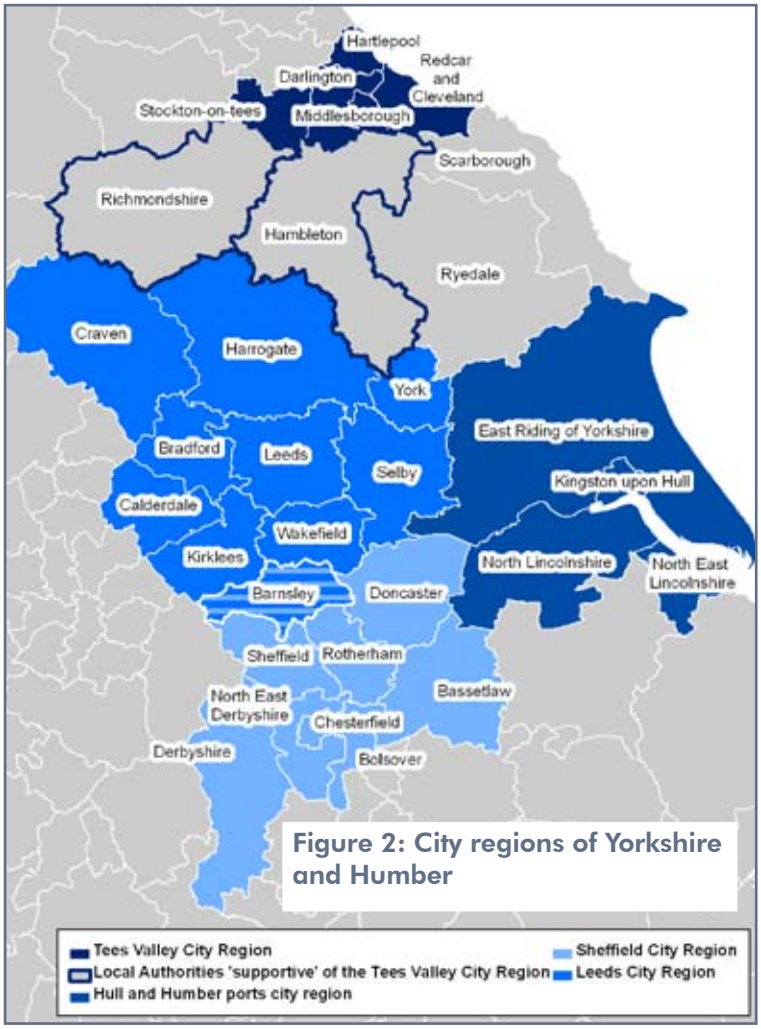


Figure 2: City regions of Yorkshire and Humber

The overall population of the Leeds City region is forecasted to increase by approximately 13% between 2006 and 2030 (Leeds University Population Projections, 2006). To accommodate this growth nearly14,000 houses will be built each year in the Leeds City Region until 2026 (The Panel Report Recommendations and Draft Regional Spatial Strategy for Yorkshire and The Humber housing provision for Local Authorities until 2026). The highest proportion of these houses will be built in Leeds and Bradford.

The carbon dioxide emissions emitted due to the consumption of residents who live in the Leeds City Region are nearly 32 million tonnes. This represents nearly 5% of the UK's carbon dioxide emissions. The average carbon footprint of a "Leeds City region" resident is 11.4 tonnes. This is 4% lower than the national average of 11.8 tonnes per person.

Figure 3 provides a breakdown of the carbon dioxide emissions of the different local authority residents on a per person basis.

Housing represents 27% of the Leeds City region's carbon dioxide emissions. Other important consumption activities that have high carbon dioxide emissions include transport (personal travel), responsible for 20%. Together these two activities represent nearly 50% of all emissions. If solely looking at household emissions, excluding government and capital investment, this figure rises to 65% (two thirds of carbon dioxide emissions).

Figure 4 provides a more detailed breakdown of the housing footprint.

Within housing we have included more than just the obvious. We have also included the embedded emissions in the materials required for maintenance of the house and also expenditure on rent. However, it is the demand for electricity and gas that dominates the carbon footprint of housing (85 – 90%). The variation in carbon dioxide emissions of the different local authorities is 11%. Households in Harrogate have the highest emissions with residents of Kirklees having the lowest.

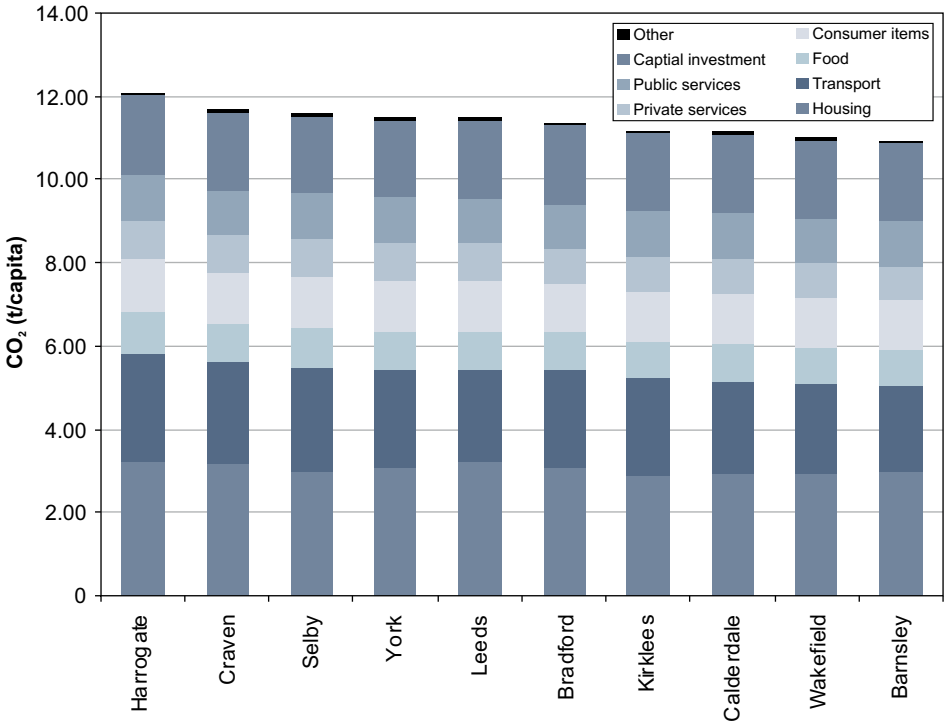


Figure 3: Carbon Footprint of Leeds City Region by Local Authority Area

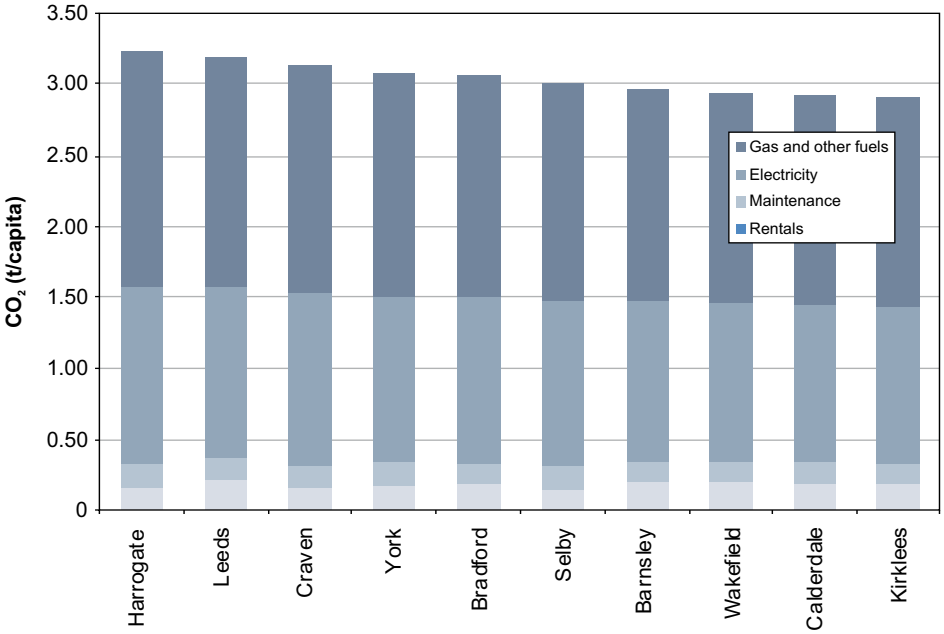


Figure 4: Housing Footprint of the Leeds City Region by Local Authority Area

If housing were to achieve a proportional reduction in line with the targets discussed earlier, by 2020 the carbon emissions would to be between 1.3 and 2.3 tonnes per person. If Leeds City Region wanted to be aligned with the UK Government's suggested reduction of 80% by 2050 then carbon dioxide emissions would need to have been reduced to 2 tonnes per person. This creates a considerable challenge for all stakeholders, especially considering the current trajectories for housing shown in the next chapter.

Results from Other Studies

USING REAP FOR AN ENVIRONMENTAL ASSESSMENT OF THE LEEDS CITY REGION RSS HOUSING POLICY

In 2006 SEI completed a study of the carbon dioxide emissions of new and existing houses in the Leeds City Region for the Yorkshire and Humber Environment Forum. The report considered the effect of 15 different policy scenarios on the carbon dioxide emissions associated with housing between 2003 and 2026. The study found that retrofitting was the most effective policy for reducing carbon emissions followed by an improvement in the energy efficiency requirements for new homes and an accompanying increase in demolition of inefficient housing. Further to this, the report concluded that only retrofit or a number of initiatives used in combination had the potential for longer term carbon reductions and that single scenarios, although achieving a degree of energy efficiency on a per household basis, did not show significant benefits in the longer term.

REGIONAL STRATEGIES AND CLIMATE CHANGE – EVALUATING THE CONTRIBUTION THAT KEY REGIONAL STRATEGIES MAKE TOWARDS ADDRESSING CLIMATE CHANGE

The Regional Strategies and Climate Change report was commissioned by the Yorkshire and Humber Assembly to provide an in-depth analysis of how existing regional strategies contribute to the regional climate change agenda and how they can be combined to tackle climate change as one of the seven regional 'landmark' issues in the forthcoming Integrated Regional Framework. The report highlighted that there is no definitive regional greenhouse gas emissions reduction target and that strategies have a variety of interim and longer term targets.

The study modelled the impact that each of the current regional strategies would have on reducing both consumption and production based emissions by 2021, considering the Baseline Scenarios (what would happen in the absence of any strategy) and the Vision Scenario (the desired impact of the strategy). Overall the study found that the current strategies would be able to stabilise the production-related greenhouse gas emissions by 2021, but not achieve any reduction. However, the strategies were found to be a long way from either stabilising or achieving any reduction in consumption based emissions. In fact consumption-related emissions were projected to almost double between 2003 and 2021 in the Vision Scenario.

This report is important for highlighting the scale of change that may be required within the current regional policy landscape in order to reduce greenhouse gas emissions.

Continuing Trends Scenario

A summary of the assumptions used in all of the policies and scenarios modelled is provided in Appendix 5.

WHAT IS A "CONTINUING TRENDS SCENARIO?

The scenario attempts to show what might be happening over the next 20 years by exploring what has happened historically and assuming these trends will continue. The limitation of such an approach is that the scenario does not take into account unexpected events. For example, if oil prices doubled tomorrow then the scenario immediately becomes redundant. However, the advantage of the approach is two fold. Firstly, it is possible to argue that many of the historical trends will not change quickly as we live in a relatively stable country with a reasonably constant economic state. It is difficult to see how social trends such as smaller family units, higher divorce rates resulting in lower occupancy rates will not continue. Secondly, the scenario does raise the issue of whether current policy is having an effect, in this case on carbon dioxide emissions, and gives something against which to compare carbon reduction scenarios.

