IT Power

PLANNING FOR CLIMATE CHANGE

Energy Efficiency Recommendations for New Developments

Final Report

May 2008

ITP/1017

Melton Borough Council

North West Leicestershire District Council
at the heart of the National Forest

Rutland County Council

Blaby District Council

District of Harborough

Hinckley & Bosworth Borough Council
A Borough to be proud of

Hinckley & Bosworth Borough Council
Rutland County Council
Blaby District Council
Oadby and Wigston Borough Council
North West Leicestershire District Council
Harborough District Council
Melton Borough Council

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Energy Efficiency Recommendations for New Developments

May 2008

Contractor:

IT Power
Grove House,
Lutyens Close, Chineham,
RG24 8AG, United Kingdom.
Tel. +44 1256 392700
Fax. +44 1256 392701
E-mail: itpower@itpower.co.uk
http://www.itpower.co.uk

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Author	Sharlene Wilson
Project Manager	Sarah Davidson
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1 INTRODUCTION

The Planning for Climate Change Project was initiated to provide evidence to underpin the preparation of future planning policy relating to climate change in the following local authority areas of Leicestershire and Rutland:

- Blaby District Council
- Harborough District Council
- Hinckley and Bosworth District Council
- Melton Borough Council
- North West District Council
- Oadby and Wigston Borough Council
- Rutland County Council

There are three key parts to the project:

1) Climate Change Assessment of Core Strategy Strategic Options

2) Renewable Energy Opportunities – Quantification of the potential for renewable energy in each of the seven local authority areas

3) Energy Efficiency Recommendations for New Developments - An assessment of the extent that it may be technically and economically possible to expect new buildings to reduce their carbon dioxide emissions beyond the requirements of the Building Regulations.

An executive summary summarising the project as a whole is available in a separate document.

This report contains the findings of the third part of the project – Energy Efficiency Recommendations for New Developments

This document aims to assess the extent that it may be technically and economically possible to reduce the carbon emissions of new buildings beyond the requirements of the building regulations, using energy efficiency measures.

The report is set out in three main parts, which are described below:

Section 2 - outlines the requirements of the existing building regulations and gives a summary of the predicted evolution of English Building Regulations for domestic and non-domestic buildings in terms of Target Emission Rates (TERs).

Section 3 - examines the technical and financial implications of applying energy efficiency measures; and

Section 4 - discusses policy options.

2 REVIEW OF EXPECTED EVOLUTION OF BUILDING REGULATIONS

The Building Regulations were originally developed to ensure dwellings are safe and suitable for application. Several amendments have been made over the past two decades, including the issuing of Part L of the Building Regulations, which focuses on fuel and energy conservation in new and existing buildings.

The most recent revision of Part L of the Building Regulations was introduced in 2006 and is being used as the main mechanism for implementing key aspects of the European Energy Performance of Buildings Directive (EPBD), which is a set of legislation aimed at improving the energy performance of buildings.

While increasing demand for more efficient buildings is driving constant reviews of the regulations for new and existing buildings, this paper will only consider the development of Building Regulations (BR) with regard to new builds. The sections of Part L relevant to new builds are:

- New dwellings – Approved Document L1A: Conservation of fuel and power (ADL1A)
- New buildings other than dwellings – Approved Document L2A: Conservation of fuel and power (ADL2A)

The regulations are set in terms of the energy use of the building **for heating, hot water and lighting only**, (expressed in carbon dioxide emissions) compared against a target emission value, which is a stated percentage improvement on a theoretical building complaint with 2002 Part L regulations.

Since the building regulations currently apply to only energy used for heating, hot water and lighting the emissions associated with these uses are referred to as **'Regulated Emissions'.**

The five main new-build criteria that must be satisfied under Part L can be summarised as:

1. The energy use of the building as built is not greater than the Target Emissions Rate (TER).
2. The performance of the building fabric and all fixed services should be no worse than the design limits.
3. Appropriate provisions are made to limit the effect of solar gains
4. The performance of the dwelling as built is consistent with the predicted emission rate.
5. Necessary provisions for energy efficient operation of the dwelling are established.

The manner in which new dwellings and buildings other than dwellings must demonstrate these criteria is largely similar, as outlined in **Table 1** below.

Table 1 – Building Regulations New build Criteria

Criterion		**Demonstrating compliance**	
		ADL1A (dwellings	**ADL2A (non-dwellings**
1	Predicted CO_2 emissions from building	The Dwellings Emission Rate (DER) is not greater than the Target Emissions Rate (TER)	The Building Emission Rate (BER) must be no greater than the TER
2	Design Limits	The performance of the building fabric, heating, hot water and fixed lighting systems should be no worse than the design limits	The performance of the building fabric, heating, hot water and fixed lighting systems should be no worse than the design limits

Criterion		Demonstrating compliance	
		ADL1A (dwellings	ADL2A (non-dwellings
3	Provisions to limit the effect of solar gains	The dwelling has appropriate passive control measures to limit the effect of solar gains on internal temperatures in summer	Where cooling systems are not provided, total gains including solar and internal gains must be limited
4	Quality of construction and commissioning	The performance of the building as built must be consistent with the predicted emissions rate (DER)	The performance of the building as built must be consistent with the predicted BER
5	Information provision	Provisions must be made to allow for energy efficient operation of the building	Provisions must be made to allow for energy efficient operation of the building

2.1 ADL1A – New dwellings

As outlined in Table 1 the Building Regulations compliance route is based almost entirely on target carbon dioxide (CO_2) emission rates. As such, the Dwellings Emission Rate (DER) and TER are key aspects of ADL1A and are calculated using the Standard Assessment Procedure (SAP) tool, which is the Governments methodology for assessing the energy performance of dwellings. The SAP calculation takes into account energy used for space heating, fixed lighting and hot water provision. While it currently does not have any provisions for energy consumed by appliances, it is likely to be updated to allow for this in the future.

The DER and TER are defined as follows:

- The DER is the estimated annual carbon dioxide emissions per square metre of the building arising from energy used in **heating, hot water and lighting**.
- The TER is the maximum allowable carbon dioxide emissions per square metre for energy use in heating, hot water and lighting in new dwellings. It is expressed in terms of the annual CO_2 emissions, in kg per m^2 of floor area.

The TER is determined by calculating the CO_2 emission rate from a hypothetical dwelling compliant with the 2002 regulations and with the same physical dimensions of the actual dwelling, after which a fuel factor and an improvement factor is applied.

The fuel factor applied is dependent on the primary heating fuel used and the improvement factor is the target improvement from the 2002 baseline for a gas heated dwelling. The improvement factor represents the CO_2 reductions required and is set at 20% in current regulations.

