Low Carbon Planning Policy Viability Study

FINAL REPORT

for

Winchester City Council

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1 Executive Summary

1. Winchester City Council is in the process of developing its Core Strategy as part of the Local Development Framework.

2. The Core Strategy Preferred Options paper contains two key policies that are intended to set the framework for CO_2 emissions reduction, renewable energy generation and wider sustainability of new developments in the district over the period of the Policy.

3. The policies proposed for the Core Strategy are challenging. An ambitious approach to tackling CO_2 emissions from new developments in Winchester can be justified on the basis that Winchester currently has a very high per capita carbon footprint, a limited renewable resource that needs to be exploited efficiently and is an affluent area, with high land values, where incremental increases in build cost may have a lesser impact on affordability than in many other areas.

4. Policy CP13 requires new residential development reaches Level 3 of the Code for Sustainable Homes, except in respect of the Energy and Water categories, where the mandatory standards of Code Level 5 are required. Post 2016, all residential development is required to meet all aspects of Code Level 6. Policy CP13 further states that non-residential development should achieve a BREEAM 'Excellent' rating from adoption of the Core Strategy and the BREEAM 'Outstanding' rating from 2012.

5. Policy CP14 describes a hierarchy for the implementation of renewable energy and decentralised energy measures. The top-level of the hierarchy is to connect to existing or contribute to the development of new district heating / cooling networks on sites where they are feasible. The level below is to generate 20% of anticipated energy demands on site, followed by the use of off-site generation to meet emissions reduction targets, as long as the off-site generation capacity is additional capacity. If none of the above is possible, then developers should contribute to a Low Carbon Buy-out Fund.

6. The mandatory energy standard of Code Level 5 of the Code for Sustainable Homes is challenging, requiring that 100% of a developments Regulated CO_2 emissions[1] are eliminated through onsite measures – energy efficiency improvements and low carbon energy generation. The Code Level 6 requirement, which Policy CP13 enforces from 2016, is even more challenging, requiring that all emissions – Regulated and Unregulated[2] – are eliminated through onsite means. The Code Level 5 mandatory water consumption standard requires that consumption is limited to 80 litre/person/day, compared to a current typical UK average consumption of 150 l/p/d.

[1] Regulated CO_2 emissions are those related to space heating, hot-water provision, fixed lighting and ventilation. The baseline from which emissions reductions are measured is the emissions expected from a Part L 2006 dwelling.
[2] Unregulated CO_2 emissions are those related to cooking and use of appliances (basically all those emissions from energy use within the home that are not included in the Regulated emissions)

7. The CO_2 reduction standards specified by Policy CP13 are significantly in advance of the rate of improving standards that is to be enforced through the Building Regulations. The trajectory for tightening of the Building Regulations is anticipated to enforce reductions of Regulated emissions of 25% and 44% in 2010 and 2013, respectively, through onsite means. The Zero Carbon Homes standard, which is expected to be adopted in 2016, will require 70% of Regulated emissions to be dealt with via onsite measures – still below the requirement of Code Level 5, although the Zero Carbon policy will require developers to invest in offsite measures ('Allowable Solutions') to mitigate the residual emissions from their development. The Regulatory water consumption standard, Part G of the Building Regulations, is planned to be tightened to 105 l/p/d in 2010

8. The purpose of this study is to understand the likely cost implications of Winchester's draft Core Strategy policies and to set these increases in the context of the impact of tightening regulations on the costs of developing sites. The study will then assess, on the basis of this comparison and in discussion with developers, whether the policies are reasonable in the context of conditions specific to Winchester District and, if necessary, recommend amendments to improve the draft policies.

9. The assessment of policy cost impacts has been based on a number of generic development types, ranging in scale and density, which have been devised to be broadly representative of the types of development that is likely to be typical in Winchester over the Core Strategy period. Each development type is composed of a mix of four standard dwelling types – a 2-bed flat, 2-bed terrace house, 3-bed semi-detached and 4-bed detached house. The development types range in scale from < 15 units (rural or urban infill) to several thousand (urban extensions). See Figure 8 for a description of the development types used.

10. In order to understand the cost impacts of Winchester's Core Strategy policies, a range of energy strategy options, appropriate to the range of CO_2 reduction standards set-out by incoming Regulations and the Code for Sustainable Homes, have been developed and costed for each of the development scenarios. The cost implications of the policies are then evaluated, assuming that developers select the lowest cost approach to meeting a particular requirement.

11. The assessment of policies CP13 and CP14 has shown that the cost of compliance is expected to be strongly driven by policy CP13. In achieving the Code Level 5 mandatory energy standard, developers are likely to look to adopt CHP & district heating systems where they are feasible (large scale sites, particularly higher density and mixed-uses), in line with the highest level of the CP14 hierarchy. In meeting the Code Level 5 standard, it is likely that at least 20% onsite energy generation will be required, in line with the second tier of the CP14 hierarchy. The additional cost impact of Policy CP14, assuming CP13 has been met, is therefore expected to be limited.

12. The cost implications of Policy CP13 are shown in the figure below. The cost increases are percentage increase on the base build cost, where the base build cost is that of building a Part L 2006 compliant dwelling. The plot includes the anticipated increase in base build cost as a result of the changes to Regulations (and Zero Carbon Homes policy) and the additional cost impact of complying with Policy CP13, in both scenarios with respect to wind availability. The costs are reported as the cost increase for an average

dwelling in a particular development scenario and the cost ranges relate to the differences in cost impacts between the various development types (the lowest costs tend to be incurred in the Urban Infill type – heavily flatted and high density, and the highest costs in the small infill – small scale and modest density).

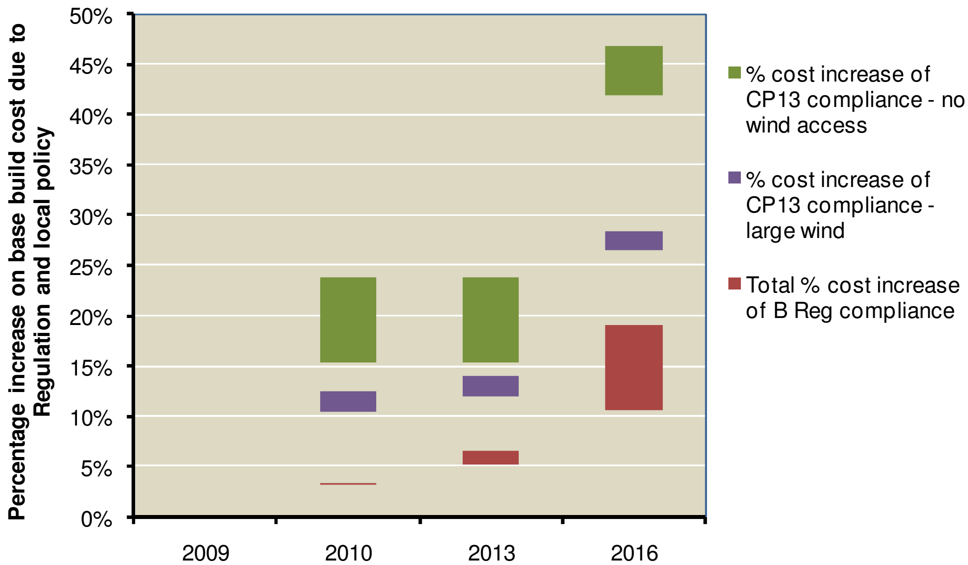


Figure 1, Estimated increases in the capital cost of construction of a dwelling associated with increasingly stringent national regulations and with compliance with Winchester Core Strategy Policy CP13 (all costs are shown as a percentage increase on the base build cost of a Part L 2006 compliant dwelling).

13. The cost impact of changes to Building Regulations is expected to be significant, at around a 5% increase on current construction costs when the 2013 standards are introduced and 10 to 20% increase when Zero Carbon Homes policy is introduced in 2016. The additional cost related to complying with Policy CP13 is estimated at a further 15% - 20% of current base build costs up to 2016, largely related to the costs of achieving the Code Level 5 energy and water standards. The on-cost of Policy CP13 over the cost of meeting regulations increases in 2016, once the Code Level 6 requirement is enforced – a total on-cost of 25% of current base build costs *in excess* of the cost of complying with Zero Carbon policy. These on-costs are mitigated to some extent on-sites where large wind is available, as shown in the plot.

14. There is less data available to enable assessment of the cost implications of Policy CP13 on non-residential development, i.e. the requirement to reach the BREEAM Outstanding rating from 2012. Based on published data, the cost implications of meeting the mandatory CO_2 reduction standard of the Outstanding rating has been estimated at a 2 to 12% increase on current base build costs, depending on the building type (relatively low on-costs in schools, high in offices and higher again in retail warehouses).

15. The Building Regulations in relation to non-domestic buildings will also be tightened over the period of the Core Strategy and a Zero Carbon Non-domestic Buildings policy is

expected to be introduced by 2019. The details of these proposed changes are not yet fixed, although zero carbon policy for the non-domestic sector is the subject of a current government consultation. These changes will increase the cost of meeting the regulatory minimum standard for new build non-domestic development.

16. Given the uncertainty in meeting the Outstanding BREEAM standard, it is recommended that the requirement to meet this rating in all new build development is delayed until the implications are better understood. The mandatory Energy & CO2 standard of the Outstanding rating could be adopted from 2013, to ensure that the performance of non-domestic development remains in advance of the Building Regulations.

17. The cost implications of Policy CP13 and CP14 on residential development are expected to be significant, to the extent that there may be impacts on the deliverability of sites for housing, due to pressure on land values, and could lead to reductions in contributions through S106 agreements. In light of the high levels of additional cost, revisions to the policies have been considered that may deliver similar benefits at reduced cost burden for developers.

18. The cost increases shown in Figure 1 consider only the capital cost increment. In certain cases, the whole capital cost increase may not be borne by the developer. In cases where a revenue is generated by operation of the energy system, for example operation of a community heating system with sale of heat and, potentially electricity, then a third-party such as an ESCO may provide finance to build the system in return for the revenues they will receive through operation. This will reduce the exposure of the developer to increased build costs. This delivery mechanism will be limited to sites where an attractive return on investment can be generated through sale of energy services. In addition to private sector ESCOs, with requirement for commercial rates of return, a number of social enterprises and not-for-profit ESCOs are beginning to appear, with much lower required rates of return on their investments. The development of a local Carbon Offset Fund in Winchester could also provide low cost finance to assist in delivery of these schemes.

19. A number of alternatives to Policy CP13 have been developed and their cost implications assessed. These options are summarised in the table below. In each case, the requirement for on-site CO_2 reduction is set at 70% of Regulated emissions, in line with the requirements of the zero carbon homes standard. The requirement for additional contribution to offsite measures, in order to offset the residual emissions, timing of introduction of increased water consumption standards and overall Code Level requirement are varied between the four options.

Policy Option	Level of CO_2 reduction to be delivered on-site (% Regulated emissions)	Requirement to offset remaining emissions (investment in Fund)	Water consumption standard (Code Level)	Overall Code Level required
1	70%	All remaining emissions	5	3 (pre-2016) 6 (post-2016)
2	70%	All remaining emissions	3 (pre-2016) 5 (post-2016)	3 (pre-2016) 6 (post-2016)
3	70%	Pre-2013 – No offset required Post-2013 – All remaining emissions	5	3 (pre-2016) 6 (post-2016)
4	70%	Pre-2013 – No offset required Post-2013 – All remaining emissions	3 (pre-2016) 5 (post-2016)	3 (pre-2013) 4 (2013-2016) 6 (post-2016)

Figure 2, Summary of the key standards to be required in potential revisions to policy CP13 of the Winchester Core Strategy. Each policy is composed of four components (i) a % reduction of regulated CO_2 emissions through onsite measures, (ii) a requirement to offset residual emissions through investment in an offset fund, (iii) a water consumption standard (expressed as a requirement to meet a certain standard of the Code for Sustainable Homes) and (iv) an overall Code Level requirement.

20. The on-costs of the options for revisions to Policy CP13 have been assessed and are shown in the plot below. The on-costs shown are the percentage uplift on the base construction cost, which is the cost of building a home that meets the minimum regulatory requirements of the day (i.e. the increasing construction costs associated with tightening Building Regulations and Zero Carbon Homes policy is included in the baseline). The ranges of cost relate to the variation in on-cost between the different development scenarios. Note that these ranges exclude the costs for the Urban Infill development scenario (highly flatted and high density), which are uniformly lower that the on-costs estimated for other development types.

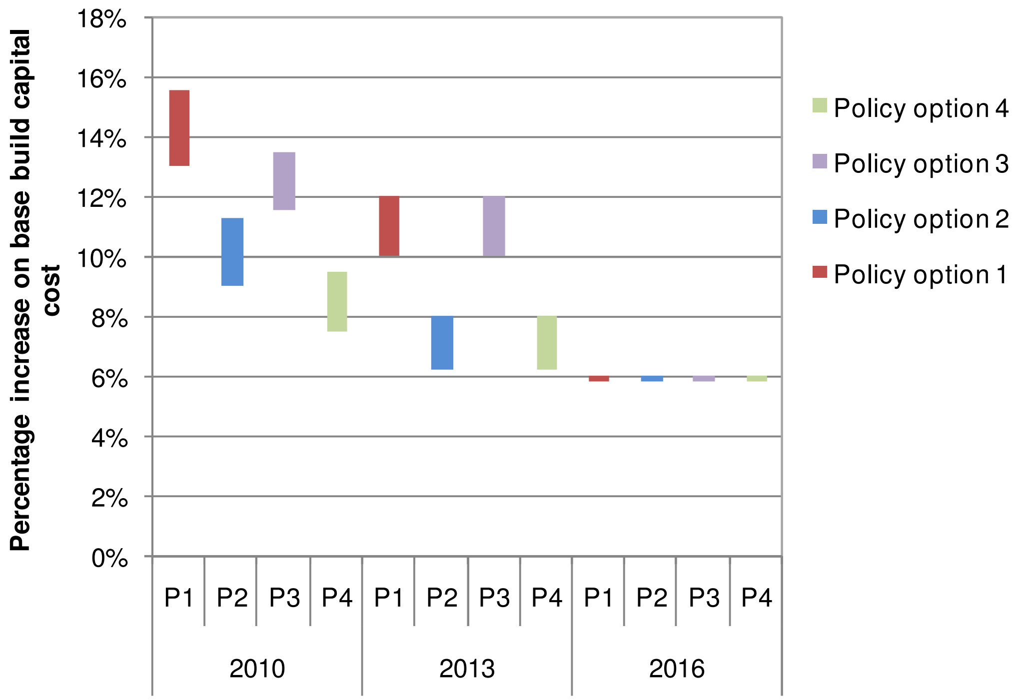


Figure 3, Percentage increase on the base build cost of construction associated with the proposed amendments to policy CP13 (all percentage on-costs are uplifts on the cost of constructing a dwelling that meets the minimum regulatory requirements in force at a particular time (including Zero Carbon Homes policy).

21. The requirements of the revised policy options post-2016 are the same, hence the on-cost of 6% is common to each of the policy options post 2016. This on-cost is comprised of the additional cost of the elevated water consumption standard and the costs associated with non-Energy categories of the Code, in order to reach the score required for Code Level 6.

22. In each of the revised policy options, the level of onsite emissions reduction has been relaxed to 70% of Regulated emissions. When combined with a requirement for the residual emissions to be offset through investment in offsite measures, this should result in a higher level of emissions reduction overall than the Code Level 5 energy standard and an equivalent level of CO_2 reduction to Code Level 6 (this is dependent on the offsetting price being set at an adequate level to deliver the required emissions reductions). The benefit of this approach is that it should incentivise investment in more cost-effective measures overall, rather than the high level Code standard approach, which tends to drive adoption of high-cost onsite technologies, such as PV (unless a particular site has potential for large-scale wind).

23. Policy Options 1 and 2 will deliver maximum CO_2 benefit, requiring all CO_2 emissions to be dealt with through a combination of on and off-site measures across the whole period of the strategy. Policy Option 3 and 4 will deliver a lower overall level of CO_2 reduction, as the requirement for additional offsetting is delayed to 2013 and 2016 respectively. Policy Option 3 has a higher on-cost than Option 2, despite the lower energy standard prior to

2013, due to the requirement for Code Level 5 water standards (which are delayed to 2016 in the case of option 2).

24. Policy Option 4 gives the lowest additional costs over the period to 2013, due to delay in the requirement for investment in off-site CO_2 reduction measures to 2016 (when it is part of Zero Carbon Homes policy) and the delay in introduction of Code Level 5 water standards, also to 2016. In terms of Energy and CO_2, this policy option remains ahead of national legislation up to 2016, when it can be argued that further intervention at a local level is no longer required.

25. An implication of the policy options discussed above is the requirement for a mechanism to collect developer contributions to off-site measures and administer the investment of this revenue in suitable carbon reduction projects, ideally in the local area, e.g a Low Carbon Buy-out Fund (LCBF).

26. Based on a requirement for developers to achieve 70% onsite carbon emissions reduction and to invest in the LCBF to offset the residual emissions, it has been estimated that the fund could receive a revenue of around £3.25 million per year (based on a buy-out price of £2,000/(tCO_2/yr)[3]. Depending on the measures invested in, this fund could deliver additional annual CO_2 savings ranging from 300 tCO_2/yr to 4,000 tCO_2/yr, assuming that the fund provides 100% of the capital cost of measures and without accounting for potential incomes from investments.

27. In reality it is likely that many of the LCBF investments would provide seed finance, leveraging additional investment into energy projects from the private sector. Depending on the overall economics of a particular project, this could result in more than a two-fold increase in the overall impact of the LCBF investments.

[3] This is equivalent to imposing the proposed Zero Carbon policy in advance of 2016. The legal and policy basis to impose this on developers would need to be carefully developed. The carbon cost of £2,000/(tCO_2/yr) is within the range of cost of Allowable Solutions being considered by government.

2 Introduction

Winchester City Council is currently in the process of developing its Local Development Framework (LDF), which is expected to shape development in the region over the period to 2026. During this period, a significant expansion of Winchester's housing stock is anticipated, with 12,740 new dwellings expected to be added to the existing stock of 44,420 dwellings (an increase of 29%). Significant additional employment and community-use space will be required, to keep step with this expansion.

National planning policy, through the Supplement to PPS1 (Planning and Climate Change) and PPS22 on renewable energy, has increased the role and responsibility of local planning authorities in driving uptake of renewable and decentralised energy systems within their regions. In responding to the national planning policy, local authorities are being required to set policy to encourage uptake of decentralised systems, particularly heat networks, identify areas of interest for development of renewable energy projects and to set targets, in terms of CO_2 reduction and renewable energy provision, for new developments.

In order to inform development of policies with respect to renewable energy generation and CO_2 reduction for the Winchester Core Strategy, Winchester City Council commissioned energy consultants ESD to perform a Renewable Energy assessment for the district. The purpose of this assessment was to define the achievable potential for renewable energy deployment in the district, to specify requirements and propose potential energy solutions for the various relevant development types and to guide development of policy, to ensure that the potential in the region is captured over the period of the strategy. This report concluded that there is significant potential for CO_2 reduction through renewable energy supply, up to a 17% reduction on the district's CO_2 emissions, dominated by potential for deployment of large-scale wind turbines and biomass-based energy systems. This, combined with Winchester's current status as the district with the highest per capita carbon footprint compared to the average in the South East region, provides the justification for a set of Core Strategy policies that promote challenging levels of carbon reduction through new development.

The policies relating to Sustainable Buildings and Renewable and Decentralised Energy in Winchester City Council's draft Core Strategy (Core Strategy Preferred Option, May 2009) seek to achieve this, through setting advanced targets for achieving Code for Sustainable Homes Energy and Water standards (and BREEAM standards for non-resi developments) and through promotion of district heating systems and onsite generation of a significant proportion of a development's energy needs. The draft policies have, however, met with some resistance from the developer community, which has questioned whether Code standards that are so advanced compared to the expected tightening of national regulations is appropriate and voiced concerns over the cost implications of the proposed policies.

In response to these concerns, Winchester City Council has commissioned the current study, with the objectives of assessing the implications of the proposed policies on the cost of development, placing these cost implications in context against a background of increasing national regulatory standards and, if appropriate, recommending modifications to the policies that while delivering the high-level objectives, will reduce any unreasonable burden on local developers.

3 Policy context

The coming decade will be a period of rapid change of the policies and regulations concerning energy use and CO_2 emissions from buildings. The government is committed to challenging targets for reducing CO_2 emissions from energy use in the UK and to increasing the proportion of energy supply that is sourced from renewable resources. Reducing the quantity of CO_2 emissions that will arise from additions to the building stock is an important part of government efforts to meet these overall objectives.

The following summarises some of the key changes to the policy environment that will have an implications for the way energy is sourced and used in new developments in Winchester District.

3.1 Building Regulations

The principal tool that government will use to control CO_2 emissions from new buildings will be the Building Regulations and specifically Part L of the regulations – 'Conservation of fuel and power'. The current Part L standards, Part L 2006, will be taken as the baseline from which the CO_2 performance of new buildings will be measured in the future. Changes to Part L in 2010 and 2013 will stipulate percentage reductions in CO_2 emissions that must be achieved in new buildings, compared to the Part L 2006 baseline.

It is important to note that Part L of the Building Regulations only governs the CO_2 emissions that are permitted from energy use for heating, hot-water and electricity used for fixed lighting and ventilation – these are the so-called Regulated emissions. The CO_2 emissions that result from energy used for cooking and electricity used by appliances are not covered by Part L – the Unregulated emissions (typically these account for around one-third of the emissions of a dwelling). The standards enforced through future versions of Part L are sometimes referred to as percentage reductions of regulated emissions.