The following assumptions have been adopted for the scenario:

- Housing Projections Data was taken from the "Panel Report Recommendations and Draft Regional Spatial Strategy". This report documents the housing provision by local authorities until 2026. These are updated figures from the previous analysis and show a higher rate of house building in the Leeds City Region. Annually, nearly 14,000 houses will be built each year in the Leeds City Region. Not surprisingly, the highest proportion will be built in Leeds followed by Bradford.
- There have been significant improvements in the analysis of the energy performance of new houses from 2002 to 2026. For the years 2002 to 2006 the standard that was required by Building Regulations has been taken into account on an annual basis. Therefore, the assumption has been taken that all 2002 houses meet 2002 energy efficiency rating outlined in the regulation for that year.
- In the previous study the Code for Sustainable Homes had not been brought into operation. Within this scenario, the carbon footprint of each of the six levels of the Code has been calculated. As with all calculations undertaken by SEI, the complete life cycle impacts have been taken into account. Therefore, while code levels 5 and 6 are suggested to be "Carbon Neutral", SEI has undertaken an analysis to understand the impacts along the complete supply chain demonstrating that there is a carbon output. In terms of the assumption for the "Continuing Trends" scenario, there are no official targets for private sector housing to meet different levels of the code, only recommendations. However, there is a trend towards ever more stringent targets for new houses. It is important that a "Continuing Trends" scenario takes this into account. Therefore the following assumptions have been made:
    - The private sector will not implement the Code at the same speed required for social housing but will make improvements. It is suggested that the private sector will achieve code level 3 by 2015, code level 4 by 2020 and code level 5 by 2025. This is difficult to predict but does ensure that a conservative estimate is established.
- In terms of the state of existing (per 2002) houses, information was taken from the Home Energy Efficiency Database, produced by the Energy

Saving Trust. There is regionally specific information available. The database provides information on a range of energy efficiency measures and their historic update, for example the number of houses with double glazing. Within this scenario we have assumed that house improvements will be undertaken independent of any specific retrofit strategy.

- Assumptions have to be made in terms of underlying behavioural change towards energy use. Increasingly, individuals are becoming more aware of the issue of climate change. Research does suggest that there is a significant gap between attitude and behaviour. Therefore while someone may identify climate change as an important issue, they might not do anything about it. According the Energy Saving Trust, even though the "Attitude – Behaviour" gap is a problem, the message is getting through resulting in an annual reduction of 0.15% in energy consumption through better management of energy in the home. This reduction rate has been adopted.
- Information from the Office of National Statistics was used to gain an understanding of the changing population of the Leeds City Region. Together with housing projections we can calculate the changing household occupancy of the region. Not surprisingly it is reducing. We calculate that the household occupancy is set to decline steadily from 2.41 in 2002 to 2.36 by 2026.
- National assumptions have been adopted for the energy mix of electricity production. As Leeds City Region is part of the national grid it seemed appropriate to adopt the national average.

CONTINUING TRENDS RESULTS

The results of the "Continuing Trends" scenario have been shown on both a per capita basis and total population (in figure 5 (below) and figure 6 on the next page).

The scenario shows that there is likely to be a modest per capita reduction (figure 5). It is suggested that the reduction from 2007 to 2026 is likely to be within the range of 3 to 10%.

Figure 6 shows the same scenario for the total population of the Leeds City region.

Due to an increase in the population of the Leeds City Region there will be an increase in the total carbon dioxide emissions from housing. This is likely to be in the region of 7% and 16% (2007 to 2026).

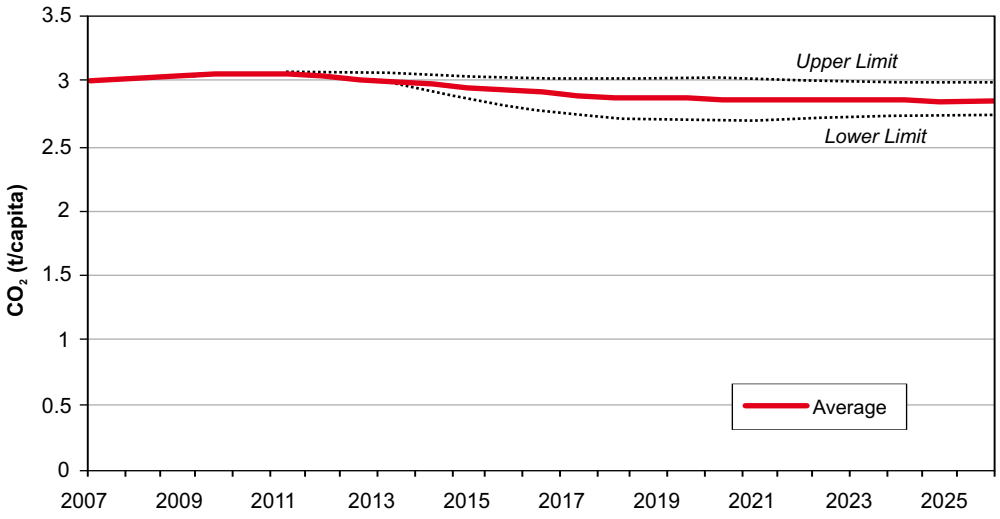
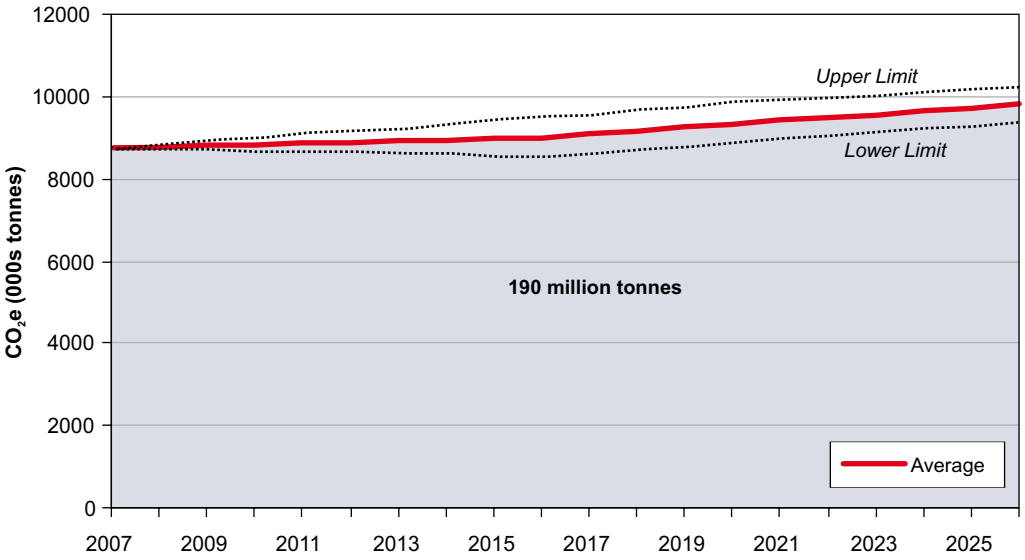


Figure 5: Continuing Trends Scenario - per capita CO_2e emissions from housing in Leeds City Region



If you add all the CO_2e emissions below the line for every year you get the "Total CO_2e Emissions"

Total CO_2e Emissions between 2007 and 2026 = **190 million tonnes**

Figure 6: Continuing Trends Scenario - total CO_2e Emissions from Housing in Leeds City Region

WHAT WOULD THE TOTAL CO_2E EMISSIONS BE IN 2026 TO ACHIEVE AN 80% REDUCTION BY 2050?

As previously highlighted, emissions by 2026 should be 40% lower than 2007 to be on target for an 80% reduction by 2050 is not the most important fact. What is important is what happens in terms of the CO_2e emissions between 2007 and 2026. There is a need to focus on the "Total CO_2e emissions". The "Continuing Trends" scenario tells us that the total CO_2e emissions between 2007 and 2026 will be 190 million tonnes.

To be on track for an 80% reduction by 2050, CO_2e emissions must reduce by the equivalent of 1.8% per year. For the Leeds City region this means that total CO_2e emissions over the period should not exceed 152 million tonnes. This total CO_2e emissions figure sets the challenge for future policy and an interim 2026 target for the rest of the report. New policies related purely to housing need to remove 38 million tonnes of CO_2e emissions by 2026. In reality, it doesn't matter when this reduction is achieved, though, as long as the total CO_2e emissions do not exceed 152 million tonnes between 2007 and 2026. The "Continuing Trends" scenario demonstrates that the total budget between 2007 and 2026 will be completely used up by 2022.

Measures to Achieve the Target

INTRODUCTION

In order to achieve the reduction in CO_2e emissions of 38 million tonnes a combination of the following measures will be required:

- Building better homes: Implementing Code for Sustainable Homes targets (zero carbon by 2016) across public and private sector
- Major retrofit of existing stock
- Behavioural change: awareness campaigns to encourage energy saving
- Low and zero carbon (LZC) technologies in existing homes
- Selective demolition and rebuild

MEASURE 1: BUILDING BETTER NEW HOMES (REGIONAL BEST PRACTICE)

Even though there have been improvements in the energy efficiency of new houses, this has not lead to a corresponding reduction in energy use. This is partly due to increased levels of comfort instead of energy reduction, as well as an increase in energy for lighting and appliances. This clearly demonstrates that there is going to have to be a significant change in the efficiency of houses to counteract the growing demand for energy for other purposes. In addition to this, by 2050, houses built between 2007 and 2050 will account for around 25% of the housing stock. However, this does not mean that 25% of houses that exist today will not exist in 2050. New houses will be in addition to this total as opposed to replacements. It is essential that any new house does not require retrofit within ten years to improve its energy efficiency. The technology does exist now to build houses to very high standards in terms of energy efficiency.

DCLG's proposed policy framework for the energy performance of new developments is based around three main policy levers:

- The planning system: DCLG's draft planning policy statement Planning and Climate Change sets out how the location and design of new developments can contribute to the reduction of the Carbon Footprint of a local area.
- The Code for Sustainable Homes is a voluntary standard with six levels of energy performance designed to increase the environmental sustainability of homes. All government funded housing will be built to at least level 3 of the code.
- Building regulations provide mandatory baseline national standards for energy use in buildings. The regulations progressively raise the energy efficiency standards of new homes over time.

Local government needs to prepare itself over the next three years to ensure developers can build all new houses to progressively higher levels of the Code for Sustainable homes. The Government has proposed targets for improving the energy performance of building regulations in line with the new Code for Sustainable Homes as follows:

- All homes built to Code level 3 by 2010 – 25% more efficient than existing building regulations
- All homes built to Code level 4 by 2013 – 44% more efficient than existing building regulations
- All homes built to Code level 6 by 2016 – 'zero carbon homes'

Adopting suggested U-values that are required to achieve the various levels of the Code for Sustainable Homes; we have modelled what this could mean in terms of carbon dioxide emissions. These figures should be used as a guideline as there will, of course, be a variation in the carbon dioxide emissions dependent on the occupants energy demand.

The 2006 Regulations represented a significant shift in performance over the average home (nearly 50%). After this the Code for Sustainable Homes gradually tightens the regulation to achieve increasingly better efficiency rating. Level 1 to 4 shows

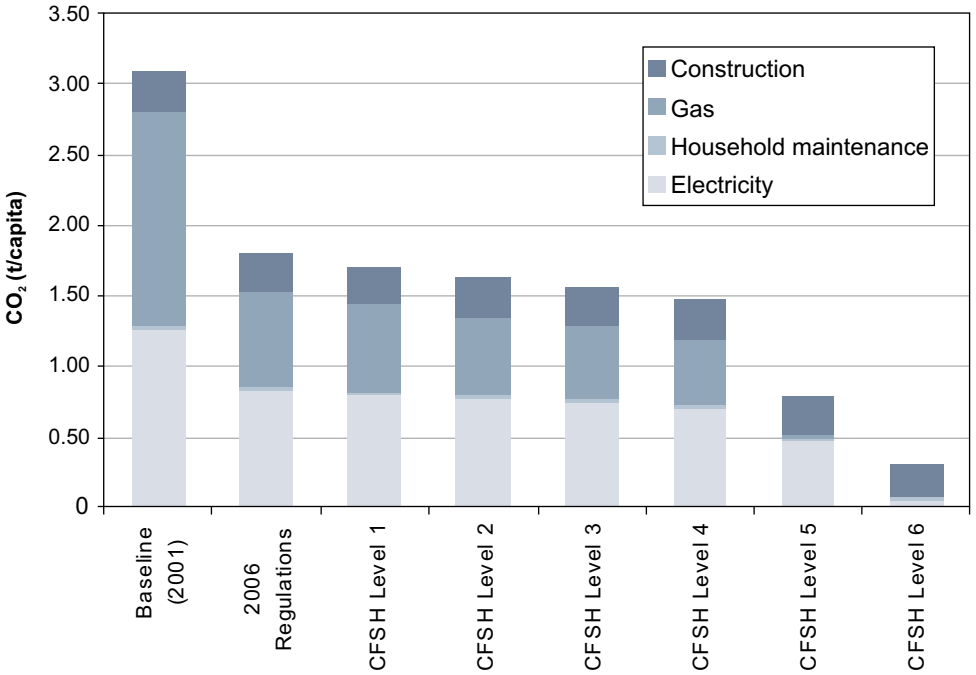


Figure 7: Carbon Dioxide Emissions of the Code for Sustainable Homes

this incremental improvement with level 4 delivering 20% saving from the 2006 Regulations. After this the improvements are even more substantial. However, at present, few examples can be found of a development that would reach Code levels 5 and 6. While level 6 is described as "Carbon Neutral", the construction of the home along with the provision of renewable energy does have some carbon output.