The design limits set out in the Building Regulations gives essential framework for achieving the TER. Design limits have been set for the building fabric by limiting the U-value, which represents rate at which heat escapes from a building and is the primary measure of energy efficiency. Standards are also defined for the rate of air infiltration and the plant efficiency and controls of all fixed services. These limits are outlined in further detail in Section 3.1.

2.1.1 Other Mechanisms Driving Improved Energy Efficiency in Dwellings

Code for Sustainable Homes

The Code for Sustainable Homes was introduced in December 2006 as a new standard for sustainable design and construction of new homes across England. The Code assesses the sustainability of a new home against nine design categories, rating the 'whole home' as a complete package.

The Code has six performance levels and sets minimum standards for materials, surface and water run-off. In addition minimum standards for at each level of the code are set for waste, energy and water use. The minimum standards of energy improvement required at each level are summarised in Table 2. These are presented as percentage reductions in Design Emission Rate over and above 2006 Part L requirements.

Table 2 - Code Levels for Mandatory Minimum Standards in CO_2 Emissions

Code Level	1	2	3	4	5	6
Minimum percentage reduction over 2006 Part L	10%	18%	25%	44%	100%	"Zero Carbon Home"

Whilst for new private homes, achieving the different levels is not mandatory, from May 2008 it is mandatory for a Code sustainability certificate or a nil rated Certificate (where an assessment has not taken place) to be included in the Home Information Pack as information to prospective purchasers of properties in England. This applies to all new homes that are marketed for sale. This policy is designed to improve customer awareness of the Code and encourage the uptake of higher rated homes. Currently developers of social housing funded by the Housing Corporation are required to meet level three of the code.

2.1.2 Likely Future of Part ADL1A

In the drive to improve the energy performance of homes, the Government it has stated its intention to achieve "zero carbon" new homes by 2016. The government defines a zero carbon home as one that achieves zero net carbon emissions from all the energy used in the dwelling over period of one year. That is, energy needed for heating, lighting, hot water and all electrical appliances must be obtained from renewable or low carbon sources. (See also Box 1 on page 8.

It seeks to achieve this goal using a number of mechanisms, including the progressive tightening the Building Regulations in 2010, 2013 and 2016, to improve the energy performance of new dwellings.

Current proposals for the amendments to Part L relevant to dwellings recommend carbon reductions of 25% and 44% above the 2006 regulations in 2010 and 2013, moving to zero carbon in 2016. As the figures in Table 2 show, the energy efficiency improvements required to achieve Code levels 3, 4 and 6 are in line with proposed Building Regulations revisions of 2010, 2013 and 2016. This is summarised in Table 3 below.

Table 3 – Expected evolution of Part L 2006

	2010	2013	2016
Improvement in energy performance compared to 2006 Building Regulations	25%	44%	"Zero Carbon"
Equivalent Code Level	3	4	6

As the Code uses Part L 2006 as its baseline, it is expected that it will be reviewed and its performance standards updated in order to reflect the energy efficiency changes planned to Part L of the Building Regulations in 2010 and beyond.

The SAP calculation procedure will be revised and updated and will address a range of issues including monthly instead of annual energy calculations; reviewing the provisions for passive solar control; and a review of procedures for handling low or zero carbon systems[1].

2.2 ADL2A – New buildings other than dwellings

The compliance route for new non-domestic buildings is also based on target emission rates. In the case of new buildings other than dwellings, the predicted Building Emission Rate (BER) and the TER are calculated using Simplified Building Energy Model (SBEM).

As outlined previously, the BER must be no greater than the TER, which is the maximum permitted CO_2 emission rate. The TER for non-domestic new-builds is determined using the formula below:

TER = $C_{notional}$ x (1 – improvement factor) x (1 – LZC benchmark)

Where:

- $C_{notional}$ is the CO_2 emission rate from a notional building compliant with 2002 standards
- Improvement factor – target improvement from the 2002 standards
- LZC benchmark – is the benchmark provision for low and zero carbon (LZC). This element is currently not mandatory but can make notable contributions to achieving TERs.

The CO_2 reductions required vary according to building type as summarised in Table 4 below.

Table 4 – Carbon reduction requirements in non-domestic buildings

Building services	**Improvement factor**	**LZC benchmark**	**Target Improvement**
Heated and naturally ventilated	0.15	0.10	23.5%
Heated and mechanically ventilated	0.20	0.10	28%
Air conditioned	0.20	0.10	

[1] Building Regulations. Energy efficiency requirements for new dwellings. 2007. Communities and Local Government

Under current regulations, the improvement factor is 15% for naturally ventilated buildings and 20% for mechanically ventilated and air conditioned buildings, and the LZC benchmark factor is 10%. Combining these factors results in a target improvement above 2002 Building Regulations of 23.5% for naturally ventilated buildings and 28% for mechanically ventilated and air conditioned buildings.

2.2.1 Likely Future of Part L2A

Although much of the proposals to the alterations of the Building Regulations focus on the domestic sector, it is expected that similar targets and timelines will be set for the non-domestic sector.

It is anticipated that non-domestic buildings will be required to reduce their carbon emissions by at least 25% and 44% above the 2006 baseline in 2010 and 2013 respectively, working towards an aspiration of zero carbon by 2019[2], subject to consultation later on this year.

Work is currently being done to develop a Code for Sustainable Buildings, a tool equivalent to the Code for Sustainable Homes, to create a framework within which industry can construct buildings to higher environmental standards.

2.3 Summary

The Government is using the Building Regulations as one of the main policy tools to drive improvements in the energy performance of buildings. Part L of the Building Regulations focuses on fuel and conservation and sets minimum standards for the carbon dioxide emissions of buildings. Compliance is dependent on achieving a stated target emission rate (TER) for a proposed building.

In the drive to achieve "zero-carbon" buildings, changes to Part L of the Building Regulations are planned. Much of the focus has been placed on housing, and as a result timelines and measures are better defined in dwellings than non-dwellings. However, it is expected that they will both follow similar trajectories which are summarised below.

Table 5 – Planned changes to Building Regulations

	% CO2 improvement above 2006 Building Regulations	
Year	New Dwellings	New Non-Dwellings
2010	25%	25%
2013	44%	44%
2016	'zero carbon'	-
2019	-	'zero carbon'

[2] Communities and Local Government. March 2008. Press release

The proposed amendments to the Building Regulations will initially stipulate a 25% reduction in the carbon emissions of all new buildings by 2010 compared to the target emission rate as defined under Part L of the 2006 regulations.

Targets will be tightened further in 2013 which will see the targets set to achieving a 44% improvement on 2006 TER before moving towards the zero-carbon (see Box 1 below) standard in 2016 for dwellings and 2019 for non-dwellings.

The SAP tool currently does not account for energy use for cooking and appliances. However, it is anticipated that these energy uses will be included in SAP from 2016.