The tightening of Part L in 2010 and 2013 are interim steps on the way to the eventual zero CO_2 standards for new buildings. The intention is that zero CO_2 standard will be adopted for homes in 2016 and for non-domestic properties from 2019. The reductions in regulated emissions expected to be enforced through Part L 2010 and 2013 are presented in Figure 4.

Year	% CO_2 emissions reduction from Part L 2006	Notes
2010	25%	These percentage improvements relate to reduction of the emissions from fuel and electricity use in heating, ventilation and fixed lighting – these are known as regulated emissions. Emissions relating to cooking and appliance use are excluded.
2013	44%	
2016	Zero carbon homes standard introduced	To achieve zero carbon status will require all emissions, including those related to appliances, to be mitigated in some manner. See Section 3.2 for details.

Figure 4, Expected reductions in permitted CO_2 emissions to be enforced through changes to Part L in 2010 and 2013.

3.2 Zero carbon policy

The intention of the zero carbon policy is that all CO_2 emissions from a new building, Regulated and Unregulated, should be eliminated or mitigated in some manner. However, it has been recognised that to deal with all emissions through provision of on-site low carbon and renewable energy results in very substantial additional cost and may not be technically achievable in certain types of development. In light of this, government proposes that the zero carbon standard will be based on a hierarchical approach to CO_2 reduction, involving reduction through energy efficiency, followed by reduction through provision of onsite low carbon energy supply and, finally, offsetting the remaining CO_2 emissions from the development by investing in carbon reduction projects elsewhere. This hierarchy is shown in the diagram below.

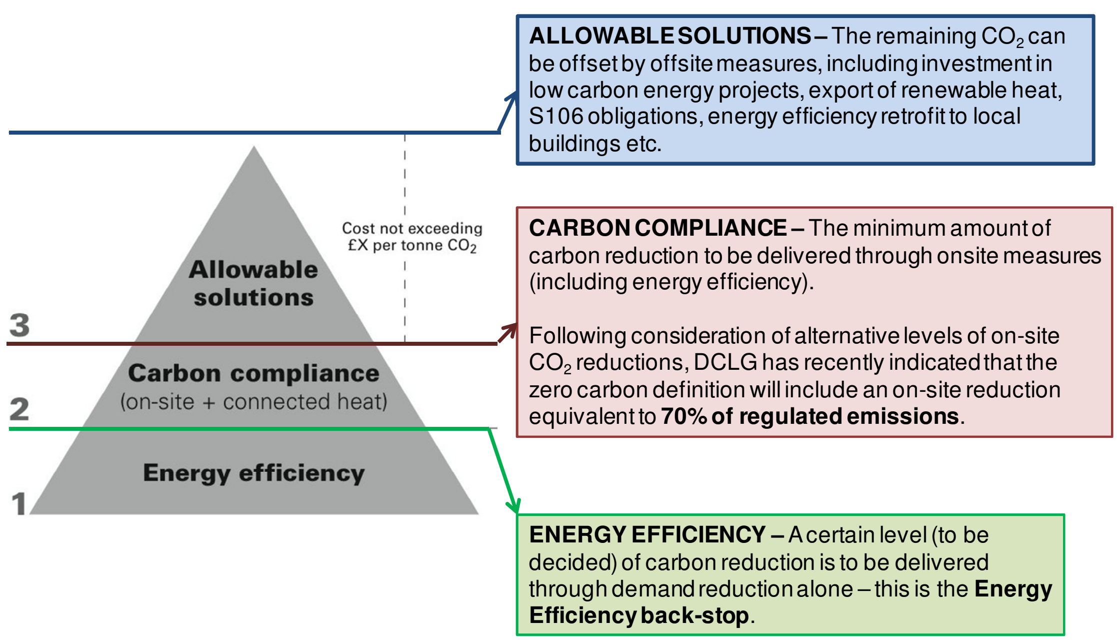


Figure 5, Schematic describing the hierarchical approach to CO_2 emissions reduction to be used in the definition of zero carbon homes and buildings.

The level of CO_2 reduction that is to be achieved through energy efficiency improvements has not yet been announced and further government consultation on this issue is expected. Following the recent consultation on Zero Carbon Homes and Buildings, the government has announced the proposal that the Carbon Compliance level be set at 70% reduction of Regulated emissions for homes (for a typical dwelling, this is equivalent to around 50% of the overall emissions, i.e. including the Unregulated emissions, are to be reduced through onsite measures). The level of Carbon Compliance for non-domestic buildings is not yet clear, as discussed below.

The measures that developers will be permitted to invest in to deal with the remaining emissions, i.e. the Allowable Solutions, are also the subject of ongoing consideration. Local authorities and their planning departments may well have a role to play in the development of projects for developers to invest in as Allowable Solutions. This may include, for example, the establishment of local funds to collect Allowable Solution revenues and to direct investment in suitable carbon reduction initiatives.

3.2.1 Zero carbon non-domestic buildings

The proposed definition of the zero carbon standard in non-domestic buildings is less developed than is the case for zero carbon homes. Government recognizes the differing technological challenges in achieving deep carbon reductions between domestic and non-domestic buildings, the diversity of the non-domestic building stock and therefore its carbon impact and the increased likelihood of a change of building use that could have a large impact on carbon emissions.

As a starting point, zero carbon consultation states that the zero carbon standard for non-domestic buildings should at least cover regulated emissions and that following a hierarchical approach, similar to that proposed for zero carbon homes, would be sensible. However, there is still uncertainty over whether the levels of the hierarchy, in particular the carbon compliance level which sets the CO_2 reduction to be delivered through energy efficiency and onsite measures, should be the same as those adopted in the case of homes.

The government is committed to revising Part L for non-domestic buildings in 2010 to require a 25% reduction in CO_2 compared to Part L 2006. It is proposed that a Forward Thinking paper on the possible changes to be made in the 2013 revision of Part L could be published alongside the 2010 amendments. The detail of the 2013 amendments would then be consulted on in due course.

The trajectory beyond 2013 will be informed by the availability and viability of technical solutions and the range of allowable solutions. Current research by the UK Green Building Council suggests that moving beyond a 44% reduction on Part L 2006 will require a step-change in the availability of technical solutions and the cost-effectiveness of those measures. At this stage, government will consider whether interim steps should be introduced between 2013 and 2019.

3.3 The Code for Sustainable Homes

The Code for Sustainable Homes was introduced in England in 2007 as a national standard against which the sustainability of new homes could be measured. The Code rates the sustainability of homes from level 1 to 6 on the basis of a points scoring system, where level 1 is a modest improvement on minimum regulatory standards and level 6 is an extremely challenging standard. Points are awarded under nine categories of sustainability on the basis of certain targets being met, e.g. reduced CO_2 emissions or water consumption, or incorporation of certain elements of sustainable design. Under some categories, such as energy, minimum standards are stipulated that must be met to achieve a certain Code level, whereas under other categories developers are given the flexibility to choose which actions to take to score the points required for a certain target Code level.

The Code is intended to be a voluntary standard, although there is evidence that planning authorities are increasingly stipulating that developers should build to certain Code standards within their Development Plan Documents. In addition, English Partnerships and the Housing Association committed to building all publicly-funded affordable housing to Code level 3 from 2008 and it is expected that the Homes and Communities Agency will make a commitment to ensuring all housing it funds will be built to Code level 4 from 2011.

Notwithstanding particular local planning requirements, developers of private housing are free to choose whether to exceed regulatory minimum standards and, if they choose to build to the Code, what Code level to build to. However, in 2008 legislation was passed that introduced a mandatory requirement for a Code rating certificate to be included in the Home Information Packs for all new housing. This does not mean it is mandatory for all new housing to be assessed by a Code assessor, as if a developer has not attempted to build to any Code level they can simply issue a 'nil-rated' certificate.

The intention of the Code for Sustainable Homes is to encourage the construction of more sustainable housing by providing better information to home-buyers regarding the sustainability of homes on the market. The Code is also intended to signal to the home building industry the future direction of change of the Building Industry, toward higher standards of sustainability. This is particularly the case in the Energy category of the Code which, among other issues relating to energy consumption in homes, sets out mandatory CO_2 reduction targets at each Code level which closely reflect the trajectory of CO_2 emissions reductions expected to be introduced through the Building Regulations, as given in Figure 6. The mandatory CO_2 emissions reduction targets for each Code Level are shown below.

Code Level	% Reduction on Part L 2006 Regulated Emissions	Notes
1	10%	The mandatory energy standards at Code Level 1 and 2 will be superseded by Building Regulations in 2010, which will require a 25% reduction on Regulated emissions as a minimum.
2	18%	
3	25%	Equivalent to Part L 2010
4	44%	Equivalent to Part L 2013
5	100%	This is equivalent to the most stringent of the potential Carbon Compliance levels proposed in the Zero Carbon consultation
6	Zero Carbon	A more stringent standard than proposed in the Zero carbon Consultation – all emissions (Regulated and Unregulated) dealt with by onsite measures

Figure 6, Mandatory CO_2 reduction requirement at each level of the Code for Sustainable Homes

3.3.1.1 Zero carbon and the Code

Code Level 6 of the Code for Sustainable Homes stipulates that new homes must be net-zero carbon over a year[4]. Zero carbon at Code level 6 refers to reduction of all CO_2 emissions, including both Regulated and Unregulated emissions, and states that renewable or low carbon energy must be generated within the building, on the site of the development or connected to the building by way of a dedicated physical connection in order for the CO_2 saving to be credited in the calculation of the dwelling's emissions. The definition of zero carbon adopted in the Code is more stringent than the definition now likely to be adopted under the 2016 Zero Carbon Homes policy, i.e. it is more stringent than the proposals put forward following the recent government consultation on zero carbon homes and buildings, which favour the adoption of a requirement for 70% of Regulated emissions to be reduced through onsite meaures, with developers able to offset the remainder by investment in offsite carbon reduction projects.

The Code Level 6 definition of zero carbon has significant implications for the investment required in energy systems and, as some studies have shown[5], may not be achievable in all types of development (for example in urban infill sites where options for onsite renewable electricity generation are highly constrained). The government's response, concerned with the potential impact of the 2016 zero carbon definition on the ability of the housing industry to deliver adequate housing supply, has been to introduce the concept of Allowable Solutions into the zero carbon definition. This will significantly reduce the cost of achieving zero carbon and provides developers an option for achieving CO_2 reductions on sites where the options for local low carbon energy generation are very limited.

3.3.2 BREEAM

BREEAM is a long established and widely used environmental assessment method for non-domestic buildings, including offices, light industrial units, retail outlets and schools among other building types. Similarly to the Code for Sustainable Homes, BREEAM assesses the performance of buildings against a range of sustainability metrics, in largely similar categories to the Code. Credits are achieved based on the building's performance under each of the categories and a rating is given based on the overall score. The rating scale used under BREEAM is Pass; Good; Very Good; Excellent and Outstanding. BREEAM was revised in 2008 to include the 'Outstanding' rating and also to set mandatory CO_2 reduction standards for the higher ratings to be achieved.

3.4 Subsidies for Renewables

Currently, renewable electricity generators are supported under the Renewables Obligation (RO), which awards tradeable certificates to generators of renewable electricity for every MWh of electricity generated. The certificates must be purchased by electricity supply companies to prove they have invested sufficiently in renewable generation. The value of the certificates (the

[4] Net zero carbon means that any CO_2 emissions resulting from energy use within the building must be matched by the CO_2 reduction attributable to exported renewable or low carbon energy.

[5] 'The role of onsite generation in delivering zero carbon homes', by Element Energy for the Renewables Advisory Board, 2008

ROCs), which can be sold alongside sale of the actual power, fluctuates due to demand, but is typically in the region of £40 to £50/MWh. Some technologies, which are further from commercial maturity, are eligible to receive two ROCs per MWh, such that the total value of the support can reach £100/MWh.

There is currently no similar support mechanism to incentivise the use of renewable heat. To rectify this and to provide more support for smaller-scale renewable electricity generators (the RO has tended to support mainly large-scale wind), the government has announced two new financial incentive schemes: the Renewable Feed-in Tariff (FiT), for renewable electricity, and Renewable Heat Incentive (RHI), to support local use of renewable heat.

These two schemes will support installation of new generating capacity by providing guaranteed, fixed tariff payments for every MWh of renewable electricity generated and renewable heat consumed over a specified period, likely to be 20 years, from the date of commissioning. Tariff levels will vary depending on the technology and installed capacity. The intention however, is to provide sufficient support to make installation of these technologies attractive to homeowners and commercial investors.

The FiT is expected to be introduced in 2010 and is a key part of the current government consultation on financial support for renewable electricity generation - The 'Renewable Electricity Financial Incentives Consultation'[6].

The key points of the proposed FiT policy are briefly summarised below:

- Electricity generators of 50 kW to 5 MW capacity can choose between support under the RO or FiT. Generators of < 50 kW capacity will only be eligible for the FiT.
- A fixed tariff will be paid for every kWh of electricity generated (whether used on-site or exported to the grid).
- A further payment will be received for electricity exported to the grid (for example, this may be valued at the wholesale price for electricity).
- Payments of the FiT will be guaranteed for a specified period, likely to be 20 years.
- Eligible technologies include PV, wind and electricity generation from biogas (e.g. produced by anerobic digestion). Electricity generation and combined heat and power from solid and liquid biofuels will not initially be supported by the feed-in tariff (this could be revised in later policy reviews).
- Biomass CHP continues to be supported through the Renewables Obligation, at a level of 2ROCs/MWh for good quality CHP systems. The intention is that biomass CHP will be further supported by the Renewable Heat Incentive (RHI) once this comes into effect.
- Some tariffs are degressed. Degression means that the level of tariff offered to new plants drops year-on-year. Note that for a particular plant, the level of tariff is fixed at the level offered in the year of commissioning for the whole period, but the level of tariff offered drops depending on the year that commissioning takes place.

[6] http://www.decc.gov.uk/en/content/cms/consultations/elec_financial/elec_financial.aspx

A consultation on the Renewable Heat Incentive has recently been published[7], setting out the government's proposals for the levels of support to be offered to renewable heat generators. Technologies to be supported under the RHI include solar thermal, air and ground source heat pumps, biomass for heating and biomass CHP. The levels of tariff vary between the technologies and the scale of plant.

[7] http://www.decc.gov.uk/en/content/cms/consultations/rhi/rhi.aspx

4 Key technologies

In the following, a number of low carbon and renewable energy generation technologies that may be of relevance to new developments in Winchester are briefly introduced. These technologies will form the basis of the energy systems assessed in following sections of this study.

Technology	Description	Relevance to potential energy strategies
Biomass boilers	• Burn solid biomass fuels such as wood pellets or wood chips (boilers that use bio-oils also available). • Available at all scales from wood-burning stoves for individual dwellings to MW-scale plant. • Large systems tend to be fuelled by woodchips. • Small-scale systems tend to use pellets (more dense and easier to handle, but more expensive). • Fuel storage and delivery are key considerations in planning a wood fuel plant.	• Biomass boilers could be relevant at a range of scales, from individual boilers in homes, block-scale boilers in flats and community-scale boilers feeding district heating systems. • Use of biomass fuels is restricted in some areas due to air quality concerns.
Gas-fired combined heat and power (CHP)	• Based on electricity generators (usually an engine or turbine), with use of the by-product heat to meet local heat loads. • Increase overall efficiency of fuel consumption by use of heat and therefore reduced CO_2 emissions (compared to gas boilers and grid electricity) • Available at a wide-range of scales, from 5kW to multi-MW electrical output.	• Potentially relevant at an individual building scale or as part of a community energy system. • CHP is best suited to applications where there is a significant baseload requirement for heat, such as swimming pools, hotels, hospitals, mixed-use community systems etc.

Biomass CHP	• Larger potential CO_2 saving than gas CHP, due to use of a low carbon fuel. • Currently only truly commercial at large-scale, i.e. > 3.5MW electrical capacity. Very significant heat loads are required to justify these plants. • Some smaller-scale technologies are being commercialised. Technologies at ~ 500kW$_e$ are close to commercialisation and other, smaller technologies are under development.	• Due to the current limitations on technology availability, biomass CHP will only be relevant to substantial mixed-use developments or business parks.
Air source heat pumps (ASHP)	• Collect thermal energy from the air via a heat exchanger unit. • Low grade heat from the air is upgraded to a useful temperature (up to 55°C) by an electrically powered heat pump. • Although require an electrical supply, heat pumps qualify as a renewables technology due to the renewable heat taken from the air (more thermal energy is delivered than electricity consumed). • Top-up heating is required to provide adequate temperature for a domestic hot-water supply (electrical immersion heater of gas boiler). • Heat pump systems are best-suited to low temperature distribution systems, such as underfloor heating. • Currently not widely used, although heat pump technology is very well known. • Ground source heat pumps, where thermal energy is extracted from the ground via buried heat exchangers or boreholes, are similar in principle to air source heat pumps. However, due to the more costly heat-exchange system, ground source heat pumps are a more expensive option	• Air source heat pumps are a potentially high relevant means of providing low carbon heating to new build residential and commercial developments. • Heat pumps can be installed in individual dwellings or at a block-scale and can be used in conjunction with wet or warm air heating sources. • For air source heat pumps, external access is required for installation of the heat exchanger (can be ground-mounted, on balconies of flats or mounted on the roof). • The carbon saving delivered by heat pumps will potentially grow, as greater penetration of renewable electricity generation on the grid results in a less carbon intense electricity supply.

Solar thermal	• Heat transfer fluid is pumped through heat exchangers mounted on the roof and is heated by the sun. Heat is transferred to a thermal store. • There are numerous ways solar thermal can be integrated into the heating system. Most often heat from the solar thermal system is used to meet hot water loads. Typically the system will be sized to meet 50–75% of hot water loads. • Installed in combination with primary heating technology, such as a gas boiler.	• Simple, low maintenance systems. However, only a modest contribution to overall energy requirements (relatively high cost energy generation). • Can be relevant to provision of relatively modest carbon reduction targets (e.g. Part L 2010 or Code Level 3).
Photovoltaics	• Semi-conductor based devices that generate electricity when exposed to sunlight. • Remain a relatively expensive technology, better suited to geographies with higher insolation (sun's radiation). • Provide a simple, low maintenance means of providing renewable energy generation.	• Despite high capital cost, provide one of few means of generating renewable electricity in dense, urban areas. • Can be useful for combination with a low carbon heating technology to meet high CO_2 reduction requirements.
Wind turbines	• Offshore and large-scale onshore wind turbines are among the most economical means of generating renewable power. • Large (MW-scale) onshore turbines have mast heights of 60–80m and 50m turbine blade diameters. • Wind turbines are available at a wide range of sizes, down to 1kW electrical output. • Small-scale wind trials have shown that the output of small-scale turbines, particularly in urban environments, is very low.	• Large-scale wind has been identified as a renewable resource of high potential in the Winchester District. • The more economical, large systems need to be situated at an adequate separation from buildings (up to 400m for large turbines). Will be suitable to larger strategic greenfield or urban extensions. • Building mounted turbine (micro-wind) not considered to be relevant, due to current poor performance of the technology.

Figure 7, Introduction to low carbon and renewable generation technologies and their potential relevance to developments within Winchester.

5 Winchester development scenarios

In order to assess the impact of Winchester's proposed Core Strategy policies on the build cost of new development in the district, a number of generic development scenarios have been devised on which the analysis is based.

Each development scenario comprises a mix of four basic dwelling types. The dwelling types are a 1/2-bed flat (F), 2-bed terrace (T), 3-bed semi (S) and 4-bed detached (D). More detail on the basic dwellings, in terms of their size and assumed energy performance is given in Section 5.1.

These basic dwelling types are combined together in varying proportions to build up the development scenarios. Five development scenarios have been developed, ranging in scale from 1 to several thousand dwellings. In general a dwelling density of around 40 dph has been selected as typical of the density of development expected in Winchester, although in the case of the 'Urban Infill' development scenario, a high density has been assumed. These development scenarios provide a basis for assessing the cost implications of various policy options and are hoped to be broadly representative of the type of development likely to be typical in Winchester over the period of the policy. It is not the intention of these generic development scenarios, however, to in any way prescribe the makeup of future development.

The key features of the development scenarios are summarised in the table below:

Scenario	Scale (N^o dwellings)	Density (dwelling/ha)	Approx dwelling mix (%)				Type
			F	T	S	D	
Rural infill	1 – 14	35	0	0	50	50	Mix of Brownfield / Greenfield
Urban infill	1 – 14	75	100	0	0	0	Brownfield
Small brownfield	14 – 100	40	30	25	33	12	Brownfield
Small urban extension	100 – 300	40	30	25	33	12	Greenfield
Large urban extension	2000 - 3000	45	30	25	33	12	Greenfield

Figure 8, Summary of typical development types used in analysis of policy costs

5.1 The dwelling types

Winchester's proposed Core Strategy policies set standards for energy/CO_2 emissions and water consumption reduction in terms of the standards set-out in the Code for Sustainable Homes. The Code's energy standards are expressed as a percentage improvement of the dwelling's emissions over the emissions that would be expected if the dwelling were constructed to meet Part L of the current Building Regulations (i.e. Part L 2006). Therefore, in order to understand what energy consumption reduction measures and low carbon energy generation technologies need to be applied to meet particular Code standards, it is first necessary to calculate the emissions that would be expected if the dwellings were simply constructed to current standards – this is the baseline from which improvements in energy standards will be measured.