Is there a case for moving more quickly than this in your local area where there are demonstrable opportunities? If your local authority wants to set local standards beyond current building regulations it will need to demonstrate that it can still meet house building targets, but this should not be treated as an obstruction to engagement with developers. The supplement to the Planning Policy Statement 1 on Climate Change[6] suggests that local authorities can set local standards beyond current regulations, provided that they have the local evidence base to justify it and a strategic approach to energy in their local authority. It also encourages local authorities to provide local guidance on low carbon design.

Building better new homes: Workshop Feedback

Harrogate Council has one of the most progressive policies on "New Build". The council has adopted the government's proposed timetable for all house building, public or private. They are also appointing assessors to ensure compliance. Many local authorities have produced design guides that have been used with varying levels of success. However, they have yet to establish a target similar to Harrogate.

The stance taken by Harrogate is unusual and it would be difficult to find many local authorities nationally who have taken such a progressive position on the issue of new build. There was concern from some local authorities that such a policy could slow down house building, hence not meeting UK Government targets. The UK Government has made it clear that any standards should not be introduced at the expense of achieving housing targets.

However, the introduction of a "blanket" policy across the Leeds City region would create a level playing field ensuring that this would not be the case. Many local authorities also mentioned that they were looking to Leeds for inspiration. One of the barriers mentioned by the local authorities was not having a level playing field meaning that most

6 Consultation Planning Policy Statement: Planning and Climate Change Supplement to Planning Policy Statement 1 (Dec 2006)

local authorities were unwilling to make the first move. A blanket policy would clearly overcome this problem.

Another issue / barrier is the lack of examples of developments built to the higher level codes. At present there are no examples at the community level of level 5 and 6, only a few individual houses. Therefore, a target has been established with little knowledge of whether it is achievable. This suggests the need for "showcase" examples as well as the targets established by Harrogate. The showcase examples cannot be individual houses, but need to be demonstrated at the community level, i.e. 100 houses plus. This is a key area where local authorities could clearly take a lead.

Finally, a further barrier was seen as a lack of expertise in a number of areas, including the construction industry and planners. There is a lot to learn and training and effective communication must form part of any policy.

Building better new homes: assumptions and results

We have taken the targets established in Harrogate and assumed that this target would be adopted across Leeds City Region. This is a generous assumption, that all houses do comply with this standard, as historically this has not been the case. Boardman suggests that up to a third of new houses fail to reach building standards. Therefore a clear enforcement strategy is required to ensure full compliance[7].

Figure 8 provides the results, along with the "Continuing Trends" scenario and the "80% reduction scenario".

Due to the limited amount of houses that can be affected by the policy, it does little to change the overall picture. This does not mean that the policy is not important. When comparing the new homes scenario with the continuing trends, the contribution that the policy makes is clear.

It would be a nonsensical situation to have to retrofit new houses in ten years time to improve the energy efficiency at greater expense. Houses built to building regulations today will need to undergo retrofit in the next ten years bearing in mind that the technology does exist to build to significantly higher standards.

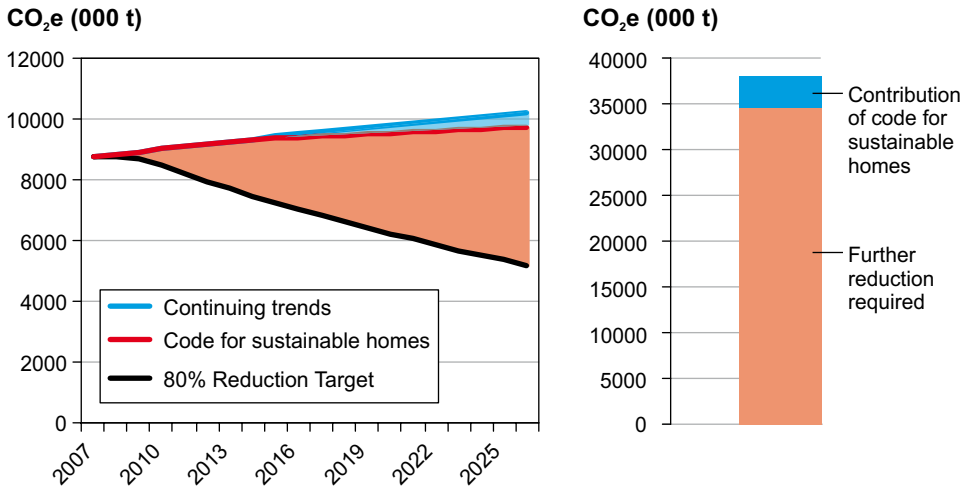


Figure 8: New Homes Total Carbon Dioxide Emissions Scenario

7 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

As has been mentioned there is also the issue of compliance. The worrying statistic that up to a third of houses does not comply with current Building Regulations is a major concern. Boardman suggests that to overcome this problem mandatory air-tightness tests must be carried out on new homes before they are allowed to be sold. Such a policy would definitely ensure 100% compliance[8].

Summary: Contribution from Building Better New Homes

Assuming Harrogate's targets for all new homes (public and private built to Code Level 3 by 2010, Code Level 4 by 2013 and Code Level 6 by 2016) are adopted across the city region:

- 150,000 houses built to Code Level 6 by 2026
- Total saving: 3.5 million tonne reduction by 2026
- Percentage contribution to target: 9% of the required 38 million tonne reduction

MEASURE 2: RETROFIT OF EXISTING HOMES (REGIONAL BEST PRACTICE)

Even by 2050, with the present UK Government's current ambitious housing building programme, 75% of current housing stock will still exist. This housing stock is currently performing extremely badly in terms of energy efficiency. Boardman points out that British Gas suggest that as a result of poor insulation, £1 is wasted for every £3 spent on heating. Any reduction in carbon dioxide emissions must address the challenging issue of how to retrofit these homes to bring them up to modern day standards as much as possible. Lapillonne and Pollier highlight that UK houses use twice as much energy for space heating as houses in Nordic countries[9].

Energy efficiency varies widely across the housing stock, but energy performance has the greatest correlation with property age, type and size for existing homes. Large, older, detached homes tend to have the poorest energy standards. Energy performance is also driven by the amount of insulation and efficiency of heating systems as well as the demands and awareness of the user (discussed below).

There is also the issue that almost four million households in the UK struggle to afford an adequate energy supply and suffer from fuel poverty. Poor energy efficiency is one of the three main causes of fuel poverty and 80% of people in fuel poverty live in homes of below average energy efficiency. While extremely important for other reasons, the current approach of purely improving the thermal efficiency for low-income families will not deliver a reduction in energy demand as the benefits will be absorbed by increased comfort.

CURS surveys have shown that almost all local authorities (93%) have entered into partnership arrangements with other agencies to tackle problems of energy efficiency in their local area. A majority (84%) provide advice and guidance on energy efficiency but the nature of service varies enormously. Energy efficiency programmes are presently driven by two main strains of funding:

- The Energy Efficiency Commitment places an obligation on energy suppliers to promote energy efficiency measures for householders and is in the middle of its second phase. The third phase (2008-11), is intended to be 50-100% more ambitious than at present and will continue in some form until 2020. At the moment 50% of savings associated with the EEC must be from low income households.
- Warm Front is the Government's main grant-funded scheme for tackling fuel poverty. Grants are offered for up to £2,700 for families to install measures such as insulation and heating systems. Just under half of local authorities provide grants themselves and with other partners. A similar number provide some form of top-up grants

8 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

9 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

for certain groups; this is most likely to happen in metropolitan authorities.

Many of these schemes are aimed at low income families and this does little to improve the energy efficiency of the majority of the population. In terms of delivering the required reduction it is the larger structural retrofit options that would bring the greatest reduction. These are often the most expensive and inconvenient for the occupier.

Retrofit Best Practice: Workshop Feedback

There were numerous examples of grant schemes for a range of retrofit options available for low income families. For example, in Harrogate, households who receive particular benefits can have free cavity wall insulation. In Calderdale over the last year 1,731 households have benefited from loans up to £2,700 to help pay for energy savings. However there is a lack of awareness and it is estimated that there are 30,000 homes that could still benefit from this initiative.

It is reasonably well known that Kirklees has done more than other local authorities to address the issue. Kirklees established that a considerable number of its residents are in fuel poverty. The key project, Warm Zone, will offer help to every household in Kirklees to improve energy efficiency including:

- Free cavity wall and loft insulation for all households
- Free low energy light bulbs to all
- Free improvements to heating systems (only for householders fulfilling set criteria, for example they are in fuel poverty, on benefits, or in hard to treat homes, and subject to funding)
- Competitive prices for replacement boilers and central heating for able to pay customers

The Kirklees Warm Zone project commenced in February 2007 and will run for three years with £21m of funding. This scheme only started this year and it is impossible to know quite how effective the scheme will be. For the purposes of this scenario, a number of assumptions have been made and are listed below.

Retrofit best practice: assumptions and results

The fact that every house in Kirklees will be approached under the Warm Zone project is extremely encouraging. This suggests that almost every house will benefit from the free energy efficiency measures in the scheme: cavity wall and loft insulation. While loft insulation is possible for nearly every house, only 68% could have cavity wall insulation.

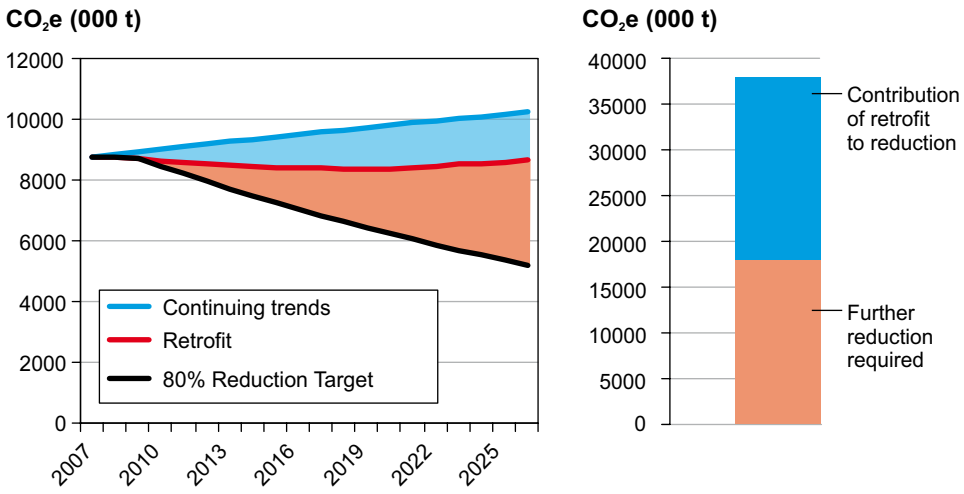


Figure 9: Retrofit Scenario – Total Carbon Dioxide

Information from the Energy Saving Trust tells us that currently 43% of houses in the Leeds City Region have inadequate loft insulation and only 27% currently have cavity wall insulation. We assume that 10% of householders will not allow their home to be improved for loft insulation as it could involve some disruption, but that this drops to 5% for cavity wall insulation.