The Code for Sustainable Homes is key tool for improving the energy performance of dwellings and is set to be used alongside the Building Regulations, as the main driver in the move towards zero carbon developments. One mandatory requirement of the Code is concerned with energy efficiency and requires a percentage reduction in energy use over and above 2006 Part L Building Regulation requirements. Code levels 3, 4 and 6 require improvements of 25%, 44% and 100% respectively, which is in line with the proposed Building Regulation changes. It is expected that the Code will be reviewed and updated to reflect the changes to the Building Regulations.

Until an equivalent Code for non-dwellings is developed the Building Regulations will remain the main policy tool for carbon improvements in this sector.

Box 1: Zero carbon –some definitions (see also section 3.1.4)

Typically the energy used in a building for lighting and appliances, cooking, heating and hot water is provided by grid electricity and natural gas. In the UK grid electricity is generated mainly from fossil fuels and also nuclear energy and a small contribution from renewables. On average for each unit of electricity delivered to a building, 0.43kg of carbon dioxide is emitted into the atmosphere. For each unit of gas used for heating and cooking 0.19kg of carbon dioxide is emitted.

A zero carbon development is one that achieves zero net carbon emissions from energy use on site, on an annual basis.[3] This means that emissions associated with energy use on the site are balanced by renewable energy generated on site.

A zero carbon home will be designed to be very energy efficient so the energy demand of the home is very low. Renewable energy systems such as solar water heating and solar photovoltaics (solar electric) will provide all of the energy required. The home would normally be connected to the grid to enable import and export of electricity and would have zero net emissions associated with energy use on site.

Technical definition -as described in the Code for Sustainable Homes Technical Guide[4]

Where net carbon dioxide emissions resulting from ALL energy used in the dwelling are zero or better. This includes the energy consumed in the operation of the space heating/cooling and hot-water systems, ventilation, all internal lighting cooking and all electrical appliances, these are now dealt with under Section 14 of SAP 2005 extension for SDLT. The calculation can take account of contributions from onsite renewable/low carbon installations. Zero Carbon homes with the Code can also take advantage of the allowance with Section 14 to omit the requirement for secondary heating where applicable.

Off-site renewable contributions can only be used where these are directly supplied to the dwellings by private wire arrangement.

Dwellings must meet the minimum mandatory energy requirements for Level 5. This means that emissions as calculated by SAP, including the contribution from any special cases, should be zero or better.

A ‘zero carbon home’ is also required to have a Heat Loss Parameter (covering walls, windows, air tightness and other building design issues) of 0.8 W/ m2K or less, and net zero carbon dioxide emissions from use of appliances and cooking in the homes (i.e. on average over a year). SAP does not contain any provision for energy consumption of appliances but is likely to be updated to do so in due course. Until SAP is updated, the appliances and cooking element of the qualification will be calculated using the formula in the calculation procedures to approximate the average appliance and cooking energy consumption. This additional power must be renewable power produced either within the area of the building and its grounds, elsewhere in the development, or elsewhere as long as the supply is via a private wire arrangement with robust contractual agreements in place to ensure continued supply over time.

[3] Towards Zero Carbon Developments: Supportive Information for Boroughs, London Energy Partnership, June 2006

[4] Code for Sustainable Homes Technical Guide, Department for Communities and Local Government, April 2008

3 ASSESSMENT OF CURRENT AND FUTURE OPTIONS AND COSTS FOR IMPROVING ENERGY EFFICIENCY

Reducing carbon emissions is a key aspect of tackling climate change. Buildings in the UK account for over 40% of the carbon emissions in the UK[5]. As a result, a number of policies are being pursed in an effort to reduce the carbon emissions of buildings. While there is significant opportunity to reduce the carbon emissions of the existing stock, this report considers the measures that can be taken to reduce the energy consumption of new buildings.

Reducing the carbon emissions of new buildings is achieved primarily through improving the building fabric, increasing the efficiency of the way the building is heated and ventilated and the use of energy efficient lighting and appliances.

Renewable energy technologies also contribute significantly towards reducing the carbon emissions of buildings and are a key element in achieving zero carbon developments.

3.1 Achieving energy efficiency over and above the building regulations - Dwellings

The Building Regulations drive improvements in the energy performance of the building by setting minimum standards on the heat loss through the fabric and dictating limits on the amount of energy that is used for heating, hot water and lighting. They do not currently regulate the energy used for cooking and appliances. However, these systems account for approximately 30% of domestic CO_2 emissions[6] and the uptake of more efficient alternatives have a role to play in reducing carbon emissions.

The table below shows typical energy consumption figures for different types of dwellings, built to the current Building Regulations (approved document Part LA1 2006) and also to higher standards of energy efficiency.

Table 6: Typical primary energy use in new homes [7]

Type of home	**Top floor flat (61m²)**		**Mid terraced house (79m²)**		**Semi-detached house (89m²)**	
Energy efficiency standard	Heating (space and water), kWh	Other energy, kWh	Heating (space and water), kWh	Other energy, kWh	Heating (space and water), kWh	Other energy, kWh
Part LA1 2006 compliant	5083	3374	5460	3983	6835	4371
Best practice	4575	3154	4914	3711	6152	4065
Advanced Design	<3558	2714	3822	3167	4785	3454
PassivHaus	<915	2714	<1185	3167	<1335	3454

[5] DUKES 2003

[6] Minimising CO_2 Emissions from New Homes. 2006. AECB

[7] CE190 Meeting the 10 per cent target for renewable energy in housing – a guide for developers and planners, Energy Savings Trust, 2006)

As outlined earlier, the current Building Regulations sets minimum energy performance standards for new builds through five main compliance routes. Design limits have been set for the building fabric by limiting the U-value and standards have been defined for the rate of air infiltration, the efficiency of all fixed services and their controls. The design limits for a traditional gas heated dwelling with a useable floor area of less than $150m^2$ is summarised in **Table 7** below. It should be noted that the standards for most of the elements will need to exceed the limits detailed below to achieve the required TER.