The CO_2 emissions performance of a dwelling is expressed as the Dwelling Emission Rate (DER), in terms of $kgCO_2$ emitted per m^2 of floor area per year. The DER accounts for emissions relating to energy use that is regulated by Part L, which includes space heating, domestic hot-water provision, electricity for fixed lighting and ventilation. These are the so-called Regulated Emissions. There are further emissions from energy use that is not regulated by Part L, such as the use of electrical appliances and cooking. These are known as the Unregulated Emissions and are not included in the calculation of DER. These emissions become important when considering Level 6 of the Code for Sustainable Homes, which requires a dwelling to be zero carbon, including both Regulated and Unregulated emissions.

The dwelling's emissions rate in the case where it complies with Part L 2006 of the Building Regs is defined as the Target Emissions Rate (TER). For each of the four basic dwelling types used in this study, the energy requirements for heating, hot-water, lighting and ventilation have been calculated using a methodology consistent with the government's Standard Assessment Procedure (SAP), assuming a Part L 2006 compliant specification. This enables calculation of the TER, the baseline from which all improvements in energy standard will be measured. The emissions relating to Unregulated energy use have also been calculated, which allows assessment of Level 6 of the Code and the impact of the Zero Carbon Homes policy.

Energy demand / CO_2 emissions rate	Dwelling type			
	F	T	S	D
Floor area (m2)	66	75	88	118
Space-heating (KWh/m2/yr)	38	65	67	62
DHW (KWh/m2/yr)	28	26	23	18
Regulated electricity (KWh/m2/yr)	9	8	8	7
TER (kgCO2/m2/yr)	20.4	25.8	25.2	22.2
Unregulated emissions (kgCO2/m2/yr)	15.2	14.6	13.5	11.2

Figure 9, Energy demands and corresponding CO_2 emissions rate of the four basic dwelling types assuming construction to meet Part L 2006 – the baseline standard.

5.1.1 Energy efficiency improvement

Initially the most cost-effective means of achieving CO_2 reduction from a Part L 2006 compliant standard will be to improve the performance standard of the building fabric, i.e. to reduce the U-values of each element (walls, roof, windows etc.) and to reduce the air permeability. Potentially deep CO_2 reductions can be achieved solely through improving the fabric performance, however, at a certain point it becomes more cost-effective to introduce a low carbon energy supply than to attempt to further reduce the dwelling's energy requirement. In order to comply with Code Level 6 of the Code for Sustainable Homes, a very high level of fabric performance is required, as the Code stipulates a maximum heat loss parameter (HLP) through the building's fabric of 0.8 W/m^2/k, which is a challenging standard.

For the purpose of this study, two energy efficiency improvement standards have been developed – a Good Energy Efficiency Package and Advanced Energy Efficiency Package. The main fabric standards specified in each of these packages are tabulated below, in comparison to the Part L 2006 compliant standards.

Parameter	Part L 2006	Good Energy Efficiency	Advanced Energy Efficiency
U-values (W/m^{2}K)			
Window / door	2	1.1	0.9
Ground Floor	0.2	0.15	0.15
External wall	0.22	0.2	0.15
Roof	0.18	0.13	0.1
Party wall	0.3	0.2	0
Air Permeability (m^3/m^2.h)	9	4	1
Thermal bridging (Y-value)	0.08	0.04	0.02
% improvement (compared DER to TER)	0%	23 – 27%	35 – 40%

Figure 10, Good and Advanced energy efficiency improvement packages compared to the Part L 2006 compliant standard.

5.1.2 Cost of energy efficiency packages

The extra-over costs associated with achieving each of the improved fabric standards in each of the basic dwelling types have been estimated and are shown in the table below (extra-over costs are the additional cost of construction for new build dwellings, compared to the cost of building to current Part L (2006)).

E/O cost of fabric package	F	T	S	D
Good improvement (£/dwelling)	£1,300	£ 2,100	£ 2,550	£ 2,543
Advanced improvement(£/dwelling)	£4,250	£ 5,400	£ 6,225	£ 6,425

Figure 11, Extra-over costs associated with achieving the Good and Advanced fabric performance standards in each of the basic dwelling types. Note that in the case of the Advanced standard, the E/O cost includes the cost of a mechanical ventilation and heat recovery (MVHR) system

6 Costs of the Code for Sustainable Homes – Energy & Water

Policy CP13 of the Winchester Core Strategy Preferred Options states that all new build residential developments should meet Level 3 of the Code for Sustainable Homes, with the exception of the water and energy categories, where Code Level 5 standards must be met. The policy further states that from 2016, all new build housing must meet all aspects of Level 6 of the Code for Sustainable Homes.

The cost implications of this policy and in particular the costs associated with meeting the challenging energy and water standards are explored in this section.

6.1 Energy standard

The energy category of the Code for Sustainable Homes is sub-divided into 9 separate issues. The first of these issues (Ene1) deals with the dwelling's CO_2 emissions and is one of the issues in the Code where mandatory minimum standards are set-out that must be achieved in order for a dwelling to be compliant with a particular Code Level. These minimum standards are expressed in terms of the reduction of the DER from the TER standard (i.e. the reduction on the current Part L standard). These minimum standards are tabulated below:

Code Level	Mandatory % reduction of DER on TER
1	10%
2	18%
3	25%
4	44%
5	100%
6	100% + reduction of all Unregulated emissions

Figure 12, Mandatory emissions improvements (DER on TER) required by Ene1 of the Code for Sustainable Homes at each Code Level.

The remaining issues in the Energy category of the Code cover issues such as the energy performance of the building fabric (Ene2), the amount of low-energy light fittings provided (Ene3), the provision of cycle storage (Ene8) and energy efficient white goods (Ene8), among others. Additional credits toward the overall Code score can be earned by taking actions under these other issues, but no mandatory standards are set (with the exception of Ene2, where there is a requirement to achieve a heat loss parameter of 0.8 W/m^2K at Code Level 6). The interpretation of policy CP13's requirement for Code Level 5 standard to be met in the Energy Category is therefore that the mandatory standard under Ene1 must be met – a 100% reduction of DER from TER (meaning that all Regulated emissions must be dealt with, leaving only the Unregulated emissions).

6.1.1 Potential energy strategies

The cost of complying with any level of the Code for Sustainable Homes tends to be dominated by the cost of meeting the mandatory energy standard at the particular Code Level. The requirement of Policy CP13 that the Level 5 energy standard is met will have a significant impact on the construction cost of a dwelling. In order to evaluate what this cost impact is, and to examine what impact alternative policies might have, a range of potential energy strategies have been defined that are capable of meeting the mandatory energy requirements of the various levels of the Code. In each case the energy strategy is a combination of an energy efficiency improvement package and a low or zero carbon generation technology.

The various energy strategies developed to meet each level of the Code are defined in the table below. Note that energy strategies have not been defined for Code Levels 1 and 2, as it is assumed that these levels of the Code do not demand a sufficient level of improvement in terms of energy performance to be relevant to discussion of Winchester's Core Strategy policies. The energy strategies shown in the table below assume that the sites do not have access to medium to large-scale wind energy. A discussion of the impact of wind energy availability on energy strategies and their associated costs is given in Section 6.4.

Code Level	% improvement DER on TER	Short-name	Description of strategy
3	25%	EE(Good)+PV_3	Good energy efficiency + photovoltaics (PV) (100W (F), 50 W (T, S), 200 W (D))[1]
4	44%	ASHP+PV_4	EE(Good)+Air source heat pump (ASHP)+PV (400W (F, T, S), 550W (D))
		Gas CHP/DH _4	Gas-fired CHP system delivering heat over a district heating (DH) system
		Bio Boiler_4	Block-scale biomass boiler[2] (F), Individual biomass boiler (T,S,D)
5	100%	Gas CHP/DH+PV_5	Gas CHP/DH + PV (1.6kW (F), 2.2kW(T), 2.5kW(S), 3kW (D))
		Bio Boiler/DH+PV_5	Biomass boiler on district heating system + PV (1.3kW(F), 1.6kW(T), 1.75kW(S), 2kW(D))
		ASHP+PV_5	EE(Good) + ASHP + PV (2.2kW(F), 3kW(T), 3.5kW(S), 4 kW (D))
		Bio boiler+PV_5	Block-scale (F)/Individual biomass boiler + PV(1kW (F), 1.2kW (T), 1.3kW (S) , 1.6KW (D))
		Bio CHP/DH+PV_5	Biomass CHP[3] on DH system + PV (0.5kW(F), 0.3 kW(T, S, D))

6	100% + Unregulated emissions	Bio CHP/DH+PV_6	Advanced EE + Biomass CHP on DH system + PV (3.2kW(F), 3.5kW(T,S), 4kW(D))
		Bio Boiler/DH+PV_6	Biomass boilers on DH + PV (3.75kW(F), 4.25kW(T), 4.75kW(S), 5kW(D))
		Bio Boiler + PV_6	Bock-scale (F)/Individual biomass boiler + PV (3.6kW(F), 4kW(T), 4.5kW(S), 5kW(D))

[1] Note that the capacity of PV required in the case of the Terrace and Semi-detached dwelling is very small. In practice a builder is likely to achieve the required standard by increasing the fabric specification slightly, rather than installing PV.
[2] Block-scale refers to a system of a communal biomass boiler in a central plant-room in each block of flats
[3] Biomass CHP is only available in the Large Urban development type

Figure 13, Summary of the energy strategies devised to meet the mandatory energy requirement (DER reduction on TER) of Code levels 3 to 6. Note these energy strategies assume that wind energy is not feasible on these sites. Where required, renewable energy is provided by photovoltaics (PV). Capacity of PV is given in brackets for the Flat (F), Terrace (T), Semi-detached (S) and Detached (D) dwelling types.

6.1.2 Extra-over costs of energy strategies

The additional capital costs associated with each of these energy strategies have been assessed and are presented in the chart in Figure 14. In each case the cost of energy strategy is presented as an Extra-Over cost (E/O cost) compared to building to Part L 2006 standards (i.e. the Part L 2006 fabric package, as shown in Figure 10, in combination with a condensing gas boiler) and include the cost of the improved fabric package (given in Figure 11) and the capital cost of all low/zero carbon technologies and heat distribution infrastructure. E/O costs are given for the average dwelling in each of the five development scenarios, i.e. the total E/O cost for the whole development has been averaged across the total number of dwellings.

There are significant increases in the cost of energy strategy as the Code level standard increases. There is also significant variation in the cost of achieving a given standards between the various potential energy strategy options and between the development scenarios. A number of key points can be taken from this chart:

- Typically, the E/O costs associated with Code Level 5 compliant strategies are in the range from £15k to £20k. This compares with £5k to £10k per dwelling for Code Level 4 compliant strategies and £25k to £35k for strategies that deliver the Code Level 6 standard.
- The lowest cost approach to meeting Code Level 5 standard is the biomass CHP and district heating system, but this strategy is available only in the Large Urban Extension development scenario (generally, due to limitations around technology availability at small scales, biomass CHP will only be relevant to sites with significant heat load, suc as large mixed-use or commercial developments).

- The lowest cost Code Level 5 strategy that is available across the full range of development scenarios is individual biomass boilers (block-scale in flats) with PV.
- The costs in the Urban Infill development scenario tend to be lower than in other scenarios (for all strategies), as this development is composed entirely of flats.

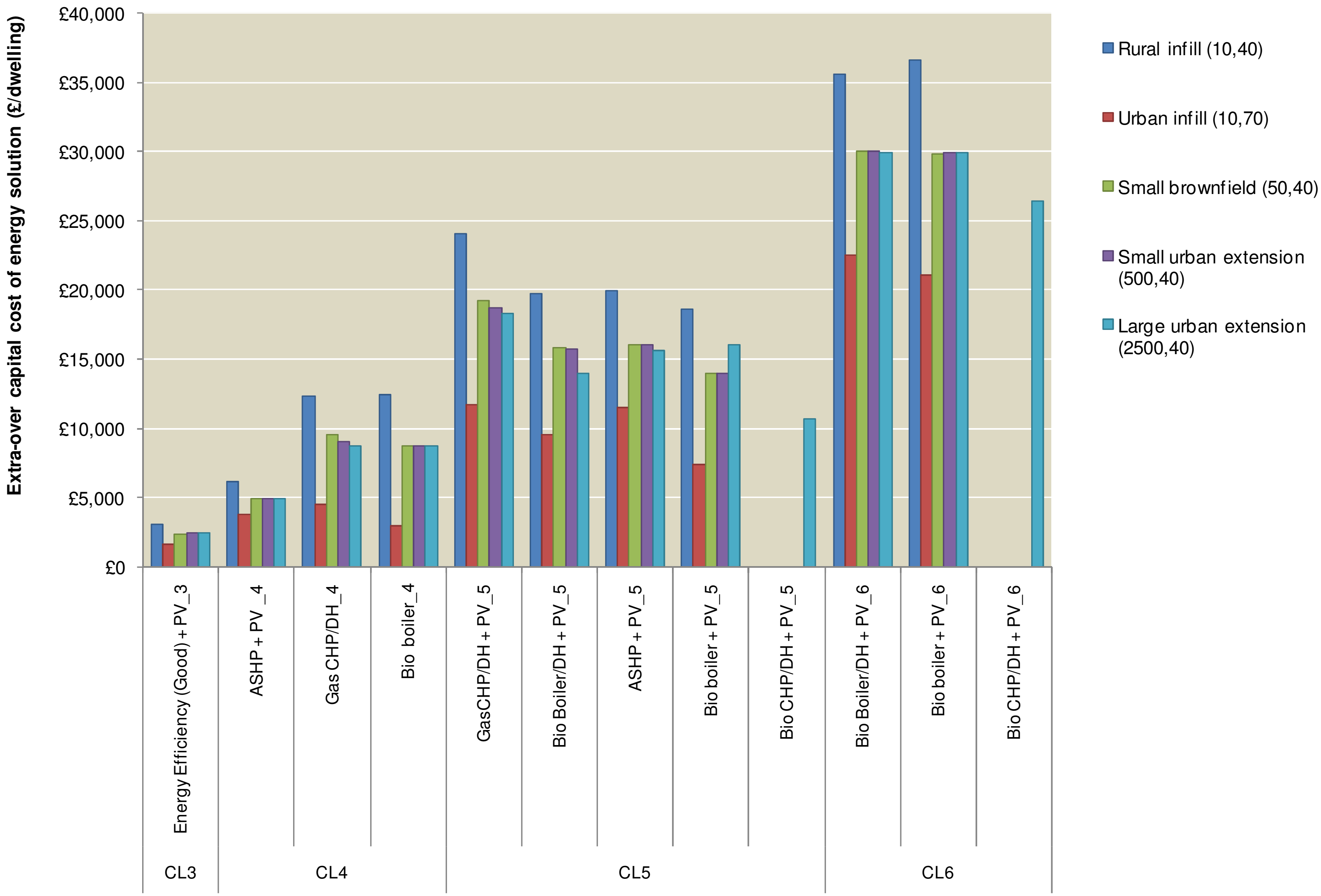


Figure 14, Additional capital costs (£/dwelling) for a range potential energy strategies, devised to comply with the mandatory CO_2 reduction standards of each level of the Code for Sustainable Homes

Based on the analysis of the E/O costs of each of the energy strategies shown in Figure 14, the lowest cost approach to meeting the mandatory energy standard of each level of the Code has been identified for each of the development scenarios. These lowest cost approaches are shown in the table below. Note these are the lowest cost approaches of the energy strategies defined in Figure 13. This is not exhaustive, as there are many combinations of energy efficiency improvements and low/zero carbon technologies that could be used to achieve the Code's energy standards. The intention, however, is that those energy strategies defined in Figure 13 represent some of the common strategies that developers are likely to choose when attempting to meet Code standards. The specific case of development on sites where the installation of medium to large scale wind turbines is appropriate is given in Section 6.4.

<table>
<tr><th rowspan="2">Development Scenario</th><th colspan="4">Code Level</th></tr>
<tr><th>3</th><th>4</th><th>5</th><th>6</th></tr>
<tr><td>Rural infill</td><td rowspan="5">Good EE + PV</td><td>ASHP + PV</td><td colspan="2" rowspan="4">Biomass boilers+ PV</td></tr>
<tr><td>Urban infill</td><td>Biomass boilers</td></tr>
<tr><td>Small brownfield</td><td rowspan="3">ASHP + PV</td></tr>
<tr><td>Small urban extension</td></tr>
<tr><td>Large Urban extension</td><td colspan="2">Biomass CHP / DH + PV</td></tr>
</table>

Figure 15, Table summarising the lowest cost energy strategy (of those assessed) to achieve the Code's mandatory CO_2 reduction standards in each of the typical development scenarios.

In subsequent analysis of the costs of achieving various Code standards or complying with a particular Core Strategy policy option, it will be assumed that the lowest cost approach has been taken to achieving the mandatory energy standard for the particular Code Level and development scenario, as defined above.

6.2 Water Category costs

The Water category of the Code for Sustainable Homes is sub-divided into two issues – Wat1, which deals with internal water consumption and Wat2, which deals with external water consumption. The bulk of the Code credits available in this category are associated with actions taken under the Wat1 issue (5 credits available for Wat1 compared to only 1 for Wat2).

Similarly to the Ene1 issue of the Energy category, the Wat1 issues is one of those to set-out mandatory performance standards that must be achieved for compliance with certain Code Levels. The minimum standards for internal water consumption defined at each level of the Code is summarised in the table below:

Code Level	Mandatory internal water consumption limit (litres/person/day)
1 & 2	120
3 & 4	105
5 & 6	80

Figure 16, Mandatory internal water consumption limits set-out at various Code Levels

The Core Strategy Preferred Option policy CP13 requires new dwellings to comply with level 5 of the Code in the water category (until 2016, when all requirements of Level 6 of the Code must be complied with). This is therefore interpreted as a requirement for internal water consumption to be reduced beneath a limit of 80 litres/person/day. The other issue under the Water category does not have mandatory standards, so it is assumed that actions to achieve these credits are at the developer's discretion.

In order to achieve these water consumption limits, it is necessary to specify fittings, such as low flow taps, low flush toilets and lower capacity baths, that will control the water consumed by occupants. Typical sets of measures that might be appropriate to achieve the water consumption standards set-out at Level 3 and above of the Code are given in the table below:

Water consumption (litres/person/day)	Measures applied
105	4/2.5 litre low flush WCs 2 litre/min washbasin taps 7 litre/min shower 120 litre bath 6 litre/min kitchen taps
90	Replace 120 litre bath with 100 litre bath Add a rainwater harvesting system
80	Replace rainwater harvesting with greywater recycling system Add water efficient washing machine

Figure 17, Indicative water fitting specifications to meet increasingly reduced internal water consumptions standards. Note 105 l/p/day is the minimum mandatory requirement of Code Level 3 and 80 l/p/day is the minimum mandatory requirement of Code Level 5.

The extra-over costs associated with these water fittings specifications have been estimated for each of the standard dwelling types and are tabulated below.

Water consumption (litres/person/day)	*Extra over cost*			
	Flat	*Terraced*	*Semi*	*Detached*
105	£200	£200	£200	£240
90	£1,550	£3,200	£3,200	£3,500
80	£1,750	£4,200	£4,200	£4,500

Figure 18, Estimated additional capital costs for installation of water fittings to deliver reduced levels of internal water consumption.

The water consumption limits set as a mandatory standard at level 3 of the Code can be achieved at relatively little additional cost, only a few hundred pounds. The lower consumption limits at Code Level 5 and 6 are more challenging and require a grey-water recycling system to be fitted. The cost implications of this system are considerable, and as a result the E/O cost associated with achieving the mandatory standard of Code Level 5 is expected to be several thousand pounds per dwelling, increasing with the size of the dwelling.

It should be noted that some concerns over the overall sustainability of greywater recycling have been raised, on the basis that although they reduce water consumption, their widespread adoption will significantly increase electricity consumption. As greywater systems would not be classified as a 'Regulated' energy use within the methodology used to assess the CO_2 reductions required under the Building Regulations or zero carbon policy, there is potential that the impact of this is not currently properly accounted for. Some further work, including field-testing, is likely to be required to better understand the overall performance of greywater recycling systems, in terms of resource savings.

6.3 Mandatory energy and water standards

The total extra-over costs of achieving the mandatory minimum standards in the Energy (Ene1) and Water (Wat1) categories of the Code for Sustainable Homes are shown in Figure 19 for Code Levels 3 to 6.

The combined extra-over costs range from just under £10k per dwelling, for flats in an urban infill, to approx. £22k per dwelling for a small infill development of larger houses.

It is clear that there is a large increase in the extra-over cost per dwelling in increasing the energy and water standards from those suitable for Code Level 4 to those required to meet the Level 5 standards. This largely results from steep increase in the required reduction of DER that occurs between Code Levels 4 (44% reduction) and 5 (100% reduction of DER from TER), although the increasingly stringent internal water consumption limit, from 105 to 80 litres/person/day, is significant.

There is a further sharp increase in extra-over costs related to advancing from a Code Level 5 compliant energy and water strategy to one that meets the requirements of Level 6. In this case, it is entirely related to the requirements of the Code's zero carbon definition, i.e. that all emissions, both Regulated and Unregulated, must be reduced through technologies that are installed onsite or that are connected directly over a private wire (note that legislative changes concerning the operation of private wire networks are expected to make this definition largely redundant – effectively, in the current drafting of the Code policy, emissions have to be dealt with by technologies that are installed onsite). This emissions reduction is extremely challenging and may not be feasible on some sites, for example, those without access to wind energy and where space is limited for installation of photovoltaics. Note the capacity of PV required to achieve Code Level 6 in the biomass boiler strategy (see Figure 13) is 5kW in the detached dwelling type. There may not be roof space to install this quantity of PV in some developments.