In terms of energy saving light bulbs, the fact that they are free should mean a significant take up. There will always be some individuals who will not want to use the light bulbs. We have assumed that this could be in the region of 10%.

Replacement boilers are not cheap for the average householder even with a discount, with most boiler replacements being in the region of £2500. There will be a natural rate of replacement and it is safe to assume that the existence of the system will speed up the replacement. At present, 9% of households have a condensing boiler. It is suggested that the scheme will contribute to a 90% replacement of the stock by 2026 with a yearly incremental increase.

Finally, there is the issue of double glazing. There is nothing specific in the plan to ensure faster than average replacement of double glazing so a natural rate of change has been assumed.

The results of the retrofitting existing houses have been shown below:

With the growing population of the region, the retrofit option would counteract these additional emissions but not reduce them. In essence, the policy in isolation would stabilise CO_2e emissions in the housing sector for Leeds City Region.

The project being undertaken by Kirklees is extremely commendable. A more significant reduction is achieved because of early implementation. Retrofit is the most important policy option to achieve the greatest reduction in emissions, because it can, effectively, change the emissions of every household in the region.

The analysis shows that there needs to be even more pressure for householders to change and accept quite significant changes to their houses to achieve considerably higher levels of energy efficiency. Boardman suggests using the Energy Performance Certificates as a driving force and the enforcement of the Housing, Health and Safety Rating Scheme System[10]. Specific carbon targets that the local authority would be responsible for achieving for the whole housing market would generate a number of diverse solutions.

Summary: Contribution from Retrofitting Existing Homes

We make the assumption that nearly all of the houses that can have the basic retrofit measures are provided with the necessary installations by 2026. 90% of houses across the city region are provided with loft insulation; 95% (of those with cavity walls) are given cavity wall insulation; 90% use energy saving light bulbs and that of those with gas heating systems 90% have a condensing boiler by 2026:

- Over 800,000 houses improved with retrofit measures by 2026
- Total saving: 20 million tonne reduction by 2026
- Percentage contribution to target: 53% of the required 38 million tonne reduction

10 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

MEASURE 3: FURTHER RETROFIT REDUCTIONS (EXTERNAL WALL INSULATION)

Further reductions could be achieved by even more extensive retrofit. However; this does require more extreme action, such as the internal or external wall insulation of single brick properties. While this may be required in the long term, it can be expensive and quite disruptive.

According to the Energy Saving Trust an annual average reduction of 7,375 kWh could be achieved per house through external wall insulation. Assuming that only the worst energy performing houses are targeted we assume a saving of 11,000 kWh could be achieved.

External wall insulation could deliver a significant saving per house. The results have been shown below. Due to the limited number of houses that would be targeted, it is necessary to implement this policy as soon as possible, therefore increasing the benefits through early implementation. It is our estimate that there are approximately 400,000 solid wall properties in the Leeds City Region.

Summary: Further Retrofit

Assuming that 90,000 houses are fitted with external/internal wall insulation:

- 22% of solid wall properties would be fitted with external wall insulation
- Total saving from either measure: 1.3 million tonne reduction by 2026
- Percentage contribution to target: 3.4% of the required 38 million tonne reduction

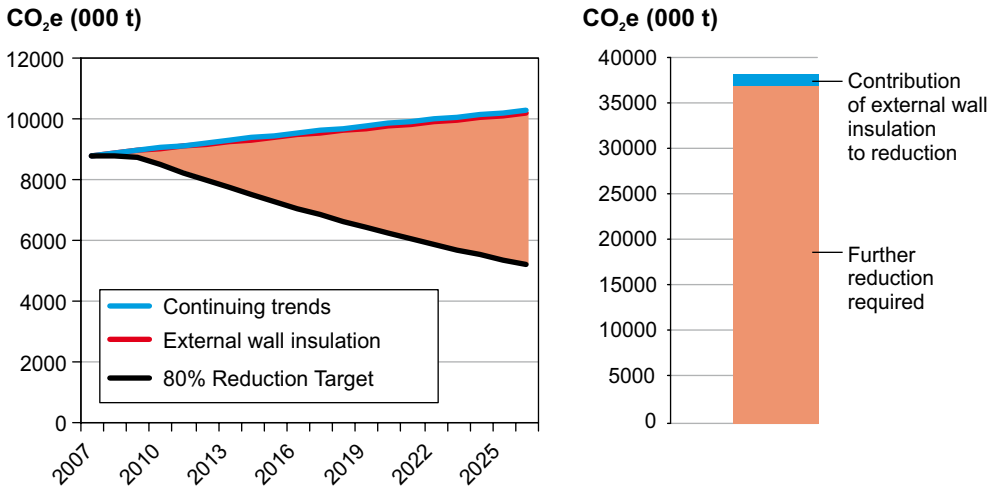


Figure 10: External Wall Insulation Results

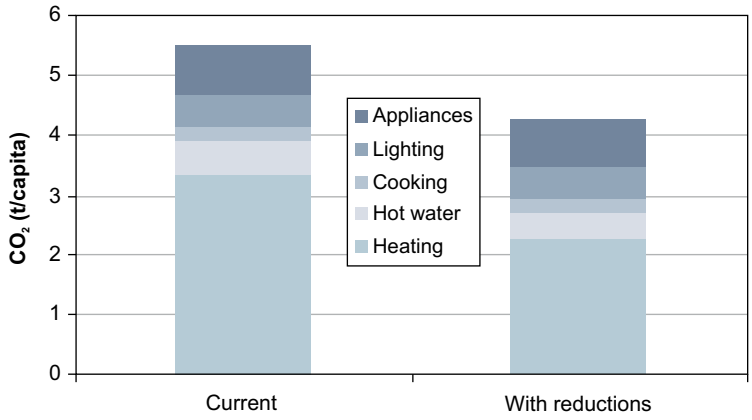
MEASURE 4: BEHAVIOURAL CHANGE

Providing efficient new homes, or even retrofitting old ones, can only work to reduce emissions if the occupier knows how to use the technology. A triple glazed window left open is no better than a single glazed window. There are numerous choices that the occupier has that will have a considerable impact on CO_2e emissions. To demonstrate this we have documented a few of the key behavioural options and shown the carbon dioxide variation of two identical houses in figure 11. The difference in the carbon dioxide emissions between these two examples is 22%.

In terms of behavioural change campaigns, there has been a considerable amount of work done to try to educate the general public with an increasing volume of national advertising from organisations such as the Energy Saving Trust (EST). However, marketing research suggests that what this can achieve can be limited and that personalised and individual targeted approaches are most likely to bring the best results. Individualised marketing has proven to be a valuable tool. In reality, it means individual households are given direct advice in the home, on how to achieve a reduction in their carbon emissions by changing their behaviour on a regular basis.

Boardman estimates that at least one third of the carbon savings in the residential sector will have to come from day to day behavioural changes (Hillman and Fawcett, 2005) as opposed to new technology or fuel switching. To achieve this Boardman proposes a package of utility focused measures such as real time energy use monitors, smart meters and micro-generation, improved billing information and details of the carbon content of fuels purchased.[11]

The other solution would be to give clear price signals to the consumer through taxation or personal carbon allowance programmes, ensuring that the consumption of excessive energy is at the forefront of their mind. However, this is beyond the scope of regional and local policy.



Thermostat at 20 degrees	Thermostat at 18 degrees
4 baths a week	50% of baths replaced by showers
Most appliances left on stand by	75% of appliances turned off
CO_2e Emissions = 5.5 tonnes	CO_2e Emissions = 4.3 tonnes

Figure 11: Potential for Behavioural Change

With few examples from the region itself, what could realistically be achieved by scaling up current activity to attempt to change the behaviour of households?

Boardman uses examples from Darby (2006)[12] suggesting that a potential 10% reduction could be achieved through the introduction of smart metering and providing households with better information on their energy consumption month by month. The UK Government suggests that in real terms this could lead to a reduction of 1% in energy consumption by 2010 and a further 1% by 2020. This clearly demonstrates the difficulty in achieving considerable reduction through behavioural change; a 1% reduction over a 10 year period is simply not enough. Referring back to Darby who suggests that considerably more could be achieved, it is essential that a

11 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

12 Darby, S (2006), The effectiveness of feed-back on energy consumption: A review for DEFRA on the literature on metering, billing and direct displays, Environmental Change Institute, University of Oxford, Oxford, http://www.eci.ox.ac.uk/research/energy/downloads/ smart-metering-report.pdf

10% reduction in energy demand is achievable over the time period between 2010 and 2026. This would result in an annual reduction of 0.6%. We have assumed that a behavioural change campaign that would achieve this goal is put into operation.

Behavioural change: assumptions and results

As with other issues, examples can be found of some activity in this area. Harrogate provides free energy audits, for example. Leeds and Calderdale have a strong behavioural change component in the upcoming Climate Change Strategies and under the LACM5 programme, Bradford City Council has developed a communications strategy.

However, there is very little or no monitoring of any of these schemes. This makes it extremely difficult to understand the effectiveness of a behavioural change programme, even though it is of vital importance. There is no local authority that is driving forward a progressive policy and many of the schemes mentioned have already been in place for some time. Therefore, the "Continuing Trends" scenario would include a certain level of activity in behavioural change. An annual reduction of 0.15% has been assumed within the "Continuing Trends" scenario due to behavioural change. A behavioural change programme has the potential to deliver significantly greater reductions than policies related to new build as it affects the entire population.

Instigating a regional behavioural change programme that gives an annual energy consumption reduction of 0.6% per year provides an 8.3 million tonne reduction by 2026, which contributes 22% to the overall target of 38 million tonnes.

Summary: Contribution from Behavioural Change

In order to achieve a significant reduction the energy consumption reduction from behavioural change is assumed to be four times the current rate of 0.15% per year – at 0.6% per year. This provides:

- Total saving: 8.3 million tonne reduction by 2026
- Percentage contribution to target: 22% of the required 38 million tonne reduction

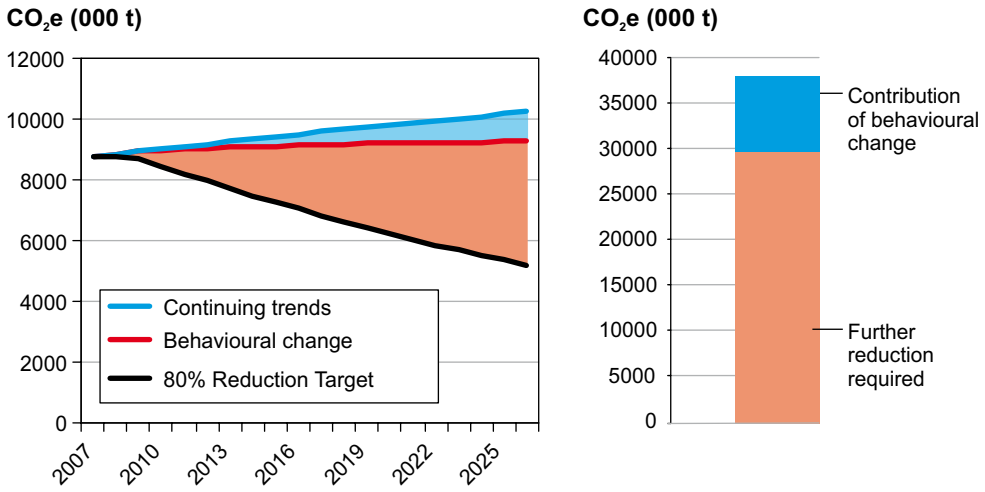


Figure 12: Behavioural Change Results

MEASURE 5: LOW AND ZERO CARBON TECHNOLOGIES

Due to the energy loss in the transmission of electricity, decentralised energy systems are being increasingly identified as a real option for significant carbon reduction. The draft EU Renewable Energy Directive requires that the UK produce 15% of its energy from renewable sources by 2020. The Prime Minister has recently supported this target and highlighted that it will be achieved.

