

Towards a Sustainable Energy Policy for Nottinghamshire

POLICY FRAMEWORK



Main Document

November 2009

Nottinghamshire Sustainable Energy Planning Partnership



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SUSTAINABLE ENERGY POLICY FRAMEWORK

Foreword

All of us in Nottinghamshire recognise the increasing importance of facing up to the global challenge of climate change. The nine local authorities in the county have recognised their role by signing up to a national agreement called the Nottingham Declaration on Climate Change (2005) which commits them to positive action. It is envisaged that the Sustainable Energy Policy Framework will be able to make a significant contribution to meeting the commitments of the Nottingham Declaration.

The Policy Framework is an advisory document that has been prepared by the Nottinghamshire Sustainable Energy Planning Partnership (NSEPP), comprised of all the local planning authorities in Nottinghamshire (including the City of Nottingham), whose work has been facilitated by Nottinghamshire County Council's Sustainability Team. It provides a framework for pursuing a common countywide policy approach to maximising the energy performance of new development; as such, it can help us to move together to tackle climate change as a priority through the planning system.

We shall expect to secure a substantial deployment of sustainable energy in new development through adopting the higher standards that government policy is now promoting. These will include renewable energy efficiency and other low carbon measures that together can advance us towards the goal of zero carbon that all new developments will be required to reach over the next ten years.

We, the Portfolio members listed below, commend this document to you.

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Towards a Sustainable Energy Policy for Nottinghamshire

EXECUTIVE SUMMARY

Introduction

- a) This document was prepared by the Nottinghamshire Sustainable Energy Planning Partnership (NSEPP) which has officer representation from each of the local planning authorities within the County and is co-ordinated by the County Council. It is intended to be used as a body of evidence and analysis to support each Council in establishing policies in Development Plan Documents (DPD), to form part of emerging Local Development Frameworks (LDF), and sets out a common county-wide approach to sustainable energy policies (utilising renewable, low and zero carbon energy sources).

In addition, it indicates that there may be options to introduce different performance levels in different locations (e.g. town centres, urban extensions) and for various land use types.

- b) The report recognises the need to both mitigate for and adapt to climate change. It draws upon national policy emerging from Energy and Climate Change legislation, Planning Policy Statements 1 and 22, best practice developed in local authorities elsewhere, and the modelling of different policy scenarios on typical development types from across the county. It takes into account:
- The Building Regulations 2006 (focussing on the specifics of a building's fabric and its heating system),
 - The Code for Sustainable Homes (all new homes to reach level 6 or zero carbon by 2016),
 - Government proposals for non-domestic buildings to achieve zero carbon by 2019,
 - The targets enshrined in UK legislation and planning policy.
- c) The Government has improved its commitment to reducing carbon dioxide (CO₂) emissions in the Climate Change Act 2008, and is aiming to progress from 29% by 2020 to 80% by 2050 (from the 1990 baseline). Since nearly half of CO₂ emissions derive from the built environment, the improvement in buildings' performance is seen as a key to real progress.
- d) The intention is that carbon emissions from new buildings will decline in the future to parallel the phased tightening of the Building Regulations towards the zero carbon goal by 2016 for domestic or 2019 for non domestic schemes. Any planning led policy intervention therefore needs to be responsive to these changes over time in order to have a sustained impact.
- e) There are strong social and economic reasons for promoting low and zero carbon energy. A countywide strategy that lessens dependence on fossil fuels

and invests in low and zero energy sources can both protect existing jobs and provide new ones by attracting businesses that research and develop, manufacture, install and maintain new technologies. In addition it can reduce the running costs of buildings for both owners and occupiers/users.

Regulated and Unregulated Emissions

- f) The Practice Guide to PPS1 Supplement (2008) encourages policy planners to base zero carbon targets for 2016 on both regulated and unregulated emissions from buildings. The distinction between these two emission types has implications for the interpretation of the Study's modelling exercise. Regulated emissions are those reported for Building Regulations approval and, apart from heating and lighting; do not include operational emissions which depend upon the choice of appliances for refrigeration, cooking, home entertainment etc by the property user. The unregulated CO₂ emissions in domestic buildings typically represent 40% of total CO₂ output.