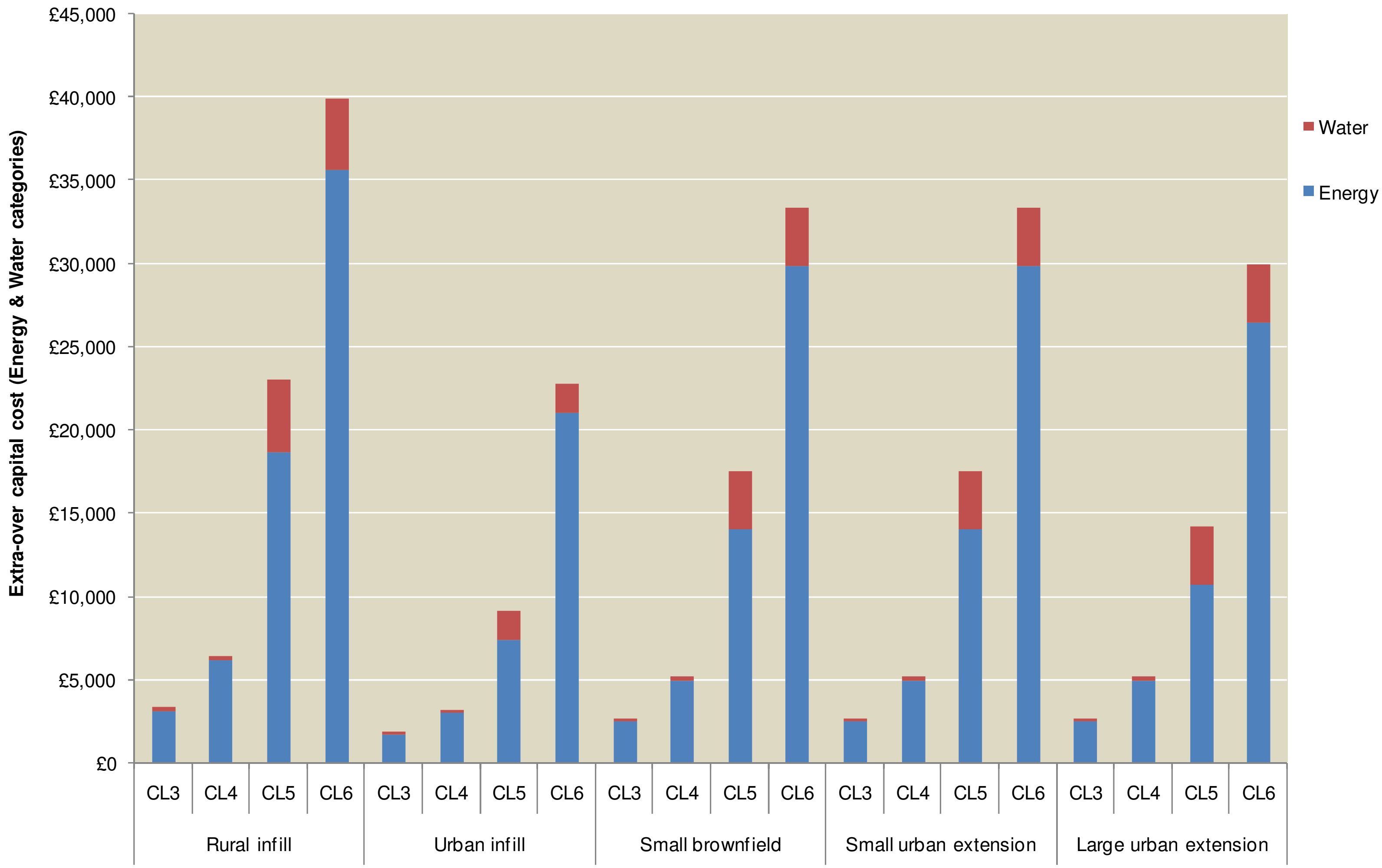


Figure 19, Total additional capital costs associated with meeting the mandatory energy and water standards of each level of the Code for Sustainable Homes

6.4 Impact of availability of wind on energy costs

The energy strategies considered to-date have been based on an improved fabric package, a low carbon heating technology of some form and, finally, reliance on photovoltaics to deliver any further emissions reduction that may be required to achieve a certain Code Level standard. The extra-over costs associated with these energy strategies have been shown to be substantial, particularly at the higher levels of the Code – Levels 5 and 6 – where a significant amount of low carbon electricity generation is required to provide the mandatory emissions standard.

Based on current technology availability, developers will in many cases be forced to rely on these PV-based energy strategies in order to meet the higher levels of the Code. This will particularly be the case in small urban infill sites, or small-scale low density greenfield sites, where there is not the scale and/or density to use biomass CHP systems to generate low carbon heat and electricity (assuming current availability of biomass CHP, which is very limited at small-scale) and not the space to install medium to large-scale wind turbines (note that micro-wind turbines, i.e. building-mounted wind turbines, have not been considered as an option in this study, due to their poor performance in field trials to-date).

The renewable energy resource assessment for Winchester[8] does, however, identify the substantial potential in the region for installation of wind turbines. It is expected therefore that many of the sites brought forward for development will present an opportunity for installation of medium to large-scale wind turbines (i.e. hundreds kWs to MW-scale turbines), particularly in the cases of the larger urban extensions.

The impact of availability of wind energy on the costs of complying with various Code Levels has been assessed for the case of the Large Urban development scenario. In this analysis, it is still assumed that an energy efficiency improvement will be applied and that a low carbon heating technology will be used. An analysis of a broad range of energy strategy options has shown, however, that the lowest cost strategies at each Code Level combine air source heat pumps (ASHP) with varying capacities of wind generation (reducing carbon emissions through installation of wind turbine capacity reduces carbon more cost-effectively than installing biomass heating, either as individual boilers or on a district system)[9].

The comparison of the lowest cost energy strategies involving wind turbine capacity to those relying on photovoltaics is shown in Figure 20, for the Large Urban development. The reduction of the extra-over cost of the energy strategy is particularly large for Code Levels 5 and 6, which require the generation of large quantities of low carbon electricity in order to achieve the DER standard.

[8] Winchester Renewable energy study, ESD, 2008

[9] Not that it is assumed that wind turbines are only installed in sites where there is sufficient wind resource for the turbines to operate at a load factor of 20%.

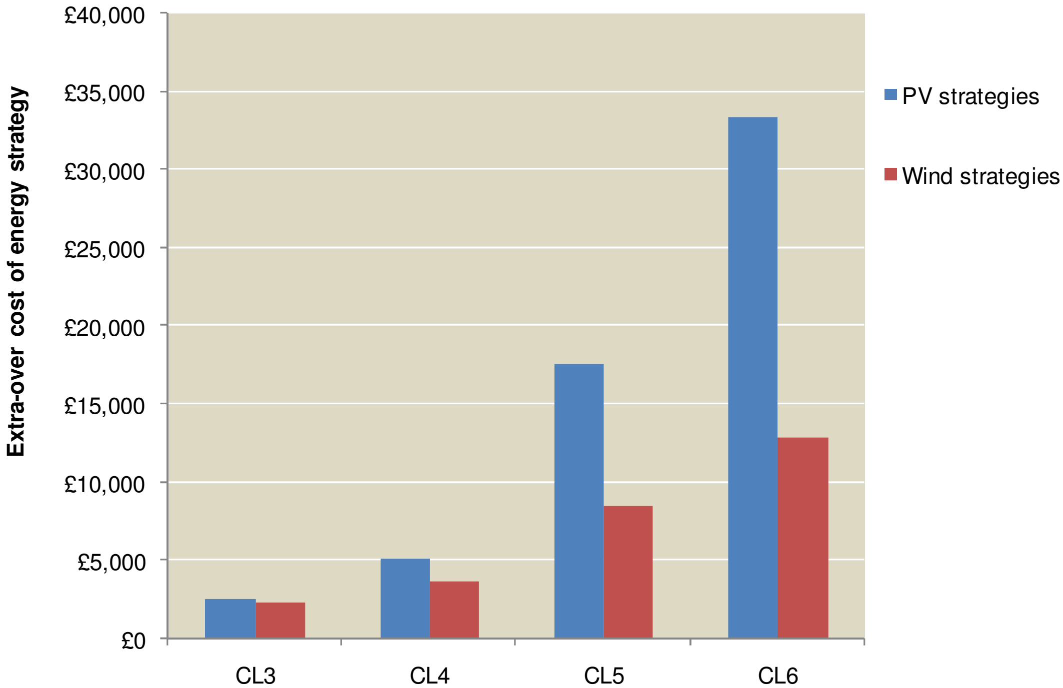


Figure 20, Comparison of the extra-over costs incurred to meet the energy standards (minimum required reduction of dwelling CO_2 emissions) of each level of the Code between a site where medium to large wind turbines can be installed and a site without wind availability.

For the Large Urban development, as defined in Figure 8 (i.e. 2500 dwellings of various type), more than 3 MW of wind turbine capacity would be required to provide sufficient CO_2 reduction to meet Code Level 5 and more than 5.5 MW to meet Code Level 6 standard. This capacity could be provided most cost-effectively by a small number of MW-scale turbines, however, on sites where such large turbines are not practical (MW-scale turbines may have mast heights of at least 60m), the capacity could be delivered by a larger array of turbines of hundreds of kW (the extra-over capital costs will be higher, but still considerably less than the PV-based strategies).

7 Stakeholder consultation

A number of developers and their representatives (e.g. energy consultants) that are actively developing sites in Winchester were contacted to discuss their approach to energy provision and any concerns regarding the Core Strategy Preferred Options policies. In particular, the consultation was aimed at:

- Understanding the level of familiarity of the developers with Policies CP13 and 14 of the emerging Core Strategy and the extent to which their implications have been considered in current development proposals.
- Understanding what technical approaches are being considered for compliance with changing Buillding Regulations and Zero Carbon Homes policy and the Winchester local policies.
- Discussing the anticipated costs associated with compliance with these regulations and local policies.
- Identifying concerns that developers may have regarding the Core Strategy policies, from a technical and financial perspective.

7.1 General views on policies

A common view expressed by the developers contacted was that the advancing standards required by changes to the Building Regulations and the introduction of zero carbon policy in 2016 and 2019 for non-domestic buildings are already challenging. Given the challenging nature of national policy, there is a general view among the developers that the accelerated standards set through policies CP13 and CP14 are not justified.

The accelerated introduction of Code Level 5 energy and water standards set through Policy CP13 attracted most comments from developers. However, it was also noted that the requirement for 20% onsite renewables provision also exceeds the regional target of 10% set through the South East Plan.

7.2 Developer energy strategies

The developers (or their representatives) of two of Winchester's significant sites – Cala with regards to Barton Farm and Grainger with regards to Newlands – were contacted to discuss the approaches that are being taken to energy provision, given the evolving policy environment.

Barton Farm is a development of 2,000 homes at an expected density of 40 dph, incorporating a full range of dwelling types, a mixed-use centre, school and other community uses. Winchester's draft Local Development Framework identifies Barton Farm as a key site, although plans for the development are already fairly advanced, with a planning submission anticipated at the end of 2009, site-works beginning in 2011/12 and the first homes due to be built in 2012/13.

Based on the proposed programme for Barton Farm, the development will run ahead of the adoption of Winchester's Core Strategy policies. Nonetheless, Cala have stated a commitment to achieving a low carbon development at Barton Farm and have committed to achieving Code Level 4 at the site, which sets CO_2 reduction standards in advance of the minimum Part L standards expected to be applicable at the time. The energy strategy to deliver the Code Level 4 objective is under development, but the approach currently being favoured consist of a site heating network fed by gas CHP. The additional cost implications of this strategy are thought to be in the region of £10k to £15k per plot. The potential for wind at the site was assessed, but disregarded at a relatively early stage on the basis of concerns over noise and impact on the amenity of the site.

A development of 1,500 units was initially planned for the Newlands site, but, based on the need for additional housing identified in the emerging Core Strategy, Grainger are redeveloping the master plan to include 2,500 units, at densities in the range of 25 – 42 dph. The original master plan included an energy strategy based on Local Plan policies (based on a dwelling-by-dwelling approach to energy provision, with a proposal for biomass use at the community centre). In light of the redevelopment of the master plan and the emerging Core Strategy policies, the energy strategy will need to be revisited. Specifics of the energy strategy have not emerged, although it is believed that wind energy has been considered and ruled out for this site. The cost implications of meeting the Core Strategy policies have been assessed, based on cost estimates for meeting Code Level 5 energy standards (see following section). These cost estimates have been based on a biomass heating and photovoltaics energy strategy, although this may not be the approach finally selected for the Newlands development.

7.3 Anticipated cost implications

A number of the developers contacted had investigated the potential cost implications of compliance with the Code for Sustainable Homes standards set-out in policy CP13. Typically, cost estimates have been based on the Cost Analysis of the Code for Sustainable Homes report, published by Communities and Local Government , July 2008 (and the preceding work published by the Housing Corporation and English Partnerships).

Specific cost projections have been provided by Grainger's energy consultants Inbuilt for the Newlands development. Based on the cost data contained within the CLG report, the following additional costs were forecast:

- An additional minimum cost uplift of £6.63 million (based on 960 dwellings) or £6,900 per dwelling to meet Code Level 5 energy requirements over the period to 2016.
- An additional cost uplift of £2.67 million or £2,775 per dwelling to meet the Code Level 5 water requirements to 2016. These costs are based on specification of low flow fittings and either a rainwater harvesting or grey-water recycling system.
- **A total minimum cost uplift for Grainger in meeting the Code Level 5 Energy and Water requirements stipulated in Policy CP13 of £9.3 million (or £9,700 per dwelling).**

The Newlands development is most closely comparable with the 'Small Urban Extension' development type of the development scenarios defined in this study. The anticipated costs of compliance with Policy CP13 provided for the Newlands development are somewhat lower than the costs of compliance estimated in this work for the small urban extension of around

£15k between 2010 to 2013 and £12k from 2013 to 2016, as shown in Figure 20 (note that these costs include the costs of achieving the Energy and Water standards, but also include an additional cost associated with achieving the further credits required to meet Code Level 3 overall). The cost forecast for Newlands compares more closely with the cost projections for the Large Urban Extension development type in this study.

Developers expressed concern that these additional costs cannot be translated into a premium paid for the property, either by way of purchase price or rent. It was noted that, in the absence of economic benefit to the developer, the escalating costs as a result of the proposed local policies will have a direct impact on land values and could lead to other deliverable community benefits being removed from schemes altogether.

7.4 Proposals for amendments

There is a general view that there is no strong rationale for local policies that place requirements on new developments that are in advance of national regulation and zero carbon homes policy.

It was noted that greater carbon savings could potentially be achieved by measures that address the energy efficiency of Winchester's existing housing stock, which will continue to be responsible for a significantly larger share of the district's total emissions than the new build developments planned over the Core Strategy period.

The Braintree Scheme was given as an example of action that can be taken at a local authority level to address the performance of the existing stock. Through the Braintree Scheme, householders were incentivized to retrofit cavity-wall and loft insulations measures via a council tax rebate of £100. This scheme is regarded as a successful initiative, leveraging investment of £5 to £10 for every £1 of council tax rebate and providing typical paybacks of 2 years for householder.

Incentivising retrofit energy efficiency measures in the existing stock is one potential use of funds collected via a local carbon buy-out fund (discussed in Section 11).

8 Core Strategy Policy CP13 – Cost assessment

Policy CP13 of Winchester City Council's Core Strategy Preferred Options paper states that all new residential developments should achieve Code Level 3 of the Code for Sustainable Homes, apart from with respect to Energy and Water, where the Level 5 requirements should be met. From 2016, the requirement of the policy is elevated to require that all new dwellings are compliant with Code Level 6 in all aspects.

In Section 0, the cost implications of achieving the mandatory Energy and Water requirements of the Code at each Code Level were considered in detail.

It was shown that the extra-over cost of meeting the Energy requirement of Code Level 5 varied in the range of £15k to £20k, apart from in a number of special cases, as follows:

- In the Large Urban development where there is sufficient scale to justify the installation of a biomass CHP and district heating system, the extra-over cost of meeting the Code Level 5 energy requirement is approx. £11k per dwelling.
- In an entirely flatted development (Urban Infill), the extra-over cost of compliance with Code 5 is also lower – around £7.5k per dwelling if based on a system of block-scale biomass boilers and PV.
- On sites where the installation of medium to large-scale wind turbines is feasible, the cost of complying with Code Level 5 energy standard can be significantly lower, estimated at an extra-over cost of £5k per dwelling.

The extra-over cost associated with meeting Code Level 5 & 6 standard for internal water consumption, a limit of 80 litres/person/day, varies from £1,750 to £ 4,500, depending on the size of the dwelling.

The Energy and Water costs do not fully represent the extra-over cost of meeting the Code, further Code points must be scored in other categories. The proposed policy CP13 sets an overall requirement that, prior to 2016, Code Level 3 is achieved, but with advanced standards in Energy and Water. The costs of the Code are, however, heavily dominated by the cost of achieving the mandatory Energy requirement and, at high Code levels, achieving the water standard is the next most costly element of the Code. The additional extra-over cost of achieving Code Level 3, once Code Level 5 standards have been met in Energy and Water, is expected to be marginal.

The requirement of policy CP13 that all aspects of Code Level 6 should be met from 2016, is expected to result in a sharp increase in the cost of compliance with the policy from that date (note that this may be mitigated by potential changes to the Code energy standards, as discussed in Section 8.1.2). It was shown in Section 6.1 that the extra-over cost of Code Level 6 compliant energy strategies is around £30k per dwelling. The exceptions to this are on sites that have sufficient scale for biomass CHP and district heating systems (around £26k per dwelling) or on sites where large-scale wind is feasible (around £9.5k per dwelling).

Code Level 6 does not require a higher Water standard to be achieved than the standard set-out at Code Level 5. However, the requirement to be compliant with Code Level 6 overall, rather than Code Level 3, will significantly increase the extra-over costs associated with gaining credits in other Code categories. Significant costs that will be incurred at Code Level

6 include those associated with incorporating Lifetime Homes principles into the dwelling design, costs associated with achieving high levels of sound insulation and the likelihood that it will be necessary to provide cycle storage, among other credits that will need to be achieved in order to reach the Code Level 6 standard. The additional costs extra-over cost of achieving credits under the other Code categories in order to comply with Code Level 6 are expected to be around £3k to 3.5k per dwelling.

The approximate extra-over costs associated with the requirements of policy CP13 are summarised in the table below. Note that these extra-over costs are all measured from a baseline of construction to current Building Regulations (2006) standards.

Policy element	Cost of compliance with CP13 (per dwelling)	
	Pre-2016	Post-2016
Compliance with Energy requirement (Ene1 mandatory standard)	£ 11 – 15k £ 5k (access to large wind)	£26 to 30k £9.5k (access to large wind)
Compliance with Water requirement (Wat1 mandatory standard)	£1,750 (flat) - £4500 (detached house)	
Overall Code Level compliance (i.e. other Code categories)	£200	£3 – 3.5k
Total extra-over cost (£/dwelling)	**£13 – 19k** **£7 - 10k** (access to large wind)	**£31 - 38k** **£14.5 – 17.5k** (access to large wind)

Figure 21, Summary of the cost implications of the requirements of Core Strategy Preferred Options policy CP13. All costs are extra-over costs compared to construction of a Building Regulations 2006 compliant dwelling.

8.1 Impact of tightening Building Regulations standards

Irrespective of any particular policies relating to energy, water or other aspects of sustainability that are adopted in Winchester City Council's Core Strategy and Development Plan Documents, developers will be enforced to increase the standards they build to by changes to the Building Regulations.

In particular, changes to Part L of the Building Regulations (i.e. the part relating to energy consumption and emissions standards) are expected to be tightened, on a trajectory toward the adoption of zero carbon homes policy in 2016. The reductions in dwelling emissions rate expected to be enforced in the 2010 and 2013 changes to Part L, shown in Figure 4, are a 25% and 44% reduction on TER, respectively. The introduction of Zero Carbon Homes policy in 2016 is expected to require a 70% reduction on TER to be delivered by energy efficiency and low/zero carbon supply technologies installed onsite, with the remainder of the dwellings emissions being dealt with through onsite measures or offset by investment in a range of offsite carbon reduction measures (see Section 3.2, for a discussion of the Zero Carbon Home definition).

The cost of building a Building Regulations compliant home will increase as these changes are introduced. The energy standard required by policy CP13 remains in advance of these Building Regulations changes, such that there will still be an extra-over cost associated with meeting the Policy, but when measured from a baseline of the increased Building Regulation standard the extra-over cost will be reduced.

Part G of the Building Regulations, which regulates water consumption standards, is also expected to be tightened in 2010. This will lower the permissible water consumption limit to 105 litres/person/day (in line with Level 3 of the Code) and will also result in an increase of the construction cost to meet Building Regulations (and a commensurate reduction in the extra-over cost of compliance with the Water requirements of Policy CP13, when measured from the improved baseline standard).