Table 7 – Design Limits for gas heated dwellings (useable floor area of <150 m^2)

Criterion 1: Predicted CO_2 emissions from building		
DER no greater than TER		
Criterion 2: The performance of the building fabric and fixed services should be no worse than the design limits		
Design aspect	Element	Limits
Building fabric U-values (W/m^{2}K)	Wall	0.35
	Roof	0.25
	Floor	0.25
	Window and doors	2.2
Ventilation system	Natural ventilation with intermittent extract fans	
	Or balanced mechanical ventilation with heat recovery efficiency 66% and specific fan power of 2W/litre/s	
Heating and hot water	Boiler	Condensing boiler; SEDBUK Efficiency 85%
	Controls	Boiler interlock; zoned heating with independent temperature control; time control of space and water heating; TRV to control temp of space heating.
	Water heating	Hot water cylinder with thermostat
	Secondary heating	10% of total heating requirements provided by electric heaters (unless specific provision made for fixed secondary heating)
Lighting	30% of all fittings to be energy efficient	
Criterion 3: Provisions to limit the effect of solar gains		
The dwelling has appropriate passive control measures to limit the effect of solar gains on internal temperatures in summer		
Criterion 4: Quality of construction and commissioning The performance of the building as built must be consistent with the prediction made in the DER.		
Air tightness	10m^3/m^2/hr	
Thermal bridging	0.08 W/m^{2}K	
Criterion 5: Provisions of information and future proofing		
Occupants provided with operating and maintenance instructions for both fixed building services, such as information on how to use the time and temperature settings of heating controls and the energy rating of the home. This is to help achieve energy efficient operation.		

3.1.1 Technical measures for improving energy efficiency

Compliance with the Building Regulations is demonstrated by achieving a DER that is equal to or less than a calculated TER. As outlined previously the TER (given in units of kg $CO_2/m^2.yr$) is a measure of the buildings energy performance taking account of the energy used for fixed internal lighting, space heating and hot water. Hence, improvements to the TER and by extension - the dwellings carbon reductions - can be made by reducing the rate at which heat is lost through the fabric and openings in a dwelling and maximising the efficiency and performance of the heating and lighting system. Measures that can be applied to various elements of a dwelling to reduce its carbon emissions are summarised in the following paragraphs.

Building Fabric

The U-value represents rate at which heat escapes from a building and is the primary measure of energy efficiency. Reducing the U-values of the external walls, floors and glazing will reduce the rate at which heat is lost from the building, hence reducing the heating costs. This can be achieved by increasing and/or improving the insulation levels of walls, roofs, floors and windows.

Reducing the average U-value of the walls can be achieved by increasing the insulation levels. For example, considering a house built using traditional methods, an average wall U-value of 0.22 W/m^2K can be achieved using masonry wall with a 150mm cavity fully filled with fibre insulation. This U-value could also be achieved for structural concrete block walls with external insulation and render with thicknesses of around 300mm.

Ventilation

The rate of air flow through the building affects its ability to retain heat. Air permeability or infiltration refers to the uncontrolled flow of air through gaps in the building fabric while ventilation refers to the controlled flow of air through buildings. Both the permeability of the building fabric and the efficiency of the ventilation system are important aspects of a buildings energy performance.

Building Regulations currently recommend air infiltration levels of $10m^3/m^2/hr$. However, it is possible to reduce this level to $1m^3/m^2/hr$ using improved construction techniques such as to plaster or screed the inside surfaces of walls, floors and ceilings.

Natural or mechanical ventilation systems can be used to ensure adequate ventilation. The Building Regulations sets minimum standards for the efficiency of mechanical ventilation systems and the performance of these systems can be improved by incorporation with a heat recovery system and by using low power consuming fans.

Heating

Improving the energy performance of the heating system can include a range of measures such as improving boiler efficiency, temperature and timed control of heating and hot water system, and creating zoned heating spaces. Building regulations require a boiler with a minimum efficiency of 85% to be installed. However, boilers with efficiencies of over 90% are readily available.

Construction details

Accredited construction details are used by the majority of UK house builders and have the effect of increasing the overall U-vales in the dwelling by $0.08kW/m^2$ to allow for thermal bridging. A series of proprietary construction details which will have the effect of increasing overall U-values by $0.04kW/m^2$ thereby increasing the thermal properties of the building, are being developed. This improved construction detail will include separate inner and outer lintels in masonry cavity walls.

3.1.2 Instruments for improving energy efficiency

In addition to the Building Regulations, a number of standards that drive increased energy efficiency in homes exist. These include standards such as the Code for Sustainable Homes (CSH); PassiveHaus; Energy Savings Trust's (EST) Guidelines; and the Sustainable Building Association (AECB) Standards. Each of these tools set minimum standards on energy performance that surpasses that of current Building Regulations.

Of these, the Code for Sustainable Homes has been adopted by the Government as the main supporting policy tool to drive reductions in carbon emissions in housing and is set to become compulsory in May 2008. The Code provides guidance on how to achieve the energy improvements required above the 2006 building regulations for each of its six levels.

3.1.3 Analysis of measures and costs for achieving carbon reductions

A cost review of the Code for Sustainable Homes was carried out by Cyril Sweett[8] which applied a range of scenarios to baseline house models to meet the energy targets required at each level of the Code. In one such scenario, a range of carbon saving measures, with the exception of the use of renewables, was applied to the baseline model to meet the energy targets required at each Code levels 1 to 3. This report focuses on increasing energy efficiency measures and as such, much of the discussions of this report are based on these findings, which are summarised in Table 8 below.

Code level 4 (or a 44% reduction on current standards) could not be achieved with the approach used by Cyril Sweett. However, the EST has developed Advanced Practice[9] guidance that aims to achieve a CO_2 reduction of 60% compared to Part L1A 2006. It is considered to be broadly equivalent to Code Level 4 by the Communities and Local Government (CLG) and is based on PassiveHaus standards. Measures and cost estimates to achieve this level of carbon reduction without the use of renewables are based on EST recommendations and findings from the Passive-On[10] project.

Based on techniques and technologies currently available, it is not possible to achieve a 100% improvement on 2006 TER (Code level 5) or a zero carbon home (Code level 6) without the use of renewable energies (such as solar water heating) or low carbon technologies (such as combined heat and power).

[8] A Cost Review of the Code for Sustainable Homes. 2007. Cyril Sweett

[9] Demonstrating compliance, Advanced Practise (2006 edition). Energy Saving Trust. www.energysavingtrust.org.uk/uploads/documents/housingbuildings

[10] Passive-On was a research and dissemination project aimed at promoting the concept of Passive Houses. http://www.passive-on.org/en/

This section aims to review cost implications of improving energy efficiency in domestic properties and will consider a semi-detached house built using traditional methods with a floor area of approximately 100m^2 that uses gas as the primary heating fuel and is compliant with the Building Regulations. Step improvements to the building to achieve energy performance improvements up to 60% above the current regulations without the use of renewables are considered and summarised in Table 8 below.

Measures applied and their respective costs showed negligible variation when applied to a detached house, hence the figures included in the table below are representative of both traditional detached and semi-detached houses.