Outcome of the Modelling Exercise

- g) In 2007/08, consultants Energy Centre for Sustainable Communities (ecsc) were commissioned to provide a report based upon the modelling of different scenarios which could help make the case for raised (building) performance standards. The ecsc modelling exercise not only looked at 5 scenarios as possible policy targets, examining each against 7 development examples, but it also built in a range of technology options to the analysis. Its conclusions were taken forward and interpreted by the Nottingham Energy Partnership (NEP) whose contribution has shaped much of the text and tables of the Report and its Appendices.
- h) The outcome has produced a robust evidence base to support a policy that can deliver planning-led standards higher than those normally applied to development proposals through the Building Regulations. It includes an assessment of the effects that adoption of such a policy will have both in terms of environmental impact (i.e. CO₂ reduction) and economic impact (i.e. cost to the developer).
- i) The approach is in accordance with the expectations of the PPS1 Supplement. This recommends that energy focussed planning controls should concentrate on promoting and encouraging available access to local low or zero carbon energy sources and their supporting infrastructure and that a proportion of the energy supply of new development is "*secured from decentralised and renewable or low-carbon energy sources*".

Key Developer Cost Issues

- j) PPS1 Supplement and PPS22 require that policies in a DPD should not make development unviable or place undue burden on developers. Hence the Study has examined likely costs as one of the outcomes of the different scenarios modelled, recording the incidences where additional above average costs

associated with low carbon technologies were found. The outcome is expressed in two tables (7.1 and 7.2) in the main report.

- k) From the scenarios modelled, the evidence for domestic properties, shows that up to a 20% CO₂ reduction from renewable energy technologies can normally be met at less than 10% additional build cost and more typically around 5%. At this level some of the extra cost is likely to be absorbed into land value.
- l) For the non-domestic properties modelled, the picture is less clear due to the high variability of building types and functions and thus of baseline costs. The Study reflects other studies in showing that it is often more expensive to reduce carbon emissions for such sites. While a 10% low or zero carbon energy policy would generally be met for less than 10% additional costs, a 20% policy may be expensive to implement in some situations.
- m) Reference has been made to The London Renewables Toolkit (2004), a Report on 'Carbon Reductions in New Non-domestic Buildings' by the UK Green Building Council (2007) and RICS research. Furthermore section 4 is devoted to exploring the range of renewable and low carbon technologies which have been successfully introduced across the county and to making an initial assessment of future potential.

Preferred Policy Approaches

- n) PPS1 supplement urges that planning authorities promote renewable and low carbon energy as part of their LDF preparation. It expects such policies to sit within a DPD to ensure they are properly tested by examination and underpinned by an appropriate solid evidence base.
- o) The actual amount of carbon to be saved annually through the use of low or zero carbon energy (LZC) sources will be calculated by applying policy specified percentages to the expected carbon footprints of buildings. These carbon footprints will be calculated from policy specified benchmark CO₂ emissions (kg/m²/year) for building type, multiplied by building floor area.
- p) The solutions chosen are geared to providing a twin track approach with different targets for domestic and non-domestic developments to accord with both the known Building Regulations and the anticipated future changes to them. See tables below extracted from the main report (Ref: 8.1 & 8.2).

Domestic

For domestic developments, it would be appropriate to set a rising percentage to be met from low or zero carbon energy sources, with increments timed to match the incremental tightening of Building Regulations.