The cost of compliance with policy CP13 of the Core Strategy Preferred Options is shown in Figure 22, over the period to 2016. The increasing cost of meeting the Building Regulations and extra-over cost of compliance with the policy, i.e. in addition to meeting Building Regulations, is indicated in this chart. The sharp increase in cost of compliance with the Policy in 2016 is related to the introduction of the requirement to meet Code Level 6. This is accompanied by an increase in the cost of meeting the minimum regulatory standard (due to introduction of Zero Carbon Homes Policy), although this insufficient to offset the increased policy cost.

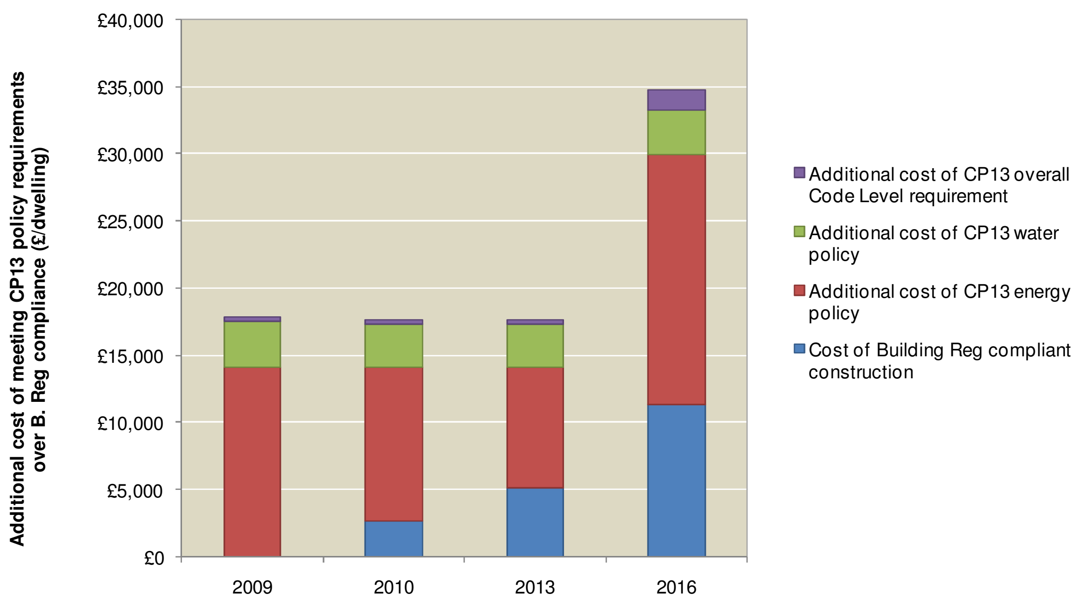
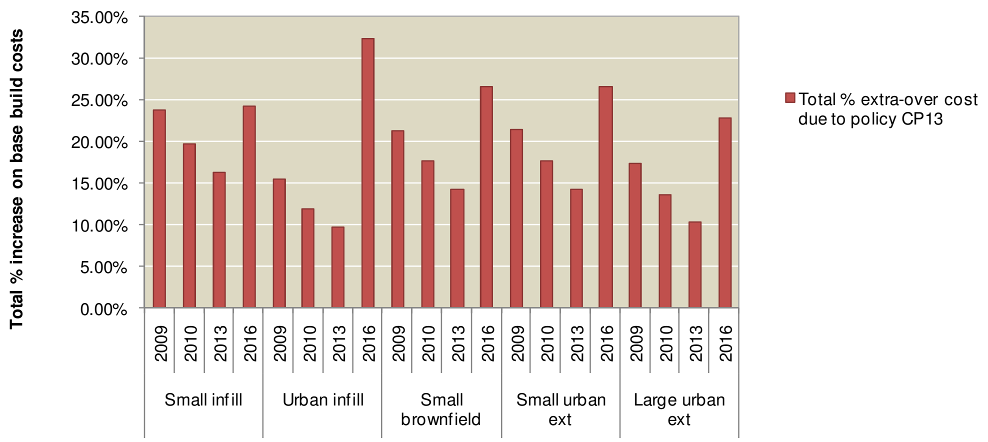


Figure 22, Change in the cost (£/dwelling) of complying with the Building Regulations over time (blue bars) and the additional cost associated with Winchester's proposed Code for Sustainable Homes requirements. Costs are shown for the small urban extension development scenario

8.1.1 Extra-over costs compared to changing Building Regulation baseline

The extra-over cost associated with meeting policy CP13 is shown in Figure 23, for each of the development scenarios. In this figure, the extra-over costs shown are the additional cost of building a dwelling that is compliant with Policy CP13 compared with the cost of constructing a dwelling that complies with the Building Regulations in force at the particular time. In this case it is assumed that there is no availability of medium to large-scale wind. Note that the changing extra-over costs shown in this figure are a result of a shift in part of the overall cost from the cost of the policy to the cost of building a Building Regulation compliant building. It does not take into account cost reductions over time, for example, as a result of the growing commercial maturity of low carbon technologies (these kinds of factors are expected to have an effect over the period to 2016 and are likely to result in a reduced cost of compliance).

Extra-over build cost (of average dwelling on each site) due to Policy CP13



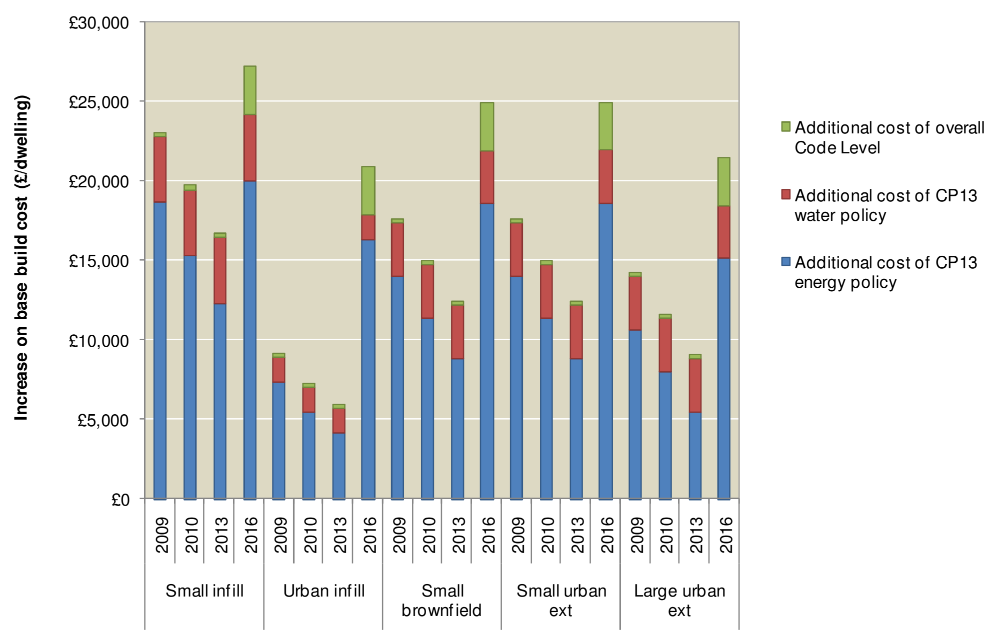


Figure 23, Extra-over cost associated with compliance with Policy CP13 compared to constructing a Building Regulation compliant dwelling. In the UPPER chart, total extra-over costs are shown as a percentage of base build cost. In the LOWER chart, extra-over costs are shown in £/dwelling, broken down between the various requirements of the policy. All costs are for the average dwelling on a particular site.

The extra-over cost of complying with policy CP13 drops as the Building Regulations are tightened over the period up to 2016. For example, taking the case of the Small Infill development type, the extra-over cost of building a dwelling to comply with CP13 in 2009 represents around a 23% increase on the cost of building a Part L 2006 compliant dwelling, whereas by 2013, the additional cost associated with complying with CP13 has dropped to around a 15-16% increase compared to the cost of building a dwelling that complies with the regulations of the day.

Although the introduction of Zero Carbon Homes policy in 2016 will significantly increase the cost of meeting minimum regulatory standards (including the cost of meeting onsite carbon reduction standards – Carbon Compliance – and investment in Allowable Solutions), the extra-over cost of the CP13 policy increases sharply as a result of requirement to comply with Code Level 6 of the Code for Sustainable Homes. The cost of compliance of CP13 in 2016 ranges from around £17k to £26k per dwelling, in addition to the cost of building a 2016 regulation compliant dwelling.

The changing extra-over cost of compliance with policy CP13 for developments where large-scale wind turbines are feasible, measured from a baseline of the Building Regulations in force at the time, is shown in Figure 24 (for the Large Urban development type). In this case the extra-over cost associated to the Core Strategy policy drops from a 10 – 11% increase on the today's base build cost, i.e. the cost of a Part L 2006 compliant dwelling, to < 6% increase on base build cost once the 2013 Building Regulations standards have come into force. The extra-over cost associated with the policy increases to around 10% more than the cost of building a regulation compliant dwelling in 2016, once the requirement for Code Level 6 comes into force.

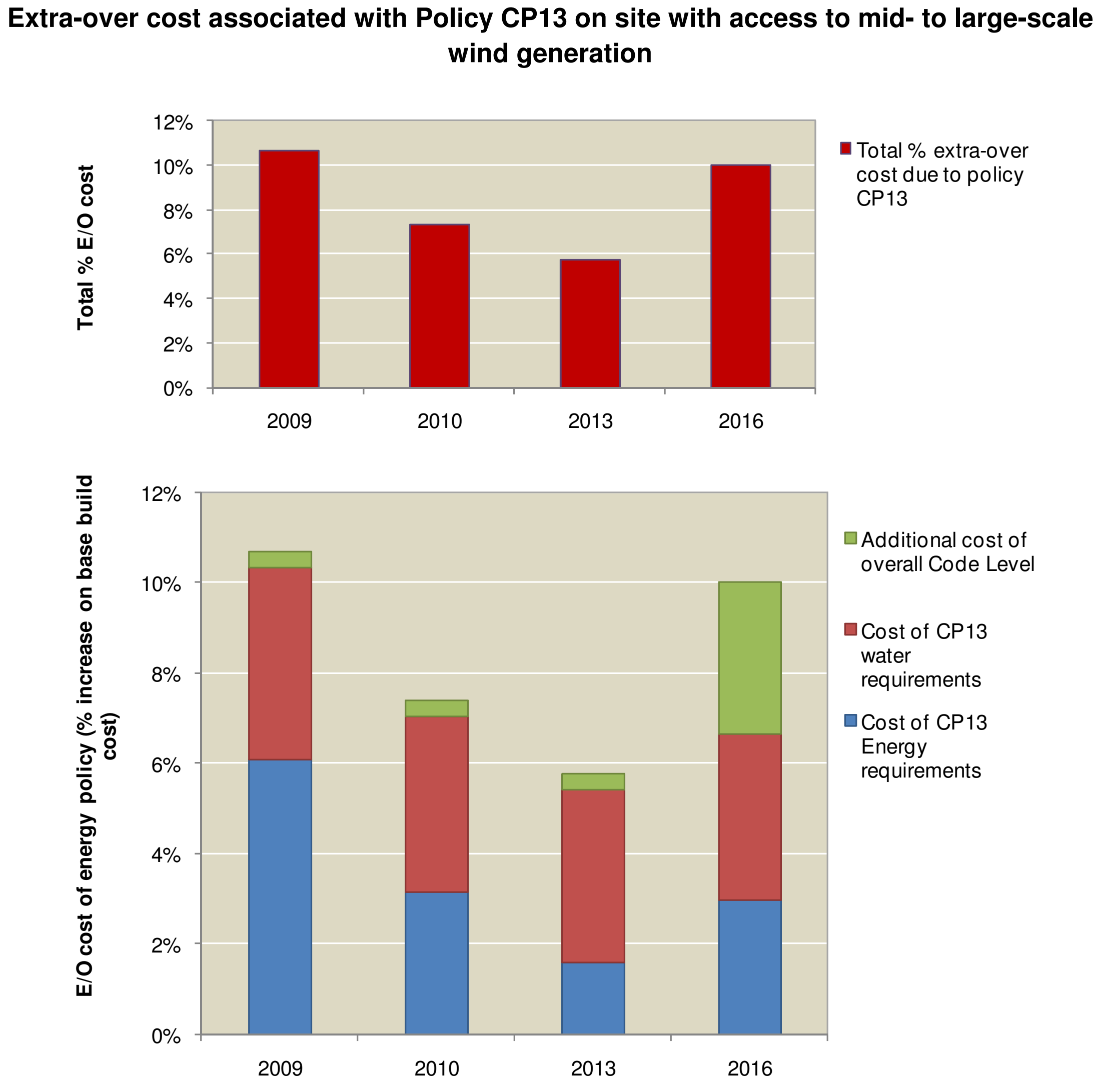


Figure 24, Extra-over cost of complying with Policy CP13 on a site where installation of medium to large-scale wind turbines is appropriate. (UPPER chart): Total extra-over cost as % of construction cost of Building Regulation compliant dwelling. (LOWER chart): extra-over cost as £/dwelling, split between main components.

8.1.2 70% Carbon Compliance

The preceding analysis considers the additional cost of complying with policy CP13 of Winchester's Core Strategy, compared to a baseline of meeting the Building Regulations in force at a particular time. This analysis assumes that the respective energy standards of Code level 5 and 6, required through policy CP13, are a 100% reduction of regulated emissions and a reduction of all dwelling emissions (regulated and unregulated) through onsite means.

According to recent government announcements, the zero carbon homes standard, due to be introduced in 2016, is expected to adopt a lower level of requirement for mitigation of CO_2 emissions through onsite measures than that of Code Levels 5 and 6. The zero carbon standard is expected to require a 70% reduction of a dwelling's regulated emissions (compared to a Part L 2006 baseline) through systems installed onsite, with the remaining emissions (i.e. the remaining regulated and all unregulated emissions) being dealt with through a range of 'Allowable Solutions', which are likely to provide a range of opportunities for developers to invest in offsite carbon reduction measures.

There is potential that the same structure of carbon reduction set out in the zero carbon homes standard. i.e. a minimum standard to be met through energy efficiency, then 70% reduction of regulated emissions reduction to be reached through onsite generation and the remainder mitigated through investment in other, potentially offsite measures, will also be adopted in the Code. This would be consistent with the intention that the Code for Sustainable Homes should provide an early indication of how Building Regulations are expected to change and would also allow a period for the mechanisms required to direct investment in Allowable Solutions to be developed in advance of the introduction of the 2016 zero carbon policy.

The impact on the extra-over costs associated with policy CP13 of adopting the zero carbon hierarchy in the Code is shown in plot below. The extra-over energy costs include the cost of meeting the 70% carbon compliance level and of investment in Allowable Solutions to provide the required additional carbon mitigation. It has been assumed that developers are required to invest in Allowable Solutions at a price of £1,500/(tCO_2/yr) (Note that the forecast price of Allowable Solutions is often referred to as being in the range of £50 to 200 £/tCO_2 for an assumed dwelling lifetime of 30 years. The figure used in this study is equivalent to the lower bound of this range, i.e. £50 per tonne of CO_2 emitted over a 30 year period is equivalent to a payment of £1,500 per tonne of CO_2 emitted annually).

Extra-over cost associated with compliance with Policy CP13 assuming that the Code for Sustainable Homes is brought into line with Zero Carbon Homes Policy

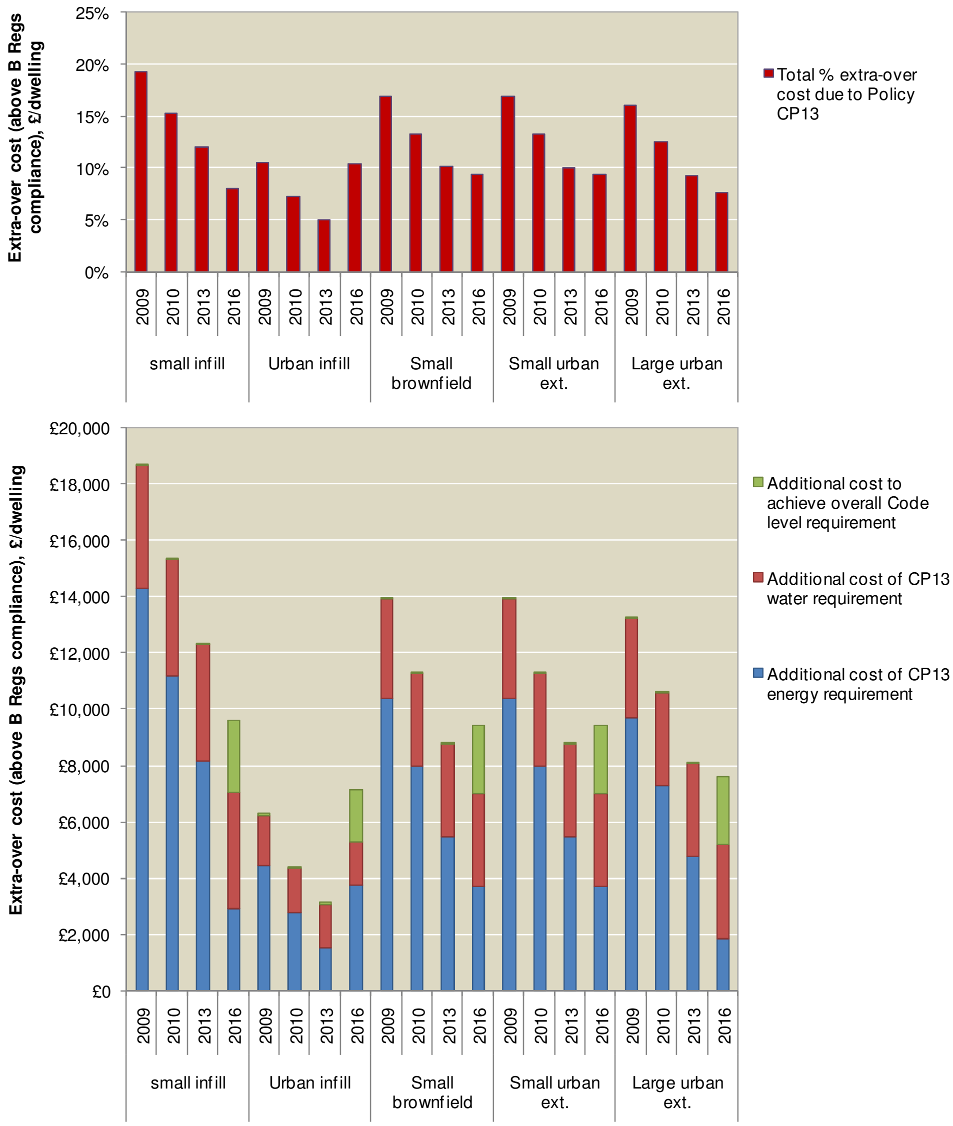


Figure 25, Extra-over cost of complying with Policy CP13 under the assumption that the Code for Sustainable Homes is revised to reflect the Zero Carbon Homes policy's CO_2 reduction hierarchy. (UPPER chart): Total extra-over cost as % of construction cost of Building Regulation compliant dwelling. (LOWER chart): extra-over cost as £/dwelling, split between main components..

When the extra-over costs shown in Figure 25 are compared with the extra-over costs shown in Figure 23 (i.e. those associated with meeting Level 5 and 6 standards of the Code as currently drafted), it can be seen that the adoption of the zero carbon policy energy hierarchy would provide a fairly substantial reduction of the extra-over costs (although they remain substantial). The greatest impact is seen in the extra-over costs in 2016, when policy CP13 requires that Code Level 6 is achieved. The energy strategies required to achieve net zero standard through onsite means are very substantial and would be significantly reduced if the standard were relaxed to require 70% reduction of regulated emissions on site and mitigation of the remaining emissions through Allowable Solutions. Indeed, the high costs associated with meeting the Code Level 6 energy requirement coupled with the technical difficulty of achieving the standard on a significant number of sites were key considerations in the governments decision to adopt a hierarchical approach to CO_2 reduction in the Zero Carbon policy, including an element of offsite investment.

8.2 Policy cost for commercial buildings

In relation to non-residential buildings, policy CP13 includes the following clause:

> *Non-residential buildings that require an Energy Performance Certificate to meet 'BREEAM Excellent' standard from the adoption of this plan and 'BREEAM Outstanding' standards from 2012, or the equivalent from the Code for Sustainable Buildings when it is Launched.*

The BREEAM rating system is similar to the Code for Sustainable Homes, in that it a building is scored against a number of sustainability criteria and a BREEAM level is awarded on the basis of the overall score. There are five BREEAM levels that can be attained – Pass, Good, Very Good, Excellent or Outstanding. The categories against which non-residential buildings are assessed under BREEAM share similarities with those set-out in the Code for Sustainable Homes, such as Energy, Materials, Water etc., although there are a number differing categories, such as transport (access to public transport) and proximity to amenities, that place greater emphasis on a building's location.

In general there has been less publicly available research done into the cost of achieving sustainability standards in non-residential building than in the residential sector. Cost consultants Cyril Sweett, working in partnership with the BRE, published assessments of typical costs of achieving various BREEAM standards for three building types - a naturally ventilated office building, an air-conditioned office and PFI health Centre[10]. The findings of this work are reproduced below. The study considered the costs associated with achieving the ratings for buildings situated in three types of location – (i) a poor location, where no location credits are available, (ii) a typical location, where a number of location credits are achievable and (iii) a good location, where all location credits are achievable. This work was completed in 2005, before the introduction of the Outstanding level into BREEAM.