The EST has suggested that micro-generation could achieve a 15% reduction in household carbon emissions by 2050 and provide 30-40% of all the electricity required in the domestic sector in the UK (at current levels of demand). A number of low or zero carbon technologies (LZCs) are available for delivery and their suitability for new and existing properties are listed in table 2, right (adapted from Boardman)[13].

To date, a total of 107,200 LZCs have been installed in the UK (EST, 2005). This figure includes all sectors, but the majority are domestic installations. Of these 107,200 nearly 80,000 are solar water heating and a further 25,000 are community combined heat and power schemes. The remaining 4,000 installations are of other technologies listed in table 2 including: photovoltaics, ground sourced heat pumps and micro-CHP and micro-wind. Currently very little electricity is generated from existing LZC installations and most photovoltaics and micro-wind have been grant aided[14].

New Buildings

In new buildings, policies such as the Code for Sustainable Homes, the Merton Rule and tougher building regulations means that many technologies will be installed in new builds.

Local authorities are in a strong position to ensure that their area responds by building on already existing policies such as the Merton Rule. The Merton rule ensures that all new developments have 10% of energy provided by on-site capacity. The more energy efficient the design, the smaller the 10% provision has to be, so the Merton Rule has the advantage of promoting lower-carbon buildings through both energy efficiency and building-integrated renewables[15].

Locally, Kirklees Council have proposed that by 2011 30% of energy consumption in every one of its new council buildings should come from renewable sources. They have also set targets for CO_2 emission reductions, which they aim to meet with the provision of renewable energy technologies in all non-residential developments larger than 500m^2 and all residential developments.

Existing Buildings

The CSH and Merton Rule should help to ensure that LZCs are installed in new builds. However, in order to achieve necessary carbon reductions the installation of LZCs cannot be limited to new builds; provision for the existing housing stock is vital. Measure 5 is therefore focused on the installation

Table 2: Low or zero carbon technologies

	New Buildings	Existing Buildings
Solar thermal	Yes	Yes
Community CHP fired by waste or biomass	Yes	Yes
Micro CHP	No – heat demand too small if built to highest CSH standards	Yes – soon, especially suburban areas
Photovoltaics	Yes – if feed-in tariff	Yes – if feed-in tariff
Ground source heat pumps	Yes – however, there are few examples in the UK. Successful implementation in Sweden, for example.	Currently only rarely – requires a large garden. Technological developments may expand the potential if less space is required.
Microwind	Maybe if for whole development	Rarely with present technology, unless rural and exposed
Woodstoves	Yes – if space for storing wood	Insufficient for whole house

13 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

14 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

15 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

of LZCs in the existing stock. Boardman highlights that an 80% carbon reduction by 2050 requires every home in the UK to have at least one of the LZCs, but at the moment only about 4 homes in 1000 do[16].

With the introduction of the Carbon Emissions Reduction Target in April 2008 utility companies are expected to provide around 121,000 LCZ technologies in existing homes, and this will nearly double the existing quantity of LZC technologies in the housing stock. However, in order to achieve an 80% reduction in carbon emissions Boardman estimates that this would need to increase to around 600,000 installations per year – a 15 fold increase over the predicted rate for 2008-2011[17].

Examples of Technology

There are a number of options available for existing housing stock – as described in table 2. Some of the technologies can be provided on an individual house basis and delivered through grant funding or supplier obligations schemes. Others, such as combined heat and power (CHP) could be provided at the community level.

CHP Schemes

One example of a successful community CHP scheme is the Dickens Estate in Portsmouth where an old district heating system was upgraded to provide energy to local schools, community buildings and flats. The total carbon saving was estimated at 40% when compared to the use of standard gas-fired boilers. In addition to the carbon benefits there were substantial cost savings for consumers. Heating and hot water before the scheme cost around £6.70/week for a two bedroom flat. Following the implementation of the CHP unit the costs were reduced to less than £3/week.

The Barton Hill Community Heating Scheme in Bristol, recorded a 30% reduction in heat usage in community CHP upgraded flats compared to unimproved blocks, along with an increase in thermal comfort levels. A 50% reduction in energy use on the Mile Cross estate in Norwich was achieved following the installation of two CHP units and a number of retrofit measures. Further examples of community CHP schemes can be found on the Combined Heat and Power Association: http://www.chpa.co.uk/.

Solar Thermal and Photovoltaics

Other individual household measures can also provide significant carbon reductions. Boardman estimates that 50% of the energy required to heat hot water for example, could be obtained through solar thermal power and would be particularly beneficial in rural areas without access to the gas supply[18]. Within the region, Kirklees has undertaken one of the largest installations of solar technologies in the UK under the SunCities scheme, funded by the European Commission. This project provided solar thermal and solar electricity systems to around 500 households.

A number of photovoltaics systems have been successfully installed in Cheshire. Kingsmead School for example, has approximately 15% of the schools energy requirements provided by a photovoltaic system.

Ground Source Heat Pumps

Heat pumps are most appropriate in new build, but they can be successful in existing properties. In July 2004 the first successful retrofit ground source heat pump (GSHP) system was fitted to a group of social houses in a rural area of Penzance in Cornwall. Fourteen bungalows were each fitted with Powergen "HeatPlant" heat pumps connected to vertical ground loops, providing space heating (via radiator systems) and hot water. Under the Powergen HeatPlant programme (which includes both new build and retrofit projects) to date 25 housing associations and local authorities have GSHP installations either completed or in progress, and the total number of systems running or being installed is approximately 700.

Overall a package of measures, including grants, renewable heat obligations (requiring

16 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

17 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

18 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050

each household to produce a proportion of its heat from LZC sources), low interest government loans and funded community power schemes could be used to make the most of the available LZC technologies.

Feed-In Tariffs

Feed in tariffs would be very useful for making LZCs more financially viable for householders. In Germany there is a feed in tariff for solar photovoltaics, wind or hydro power. Anyone generating electricity from these technologies gets a guaranteed payment of four times the market rate for 20 years. This reduces the payback time on such technologies to less than 10 years and offers a return on investment of 8-9%. The cost is spread by generating companies among all users and has added about one cent/kwh to the average bill, or an extra €1.50 (£1) a month[19]. Although this could not be implemented at a regional level, it is important to recognise the potential benefits of working towards changes on a national scale.

LZC technologies: assumptions and results

We have assumed that 30,000 houses per year are fitted with a LZC technology, resulting in nearly 500,000 installations between 2010 and 2026. 35% of the total housing stock will have a LZC technology by 2026.

A regional requirement for all sizable new developments to have 10% of energy from renewable sources and the local initiatives taken by Kirklees is a starting point for CO_2e emissions reductions through decentralised energy systems and renewable technologies. However, this type of policy is in the early stages of development. There are a number of examples of small scale projects such as the solar panels installations in Kirklees, but no major projects or plans that would reach the 500,000 installations modelled in this scenario.

There is considerable potential for more decentralised energy provision across the region and the examples above demonstrate the benefits and opportunities within this sector.

If 500,000 LZC technologies were installed by 2026 there would be a 4.7 million tonne reduction in CO_2e emissions. This would contribute 12.4% to the 38 million tonne target. There is scope to further this after 2016, increasing the number of installations over the next 10 years until 2026.

Summary: Contribution from Low/ Zero Carbon Technology

Installing nearly 500,000 LZCs across the region will provide:

- 35% of the existing housing stock with an LZC
- Total saving: 4.7 million tonne reduction by 2026
- Percentage contribution to target: 12.4% of the required 38 million tonne reduction

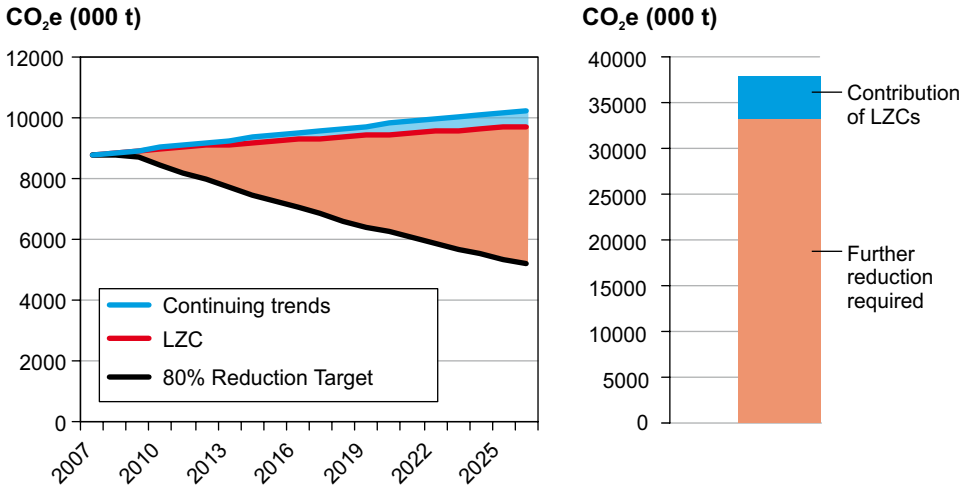


Figure 13: LZC Results

19 Ashley Seager , The Guardian, 23 Jul 2007.

MEASURE 6: REBUILD OF DEMOLISHED PROPERTIES

Measures 1 to 5 reduced CO_2e emissions by improving the energy efficiency of existing houses and ensuring that any new houses added to the stock are of a very good energy efficiency standard. However, there are occasions when some of the existing stock are considered non-decent[20] and have very poor energy efficiency. If this is the case then it may be more appropriate to remove and rebuild the houses rather than retrofit.

Historically, the highest level of demolition nationally occurred between 1961 and 1975, when the annual rate was just over 81,000 per year in Great Britain, the majority being defined as unfit. However, more recently the demolition rate has fallen; in the Leeds City Region for example, it has fluctuated between 0.02% and 0.09% of the housing stock per year during the 1990s. Even with the highest recorded level of demolition it would take over 1,000 years for the housing stock to be fully replaced.

Boardman[21] models the removal of 14% of the current housing stock, through a policy of targeted demolition. In the UK as a whole this amounts to a four fold increase in the current demolition rate, to 80,000 houses per year until 2016. There is no doubt that some of the housing stock needs to be replaced to achieve the 80% target. Increasing the demolition rate in the Leeds City Region to 0.25% of the housing stock by 2026 (in line with the UK model by Boardman would mean that nearly 3,000 houses would be demolished per year.

It is important that the most inefficient properties are targeted. Recently the criteria for demolition may have shifted as only 20% of those demolished between 1996 and 2004 were considered to be unfit[22]. To ensure that a selective demolition and rebuild policy is effective, the most energy inefficient properties must be demolished and replaced with high standard new homes. The Energy Performance Certificates act as a useful tool to identify the worst performing houses; these could be single brick terrace houses with poor insulation, single glazed windows and an inefficient central heating system. They could also be considered unfit for other reasons and a policy of demolition and rebuild that replaces these homes could have benefits beyond improving energy performance; providing generally higher quality housing.

Across the North of England approximately one third of housing is classed as non-decent – unhealthy, in disrepair, in need of modernisation or providing insufficient thermal comfort[23]. There is therefore scope to replace a number of these dwellings.

The process of demolition and reconstruction activity will create carbon emissions itself, but as long as the new buildings are more energy efficient than the previous ones then eventually these one-off emissions will be more than offset and emissions savings will be made. In terms of payback time, it would take 8 years for a house built to Code level 6 of the Code for Sustainable Homes to offset the initial emissions, taking into account the embodied energy in all the building materials. This could increase to 9 or 13 years if the houses were built to Code level 5 or 3, or if the replacement had an Energy Performance Certificate of E or F.

There is the risk that any regeneration schemes will be built only to the required building standards of that year. This may discourage the inclusion of any energy efficiency features in the rebuild which will increase the pay-back period for the carbon emissions resulting from demolition and construction. If this was the case the new housing would also require further retrofit in the future.

For this measure we assume that the new homes are built in line with the timetable for new builds in measure 1 (building better new homes).

20 To be defined as decent, a home must meet each of the following criteria: Is above the current statutory minimum standard for housing; Is in a reasonable state of repair; Has reasonably modern facilities and services; Provides a reasonable degree of thermal comfort. A Decent Home: Definition and guidance for implementation, Communities and Local Government, June 2006.