Proposed Domestic Requirement:

Time Periods	Current-2010	2010-2013	2013-2016	2016 onward
% Low/Zero Carbon Contribution for new development¹	20%	23.5%	27%	100%⁶

Benchmark CO₂ emissions for setting a scheme's target (kgCO₂/m²/year)²	36.7	31.2	27	-
Of which regulated emissions (kg CO ₂ /m ² /year) ³	22	16.5 (25% x22kg)	12.32 (44% x22kg)	-
Of which unregulated emissions (kg CO ₂ /m ² /year) ⁴	14.7	14.7	14.7	-
Expected annual carbon saving in kg CO ₂ m ² /year ⁵	7.34	7.34	7.34	
Balance betw regulated and unregulated emissions	60:40	53:47	46:54	-

Table explanation

It is important to set the benchmarks from which developers can calculate their development's carbon footprint at the same time as setting the targets. This then determines the CO₂ to be saved from LZC sources and allows a predictable outcome for developers up to 2016 from when 100% adherence will be the norm.

Subsequent tighter building regulations will ensure that the carbon footprint of all new schemes will fall in stages towards 2016 when the zero carbon standards are due to be adopted. In effect the narrower footprint will lead to progressively less CO₂ saving from and to investment in LZC technologies over the time period.

Footnotes

¹ The 20% is the preferred policy approach for residential development until 2010. 23.5% and 27% are step changes designed to maintain the 20% LZC contribution once the stricter energy performance measures are introduced via building regulations in 2010 and 2013.

² The 36.7 kgCO₂ is derived from the sum of the average regulated and unregulated carbon emissions per dwelling for the UK. See following footnotes.

³ The 22kgCO₂ is the average regulated emissions for UK dwellings as derived from publications quoted in Appendix 3 of the main report.

⁴ The draft Companion Guide to PPS1 Supplement (2008) indicates that typically for new homes 40-50% of total carbon emissions are from unregulated sources. In consequence 14.7kgCO₂/m² has been calculated as 40% of 36.7kgCO₂/m² to arrive at a final CO₂ emissions figure. This represents a 40:60 split between unregulated and regulated emissions.

⁵ This represents the likely actual carbon saving that each scheme will aspire to. It is a constant saving of 7.34 kgCO₂/m²/year achieved by policy's percentage being applied to the benchmark

⁶ From 2016, all dwellings will be required to be true zero carbon or Code 6 under the Code for Sustainable Homes and thus all CO₂ emissions generated by their occupiers will need to be offset within the development. This will only be possible through the installation of LZC technologies which will necessitate a 100% policy to apply to the entire residual carbon footprint from that date.

- q) This approach will ensure that the investment in low and zero carbon energy stays at least at the same level of commitment as supported by the evidence base, or grows over time. As such it will be a straightforward route for domestic buildings to follow, as the timescale and increments for building regulations are already set.

Non-domestic

- r) A huge diversity of buildings is covered by 'non-domestic' and they give rise to an even wider range of potential carbon footprints and build costs. The requirement for setting a percentage target that does not place 'undue burden' on developers is thus more difficult. The Study's evidence base points to a 10% target for non-domestic buildings being achievable in line with current (2006) building regulations.
- s) The proposal opts to derive a building's carbon footprint from fixed benchmark emissions data giving rise to a fixed 10% carbon reduction target. This is considered to be the optimum route for non-domestic buildings to follow, since the calculation of carbon footprints depends upon an extensive range of benchmark data, which will be extremely difficult to keep up-to-date in totality. In practice, whilst the percentage rate does not increase over time, it will result in more than a 10% carbon saving from low or zero carbon technologies because buildings will actually become more efficient against the 2005 benchmark emissions data (as shown in the table below).

NB. The worked example in the following table is based upon a building emitting 100 tonnes of CO₂ per year.

For non-domestic developments, it is considered that a fixed percentage rate could be used linked to fixed benchmark data from which the CO₂ target is calculated; i.e. maintaining a constant 10% rule and consistently applying 2005 BRE benchmark data to the building emissions baseline below/overleaf.