[10] Costing Sustainability: How much does it cost to achieve BREEAM and EcoHomes ratings?, Cyril Sweett and BRE, 2005

Building type	Location	% increase on base build capital cost			
		Pass	Good	Very Good	Excellent
Naturally ventilated office	Poor	-0.4	-0.3	2.0	-
	Typical	-	-0.4	-0.3	3.4
	Good	-	-0.4	-0.4	2.5
Air-conditioned office	Poor	0	0.2	5.7	-
	Typical	-	0	0.2	7.0
	Good	-	-	0.1	3.3
PFI health centre	Poor	Not assessed			
	Typical	-	-	0	1.9
	Good	-	-	0	0.6

Figure 26, Expected additional capital costs associated with achieving Pass/Good/Very Good/Excellent BREEAM ratings in a range of building types (based on research published by Cyril Sweett and BRE)

The results of the Cyril Sweett / BRE analysis suggest that the additional capital costs of achieving advanced BREEAM standards are not as onerous as the additional costs of achieving, say, Levels 5 or 6 of the Code for Sustainable Homes, particularly in the case of the naturally ventilated office and the health centre. However, in all cases there is a sharp cost increase in advancing from a Very Good to Excellent standard which if continued, could result in the cost of achieving the Outstanding rating being more substantial, i.e. if the low cost credits have been achieved in reaching the Very Good standard and increasingly more expensive measures have to be adopted in advancing to the Excellent and Outstanding rating.

BREEAM has fewer mandatory credits than the Code for Sustainable Homes, i.e. fewer minimum standards that have to be achieved in a certain category in order to qualify for a particular rating, however, in the Energy category there are some mandatory standards. In order to reach the Excellent rating a minimum of 6 credits must be achieved in the Energy category and to attain an Outstanding rating, a minimum of 10 Energy credits are required. Like the Code for Sustainable Homes, credits are awarded under the Energy category for achieving particular CO_2 reductions, although BREEAM differs from the Code in that it uses the EPC carbon rating as the metric for measuring CO_2 reduction. The minimum standards for the Excellent and Outstanding rating relate to achieving an EPC rating of 40 and 25 respectively.

The EPC rating required to achieve the Outstanding level corresponds to a 50% reduction of the Buildings CO_2 emissions from the emissions of the standard building. It should be noted that the standard building is not directly comparable to the baseline of a Part L 2006 compliant building, however an accurate translation of EPC ratings into reductions on current Part L is not straightforward. The Scottish Executive has published some research into the costs of achieving varying levels of CO2 reduction in Non-domestic buildings, performed by the cost consultancy Davis Langdon[11]. This work examined the costs of achieving up to a 50% CO_2 reduction (up to 80% in some cases) in two types of school building, a city-centre office and a retail warehouse via various combinations of energy efficiency improvements and integration of low carbon generation. The additional capital costs associated with the lowest cost approaches to achieving various CO_2 reductions that were identified in this investigation are reproduced in the figure below.

Additional capital costs (% of base build cost) associated with achieving various levels of CO2 reduction in a range of non-domestic buildings

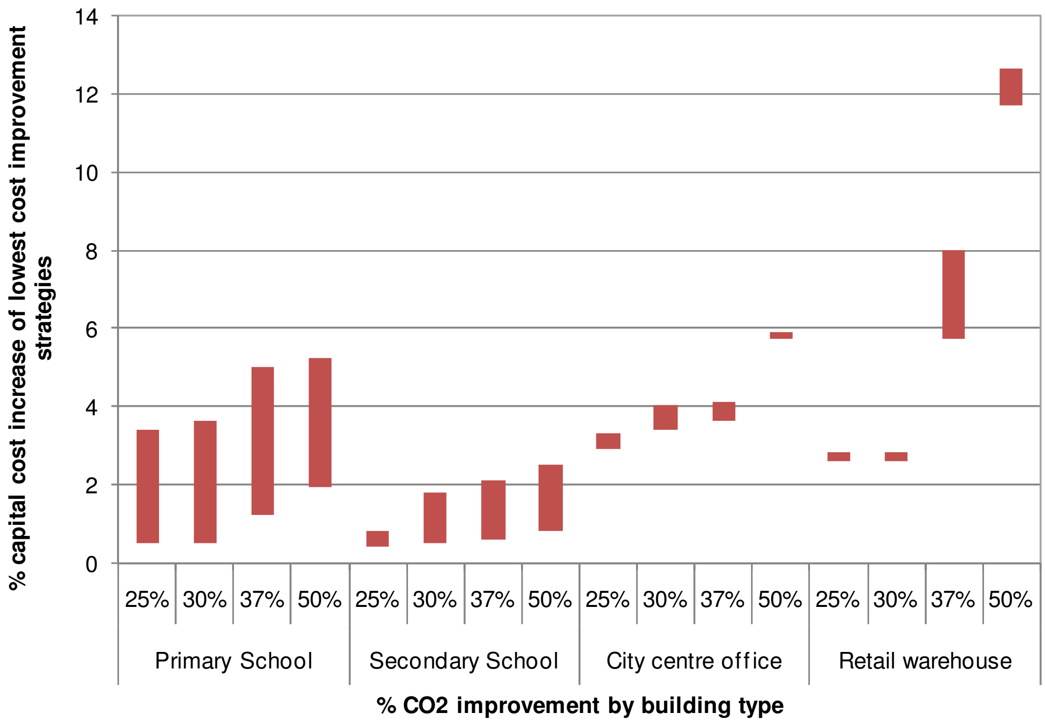


Figure 27, Percentage capital cost increase for various levels of CO_2 reduction in a range of building types, based on the most cost-effective strategies (based on work published by Davis Langdon for the Scottish Government).

The cost increases associated with achieving a level of CO_2 reduction approximating that required to achieve the Outstanding BREEAM rating varies from 2 to 5% in schools, around 6% in an office building and up to 12% in the retail warehouse building type. It should be noted, however, that as in the case of domestic buildings, Part L of the Building Regulations will change in 2010 to improve the minimum mandatory standard required of non-domestic buildings. This change to Part L is expected to require a 25% improvement over the existing Part L standard. The additional cost of compliance with Policy CP13, in terms of meeting the required BREEAM energy standard, should therefore be measured as the cost increase in moving from a 25% to 50% CO_2 reduction. This substantially reduces the cost increment in the case of the schools and the office building.

[11] Assessing the costs of proposed changes to non-domestic energy standards in 2010, Davis Langdon for the Scottish Government, June 2009

These costs are only the costs of meeting the Energy category requirements of the Outstanding rating. Data on the overall cost of meeting the Outstanding rating is currently scarce, which is probably in part due to a lack of buildings that have achieved the standard since its introduction in 2008. The BRE itself reports that the overall cost increment of achieving the Excellent standard in schools is between a 4% to 7% uplift, whereas the cost of achieving what the BRE describes as a low/zero carbon school is up to a 15% increase (again, this does not provide a clear indication of cost of the Outstanding standard). Generally the cost of achieving a particular BREEAM rating does not tend to be as heavily dominated by the costs of the Energy category as is the case in the Code for Sustainable Homes. Given the costs associated with achieving the CO_2 reduction standard, the overall cost of achieving the BREEAM Outstanding standard are expected to be at least 10 – 15% in schools and offices and significantly higher in the retail warehouse case.

On the basis that the overall costs of achieving the BREEAM outstanding rating are currently uncertain, there may be a rationale for leaving the overall BREEAM requirement at Excellent, but requiring that the mandatory credits for the Outstanding rating are achieved in the Energy rating. This elevated energy requirement could be brought into force in 2013, when Part L of the Building Regulations are expected to be tightened further, to ensure that new non-residential development in Winchester remains at an advanced standard compared to the national regulations..

9 Core Strategy Policy CP14 – Cost Assessment

Policy CP14 of the Winchester Core Strategy Preferred Option requires that a following hierarchy is applied to adoption of renewable and decentralised energy systems. The hierarchy is intended to specify an order of preference, such that the highest level of the hierarchy that is suitable and viable for a particular development is implemented.

The proposed hierarchy is as follows:

1. Connect to a combined heat and power (CHP) and District Heating / Cooling Network, with larger schemes (1000 dwellings or more) designed to use District Heating / Cooling networks and provide / contribute to these networks where they do not yet exist.

2. Generate at least 20% of their anticipated energy demands on site.

3. Use off-site generation to meet emissions reduction targets as long as the off-site generation is additional capacity.

4. If none of the above is possible, contribute to the District Carbon Reduction Fund.

In this section, the additional costs associated with this policy are assessed and, importantly, the way that this policy integrates with policy CP13 to provide a coherent body of policies with respect to low and zero carbon energy and sustainable buildings. A number of key points can be drawn out of this assessment, as follows:

1. Policy CP14 strongly promotes the implementation of district heating systems linked to CHP. While it is certainly true that district heating and CHP systems can provide a route to low carbon heat, particularly where the CHP system is fuelled using a renewable fuel, there are a number of factors that need to be considered:

    a. The economic viability of district heating systems is best on sites that are built to high density, i.e. where the heat density is high. High heat density sites offer a substantial opportunity to sell heat for a limited investment in district heating infrastructure (because the heat loads are closely spaced). Much of the development in Winchester is expected to be at relatively modest density, which may not be ideal for district heating.

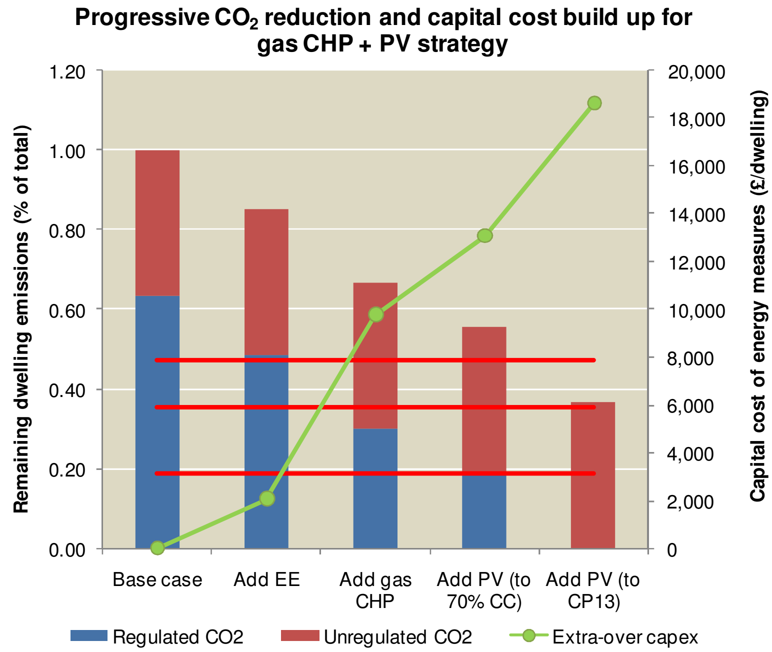
    b. The economics of CHP systems improve as the load factor (the proportion of the time that the system is operating) increases. This usually means that CHP is best suited to sites where there a mix of uses, such that there is a diversity of heat loads. Wholly residential sites do not always present the best opportunities for CHP as there are long periods of low heat load, e.g. the summer months and during the day when people are at work.

    c. CHP and district heating systems only deliver very low carbon heat when the CHP system is renewably fuelled. The availability of biomass CHP systems is currently fairly limited, with only relatively high capacity systems (in terms of installed power output) being available at economic costs. This means that biomass CHP may only be relevant to large, ideally mixed-use, sites, which is only expected to represent a small number of Winchester's sites. It should be recognised, however, that biomass CHP technology is under development and over time, lower capacity and more economic systems are likely to become available. District heating systems are best installed while a site is being developed (retrofitting to an existing development is disruptive and more costly), so there is potentially merit in installing district heating systems that are initially fed by gas-fired systems (or potentially biomass boilers), which can be swapped-out for biomass CHP at a later date when the technology matures.

2. Policy CP13 requires that Code Level 5 standard is met for energy up to 2016 and Code Level 6 standard thereafter. The analysis in Section 7 demonstrated that the most cost-effective approach to reaching Code Levels 5 and 6 in the typical development scenarios is only likely to involve CHP and district heating in the case of the Large Urban Extension development scenario. In the other cases, a system of biomass boilers and photovoltaics is preferred (or on sites where there is adequate space and resource, large-scale wind would provide a lower cost route).

   The comparison of energy strategy extra-over costs given in Figure 14 suggests that the difference in cost between employing individual biomass boilers in each dwelling (or block of flats) compared to a centralised biomass boiler system feeding heat over a district heating network is relatively marginal and, in terms of logistics of biomass delivery and ongoing costs of supplying biomass fuel, the centralised system may be preferable. As discussed above, this may present an opportunity for a biomass CHP system to be installed at a later date, once suitable technologies are available.

   Given the current lack of availability of biomass CHP systems, the hierarchy stated in CP 14 may encourage developers to consider the installation of a gas CHP system with a district heating system. In order to also meet the requirement of policy CP13, a substantial amount of renewable electricity generating capacity would need to be installed alongside the CHP system. In Figure 28, below, the gas CHP / DH and PV strategy is compared against the strategy of biomass boilers (individual) and PV. In each case the progressive reduction of CO_2 emissions due to each component of the system is shown, together with the cumulative capital cost (results are shown for the Small Brownfield development). Also shown in the plots are the target CO_2 reduction levels associated with Levels 3 and 4 of the Code and the onsite CO_2 reduction level proposed for the Zero Carbon Homes standard.



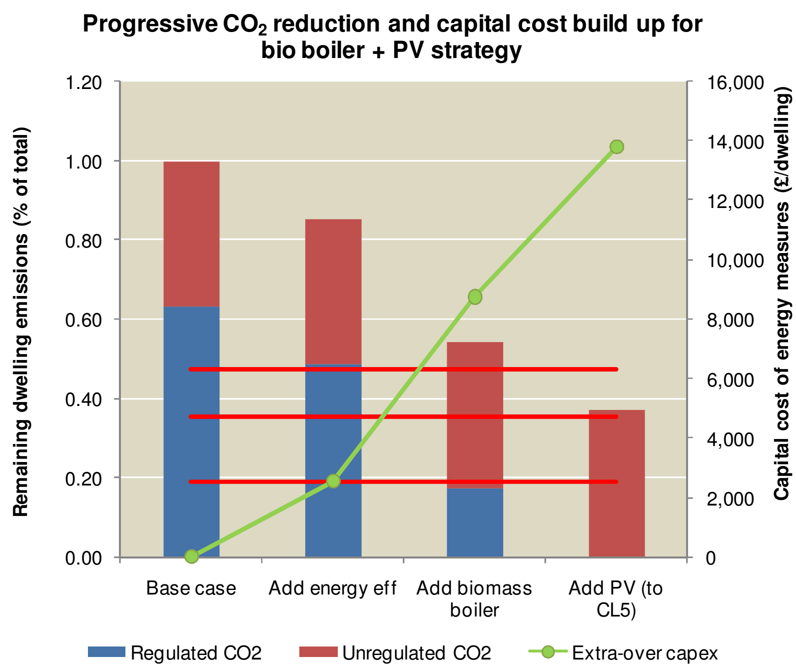


Figure 28, Cumulative plots of the CO_2 emissions reduction and extra-over capital cost associated with each element of gas CHP / DH and biomass boiler based energy strategies. The horizontal red lines identify the target emissions reductions for Code Level 3, 4 and the zero carbon homes onsite emissions reduction requirement.

The capital costs associated with compliance with Code Level 5, i.e. meeting Core Strategy policy CP13, shown in Figure 28 confirm the better capital cost-effectiveness of the biomass based approach (an extra-over capital cost of around £14,000/dwelling compared to over £18,000/dwelling in the gas CHP based case). The biomass boiler strategy would also provide the lower cost means of achieving the proposed zero carbon standard. To meet the mandatory requirement of Code Level 4 (i.e. a 44% reduction of regulated emissions) has a comparable cost in each case.

Given the cost difference between the gas CHP and district heating strategy compared to the biomass boiler strategy, it is unlikely that developers would select the gas CHP route to compliance with policy CP13. If adopting the biomass boiler strategy, then developers would automatically meet the second level of the hierarchy stated in CP14, i.e to generate 20% of energy demands on-site, so no additional cost would be associated with meeting this policy.

Gas CHP provides a lower cost means of Code level 4, but once require Code level 5 (or a 70% onsite carbon compliance) then biomass becomes more cost-effective.

3. Assuming that a developer is complying with policy CP13, to meet the energy standards of Code Level 5 or 6, it is likely that they will also meet the second level of the policy CP14 hierarchy. Any strategy that delivers a 100% reduction of regulated CO_2 emissions (or greater in the Code Level 6 case) is likely to incorporate sufficient renewable energy generation to meet the requirement for 20% of energy demands to be met on-site without further investment in generating technologies. Even if the very highest levels of fabric performance were achieved, such that the space heating load is reduced to a very low level, in order to reach the Code level 5 standard will still require 20% reduction of CO_2 demands through renewable energy provision.

In summary, Policy CP14 is expected to reinforce Policy CP13 in promoting the selection of CHP and district heating systems on large sites, particularly where there is a mix of uses. On smaller, less dense sites, however, developers are likely to adopt lower cost means of complying with Policy CP13, rather than adopting heat networks. Assuming that a developer has complied with policy CP13, they will automatically have achieved the second tier of the hierarchy stated in policy CP14, i.e. generation of 20% energy demands on site. On this basis, although Policy CP14 reinforces the actions promoted by policy CP13, it is not clear how much additional action will be required in order to comply with CP14 once the requirements of CP13 have been met.

10 Viability impacts

While the national planning guidance on climate change and renewables (supplement to PPS1 and PPS22) has placed an obligation on local planning authorities to ensure local opportunities for low carbon energy generation are captured, at the same time authorities must be able to justify setting targets that differ from national policy.

Through policy CP13 and CP14, Winchester District Council is proposing to set targets for new developments that are significantly ahead of the planned introduction of carbon reduction targets through national policy, and so a sound justification of these targets is required. In this section, the viability and justification of the existing policy proposals are examined and possible alternatives assessed.

The sustainable building and low carbon energy policies proposed in the Core Strategy Preferred Options paper have been based on a renewable energy assessment performed for Winchester District Council by ESD in 2008[12]. This report came to a number of key conclusions:

- There is a large technical potential for renewable energy in the district (i.e. physically practical potential, but unconstrained by economic considerations). This technical potential is dominated by large wind turbines and biomass.
- A target for renewable energy installation sufficient to provide an overall 17% reduction of the district's current CO2 emissions over the next 15 years was identified. 50% of this target would be provided by biomass and one-third from wind energy. This would require 10% of the district's agricultural land to be used for cultivation of energy crops and installation of twenty large wind turbines.
- The CO_2 reduction target from renewable energy supply over the next 15 years is theoretically sufficient for all new development in the district over the period to be zero carbon.

The renewable energy study has identified that there is significant potential for a rapid increase in the level of renewable energy supply in Winchester over the period of the Core Strategy. In addition to this, Winchester currently has the highest per capita carbon footprint compared to the average for the South East Region, which provides a specific driver for ensuring CO_2 emissions growth from additions to the stock should be limited as far as possible. On this basis, the need and opportunity for CO_2 reduction targets in Winchester that are ahead of the national average can be established. The key question therefore is whether the Core Strategy policies as currently drafted are appropriate to deliver the high-level aims.

10.1 Viability of existing policies

The costs implications of the existing Core Strategy policies have been explored in detail in Sections 8 and 9. This analysis has shown that the cost impact is strongly driven by policy CP13, as either the upper or, more likely, the second tier of the low carbon energy hierarchy proposed in CP14 will be met as a corollary of complying with policy CP13.

[12] Renewable Energy Study for Winchester District Development Framework, ESD, December 2008

The costs impact associated with meeting policy CP13 is significant, a result of the requirement for the standards of the upper levels of the Code for Sustainable Homes to be met in the Energy and Water category (particularly Energy, which dominates overall Code costs). The cost implications of compliance with policy CP13 is shown in the figure below, alongside the increasing construction costs that will result from tightening of the Building Regulations over the period to 2016 (the cost ranges relate to the variance in cost of achieving a certain level of carbon reduction between the typical site scenarios).