Table 8 – Step improvements in energy efficiency for a semi-detached dwelling

<table>
<tr><th rowspan="2"></th><th>Baseline TER</th><th colspan="4">% improvement in energy efficiency (TER)</th></tr>
<tr><th>2006 Part L compliance package</th><th>10%
(Code Level 1)</th><th>18%
(Code Level 2)</th><th>25%
(Code Level 3)</th><th>44%
(Code Level 4)</th></tr>
<tr><td colspan="6">Building Fabric: Insulation levels and construction details (W/m^2K)</td></tr>
<tr><td>Roof</td><td colspan="4">0.14</td><td>0.15</td></tr>
<tr><td>Walls</td><td colspan="2">0.28</td><td colspan="2">0.25</td><td>0.15</td></tr>
<tr><td>Ground Floor</td><td colspan="4">0.22</td><td>0.15</td></tr>
<tr><td>Windows</td><td>1.8</td><td>1.8</td><td>1.3</td><td>1.5</td><td>0.8</td></tr>
<tr><td>Doors</td><td colspan="4">2.00</td><td>0.8</td></tr>
<tr><td>Thermal bridging</td><td colspan="3">0.08</td><td>0.04</td><td>0.01</td></tr>
<tr><td colspan="6">Ventilation</td></tr>
<tr><td>Infiltration ($m^3/m^2/hr$)</td><td>10</td><td colspan="2">5</td><td>3</td><td>1</td></tr>
<tr><td>Ventilation</td><td colspan="3">Natural ventilation with intermittent extract fans</td><td colspan="2">Mechanical ventilation with heat recovery 85% (specific fan power of 1W/s)</td></tr>
<tr><td colspan="6">Heating</td></tr>
<tr><td>Boiler</td><td colspan="2">Condensing boiler; SEDBUK B, Seasonal Efficiency 85%</td><td colspan="2">High efficiency (91.3%) condensing boiler</td><td></td></tr>
<tr><td>Heating system controls</td><td>Programmer;
Room thermostat;
TRV's
Separate time control for space and water heating</td><td colspan="4">Delayed start thermostat;
Zoned time and temperature control to heating system</td></tr>
<tr><td>Hot water system</td><td>Hot water cylinder</td><td colspan="4">Add thermostat in hot water cylinder and separate time control for hot water system</td></tr>
<tr><td colspan="6">Lighting</td></tr>
<tr><td>Fixed low energy lighting</td><td colspan="3">30%</td><td>75%</td><td>100%</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Average[11] cumulative cost</td><td>0</td><td>275</td><td>1715</td><td>4200</td><td>8300</td></tr>
<tr><td>% increase in build cost</td><td>0</td><td>Less than 1%</td><td>2 – 3%</td><td>4-6.5%</td><td>5.5-10%</td></tr>
<tr><td>Annual CO2</td><td>-</td><td>1.68</td><td>1.23</td><td>2.28</td><td>6.91</td></tr>
</table>

[11] Average cumulative cost of applying measures in traditional detached and semi-detached dwelling.

savings (kg/m2)					

Table 8 shows that a 10% improvement in TER (Code level 1) can be achieved with a minimal (less than 1%) increase in build costs. This improvement was accomplished by improving the controls to the heating and hot water systems - allowing heat to be provided to the required areas only, and reducing air leakage to $5m^3/m^2/hr$. Implementation of these measures resulted in annual savings of approximately 1.70 kg CO_2 per square meter.

To achieve an 18% reduction in energy use the U-values for the external walls and windows were reduced to 0.25 and 0.13 W/m^2K respectively and the efficiency of the boiler improved from 85% to 91.3%. These measures will save approximately 1.3 $kgCO_2/m^2$ annually and can be achieved at an increase in build costs not exceeding 3%.

The energy efficiency measures outlined thus far were built on to realise a 25% increase in the energy performance of the dwelling. This was achieved by adding a whole house balanced mechanical ventilation system with high efficiency (85%) heat recovery system with a specific fan power of 1W/s, reducing air leakage further to $3m^3/m^2/hr$ and using proprietary construction details to give a thermal bridging value of $0.04W/m^2K$. Incorporating these measures will increase build costs by approximately 5% and will result in additional carbon savings of 2.3 kg/m^2 per year.

The EST Advanced Practice Standard, which is largely based on PassiveHaus standards, has been designed to achieve a 44% reduction in 2006 TER. It is considered to be broadly equivalent to Code Level 4. This standard mandates that the total energy demand for space heating is limited to $15kWh/m^2$ per year compared to $55kWh/m^2$ per year for a home compliant with the Building Regulations and limits the primary energy use for all applications (including space heating) to $120kWh/m^2/yr$, encouraging the use of energy efficient lighting and appliances throughout. The PassiveHaus principle aims to reduce the demand for heating and cooling to a level that negates the need for a traditional heating system.

To achieve this level of energy efficiency it is necessary to reduce the average U-values of all the external elements to 0.15 W/m^2K and the windows and doors to 0.08 W/m^2K. The use of passive design to maximise the effects of solar gain is also key in realising this goal. Air infiltration must be less than $1m^3/m^2/hr$ and a mechanical ventilation system with a specific fan power of less than 1W/s and a highly efficient heat exchanger with a heat recovery rate of over 80% employed.

Currently approximately 6000 homes have been built to this standard Europe, 4000 of which in Germany. With the bulk of the remaining Passivehaus developments in central Europe, there is very little experience of building to these standards in the UK. Based on experience from these developments, analysts from the Passive-On project estimate that the cost of building to this standard lies between 5.5 % and 10% of the total build cost.

Although more work is needed to clearly define the costs involved in building to this standard, these initial results show that is it possible to improve the energy performance of homes up to 60% above the current Building Regulations, without the use of renewable, at costs in the region of 10% of build costs.

Table 9 summarises the increase in build costs needed to achieve reductions in carbon emissions above current regulations without the use of renewables. Findings suggest that it is possible to achieve highly energy efficiency homes at a cost of up to 10% of total build costs[12].

[12] A Cost Review of the Code for Sustainable Homes. 2007. Cyril Sweett

Table 9 – Costs of making energy efficiency improvements above Building Regulations without the use of renewables

% Improvement on 2006 TER	Equivalent Code Level	% increase in build costs
10	1	< 1%
18	2	2 – 3%
25	3	4 – 6.5%
44-60	4	5.5 – 10%

These findings are in line with results of a separate study carried out for the South West Regional Assembly, South West Regional Development Agency and the Government Office for the South West.[13]. The in-depth analysis showed that a 100% improvement in regulated emissions can be achieved for about 1-12% extra build costs (of which 4% is for energy efficiency measures).

Most recent work for the Department of Communities and Local Government[14] indicates that where it is possible to use medium or large scale wind on or just off site, this can provide some cost effective solutions. For example zero carbon can be achieved for an end of terrace home for around 12% additional costs and a Code Level 4 home for 3% additional costs compared to 42% and 14% where wind is excluded.