Proposed Non-Domestic Requirement:

Time Period	Current - 2011	2011-2015	2015-2019	2019 onward
% Low/Zero Carbon Contribution from New Development¹	10%	10%	10%	100%⁷

Worked example

CO ₂ emissions footprint per yr, if based on static 2005 benchmark (tonnes) ²	100	100	100	-
Carbon saved (tonnes) ³	10	10	10	+10

Expected actual total footprint as Bu Regs tighten (tonnes) ⁴	100	85	73.6	
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Of which regulated emissions (tonnes) ⁵	60	45 (25% of 60t)	33.6 (44% of 60t)	-
Of which unregulated emissions(tonnes) ⁵	40	40	40	-
Actual % saved ⁶	10%	11.8%	13.6%	100%

Footnotes

¹ The preferred policy approach for non-domestic development until 2010 is a 10% contribution (i.e. the target is fixed at 10% carbon footprint reduction from low or zero carbon energy sources).

² With benchmark data for assessing a new development's carbon footprint fixed to 2005 Building Research Establishment benchmarks, the same building type would have the same footprint, for calculation purposes all the way through to 2019. 100 tonnes has been selected for ease of calculation.

³ In this example, applying 10% to 100 tonnes would place a constant requirement to install LZC energy sources to cut the buildings footprint by 10 tonnes, irrespective of how energy efficient the building actually is.

⁴ If building regulations for non-domestic follow the same path as domestic, with regulated emissions cut by 25%, 44% and 100% towards 2019, this would be the actual expected footprint of this building type over this time scale.

⁵ The actual total footprint is made up of both regulated emissions (falling in line with building regulations) and unregulated emissions, which generally represent around 40% of current total emissions. (See Domestic footnote 4) Unregulated emissions are not expected to fall appreciably.

⁶ By comparison to the 10% policy target, the actual achieved percentage CO₂ is improved as a result of the tightening of the building regulations in the stated periods.

⁷ It should be noted that from 2019 all non-domestic buildings will be required to be true zero carbon, so that all CO₂ emissions from their use (including appliances) will need to be offset within the development. This will only be possible if the entire residual carbon footprint is mitigated by the installation of low or zero carbon technologies, which implies a 100% policy from that date.

Local Development Areas

- t) Paragraph 26 of the PPS1 Supplement anticipates that there will be some situations “where there are particular and demonstrable opportunities for greater use of decentralised and renewable or low carbon energy than the target percentage” and that local authorities will establish “development area or site-specific targets to secure this potential”. These higher targets should relate to an identified local low carbon resource but would still need a clear rationale and proper testing.
- u) For example, the proximity of a district heating network, or coal mine methane plant or a viable site for a large wind turbine could justify the case for different area or site-specific target levels. Local authorities can also consider parallel energy-based rather than carbon-based targets to reinforce a plentiful technology if required. Whatever target or area is chosen, it will require to be underpinned by sufficient evidence and properly tested through the development plan process.

Implementation

- v) In order to realise opportunities for sustainable energy, planners and developers will need to become more familiar with how different low and zero carbon technologies perform, and how that performance can best be managed and monitored.
- w) Local planning authorities should scope overall energy resource potential and assess the case for promoting certain key development sites / areas for incorporating appropriate technologies that can assist in achieving the preferred low/zero carbon standard.
- x) Energy performance statements, identifying the likely CO₂ emissions should be required from developers with planning applications as part of the Design and Access Statement or as an additional document. The statement will be expected to demonstrate that all on-site and potential off-site low or zero carbon energy options have been explored and that the scheme has been designed accordingly. As the low or zero carbon energy sources will be integral to the design, the preferred policy approach assumes no minimum development size threshold.
- y) There will be circumstances, mainly in local development areas where local authorities may need to take steps to ensure that an existing major local energy source can be utilised more effectively (for example a District Heating Scheme). Where a substantial redevelopment site or urban extension is proposed, any connection to a separate energy network will often involve agreement at the master planning stage and the engagement of an Energy Services Company (ESCO). The role of ESCOs in financing and implementing

a range of schemes is expected to grow, since very few developers will want to retain liability for energy generation, its infrastructure and fuel supply.