21 Boardman 2005, 40% House

22 English Housing Condition Survey, 2001

23 English Housing Condition Survey, 2005

Rebuild of demolished properties: assumptions and results

The following assumptions have been made:

- 3,000 houses a year will be replaced between 2010 and 2026. This is a total of 51,000 houses over the time period.
- Houses demolished between 2010 and 2012 will be replaced with houses achieving Code level 3. Between 2013 and 2015 they will be replaced with Code 4 houses, and from 2016 onwards they will be replaced with Code 6 houses (in line with the assumptions in the build better homes policy).
- Houses will be demolished that are considered non-decent and rated E, F or G.
- By 2026, the saving through demolition would be 18,936 kWh per house.

Regional plans indicate that demolition and rebuild policies already in place may make up a significant proportion of this target. For example, East and South East Leeds have a 20 year joint venture to replace 5,000-10,000 houses. Also in Leeds, Beeston Hill and Holbeck have plans to clear 700 units over the next 3-4 years with a policy of rebuild planned for 2010 and renewal is also being considered in Little London. Potentially an additional 20,000 back to back houses could also be replaced under a programme of urban regeneration.

If these plans for Leeds are implemented only an additional 20,000-25,000 houses would need to be demolished in order to reach the 51,000 houses target by 2026. Alternatively, the policy of demolition could be further expanded, to make additional savings, reducing the requirement in other areas such as retrofit or LZCs for existing homes.

Demolition and rebuild as described would remove another 1.3 million tonnes of CO_2e emissions from the housing sector.

Summary: Contribution from rebuild of demolished properties

- 51,000 houses demolished between 2010 and 2026.
- 51,000 replacement houses built:
  - 8,000 built to Code Level 3 2010-2012,
  - 8,000 built to Code Level 4 2013-2015
  - 35,000 built to Code Level 6 2016-2026
- Total saving: 1.3 million tonne reduction by 2026
- Percentage contribution to target: 3.4% of the required 38 million tonne reduction

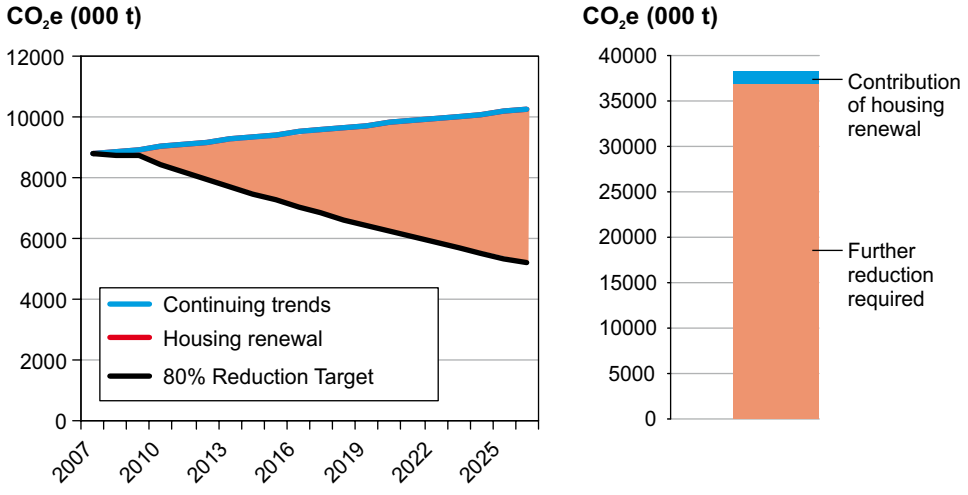


Figure 14: LZC Results

Potential Policy Mixes

Each of the measures have been analysed separately to show their potential contribution towards the target. This section combines a different selection of these measures to provide four different "Policy Mixes".

The first policy mix consists of best practice examples for new and existing homes currently undertaken at the local authority level in the Leeds City Region and investigates the potential carbon dioxide reduction attainable if all local authorities were to adopt the best practice examples. A detailed list of all the responses from the workshop on this particular issue has been included in the appendix. Some local authorities within the Leeds City region were not in a position to attend the workshop or provide feedback when requested. Therefore, there is the possibility that further best practice examples do exist that have not been documented in this study.

The first policy mix does not include any wide scale behavioural change programme and the implementation of LZC technologies because they do not occur on a wide enough scale to suggest that roll out across all the local authorities would be possible. This is not a criticism of any of the current schemes, but there are a limited number of large scale examples across the region.

Policy mixes 2, 3 and 4 contain the same measures for building new homes, retrofitting existing homes; behavioural change; and LZC technologies. These policies achieve the largest reductions so are a necessity if the 38 million tonne reduction is to be achieved. The only variation between these options is in achieving the final reductions to reach the target; through either:

- Further retrofitting (external wall insulation on those houses without cavity walls)
- Wider installation of LZC technologies
- Selective demolition and rebuild: removing the poorest energy performing houses from the stock

A summary of measures included in the four options is shown in table 3, below.

Table 3: Measures included in the four policy mixes

Measure	Best practice applied City Region-wide (1)	80% reduction Extra retrofit (2)	80% reduction Extra LZC technologies (3)	80% reduction Demolition and rebuild (4)
Building better new homes	Yes	Yes	Yes	Yes
Major retrofit of existing homes	Yes	Yes	Yes	Yes
Further retrofit	-	Yes – 90,000 houses fitted with external wall insulation.	-	-
Behavioural change	-	Yes	Yes	Yes
Low and zero carbon technologies	-	Yes	Yes	Yes and further 170,000 installations
Selective demolition and rebuild	-	-	Yes – 51,000 houses demolished between 2010 and 2026	-

The policy mixes 2, 3 and 4 will all achieve the necessary 38 million tonne reduction by 2026. Over 60% of the reduction in each option comes from expanding best practice for new homes and retrofit across the region. The remaining 40% comes from a combination of behavioural change and LZC technology, along with either selective demolition and rebuild; further LZC systems; or external wall insulation.

Each of the measures available and their individual contribution to the 80% reduction target are discussed in turn below.

POLICY MIX 1: BEST PRACTICE APPLIED THROUGHOUT THE CITY REGION

The combined impact of current LA best practice for new homes and retrofit has been shown below. The best practice scenario delivers a CO_2e reduction of 23.7 million tonnes by 2026. The majority of this reduction comes from retrofit.

The best practice policy mix has not included any regional programme for behavioural change beyond what is done nationally by the Energy Savings Trust, which we assume gives a 0.15% reduction in energy consumption per year. This reduction is modelled in both the Continuing Trends and this combined City Region best practice policy mix.

The result of combining the retrofit and new build policies shown below:

In this policy mix the largest contribution is from retrofit. The building better new homes measure is important to show leadership in the housing sector and ensure that all new homes are built the highest standard possible to prevent them needing retrofit in the future.

When the best practice measures for new builds and retrofit are combined and implemented across the region there is still a shortfall of 14.3 million tonnes. Consequently additional ways of achieving a reduction must be found – in all of following 80% reduction policy mixes (2, 3 and 4) a combination of behavioural change and LZC technologies provide these additional reductions.

Summary: Combined best practice scenario

Combining the retrofit and new homes scenario provides:

- Total saving: 23.7 million tonne reduction by 2026
- Percentage contribution to target: 62% of the required 38 million tonne reduction
- 14.3 million tonnes still required

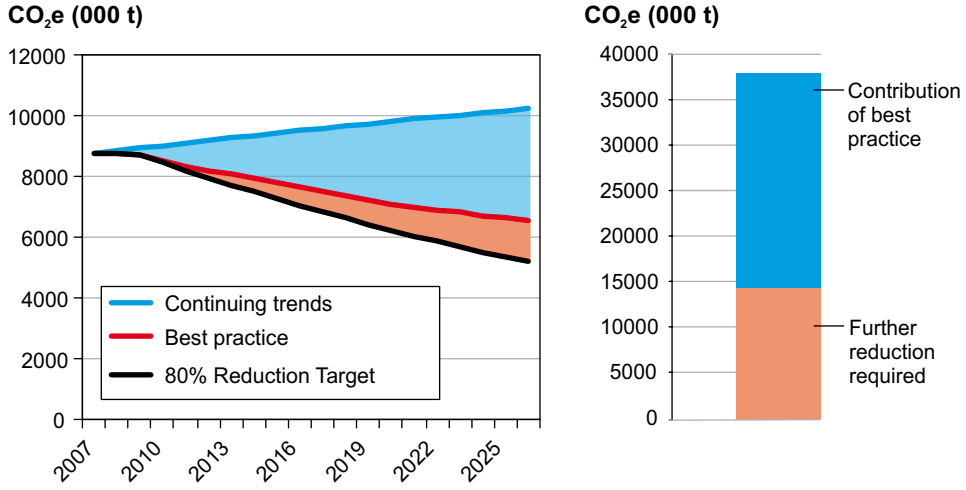


Figure 15: Best Practice Results

POLICY MIX 2, 3 AND 4: THE PATH FOR ACHIEVING THE 80% REDUCTION TARGET

There are three policy mixes shown here that could achieve the 80% reduction target. All of them include a combination of the regional best practice measures, behavioural change and the installation of LZC technologies across the existing housing stock. This provides a reduction of 36.7 million tonnes. A further 1.3 million tonne reduction is still required and this is delivered differently in each of the policy mixes.

Policy mix 2: A further 90,000 homes without cavity walls are provided with external wall insulation

Policy mix 3: A further 170,000 installations of LZC technology (on top of existing installations)

Policy mix 4: Remove and rebuild 51,000 energy inefficient homes between 2010 and 2026

A summary of the reductions from each of the scenarios and how the 38 million tonne target is achieved is shown below:

These results have also been shown in tabular form, on the next page.

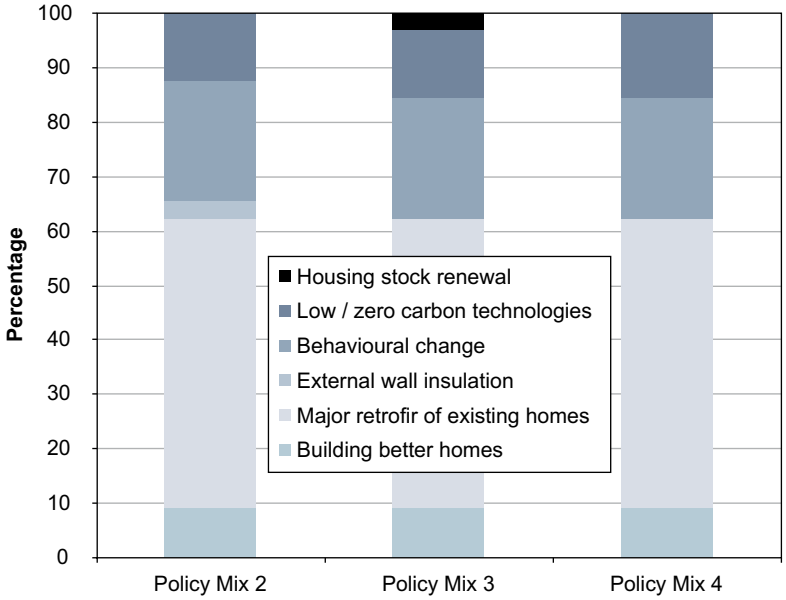


Figure 16: The Contribution of the different policy options within each policy mix.

There is scope to change the composition of the policy mix; for example demolition and rebuild could increase, reducing the need to retrofit, but any change is restricted by the reduction limits in each policy area. Retrofit measures give the greatest reductions by far, so dramatically reducing the retrofit policy would have a considerable impact on the total reductions achievable. New homes will only ever make up a limited percentage of the total housing stock unless an increased number of houses are demolished. Consequently the reductions achievable from new builds are limited.

Overall, there is a small amount of variation within the basket of policies, but it is not possible to pick and choose from a policy list; a contribution from all of them is required to achieve the necessary reduction.

To maximise the potential of any policy all decisions must be well informed. For example, when deciding upon retrofit measures it is important to understand which measures are required, most appropriate and would have the greatest impact. Similarly it is important that any selective demolition and rebuild policy targets the worst energy performing houses.