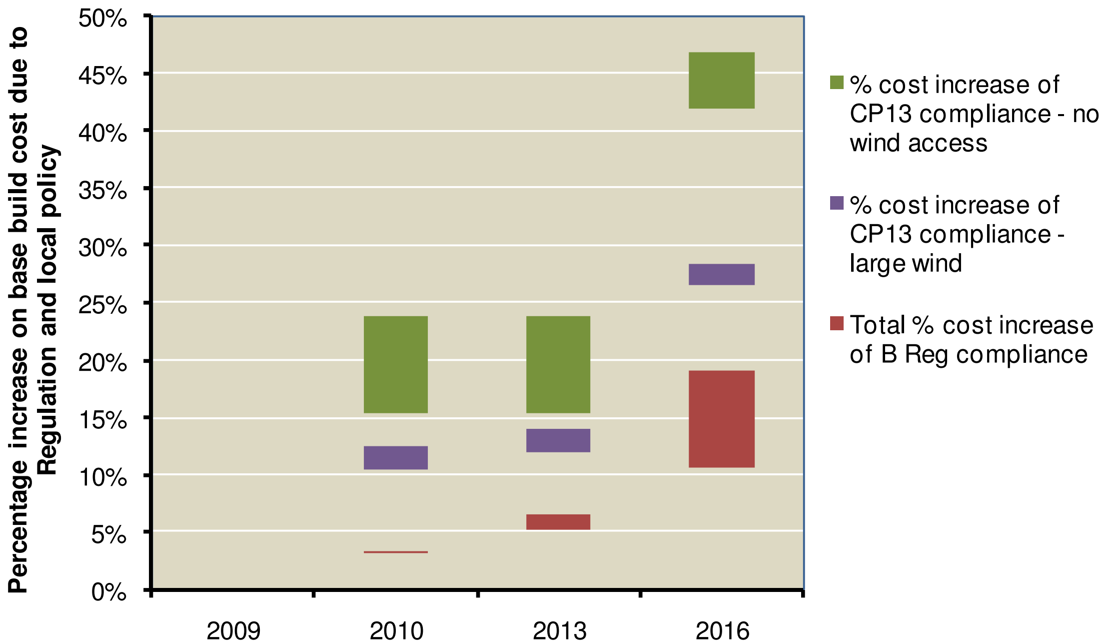


Figure 29, Percentage capital cost increase of meeting the tightening Building Regulations and of complying with policy CP13 (additional capital cost per average dwelling)

The Building Regulations alone will substantially increase construction costs for new dwellings – by more than 5% when the 2013 changes to the Regulations are made and between 10% to 20% once the zero carbon homes standard is introduced. The additional cost of meeting policy CP13 is clearly significant, a further 10 – 15% in 2013 and up to a further 25% in 2016, resulting in a cumulative additional construction cost that could be 45% higher than current costs. These cost increases are mitigated to some extent on sites where the installation of large wind turbines is feasible, limiting the additional cost in 2016 to around 25 - 30% above current costs compared to a 10 – 20% increase associated with meeting the tightened Building Regulations.

The concern regarding high levels of cost increase is that they could jeopardise the viability of sites, leading to a lack of housing supply. Assuming that developers are not able to pass the construction cost increases onto home-buyers, then developers are likely to attempt to protect their profit margins by putting pressure on land values or negotiating for reduced S106 contributions. Clearly housing developers compete for land with other potential uses and so there is a minimum to which land values can drop before these other uses become more attractive to land-owners. Alternatively, if a developer holds a long-term land bank, i.e. the land has been purchased so the land value is fixed, then the increased construction costs directly undermine profit margins (and potentially Section 106 contributions). In this case, a point could be reached when it is no longer attractive for a developer to develop on land that they own and that land might then be sold on to other uses.

The cost increases associated with Policy CP13, as shown in Figure 29, are high and developers consulted in the course of this work have suggested that they could impact on site viability. It should be noted, however, that the on-costs shown in Figure 29 are expected to represent a worst case scenario for the capital on-costs and for the additional cost burden on developers. The costs used in this study do not account for capital cost reductions of low carbon technologies over the period to 2016 (and beyond), which are likely to occur as the markets for the technologies mature. Also, the changes to the Building Regulations are likely to result in house builders making more fundamental changes to their housing designs, in order to find the most cost-effective means of meeting CO_2 reduction targets. It may also be the case that the whole capital on-cost is not met by the housing developer. Particularly in cases where a centralized energy system is employed, such as a district heating network, developers may be able to attract involvement of third-party organisations, such as an ESCO, that would part-finance the development of the system on the basis of the ongoing revenues from the sale of energy services.

Notwithstanding these mitigating factors, it is expected that policies CP13 and 14 will significantly increase the cost of development in Winchester. In the following section, we examine whether the policies could be amended to deliver similar overall objectives, at a reduced cost to developers.

10.2 Policy amendments

The Renewable Energy Study for Winchester has identified that there is high potential for renewable energy exploitation in the district and that this potential is dominated by biomass and large-scale wind resource[13]. On this basis, the key objective is to ensure that the carbon emissions resulting from new development in the district is mitigated as far as possible and to encourage the uptake of biomass and wind turbines as the means to achieve this aim.

As was discussed in Sections 6 and 8, policy CP13 is likely to be partially successful in achieving this aim. The lowest cost approach to meeting policy CP13 will be the installation of large wind turbines and so, on sites where installation of these turbines is feasible, this is the route that developers would be expected to take. On sites where installation of wind turbines is not feasible, then it has been shown that the installation of biomass heating systems is the most cost-effective approach. Only on the largest, mixed-use sites is this likely to be in the form of biomass CHP systems linked to district heating systems (as preferred by the hierarchy defined in CP14). On the majority of Winchester’s smaller, modest density sites, developers would be expected to select individual biomass boilers in each property or centralised biomass boilers linked to a district heating system. So, it can be expected that policy CP13 will require

[13] Note that the findings of the Renewable Energy Study are assumed as inputs this study, the validity of the conclusions of this study have not been tested.

high levels of CO_2 reduction in new developments and that developers would seek to meet the policy by deploying biomass systems or, where appropriate, large-scale wind.

The selection of the Code for Sustainable Homes energy standards as the means to drive CO2 reduction in new developments does, however, result in high cost of compliance and potential deviation from the least cost means of delivering CO_2 reduction in the district overall. Policy CP13 requires that Code Level 5 energy standard is met prior to 2016, which requires a 100% reduction of regulated emissions from measures installed on the site. This level of CO_2 reduction cannot be achieved through increased energy efficiency and installation of a biomass heating system (apart from where the biomass system is a CHP, which is only relevant on the largest sites). Hence, on sites where wind turbines are not feasible, developers are likely to be forced to invest in photovoltaics as a means of delivering the additional renewable electricity supply required to meet the Code Level 5 standard. Post 2016, policy CP13 states that the Code Level 6 energy standard is met, which requires all CO_2 emissions from the dwellings, regulated and unregulated, to be reduced through on site measures. On smaller sites, without possibility of installing large-scale wind, this will push developers to installation of lager quantities of photovoltaics (on some sites, the limitations on area available for installation of PV may render the requirement unachievable). A local policy that drives developers toward installation of large amounts of PV is not complementary with the findings of the Renewable Energy Assessment and will not deliver the most cost-effective CO2 reduction for the district overall (photovoltaics are not a very cost-effective means of renewable energy generation in the UK).

A more effective policy would be to set a lower requirement for reduction of CO_2 through onsite means and then to require developers to provide investment in offsite carbon reduction measures. The Zero Carbon Homes policy is expected to adopt a requirement for 70% reduction of current Part L regulated emissions through energy efficiency and onsite measures. As was shown in Figure 28, on sites where large-scale wind is not available, this level of onsite carbon reduction is still likely to be most cost-effectively met through adoption of biomass heating systems, but will not require developers to make significant additional investment in photovoltaics. Implementation of a revised policy CP13 that required a 70% reduction of Part L 2006 regulated emissions through onsite means (energy efficiency and low carbon generation) is therefore likely to be equally effective at delivering uptake of onsite biomass and large-scale wind installations as the currently drafted policy.

In order to provide the same level of carbon reduction overall as the existing policy, developers could then be required to make an additional contribution to offsite measures, similarly as to the intended system under the Zero Carbon Homes policy. This additional contribution could be used to fund a range of carbon reduction initiatives, such as large-scale energy projects in areas where they are most viable, establishing heat networks or providing grant assistance for energy efficiency improvements, among other potential measures.

Once the Zero Carbon Homes policy comes into force in 2016, the requirements of the revised CP13 policy described above will be enshrined in national regulation, such that further local policy intervention with respect to CO_2 reduction from new development becomes redundant.

A policy to require a certain overall Code Level standard could be maintained to ensure that other aspects of sustainability are also paid attention to[14].

Assuming that the other aspects of policy CP13 remain the same, the requirements of the revised policy are summarised in the table below.

Amended CP13 Option 1 – Reduced onsite CO_2 reduction standard

Required standards	**2010**	**2013**	**2016**
Onsite CO_2 reduction	70%	70%	70%
Contribution to offsite measures	All remaining emissions (zero carbon standard)		
Water consumption standard	Code level 5	Code level 5	Code level 5
Overall Code Level	Code Level 3	Code Level 3	Code Level 6*

* With the exception that the mandatory energy requirement has not been met.

The capital cost implications of this revised policy are shown in the figure below: The additional costs are shown as percentage increases over the cost of meeting the Building Regulations at the particular time.

[14] Note that the Energy and CO_2 requirements of Code Levels 5 and 6 are not compatible with the proposed structure of the energy requirements under an amended policy CP13. If Code Level 5 or 6 overall ratings are specified, it should be stipulated that the energy requirement as stated in policy CP13 should be applied in preference to the requirements of the Code.

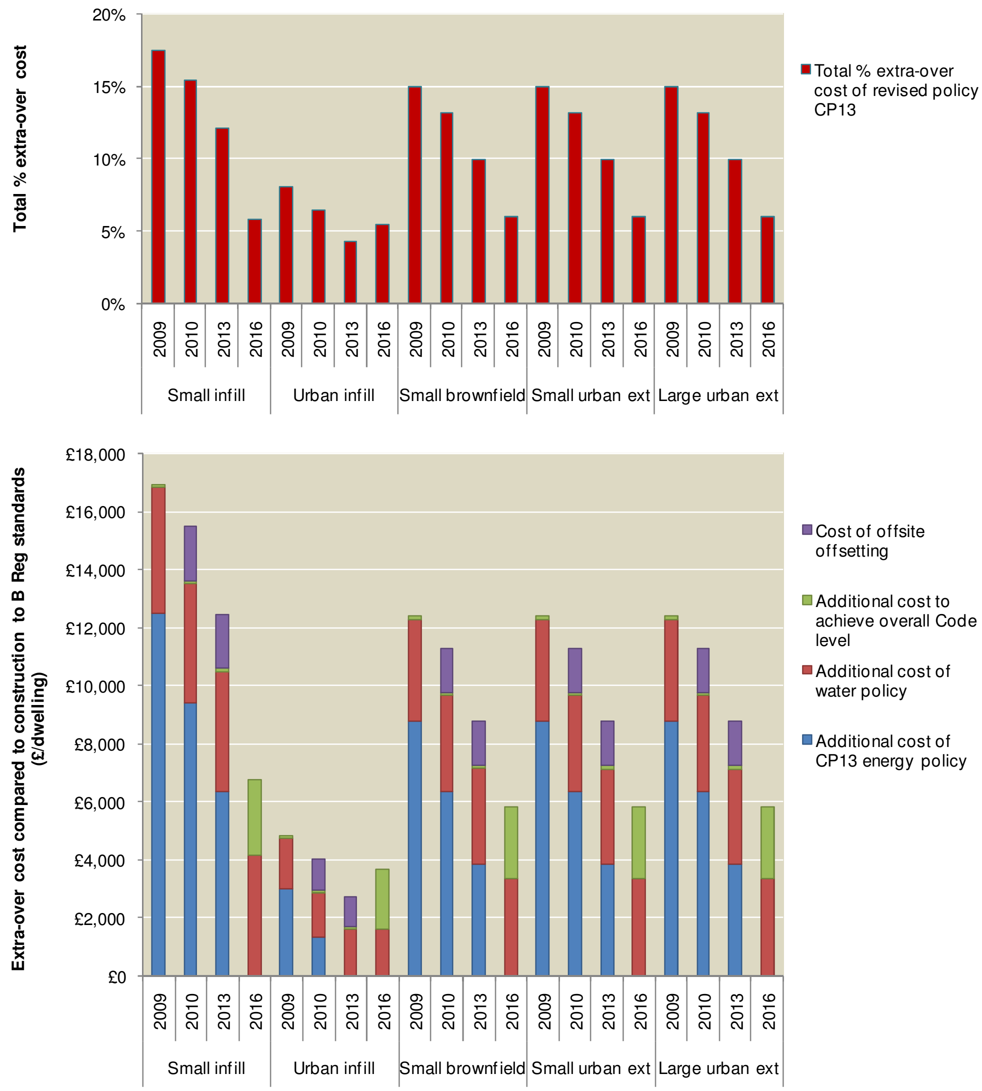


Figure 30, Increase on base build cost over compliance with the Building Regulations in force at a particular time for amended policy CP13 (Option 1). Build cost increases are shown as % (Upper Chart) and as £/dwelling (Lower chart).

The capital cost implications of the revised policy CP13 are significantly lower than those associated with the current drafting of the policy (see Figure 23), but deliver the same overall carbon reduction and reduction of water consumption.

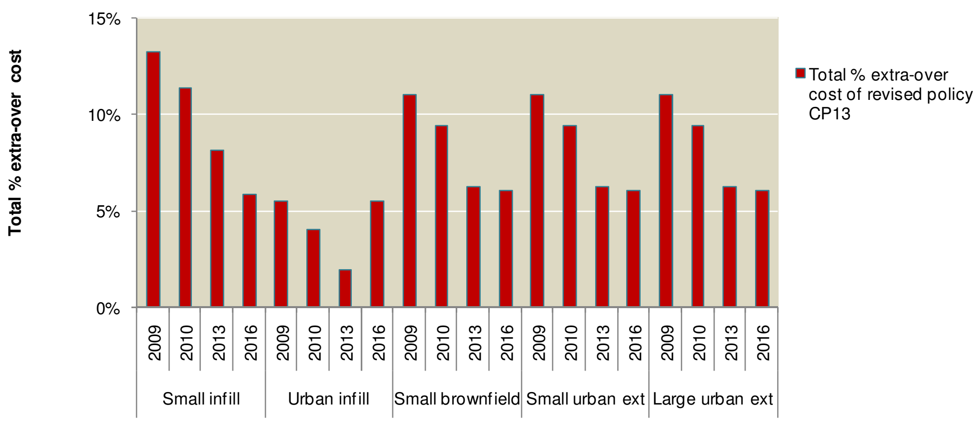
The developer community may feel that the overall cost impact of the policy is still high, particularly in the early years of the policy. Further reductions in the additional capital costs are likely to be at the expense of either the overall levels of carbon reduction or reduction in water consumption. Two possible variations on the revised policy that would further mitigate the cost impact are highlighted below.

Amended CP13 Option 2 – Reduced water consumption standard

The additional capital costs of achieving the Code Level 5/6 water consumption standard is high. In this option, the impact of delaying the requirement for this standard to be met until 2016 is assessed.

Required standards	**2010**	**2013**	**2016**
Onsite CO_2 reduction	70%	70%	70%
Contribution to offsite measures	All remaining emissions (zero carbon standard)		
Water consumption standard	Code level 3	Code level 3	Code level 5
Overall Code Level	Code Level 3	Code Level 3	Code Level 6*

* With the exception that the mandatory energy requirement has not been met.



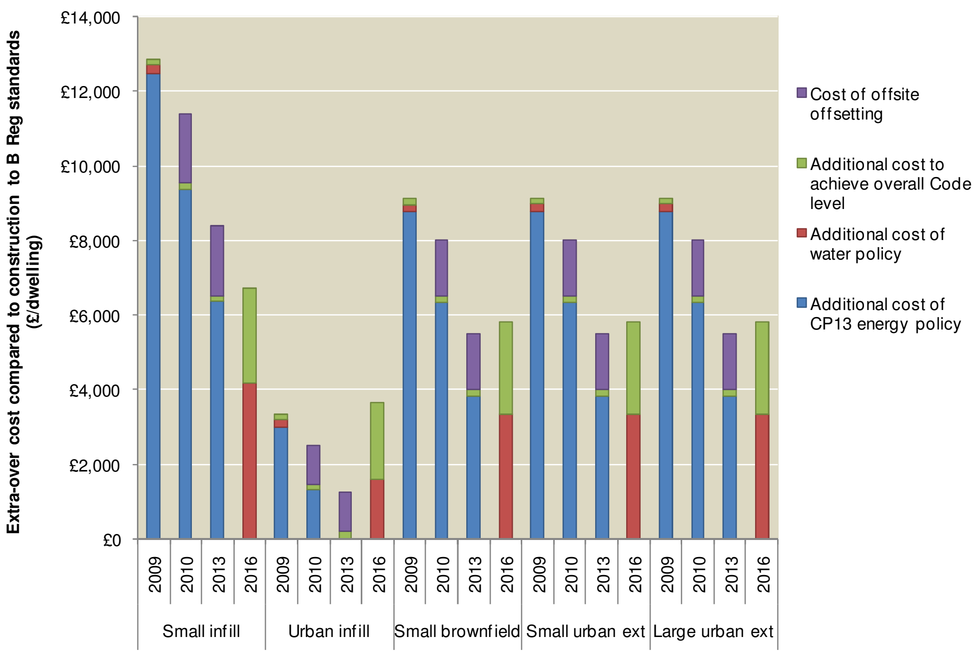


Figure 31, Increase on base build cost associated with a variation on the revised policy CP13 (option 2), such that the requirement for reduced water consumption is delayed. Build cost increases are shown as % (Upper Chart) and as £/dwelling (Lower chart).

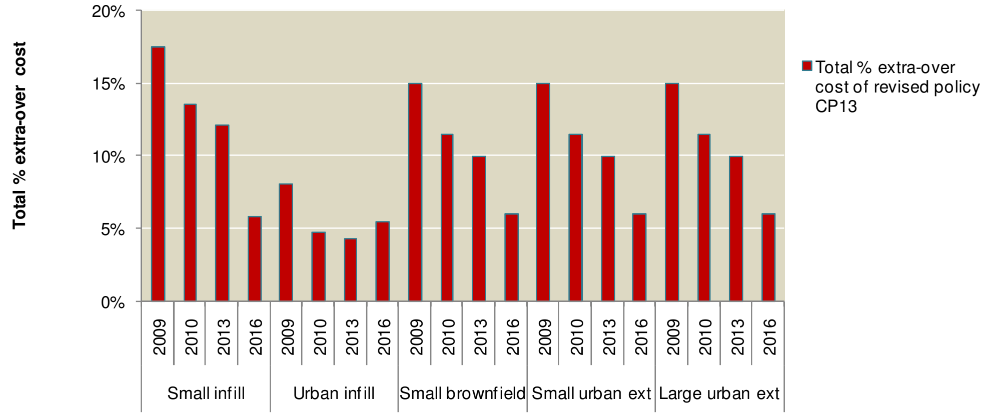
In general the extra-over costs in this option are limited to less than a 10% increase on the cost of compliance with the Building Regulations of the day (the 2009 costs are higher, but realistically the policy will not be adopted before the 2010 changes to the Building Regulations have come into force). The policy will not provide the extent of mitigation of water consumption in the near term, although there are currently some concerns regarding the overall sustainability of greywater recycling systems, which are likely to be an integral part of the Code Level 5/6 compliant water strategy. The delay in adoption of this standard may therefore be appropriate, to enable these issues to be resolved.

Amended CP13 Option 3 – Delayed requirement for offsite contribution

In this option, the requirement for a 70% reduction of Part L 2006 regulated emissions by onsite means is introduced from 2010, however, the requirement for additional investment in offsite measures is not enforced until 2013.

Required standards	2010	2013	2016
Onsite CO_2 reduction	70%	70%	70%
Contribution to offsite measures	None	All remaining emissions (zero carbon standard)	
Water consumption standard	Code level 5	Code level 5	Code level 5
Overall Code Level	Code Level 3	Code Level 3	Code Level 6*

* With the exception that the mandatory energy requirement has not been met.



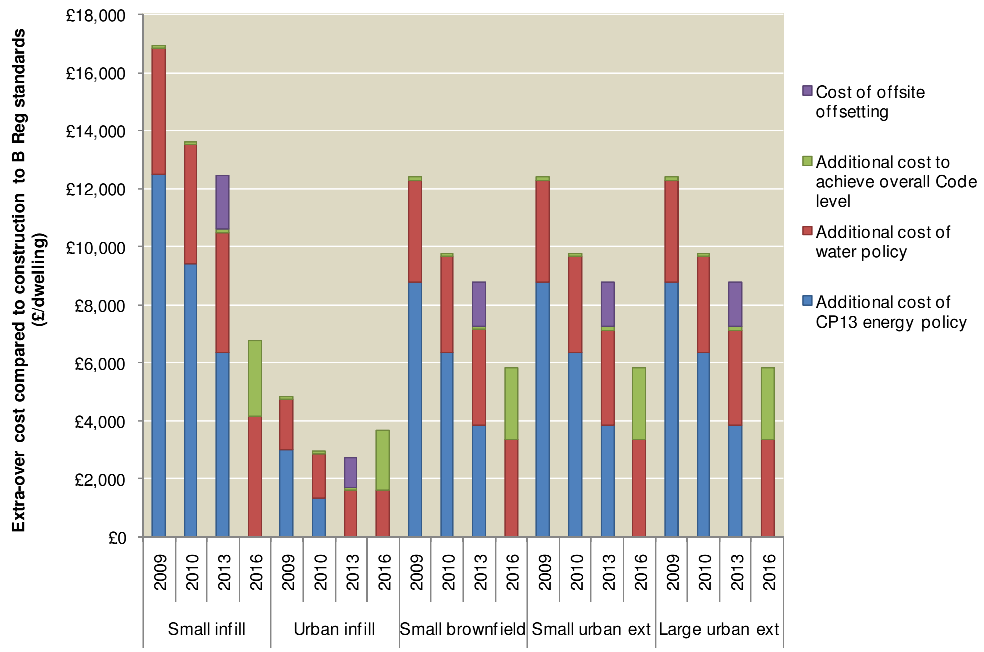


Figure 32, Increase on base build cost associated with a variation on the revised policy CP13 (option 3), such that the requirement for contributions to offsite measures is delayed until 2013. Build cost increases are shown as % (Upper Chart) and as £/dwelling (Lower chart).