Further work on developing robust information on additional costs is ongoing. Actual costs of achieving high levels of energy efficiency and the higher levels of the Code for Sustainable Homes will be reported by English Partnerships and works especially relating to the 'Carbon Challenge Programme' completes.

3.1.4 Zero carbon homes

The improvements in energy performance discussed thus far are equivalent to Code levels 1 to 4. It has been shown that Code levels 1 – 3 can be readily and affordably achieved with existing techniques and technology without the use of renewables. Code level 4 is essentially a high efficiency house and although there is limited practical experience in the UK, it is possible to achieve this level of reduction without the use of renewables.

Code level 5 requires a 100% reduction in carbon emissions over current requirements. It should be noted that current Part L loads do not include electricity for appliances, and at this level, grid electricity can be used without a requirement for offsetting emissions.

A Code level 6 or zero carbon home is defined as one which has no net carbon emissions over a year. It requires all the energy used in the home, including that consumed by appliances, to be provided from low carbon or renewable energy technologies onsite. (see also Box 1 within section 2.1).

[13] Supporting and Delivering Zero Carbon Development in the South West, Final Policy Report, Faber Maunsell and Peter Capener, January 2007 http://www.southwest-ra.gov.uk/nqcontent.cfm?a_id=1866

[14] Cited in 'Cracking the Code –How to achieve Level 3 and above', The Housing Corporation April 2008 http://www.housingcorp.gov.uk/upload/pdf/Cracking_the_Code_20080528102051.pdf

A report from the Renewables Advisory Board (RAB) examines the costs and implications of achieving zero carbon homes[15]. The key challenge to achieving zero carbon is meeting the electricity demand from renewables. The RAB report suggests that a zero carbon development can be achieved in 2016 at an additional cost of approximately £13,000 per house in urban locations using low heat to power micro combined heat and power (CHP) units to provide heating, together with photovoltaics (PV) to provide electricity. The cost of achieving Code level 6 is generally less for rural developments where a better wind resource may be available. The RAB report found that Code level 6 could not be achieved with its model for a small (less than 10 dwellings) development of flats in an urban location due to limited capacity to generate renewable electricity onsite.

The additional costs of achieving Zero Carbon are influenced by the number of dwellings in a development. This is the subject of ongoing research. The figure below was presented by Chris Twinn of Arup at the Renewable Energy Association's On-site Renewables Conference in February 2008. The additional costs of achieving zero carbon homes is much reduced once the development size reaches 500 or so dwellings.

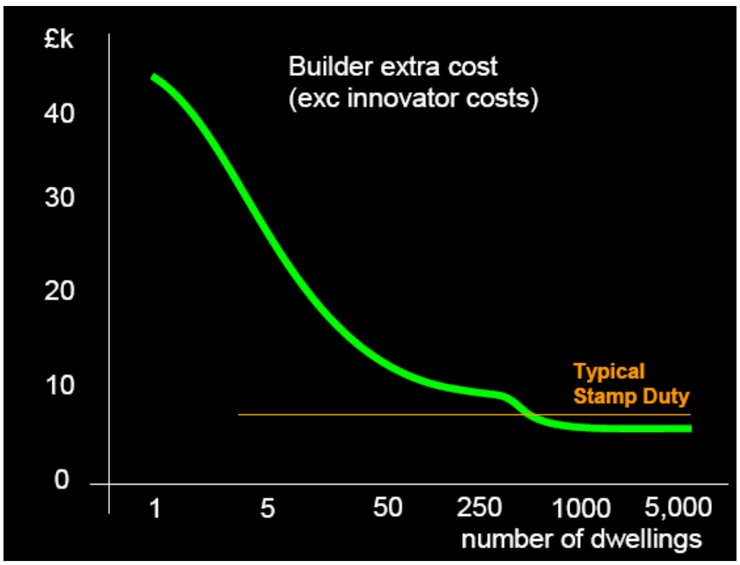


Figure 1: Additional costs of achieving zero homes compared to building regulations minimum standards –variation with size of development (Arup)

3.1.5 Future Costs

The cost of reducing the carbon emissions of a dwelling can be considered in two main segments – the cost of energy efficiency improvements and the cost of incorporating low and zero carbon technologies.

In the case of energy efficiency improvements, it is difficult to quantify how much variation there will be in the costs in the medium to long term. However, as energy standards are tightened through the building regulations and the CSH becomes mandatory, it is likely that the increased uptake of existing technologies and development of new more efficient alternatives and improved construction methods will drive costs down.

[15] The Role of Onsite Energy Generation in Delivering Zero Carbon Homes. 2008. Renewables Advisory Board

Experience curves[16] for low and zero carbon technologies (i.e. CHP and renewable energies) suggests that the level of costs could be reduced to between 95% and 60% of their previous level for each doubling in installed capacity with a reduction to around 82% of previous cost being considered a reasonable average figure.

3.1.6 Conclusions

Code Levels 1, 2 and 3 can be readily achieved through energy efficiency improvements and at a cost not exceeding 7% of the total build costs.

Code Level 4 can also be achieved with energy efficiency improvements by adopting the EST Advanced Practice Standard. However, there is currently little experience of building to this standard in the UK, hence the estimated cost of an additional 10% of total build cost is difficult to verify. Note: Code Level 4 can also be met by a combination of energy efficiency measures and on site renewable energy at a cost of less than 10% additional costs although this has not been explored as part of his study.

As the Building Regulations progressively lower U-values to drive carbon reductions the market uptake for the appropriate technologies and construction techniques to achieve high efficiency homes will be increased. However, it should be noted that building to these standards will require a greater uptake of more expensive renewable electricity technologies once zero carbon standards are required. The CSH and the zero carbon policy are likely to stimulate uptake of renewable energy technologies thereby reducing costs, which will reduce the cost of achieving zero carbon in high efficiency homes.

3.2 Achieving energy efficiency over and above the building regulations – Non-Dwellings

Non-domestic buildings are considerably diverse in their application, form and size, presenting considerable challenges for the analysis and evaluation of energy performance in this sector. There is currently little understanding of the energy performance of non-domestic buildings as energy consumption data for this stock is limited and of poor quality.

Although there is currently no clear policy for the future carbon reductions in new non-domestic buildings, work is being done to pave the path to zero carbon developments and the UK Green Building Council (UKGBC) has released a report[17] that seeks to examine the implications of achieving zero carbon non domestic buildings.

The report notes that while is it difficult to generalise across all non-domestic buildings, energy use, particularly the electricity to heat ratio, is significantly higher in non-dwellings than it is for homes. As a result, the implementation of on-site renewable energy solutions is much more challenging for most non-dwellings than it is for dwellings. The UKGBC suggests adopting a clear hierarchy for achieving carbon emissions reductions, beginning with demand reduction through passive design measures and high-performance specification.