Every policy option presented in this report has the potential to have benefits beyond that of a reduction in emissions. The standard of people's homes in the region will significantly improve, providing social and potential economic benefits if the market values increase as a result of the measures. The region could become a leader in the design and implementation of low and zero carbon technologies; encouraging new industry and employment to the region.

Table 4: Details of Scenarios

Measure	Best practice applied City Region-wide (1)	80% reduction Extra retrofit (2)	80% reduction Selective demolition and rebuild (3)	80% reduction Extra LZC technologies (4)
Building better new homes	3.5 million tonne reduction (9%) from 14,000 new properties per year			
Major retrofit of existing homes	20.2 million tonne reduction (53%) from 90-95% take-up across the city region			
Further retrofit to solid wall properties	-	1.3 million tonne reduction (3.4%) from 5,000 more retrofits per year	-	-
Behavioural change	-	8.3 million tonne reduction (22%) - 0.6% energy reduction per year		
Low and zero carbon technologies	-	4.7 million tonne reduction (12.4%) from 30,000 installations per year		Further 1.3 million tonne reduction (3.4%) from 10,000 further installations per year (6 million tonnes from LZCz in total)
Selective demolition and rebuild	-	-	1.3 million tonne reduction (3.4%) from 3,000 houses removed / rebuilt per year	-
Total reductions compared with Continuing Trends	**23.7 million tonnes**	**38 million tonnes**	**38 million tonnes**	**38 million tonnes**

Regardless of the policy option selected and any additional benefits it is important that all policies are implemented as soon as possible to reduce the total CO_2e emissions. The earlier the policies are implemented the easier it will be to achieve the reduction targets. The "Distance to Target" analysis in each section highlights the importance of this for each policy.

The problem of accumulated emissions clearly demonstrates a need for an annual total emissions target. When aiming for reductions by a certain year, potentially all of the reductions could be made in the final year before the target, resulting in an accumulation of emissions in the years in between. To prevent this, an annual total emissions target could be established, meaning that the risk of increasing accumulated emissions would be minimised.

Policy Implications

General

- The creation of an overall carbon emissions reduction requirement as developed for the housing sector in this report, should be adopted for other sectors as part of a new approach to local carbon accounting.
- Implementing all the necessary measures at a sufficient scale will require commitment and co-operation between public and private sector organisations.
- Local authorities will need co-ordination and support if they are to guarantee compliance with the Code for Sustainable Homes timetable and be successful with retrofit and behavioural change campaigns. In particular, they will need help in securing appropriate funding and ensuring the necessary skills and investment are available within the private sector. The Regional Development Agency, Yorkshire Forward, could play a lead role.

Retrofit

- Each local authority will need to have a comprehensive retrofit strategy in place before 2010. The scale of investment will require a strategic regional or national funding model.
- Retrofit of 90% or more of homes represents a significant employment opportunity for the city region but will require new knowledge and skills among architects, developers and contractors involved in specifying, supplying, installing and maintaining high quality products and materials appropriate for numerous different retrofit situations.
- Retrofit of existing homes for carbon reduction overlaps and should be integrated with that for climate change adaptation – for example flood resilience, water efficiency and dealing with overheating. Ways of working together with organisations dealing with climate change adaptation, such as the Environment Agency, should be developed.
- Information collected from Energy Performance Certificates and held on database offers an opportunity for better understanding of the energy efficiency of existing housing stock to target retrofit investment.

Behavioural change

- Personalised and individually targeted approaches, giving direct and regular advice to householders, tend to be most successful and a recent House of Commons Communities and Local Government Committee report urges rapid introduction of the new Green Homes Service nationwide.
- Spatial-demographic intelligence available within the city region should be used to target messages and support to householders.
- There is potential to link with awareness, support and behavioural change campaigns for climate change adaptation especially those relating to water efficiency.

Low and zero carbon technology

- Developing technology industries to supply 30,000 installations per year within the city region, in addition to LZCs required post-2016 for zero carbon new build, is a major economic and employment opportunity for the region. Currently a large proportion of LZC technology is manufactured overseas.
- Partnerships or supply agreements between investors and specialist Energy Service Companies will be needed to finance ("off balance sheet") and deliver community-wide schemes such as biomass combined heat and power generation.

New Build

- A consistent and co-ordinated approach will be needed between planning authorities in establishing and enforcing standards and ensuring compliance with the government's challenging Code for Sustainable Homes timetable across the city region. Building regulation non-compliance is currently commonplace.

Appendix 1: Workshop Feedback on New Builds

	Current Approaches
Harrogate	Core Strategy is to be submitted to the Planning Inspectorate on the 7th September 2007 and due for adoption in 2008. In relation to building better homes the policy seeks developers to achieve Code for Sustainable Homes ratings as follows: 2008 – 2010 Level 3 2011 – 2015 Level 4 2016 – Level 6 Core Strategy will also require that other developments achieve BREEAM standards. There will be assessors available within the Council to ensure delivery and potentially monitor progress. Also expecting to rely on public pressure from future home buyers to drive compliance.
Bradford	UDP contains positive sustainable design policies but these are rarely used. The recently adopted SPD was issued before the Code for Sustainable Homes was published and hence contains no targets. Are considering revising. Intend to look to Leeds to see what they are doing.
Barnsley	New buildings above the following sizes, including conversion of existing buildings to new uses, must include equipment for producing renewable energy. Housing development of 10 homes or more Business development of 1000 square metres or more floor space Community development of 1000 square metres or more floor space The renewable energy production equipment must reduce the overall carbon emissions by at least the following; 10% for applications submitted before 2011; 15% for applications submitted from 2011 to 2015 inclusive; and 20% for applications submitted after 2015. We will refuse planning applications that do not meet these conditions The RSS impacts on Barnsley and has made an indicative estimation that there is the potential to generate 15.4 MW of renewable energy in the area by 2010 (table 15.12 draft RSS).
Leeds	Leeds currently has a suite of design policies but with no specific targets and therefore they are reportedly easy to ignore. At the time of the workshop a public consultation on the draft 'Supplementary Planning Document' was underway which will provide a set of standards for sustainable design and construction including the requirement for all new construction to be delivered at level 3. Leeds city council receive 400/500 planning applications per year so if approved would have a significant impact. The supplementary planning document also includes a target for 10% on site renewable energy generation. This target will encourage developers to be more energy efficient.
Calderdale	The UDP released in August 2006 provides mostly qualitative guidance on the provision on sustainability in new developments, however the following target has been set: Renewable energy must be provided in new builds, conversions and renovations: For major employment and retail of 1000m^2 (gross) or more and residential developments of 25 houses or more. Such developments are required to incorporate on site renewable energy generation of at least 10% of predicted energy consumption by 2010, 15% by 2015 and 20% up until 2020.
Yorkshire and Humber	The draft Regional Spatial Strategy for the Yorkshire and Humber region has set targets for increased use of renewable energy: ENV 5: Increasing in energy efficiency and increases in renewable energy capacity to 708MW by 2010 and 1862 MW by 2021.
Yorkshire Forward	The Agency's involvement in housing is principally concerned with ensuring that housing provision matches the economic needs of the region, at the strategic level. However, we might fund certain exemplar projects which relate to housing, and through our role as a statutory consultee we seek to promote best practice in terms of energy efficiency and overall sustainability of new housing developments.

Other	Carbon challenge – South Yorkshire – Level 6 initiative Housing Corporation is requiring achievement of level 3 for all Affordable Housing funded by them Draft RSS includes a sustainable housing target for 10 dwellings or more – need to follow up what the target is. North West – Will have a target of all new developments achieving 10% of their energy requirements from renewable energies as part of their RSS when it is made statutory. To assist developers the North West have developed an online tool kit to assist developers in achieving this target with both guidance and an online carbon calculator that determined the estimated energy requirements for the development and demonstrates how energy consumption can be reduced.
Future?	Intention to have policy similar to Harrogate's in Bradford. Don't have details of dates when the LDF will be developed (need to follow this up in the Local Development Scheme. Currently at issues and options stage. Need to reach out to smaller developers and provide support to help achieve higher standards Gov Office – driving forward agenda and making links between planners across the Region to keep them up to date with each other's approach Need to achieve a reasonable lead in time given how difficult it can be to achieve CfSH over level 4. Identify potential to develop links through Local Area Agreements to drive forward consistent policies and raise awareness Allow for variation until costs reduced across the Region to help sustain less affluent authority areas. Leeds council are very keen to push things forward and are aiming to approve the supplementary planning document that would require all new buildings to achieve Level 3.
Barriers	Level Playing between different authorities Impact on smaller developers given the costs associated with sustainable housing Construction skills available locally to deliver sustainable buildings Cost? (Although developers have been saying not too difficult to achieve level 3) Provision of micro renewables more difficult for smaller scale schemes Value of land – cost implication for home buyer Risk that Sustainable Homes policies could slow development down The rate of redevelopment, there are still lots of old inefficient houses. This is a new area of expertise for planners and the technical side is hard for people to get a grasp of making it easy for developers to 'pull the wool'. A planning authority can set guidelines however a developer on a site specific building will build it how they want to. The actual policing of building can be an issue as the buildings are self certified by builders. Commitment is therefore required from the company. Possible lack of skills in the industry. It has been questioned whether there are enough builders that can build to the required standards. Fro example traditionally plasters leave an inch gap between the floor surface and the plastered wall. To achieve high thermal insulation values the plaster needs to be airtight.

Appendix 2: Retrofitting

	Current Approaches
Harrogate	LA21 team has more information, contact Jane Money. The Council have created a Renewable Energy Guide with information on grant funding. There is also access to free cavity wall insulation for people on benefits and a free DIY Home Energy check and Grant advice service. Harrogate's Building Management Team are carrying out studies of different micro-renewable schemes including GSHP use
Bradford	Jane Scott to forward contact details for further information.
Kirklees	Warm Zone project is providing free insulation (contact Phil Webber) to all in the area with £21m of funding. Due to commence initiative in February.
Barnsley	Under the 'Decent Homes' programme there has been a lot of work completed through our Strategic Housing department that will reduce the CO_2 emissions from the existing housing stock e.g. effective insulation etc. As part of our partnership with the Carbon Trust on the Local Authority Carbon Management Programme phase 5 (LACM5), we are currently investigating what we might possibly do, within resource constraints, to look at reducing the carbon footprint of our existing housing stock. I believe that unless we are able to address this area then we are missing a big opportunity to reduce carbon emissions c.f. 25% of the Leeds City Region carbon footprint is from emissions from its existing housing stock.
Calderdale	No targets have been set. Affordable warmth strategy: over the last year 1,731 households have benefited from loans up to £2,700 to help pay for energy savings. However there is a lack of awareness and it is estimated that there are 30,000 homes that could still benefit from this initiative. The Calderdale health energy action programme provides energy insulation to over 60s. No data. The sunrise programme (DTI) provides grants for PV of up to 50% of the costs.
Leeds	Improvements have been mode to the council housing stock through the "warmfront" grants. A guidance note will be developed for loft conversions requiring the input of insulation.
Yorkshire Forward	As far as Yorkshire Forward is concerned this area is addressed by local authorities, and the Homes and Communities Agency.
Other	Demolition and rebuild orgs – contact Lyndsey Greenwood for further information about what the Housing Market Renewal Pathfinders are doing See Future Energy Yorkshire and Recycling Yorkshire at the Round Foundry Media Centre See local authority Decent Homes Standards WWF – producing a report focusing on retrofitting and due for publication in November. The report will look at how to work with energy companies to decrease the energy use of houses. Could learn some lessons on improving the housing stock from the pathfinders housing market renewal areas.