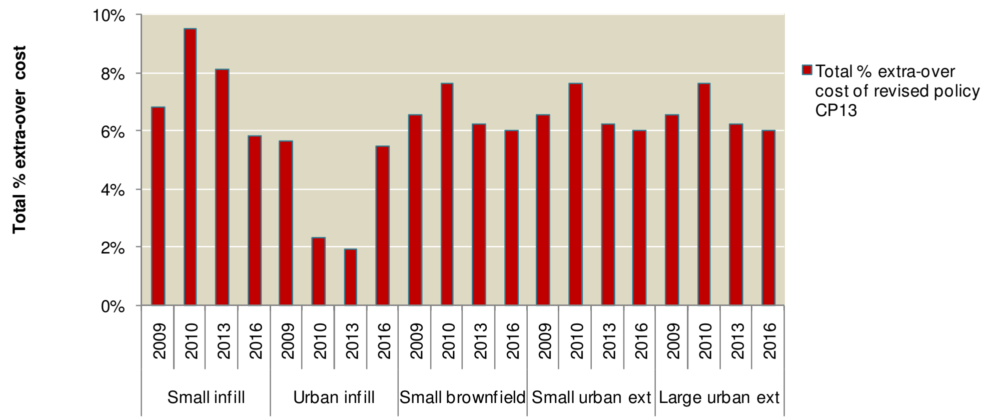
In this case the additional capital costs associated with the policy over the period from 2010 to 2016 are around 10% - 12% (apart from in the flatted development, where lower cost energy solutions are feasible). Beyond 2016, the costs of the water policy and requirement to achieve other sustainability standards in line with Code 6 results in around a 6% cost increase over compliance with the zero carbon homes policy.

This policy variation will result in a lower level of CO_2 reduction overall, although the period to 2013 may provide an opportunity for development of the mechanism by which developer contributions will be collected and invested in low carbon projects in the district, such as large-scale wind development.

Amended CP13 Option 4 – Reduced water consumption standards and delayed requirement for offsite energy investments

The final alternative option has the lowest additional cost implications of the proposed amendments. In this case, the Code Level 5 water consumption standards are not enforced until 2016 and the requirement for developers to invest in offsite measures to mitigate residual site emissions enforced from 2013 onwards.

Required standards	**2010**	**2013**	**2016**
Onsite CO_2 reduction	70%	70%	70%
Contribution to offsite measures	None	All remaining emissions (zero carbon standard)	
Water consumption standard	Code level 3	Code level 3	Code level 5
Overall Code Level	Code Level 3	Code Level 4	Code Level 6*



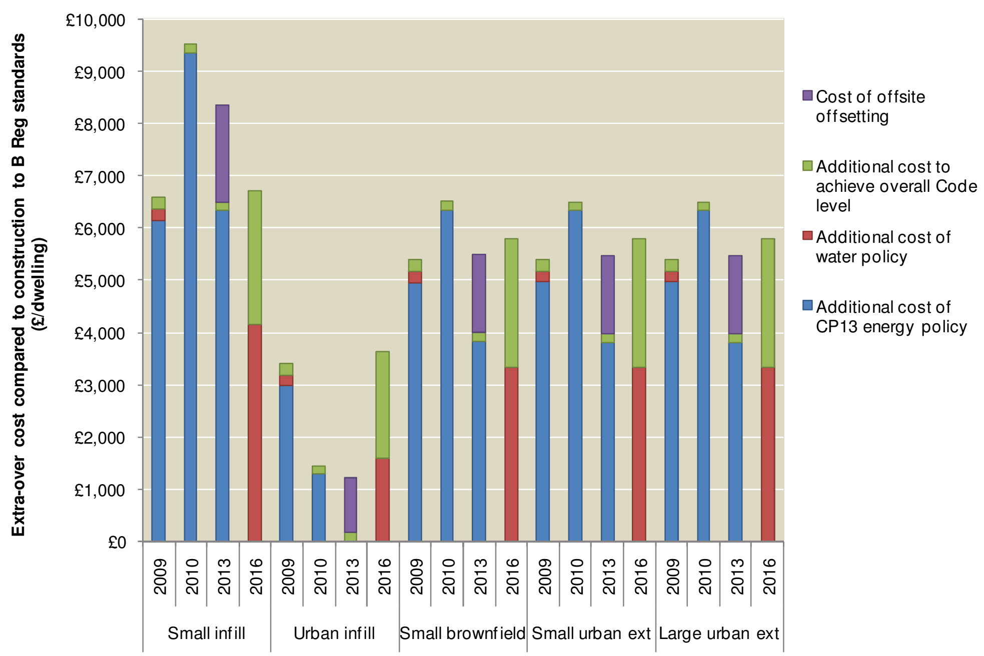


Figure 33, Increase on base build cost associated with a variation on the revised policy CP13 (option 4), such that the requirement for increased water consumption standards is delayed to 2016 and contribution to offsite CO_2 reduction is required from 2013

Under this policy option, the anticipated increases in the build cost are limited to < 10% above the Building Regulation (or zero carbon standard) in force at any particular time. In terms of CO_2 reduction, the policy maintains a standard well in advance of the proposed changes to the regulatory requirements up to 2016, when the energy policy becomes aligned with the Zero Carbon Homes policy.

Overall, this amended policy would deliver a lower level of CO_2 reduction from new development in the district than the existing Core Strategy policy. However, the progression of investment in CO_2 requirement is still challenging, is better aligned with (although in advance of) the progression being proposed by government and has associated levels of increased cost burden that are likely to be more palatable to developers.

11 District Low Carbon Buy-out Fund

The policy options discussed in the preceding section, comprise a mix of onsite CO_2 reduction and the requirement for developers to contribute to offsite measures to offset the remainder of the emissions from a development. This is in line with the concept of Allowable Solutions, introduced by government as part of the Zero Carbon Homes policy.

The mechanism by which investment in Allowable Solutions will be administered and monitored has not been decided and a number of options are being explored within government. One option is the creation of local buy-out funds, which would collect Allowable Solutions revenues and invest them in carbon reduction measures within the local area. Such a local buy-out fund could be created in Winchester to handle the contribution of developers to offsite measures.

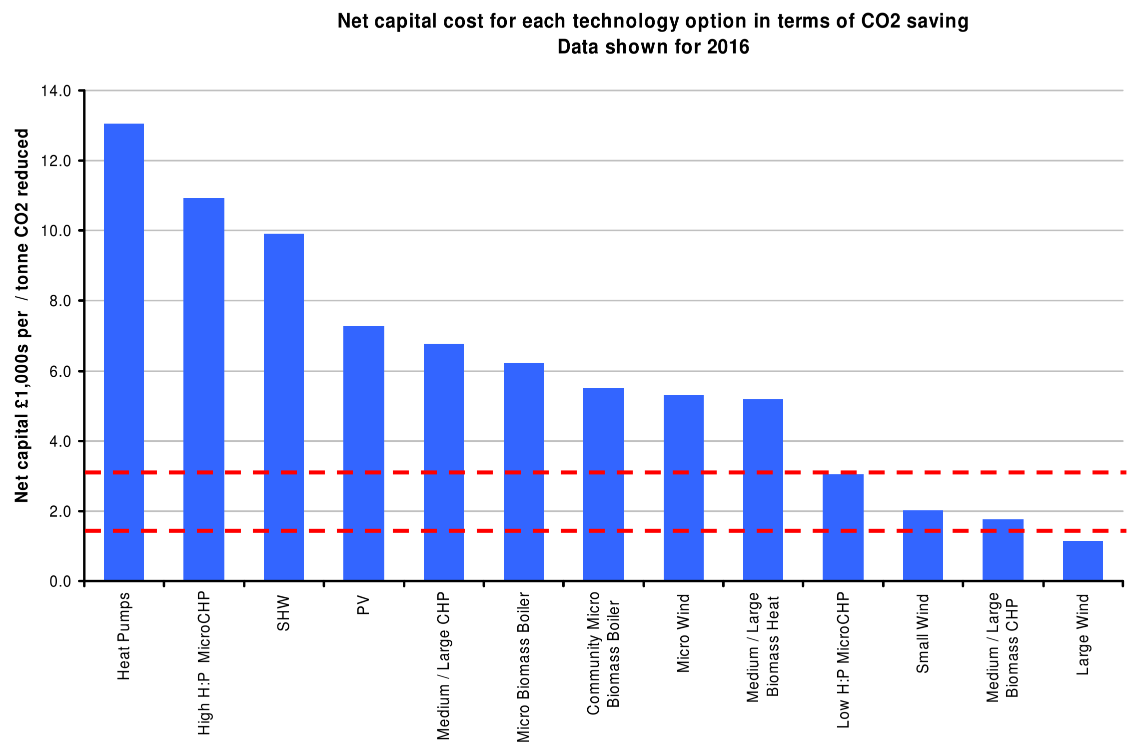
The LCBF could be used to provide greater flexibility in the Core Strategy low carbon policy. For example, if a relatively high minimum requirement for onsite CO_2 reduction is set, as is the case in the policies discussed in the preceding section, then developers are likely to use the LCBF to offset all remaining emissions beyond the minimum onsite requirement, provided that the buy-out price is less than the cost of providing high levels of CO_2 reduction through onsite means. Alternatively, the Core Strategy policy could stipulate no greater CO_2 reduction through onsite measures than is required by Building Regulations, and allow developers freedom to choose between providing CO_2 reduction through onsite measures or investing in the LCBF. In this latter case, the buy-out price should be set to incentivise developers to invest in cost-effective technologies, but to limit the overall cost that a developer is likely to incur (as when cost-effective opportunities are exhausted, they will opt to buy-out). This flexibility may ensure that the CO_2 reduction policies do not disproportionately penalise developers of sites where there are limited cost-effective options for provision of onsite CO_2 reduction. Post 2016, however, when zero carbon policy is introduced nationally, a minimum onsite CO_2 reduction of 70% will be imposed through national policy.

11.1 Price of the buy-out fund

The over-arching principle of the buy-out fund is that it enables the emissions from a development to be offset by investment in carbon reduction measures elsewhere, where the emissions reduction can be achieved more cost-effectively. Therefore, for every tonne of CO_2 that a development produces that is required to be offset, the investment in the buy-out fund should be sufficient to fund measures to provide a tonne of CO_2 reduction. In order to set the buy-out price, it is therefore important to understand the level of investment required to deliver CO_2 reduction through the range of options that may be available for the fund to invest in.

The investment costs associated with CO_2 reduction through a range of renewable energy generation and energy efficiency measures are shown in the charts in Figure 34, below. The costs are shown as the capital cost invested per tonne of CO_2 saved annually by the particular measure. In the case of energy efficiency measures, the costs relate to retrofitting of the measure to the existing stock (based on the cost of upgrading a 3-bed semi)[15].

[15] Costs of measures and annual CO_2 reduction are taken from Defra's Impact Assessment into the Carbon Emissions Reduction Target (CERT) 2008 -11, 04/05/07


Net capital cost for each technology option in terms of CO2 saving
Data shown for 2016
Net capital £1,000s per / tonne CO2 reduced
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Heat Pumps
High H:P MicroCHP
SHW
PV
Medium / Large CHP
Micro Biomass Boiler
Community Micro Biomass Boiler
Micro Wind
Medium / Large Biomass Heat
Low H:P MicroCHP
Small Wind
Medium / Large Biomass CHP
Large Wind

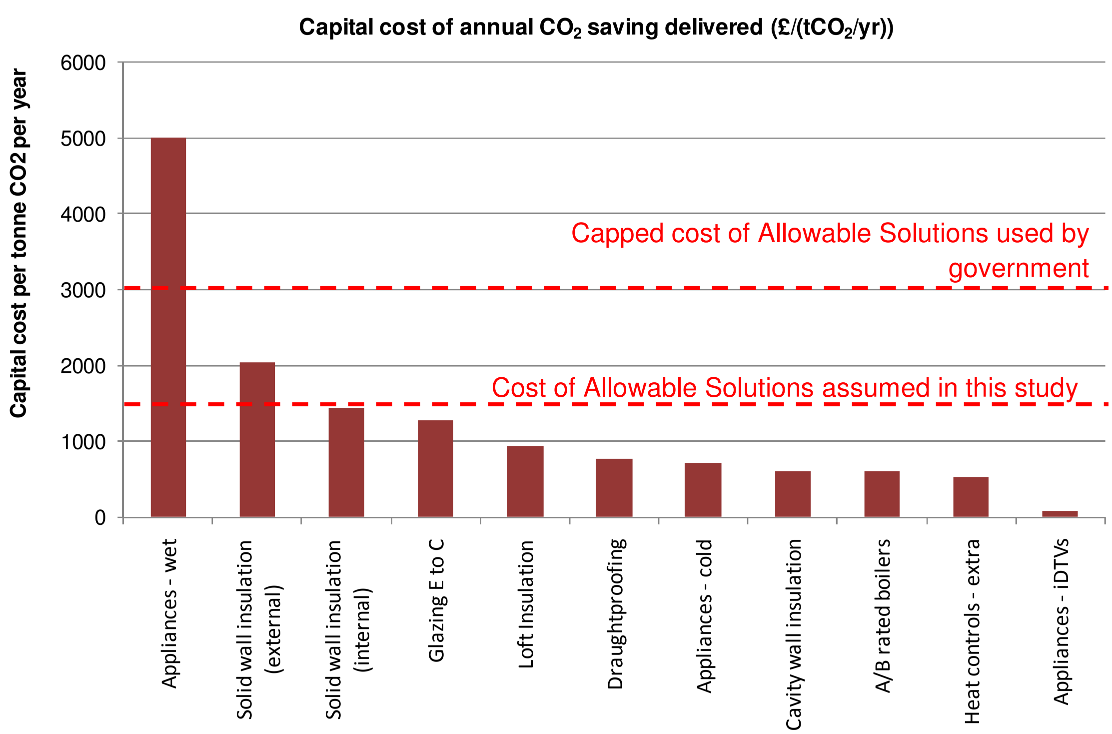

Capital cost of annual CO_2 saving delivered (£/(tCO_2/yr))
Capital cost per tonne CO2 per year
6000
5000
4000
3000
2000
1000
0
Capped cost of Allowable Solutions used by government
Cost of Allowable Solutions assumed in this study
Appliances - wet
Solid wall insulation (external)
Solid wall insulation (internal)
Glazing E to C
Loft Insulation
Draughtproofing
Appliances - cold
Cavity wall insulation
A/B rated boilers
Heat controls - extra
Appliances - iDTVs

Figure 34, Capital investment cost per annual tonne of CO2 saved by a range of low carbon and renewable technologies[16] (TOP) and for a range of retrofit energy efficiency measures

The charts in the Figure above highlight the difficulty in setting a Low carbon buy-out price, which is the wide variability in the cost of delivering CO_2 reduction via various measures. Typically energy efficiency improvements present a lower cost means of reducing carbon than investment in renewable or low carbon energy generation. The capital costs of CO_2 reduction from low carbon generation vary from approx. £1000/(tCO_2/yr) for large wind to in excess of £10,000/(tCO_2/yr) for heat pumps.

Included in the charts is the level of investment in Allowable Solutions that has been assumed in this study in generation of the costs of compliance with Core Strategy policies, given in earlier sections. This level of investment would be sufficient to fund CO_2 reduction through the majority of energy efficiency retrofitting options, but is insufficient to deliver a tonne of CO_2 saving per year through provision of renewable energy via any technology option other than large-scale wind.

Also included in the charts is the upper bound assumption on the investment price for Allowable Solutions considered by government in their recent Impact Assessment on the Zero Carbon Homes policy (this was actually set at £100/tCO_2 of a dwelling's remaining emissions, but to be paid for an assumed 30 year lifetime of the home – amounting to a total investment of £3000/(tCO_2/yr) for each tonne of CO_2 emitted by the dwelling annually). At this level of investment, other renewable generation technologies become affordable, such as large biomass CHP and small wind (note this refers to turbines of around 50 kW, not micro-wind turbines, which have a significantly higher cost of carbon). However, even at the upper bound Allowable Solution price, the investment is insufficient to deliver an annual tonne of CO_2 reduction via the majority of the renewable and low carbon options.

It should be noted that the costs of CO_2 saving shown in Figure 34 are simply the capital outlay required to install sufficient capacity to generate a tonne of CO_2 saving annually. The calculation of cost of CO_2 saving takes no account for the revenues that accrue as the system operates. In the case of energy efficiency measures and some microgeneration technologies this is a fair assumption, as the revenues (e.g. saving in energy bills in the case of energy efficiency investments) are likely to benefit the building occupant, rather than being realised by the investment fund. However, in the case in the case of large-scale energy projects, such as large-scale wind or district heating systems, the profits are expected to be returned to the financing organisations. In these cases where there is an ongoing revenue stream, an investment by the Buy-out fund would be expected to leverage greater investment (e.g. from private sector partners in an energy project), such that greater overall CO_2 saving can be stimulated at a lower level of investment by the fund. This is likely to be increasingly the case in the future as various financial incentives to support renewables, such as the Renewable Heat Incentive (RHI) and Renewable Feed-in tariff (FIT), come on stream (see Section 3.4 for an introduction to these incentive schemes).

Schemes such as the RHI and FiT are expected to make investment in certain types of low carbon and renewable energy generation attractive to private investors, seeking commercial

[16] Graph taken from the report 'Role of Onsite Generation in Delivering Zero Carbon Homes', Renewables Advisory Board, Element Energy, 2008

rates of return. In these cases, for example for technologies such as large-wind and biomass-based district heating, the investment of the LCBF may be useful to seed-fund projects, de-risking the investment for the private market. As confidence in the revenue streams builds, for example as the number of customers on a district heating system grows in a phased development, then the LCBF may be able to reduce its stake in the project, as interest from commercial investment grows.

11.2 Potential size of the LCBF

The size of the LCBF will depend on the rate of development and the fraction of their emissions that developers seek to offset through the fund.

The ESD Renewable Energy Study provides an indication of the levels of new residential and non-residential development expected in Winchester over the period to 2026. For the purposes of estimating potential fund revenues, it has been assumed that this development is evenly spread over the period. The housing mix has been assumed to follow the mix proposed for the generic development types (see Figure 9), based on data regarding the mix of historic development in Winchester.

The proportion of a development's emissions that a developer seeks to offset through the fund will depend on the local policy. It has been assumed in the following that the local policy requires developers to reach 70% CO_2 reduction through onsite measures and to buy-out the remainder (i.e. in line with the zero carbon homes policy). The proposed Core Strategy policy regarding non-residential development requires BREEAM outstanding standard to be reached from 2012, which has a mandatory requirement for onsite CO_2 reduction. The zero carbon policy for non-residential buildings is likely to follow the same structure as the zero carbon homes policy, i.e. a Carbon Compliance level and a required investment in Allowable Solutions, however the details have not yet been developed. In the following estimation of the size of the fund, it has been assumed that non-residential developers access the fund to offset 20% of their emissions.

Based on the assumptions stated above and assuming a buy-out price of £2000/(tCO_2/yr), i.e. in between the large-scale wind capital cost per tonne and the upper bound price of Allowable Solutions currently being used in government planning, the annual revenue into the LCBF has been estimated, tabulated below:

	Annual build	Emissions to be offset (tCO_2/yr)	Revenue to LCBF
Domestic	612	1,044	£2,087,521
Non-domestic	28,155	573	£1,146,697
TOTAL		**1,617**	**£3,234,218**

Figure 35, Estimation of potential annual revenues into the low-carbon buy-out fund, based on a buy-out price of £2,000/tCO_2.

A potential annual revenue of around £3.25 million is forecast, based on an assumed buy-out price of £2,000/(tCO_2/yr). Note that this estimate is based on a particular form of policy, i.e.

implementation of the proposed Zero Carbon Policy (for domestic development), buy-out price assumption and annual build rate. The predicted size of the fund is highly dependent on the values assumed for these parameters. The legal and policy basis for a low carbon development will require careful development, particularly if it is to be imposed prior to introduction of zero carbon policy in 2016. Post-2016 the role of the buy-out fund will be dependent on the mechanisms chosen to collect and disburse Allowable Solutions contributions[17].

The table in Figure 36 below indicates the scale of measures that this annual fund could finance. Note that this is purely based on funding the capital costs (no account has been taken of revenues from the energy projects) and assumes that 100% of buy-out revenues are available for investment.

Investment project	Specific cost (£/kW or £/dwell)	Installed capacity (kW)/ dwellings treated	Annual CO_2 saving (tCO_2/yr)
Large-scale wind	1500	2,167	2,804
Photovoltaics	4500	722	341
Biomass CHP / DH	8500	382	1,415
Cavity wall insulation	500	6,500	4,095
Loft insulation	300	10,833	3,358

Figure 36, Indicative scale of energy generation and energy efficiency measures that could be funded by the Low carbon buy-out fund's forecasted annual revenues.

As discussed in the preceding section, for those types of investment that have potential for revenue generation, such as investment in the larger scale energy projects, this is a lower bound for the scale of activity that could be catalysed by the LCBF. For example, based on a simple analysis of the economics of biomass CHP/DH, it can be shown that an investment of around 40% of the capital would be sufficient to leverage the remaining investment from the private sector (based on achieving an IRR of 10%). This would mean that for the same level of investment 2.5 times the number of dwellings could be connected to DH systems – around 950 dwellings based on the £3.25 million investment pot discussed above.

[17] Note that proposed changes to the Code for Sustainable Homes could increase the role of a buy-out fund to administer Allowable Solutions contributions prior to 2016. A government consultation on these changes in currently open (closing on 24th March 2010) – www.communities.gov.uk