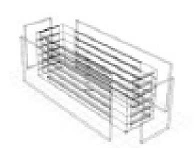
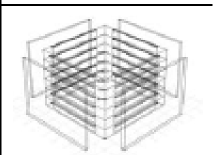
[16] Cited within Based on research conducted by, M. Hinnells, IEA and the Government Performance and Innovation Unit

[17] Carbon Reductions in New Non-Domestic Buildings

Part L2A sets minimum standards for the energy efficiency in non-domestic dwellings. Design limits have been set for the building envelope by limiting the U-value and standards have been defined for the rate of air infiltration, the efficiency of all fixed services and their controls. Fixed services for non-domestic buildings are more varied and complex than those for domestic and includes cooling plant, air handling plant, energy meters, heating and hot water systems, lighting and their controls.

In its report, the UKGBC examined the technological solutions that could be used to achieve a zero-carbon building. The non-domestic stock was grouped into three building types as described in Table 10 below.

Table 10 – Generic Building Types modelled in UKGBC report

Group	Description	Uses	Typical construction	
1	Shallow plan sidelit	Offices, hospitals, education and numerous uses	Various fabrics and glazing, rarely full curtain wall glazing. Commonly low-rise 3-6 floors, but can be high rise.	
2	Deep plan high rise	Mainly offices, almost always air-conditioned	Commonly high-rise, often full glazing.	
3	Sheds	Warehouses, factories, supermarkets, various large and out of town retail	Single floor, large floor-to-ceiling height, little glazing.	

The approach of the study was to initially improve the energy efficiency of buildings by using more efficient systems, improving the building fabric, using passive cooling, and improving control systems and building management systems. Once all cost effective energy efficiency measures where completed, low and zero carbon technologies were considered. The cost results of this modelling exercise are summarised in Table 11 below.

Table 11 – Cost of low carbon dynamically modelled buildings

	Shallow Plan Office £/m≤ GIFA	Deep Plan Office £/m≤ GIFA	Retail Warehouse £/m≤ GIFA
Net base building cost	1640	1520	480
Extra over cost of enhancements to:			
1. External envelope and windows	270	230	230
2. Thermal mass (exposed soffit etc)	60	60	–
3. HVAC	70	50	110
Revised net cost without renewables	**2040**	**1860**	**820**
3. Renewables	90	90	230
Revised net cost for all measures	**2130**	**1950**	**1050**
Preliminaries and contingencies	510	460	220
Total cost	**2640**	**2410**	**1270**
Percentage extra over cost without renewables	**24%**	**22%**	**71%**
Percentage extra over cost for all measures	**30%**	**28%**	**119%**

Note: GIFA = gross floor area

The UKGBC modelling of low carbon buildings revealed that energy efficiency enhancements could be achieved at a cost of 22% (in large offices) to 71% (in retail warehouses) of the base building costs. The cost of improvements to the external envelope was found to be the major cost with over 50% of expenditure associated with improving the thermal performance of glazing and providing shading to reduce solar gain. The high cost of energy efficiency improvements, particularly in the case of retail warehouses, makes it economically unattractive to pursue energy efficiency measures to its fullest extent.

3.2.1 Instruments for improving energy efficiency

As with the domestic sector, a number of voluntary standards to encourage energy efficiency in non-domestic buildings exist. The main standard being used to encourage carbon reduction in new non-domestic buildings is the Building Research Establishment Environmental Assessment Method (BREEAM). BREEAM was launched in 1990 and has become the most widely used environmental assessment rating for buildings. BREEAM awards credits in the following eight areas:

- Management
- Health and well-being
- Energy
- Transport
- Water
- Mineral and Waste
- Land use and ecology
- Pollution

Credits are awarded based on performance in each of these areas and a set of environmental weightings then enables the credits to be added together to produce a single overall score. The BREEAM ratings that can be achieved are Pass, Good, Very Good or Excellent.

BREEAM does not set any mandatory minimum standard for reductions in carbon emission above building regulations. However, carbon emissions reductions are heavily weighted with 18% of the points available directly relating to energy improvements above 2006 Part L.

BREEAM 2008 is set to introduce minimum standards such as carbon reductions for higher rating levels[18] and there is some suggestion that this version may be the precursor to the Code for Sustainable Buildings. A new top rating level “Outstanding”, is also due to be introduced.

3.2.2 Conclusions

There is still little understanding of the energy performance of buildings in the non-domestic sector when compared to the domestic sector. A better understanding of the performance of buildings in this sector is required if its performance is to be improved. Work is being undertaken to gain a greater understanding of the costs of low and zero carbon non-domestic developments. Initial results of this work found that pursing energy efficiency

[18] Building Research Establishment Press Release. March 2008

improvements could result in increases of between 22% and 70% of baseline costs. This makes carbon reductions beyond the requirements of the current building regulations economically unattractive for many non-domestic buildings.

Outside of the Building Regulations, BREEAM ratings is the main voluntary tool currently used to help stimulate improved environmental performance of this stock. Achieving BREEAM “very good” or “excellent” currently does not require reductions above Part L, however this is set to change with BREEAM 2008. Building to these standards in developments such as offices, hospitals and schools should then be encouraged.

4 POLICY RECOMMENDATIONS

Based on the findings of the measures and costs involved in achieving energy efficiency improvements beyond the current regulations, the following issues have been identified as key for consideration.

1. Energy performance improvements in new dwellings of up to 25% on the current building regulations (Code level 3) can readily be made at a cost not exceeding 7% of baseline build costs.
2. Energy performance improvements in new dwellings of up to 44% on the current building regulations can be achieved using the relevant design techniques and technologies at no greater than 10% of baseline build costs.
3. The Building Regulations proposal tends towards high efficiency buildings. Hence, gaining experience in this area will be advantageous.
4. High efficiency buildings will require more expensive renewable energy solutions if a zero carbon development is to be achieved. However, the cost of renewable energy technologies is set to reduce in the medium term as the Code for Sustainable Homes takes effect.
5. Stipulating the achievement of CSH levels 1- 3 without use of renewables may in the short term, affect the uptake of renewable energy technologies currently used to meet these levels, such as solar water heating and small wind turbines.

4.1 Policy Recommendations for Improving Energy Efficiency in Dwellings

The key points outlined above summarise the supporting arguments for the energy efficiency of new dwellings policy proposals outlined in Table 12 below.

Based on the evidence reviewed, IT Power recommends accelerating the move towards lower carbon dwellings (keeping the zero carbon by 2016 target). Table 12 sets outs IT Power's recommendations for local policies to require improved emissions reductions in new dwellings over and above the national building regulations.