Future?	Follow example of Kirklees Carry out measurement of take up rates Ensure new development is of a high enough standard to avoid the need to retrofit buildings in 10 years time Work more closely with LA21/Sustainabilty teams Promote championing of the sustainable development agenda Local Performance Framework– duty on Local Authorities to be community leaders. They have a duty to report from 2008/9 – the LPF should be used to influence progress. Energy companies are considering the potential of selling 'comfortable rooms' as a way of marketing retrofitting technologies whereby the cost of the introduction of the relevant technologies is offset with cheap bills – developed as a package by the energy companies – this is an idea still under development. Incentives – tariffs – link home energy to council tax – rewards Microgeneration – Yorkshire Forward & Future Energy Yorkshire –Paul Roberts, Tania Christianson, Barnaby Fryer can provide further information. Investigate the possibility of LAs investing in housing stock to promote retrofitting Promote more public sector exemplars Make more main stream help with cost of technologies Offset our carbon emissions in the UK through investment in UK based retrofit and renewable energy schemes. Need to asses to see how far we can go with retrofitting as emphasis is currently on investment in the new housing stock. Mortgages could play a role in retrofitting, such as providing low interest loans for improving the energy efficiency of the house. Opportunity now that the housing market is slowing. People more likely to reside in current place of residence for longer period of time making retrofitting a more attractive option. Campaigning to improve awareness. This has just started at the regional level. Awareness can be raised with both the public and elected members.
Barriers	Difficult to influence private sector Compliance with incentives/initiatives How many skilled people are available to install technologies in any given area? People may not want mess of having builders into their home even if the installation is free Funding stretch and Costs National level policies The difficulties are not what we could do, but more how this would be facilitated with the costs being the main barrier to progress. Some houses do not have cavity wall insulation. Awareness - Widespread knowledge of grant assisted retrofitting schemes is limited. The irony is that the people who should benefit are those that are the least informed. People moving house therefore not willing to part fund retrofit options. Buy to let market. Possible conflict with existing period features in older houses.

Appendix 3: Behavioural Change

	Current Approaches
Harrogate	Free energy audits Harrogate Community Strategy – need to know how to respond to climate change – the Strategy shows that the Community want action Harrogate LA21 Team are involved in marketing issues in relation to Climate Change Helplines
Leeds	The climate change strategy will have a behavioural change component. This is due for publication next year. Leeds will have a 'Leeds travel' website that allows people to choose their best route home which also takes into consideration traffic, to be up and running next year.
Calderdale	Anthony Ray is developing the council's climate change action plan which will contain a behavioural change component.
Barnsley	Again under the LACM5 programme we have developed a communications strategy to help in this area regarding CO_2 emissions from the Council. In addition, we have signed up to the Nottingham Declaration on Climate Change which commits us to produce plans to assist in the reduction of CO_2 emissions across the borough – behavioural change programmes are seen as essential in achieving this objective. We currently run Sustainability Roadshow where we meet up with the public to discuss how they can reduce there CO_2 emissions and do their bit for the environment and to help mitigate climate change. We have an active Local Strategic Partnership, where we interact with our partners and key stakeholders in investigating how we can effectively engender behaviour change to reduce CO_2 emissions across the borough.
Yorkshire Forward	We are the only RDA to include a greenhouse gas target within our Regional Economic Strategy (RES), we have a target to cut greenhouse gases by 20-25% by 2016. Our objective is to become a leading edge region in reducing greenhouse gas emissions and decoupling growth and pollution. Objective 5 C) Ensure Effective Energy, Utilities and Broadband Investment of the RES sates: ii) 'Promote energy security and reduced fossil fuel dependency by more energy efficiency and clean and renewable energy generation' Objective 5 D) Protect, Enhance and Utilise the Environment and Natural Resources i) 'Deliver projects that reduce and mitigate greenhouse gas emissions and enhance economic performance ii) Deliver 'waste to work' projects to create jobs and growth through recycling and re-use iii) Harness the potential of the natural and built environment, including sustainable approaches to tourism, farming and forestry iv) Analyse and respond to flood risks associated with climate change v) Apply shared, high quality design and environmental standards for all developments receiving public sector support.' Policy ENV5 (Energy) in the Regional Spatial Strategy requires 'The Region will maximise improvements to energy efficiency and increases in renewable energy capacity. Plans, strategies, investment decisions and programmes should ..Ensuring that publicly funded housing and RDA supported development meet high energy efficiency standards.'
Other	Yorkshire – incentives to promote waste management are a good eg of how to change behaviour Community LASER (local action for sustainable economic renewal). Environment Agency – In collaboration with the carbon trust ran a campaign on World environment day to encourage residents to sign pledges in return for gifts. The North East has a climate change dome that is used at events. Inside are activities and an areas where people can make pledges to reduce their impact

Future?	Sophisticated market research Promote peer pressure Make easier to take action – show how to save money – (Caution however with money saving solutions, there is the risk of the rebound effect where people spend money saved on energy outgoings on other, perhaps more energy intensive activities such as foreign holidays) Communicating – word of mouth Primary schools – eco schools, use of questionnaires etc (See UKCIP latest schools projects with Climate Change quizzes etc) Pre-application discussions – consider the possibility of discussing incorporate of appliances into new housing developments with developers as part of the negotiations process (where links with policies to reduce overall energy consumption of a building) Sust life coaches See marketing solutions eg Mosaic Databases Desire to follow in the path of NE Lincolnshire with their global action plans and initiatives.
Barriers	Mess of retrofitting Knowing how to influence behaviour Specific targeting is important for effective behaviour change National legislation - market transformation programme Design Meters Cost of marketing also unknown cost to make a behavioural change scheme effective. Community cohesion – transient communities, multiple ethnicity, languages, growing diversity can make it more difficult to influence change A sustained effort is required to encourage behavioural change. There is a tendency for large capital projects to be more popular as the results of investment are more visible than with ongoing behaviourable change projects.

Appendix 4: Low / Zero Carbon Technologies

	Current Approaches
Harrogate	Core Strategy aims for 15% on site renewables provision There is some experimentation with GSHP and small hydro schemes Speak to Jane for examples
Bradford	Bradford have attached wind turbines to the top of five high-rise tower blocks which contribute to the lighting of communal areas.
Barnsley	Biomass scheme being developed – no date available but contact is Dick Bradford. Barnsley is proud of its work in the field of biomass implementation and associated community heating schemes – we can boast the largest in the UK. We will actively encourage microgeneration and will use the new proposed planning orders system so that householders will not need to get planning permission for the fitting of renewable energy technologies such as wind turbines. Barnsley has supported applications for wind farms in the borough where appropriate e.g. recently passed application for 7.5Mw wind farm which is 50% of our RSS target. We are confident of meeting and surpassing our RSS target.
Leeds	Vague policies and no targets. A CHP plant is intended for the new Holbeck development however the technical knowledge of implementation is an issue. The Development Plan Document (DPD) will pick up on the issue of resource use and waste generation which will include energy consumption or the Local Development Framework. The green building http://www.thegreenbuilding.co.uk/ uses a biomass boiler and designed for reduced energy consumption.
Calderdale	The current framework is vague. The UDP released in August 2006 states that wind farms or turbines are allowed, requiring that they do not pose any negative impacts to local populations and the local environment. Solar heating and PV are permitted however conservation areas should be avoided. If a building has PV then it is protected from the development of adjacent buildings that would overshadow.
Yorkshire Forward	The RDA is a statutory consultee on applications that are of regional/strategic significance, and which meet our consultation criteria . The threshold for residential developments is 500+ dwellings, and within the market towns where Yorkshire Forward is supporting a Market Town Initiative programme, the threshold is reduced to 100+ dwellings. The following thresholds are used for commercial developments B1/B2 (25,000m^2), B8 (50,000m^2), and Retail/Leisure Mixed Use (25,000m^2). In addition, we put forward representations on electricity generation schemes which produce in excess of 5 mega watts. Through our statutory consultee role we try to encourage developers and local authorities to follow best practice in terms of installing decentralised energy systems, and promoting energy efficiency within schemes. As an example of the type of comments we make on renewable energy schemes in the region, I have attached a copy of the comments we submitted in relation to a Straw Burning Power Station in the East Riding. Yorkshire Forward also support a number of exemplar projects which are designed to either bring forward new renewable energy technologies / help to bring forward market investment in schemes which will reduce the regions dependency on fossil fuels. For example, the Agency is working to help in the development of a CHP loop within Holbeck village.
Other	Yorwoods – Woodcamp boiler promotion using local fuels Y.F investing in infrastructure development Sub Regional Renewable Energy study informed RSS RSS has onsite renewables policy and looks at the micro renewables capacity for the region and sub regional areas, including targets. See 'Vision for Biomass' – due out next week Regional energy forum Future energy Yorkshire

Future?	Encourage delivery of RE targets – monitoring is v important SPD – guidance could be developed in Harrogate – and could improve link with LA21 team Specialist Agency perhaps at Regional level Manage woodland property For developments of 100 to 300 houses could create distributed energy systems Have to feed into LDF policy frameworks to ensure delivery
Barriers	Costs Supply of biofuels Designations – wind energy v Appropriate Assessment/AONB/SPA/SAC Planning policy Resistance for households to feed back into the grid. Housing density and legislation on housing density may pose issues to implementation Lack of market. We have proven technology such as ground source heat pumps which are not being used. Conservative nature of the building industry.

Appendix 5: Table of Assumptions made for Each Measure

Policy	Assumptions
Continuing Trends Scenario (and underlying trends for all other scenarios)	Housing growth: 14,000 houses per year Private sector new builds: Level 3 of Code for Sustainable Homes (CSH) by 2015, Level 4 by 2020, Level 5 by 2025. Occupancy rates: reducing from 2.41 in 2002 to 2.36 in 2026. Existing houses: improvements made similar to historical trends Underlying behavioural trends: 0.15% reduction in energy use per year National grid energy assumptions: same as current UK
Measure 1: Building Better Homes	New builds: all homes (public and private) built to CSH: • Code Level 3 2010-2012 - 25% more efficienct than 2006 Building Regulations • Code Level 4 2013-2015 - 44% more efficienct than 2006 Building Regulations • Code Level 6 2016-2026 - "zero carbon" homes
Measure 2: Retrofitting existing homes	Existing houses: 90% have energy saving light bulbs; 90% have loft insulation; 95% of those with cavity walls have cavity wall insulation; 90% with access to the gas network have condensing boiler; natural rate of change for double glazing; all by 2026 (see table below for assumed savings per retrofit measure). In total over 800,000 houses improved with retrofit measures by 2026.
Measure 3: Further retrofitting of existing homes (policy mix 2)	Estimated solid walled properties in city region: 400,000 (32% of total stock) 90,000 of these fitted with external wall insulation A saving of 11,000 kWh per house per year
Measure 4: Behavioural change	Behavioural change: annual 0.6% reduction in total energy consumption across the city region every year until 2026.
Measure 5: LZC technology and further LZC installations (policy mix 3)	LZC technology: 30,000 houses fitted with LZC technology per year, a total of 500,000 installed by 2026 (covering 35% of the housing stock). An average of 3,000kWh saving provided per installation. Further LZC: an additional 170,000 houses are fitted with a LZC by 2026 (10,000 per year).
Measure 6: Rebuild of demolished properties (policy mix 4)	Existing houses: 51,000 of the worst energy performing houses are demolished by 2026: (proportions in line with estimated percentages of existing stock at each grade) • 37,000 grade E demolished, each house ~ 15,500 kWh per year • 10,000 grade F demolished, each house ~ 21,500 kWh per year • 4,000 grade G demolished, each house ~ 32,000 kWh per year Replacement homes: • 8,000 built to Code Level 3 2010-2012 • 8,000 built to Code Level 4 2013-2015 • 35,000 built to Code Level 6 2016-2026

Retrofit Measure / LZC Technology / Behavioural change	Number of house provided with measure (approximate/rounded figures)	Annual energy savings (kWh/year)
Loft insulation 0 to 270mm	185,000	6,149
Loft insulation 25 to 270 mm	300,000	2,772
Cavity wall insulation	450,000	3,305
Double glazing	220,000	1,618
Condensing boiler	250,000	3,411
Solar water heater	Incl. in average for LZCs	1,706
Ground source heat pump	"	10,893
Photovoltaics (2 kWp)	"	1,500
Turn heating down 1°	Incl. in average for behavioural change	1,376
Turn off lights	"	72
CFLs	For reference*	34
Kettle	For reference*	51

* These are included in the table for reference as they are shown in Figure 11 (pg 17) however, they are not included in the modelling for any of the measures

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The Stockholm Environment Institute

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