Table 12 – Proposed Policy Guide for Improving Energy Efficiency in Dwellings beyond requirements of current regulations

Period	Building Regulations evolution (relative to 2006)	Recommended policy requirements: Improvements in regulated emissions to be achieved
2008 - 2010	-	25%
2010 - 2013	25%	44%
2013 - 2016	44%	60% (100% improvement in TER)*
2016 onwards	Zero carbon	Zero carbon

* Up to 60% emissions reduction can be achieved by energy efficiency measures alone. Developers should be required to meet 100% reduction in regulated emissions in total from energy efficiency and renewables from 2013.

Ultimately, minimising energy demand is essential to achieving carbon reductions. High efficiency buildings offer the best low carbon solution. **Developers should however be given the flexibility of choosing the best combination of energy efficiency measures and renewable energy technologies for a particular development, to enable the most cost effective solution to be used.** It is therefore recommended that local policies stipulate emissions reductions rather than energy efficiency improvements.

4.1.1 Existing local policy

There are a few existing local planning policies which make local requirements for energy efficiency. These tend to place wider requirements on sustainable construction and whilst this report has looked only at energy efficiency, the wider issues of sustainable construction should be addresses.

Areas of England and Wales with local requirements for energy efficiency include Milton Keynes, London, South West England and Wales. Their policies are described briefly here:

The **2005 Milton Keynes Local Plan** contains policy on zero carbon and carbon offsetting. All new developments exceeding five domestic dwellings or those that incorporate over 1000 square metres of floor space must include the following:

- Energy efficiency by siting, design, layout and buildings' orientation to maximise sunlight and daylight, avoidance of overshadowing and passive ventilation systems.
- Grouped building forms in order to minimise external wall surface extent and exposure.
- Landscaping or planting design that optimises screening and improves individual buildings' thermal performance.
- Renewable energy technologies.
- Carbon neutrality or financial contributions to a carbon offset fund to enable carbon emissions to be offset elsewhere.
- Other requirements include sustainable urban drainage, sustainab;e building materials and waste recycling

Since its inception in late 2005, Policy D4 of the Local Plan has resulted in the region of 50 small scale renewable energy solutions being granted planning consent across the borough. These are determined on a site by site basis with wind turbines, solar water heating, PV panels, biomass boilers and ground source heat pumps being the main renewable solutions utilised. There is no one specific technology that is used more than any other across Milton Keynes- developers source the most appropriate for their site on the basis of the type and size of development, the location of the site and cost, which results in a variety of solutions.

Milton Keynes Council also operates a Carbon Offset fund which is in place to ensure that development achieves carbon neutrality. A fee of £200 per tonne of Carbon Dioxide emitted by each development in its first year is charged, with the fund being spent on improvements to the efficiency of the existing housing stock. An allowance for this is made in the Milton Keynes Tariff for Carbon Offset and it is expected that in the short/medium term this practice will continue in Milton Keynes. It is anticipated that the Council will prepare a review of the delivery of the Offset fund to evidence its viability and soundness as a policy requirement.

The replacement Milton Keynes Local Plan was adopted in December 2005. It is a district-wide plan setting out policies and proposals for the period up to 2011. It is a saved plan until the end of 2008, eventually to be replaced by the Core Strategy and other subsequent Local Development Documents.

The Local Plan contains Policy D4- Sustainable Construction, and D5- Renewable Energy. Policy D4 sets out requirements from development in terms of construction standards, including a requirement for 10% of energy to be sourced on site from a renewable technology. The policy is expanded by a Sustainable Construction Supplementary Planning Document, which explains the requirements in more detail.

Policy D5 sets out the criteria against which renewable energy installations will be assessed, looking primarily at the environmental impacts.

Information about the Milton Keynes Policy can be found on the dedicated website http://www.cartoplus.co.uk/milton_keynes/text/00cont.htm and also in an Energy Savings Trust Case Study[19].

Policy 4A.4 of the London Plan requires all strategic planning applications to submit an energy assessment demonstrating how the scheme is consistent with the London Plan's energy policies. All major applications to London Borough Councils should include an assessment of energy demand.

Energy assessments should take a site-wide approach and demonstrate how a proposed development incorporates (in a sequential hierarchy) a reduction in energy demand, use of renewable energy and efficient energy supply into the design.

The policy sets a broad target of 25% improved energy efficiency above the minimum requirements of the building regulations. Once energy demand has been reduced it requires the use of 1) combined heat and power and 2) onsite renewable energy generation to reduce carbon dioxide emissions by a further 10%. Further information on the London Plan requirements can be found in the accompanying report 'Renewable Energy Opportunities'

The **Welsh Assembly Government** has stressed it wants to move more quickly than the UK's commitment to achieve zero carbon standards by 2016.

In February 2008 the Welsh Assembly Government signaled proposals to achieve zero carbon levels for all new buildings in Wales by 2011[20]. The Sustainable Development Commission will present a report to the Climate Change Commission for Wales in September 2008.

As a first step the Welsh administration has stated that it will be insisting that as a core condition all Assembly Government funding, grants, investments, joint ventures and land disposals which involve new buildings will have to achieve the current top category of environmental performance under the system developed by the Building Research Establishment - the BREEAM 'excellent' rating.

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19 http://www.energysavingtrust.org.uk/uploads/documents/housingbuildings/epbc_miltonkeynes_cs_new.pdf

20 http://www.planningportal.gov.uk/england/government/en/1115314843329.html

The **South West Region's Draft Regional Spatial Strategy** Development Policy G 'Sustainable Construction' requires all new and refurbished homes to meet at least Level 3 of the Code for Sustainable Homes. Larger scale developments are required to meet Level 5 of the Code. An independent report commissioned by the Regional Assembly recommended that the policy be revised to require all new residential developments of 10 or more dwellings to meet Code Level 4 (44% improvement in regulated emissions) by 2008 and Code Level 5 (100% improvement in regulated emissions) by 2011.[21]

4.2 Proposed Policy Guide for Improving Energy Efficiency in Non - Dwellings

The future policy for reducing carbon emissions in new non-domestic buildings is currently poorly defined.

Initial studies of this stock found baseline costs could increase between 22% (for offices, schools, hospitals) and 70% (for retail outlets, warehouses, factories) if energy efficiency improvements were pursued.

This makes carbon reductions beyond the requirements of the current building regulations economically unattractive for buildings such as warehouses supermarkets and factories.

Buildings such as offices hospital and schools can achieve significant reductions beyond the building regulations more economically.

It is therefore proposed that the Building Recommendations remain the main guide for energy performance in the non-domestic sector.

However, and especially in the case of buildings such as schools, hospitals and offices carbon reductions should be pursed through advocating the requirement for a BREEAM assessment rating of "very good", "excellent" and "outstanding" when the new system is introduced later this year.

[21] http://www.southwest-ra.gov.uk/nqcontent.cfm?a_id=1866