- z) The full version of the framework document, 'Towards a Sustainable Energy Policy for Nottinghamshire' provides a body of evidence upon which local planning authorities may anchor their DPDs when promoting low or zero carbon energy for new development. It has been slightly modified and updated following the consultation period held in early 2009. The comments received appear to support the basic principles of the chosen methodology. Further promotion of sustainable energy is now recommended in the form of training for practising planners to assist in implementation. It will be open to all councils within the NSEPP partnership to use this document as part of their evidence base and adapt the recommended policies to use in their own DPDs.

Towards a Sustainable Energy Policy for Nottinghamshire

MAIN REPORT

1. INTRODUCTION

- 1.1 “Large scale uptake of a range of clean power, heat and transport technologies are required for radical emission cuts in the medium to long term.” “Land-use planning and performance standards should encourage both private and public investment in buildings and other long-lived infrastructure to take account of climate change.”

Stern Review: The Economics of Climate Change: Report to H.M. Treasury (2007)

- 1.2 As the Stern Report (2007) and Planning Policy Statement 1: Delivering Sustainable Development (PPS1) and the Climate Change Act (2008) make clear, planning will be one of the key elements in successfully responding to climate change, particularly as it embraces both mitigation and adaptation. In this new era for energy, development plans and proposals will be tested for their low carbon ‘ambition’; they will need to contribute not only to reducing CO₂ emissions across a wide range of development but also to ensuring that new buildings and their supporting infrastructure incorporate a climate resilient design.
- 1.3 The Framework document embraces the new agenda and sets out a policy approach to reducing the carbon footprint of development proposals within Nottinghamshire; it will hopefully lay the foundation for the inclusion of target led sustainable energy policies in the development plan documents which will become part of the Local Development Framework (LDF) of the reformed planning system.
- 1.4 Sustainable energy embraces the provision of low carbon heat, cooling and power at an infrastructure planning as well as at a building design scale. On the one hand it is about introducing more decentralised, efficient and flexible energy supply systems; and, on the other, it is about reducing demand for energy through best practice passive design and procurement and, where appropriate, ensuring that new and refurbished buildings can support that reduced level of demand through local generation, notably from renewable sources, and appropriate management.
- 1.5 The main aim of the Study is to provide a resource for local planning authorities which they can shape to fit with their individual LDF. The focus will be on constructing a policy approach with appropriate justification which should be suitable for inclusion in development planning documents. The policy proposals will avoid being overly prescriptive but will endeavour to find solutions backed by a sound evidence base which can be applied consistently across the County. In addition, it will indicate to local planning authorities that

there may be options to introduce different performance levels in different locations (e.g. town centres, urban extensions) and for various land use types.

- 1.6 The original rationale for the Study was established in a short report to the Nottinghamshire Planning Policy Officers Group in October 2006 - it can claim to have anticipated the draft PPS1 Supplement entitled 'Planning and Climate Change' by two months. It explored the value of developing a common policy framework with recommended standards that can be tailored to the needs of and adopted by individual planning authorities. The report provided a case for the nine local planning authorities to pursue a countywide approach to sustainable energy, drawing upon national policy emerging from the Energy White Paper 2003, PPS1 and Planning Policy Statement 22: Renewable Energy (PPS22) and best practice developed in local authorities elsewhere – notably those 150 authorities which had already adopted 'Merton Rule' policies (see also section 3.4). It recognised that there was a merit in pooling resources and working together in partnership; in particular the need to employ outside expertise was anticipated as instrumental in assembling a technical evidence base to support new policy strands.
- 1.7 A steering group of local planning policy officers that was already established to take forward the Nottinghamshire Sustainable Developer Guide (SDG) project agreed that a Sustainable Energy Policy Framework was a natural progression of its work. The Guide identifies energy as meriting increased attention from planning professionals in the light of heightened concerns about the impacts of global warming and subsequent climate change.
- 1.8 The results of the consultation exercise, which ran from 20th February to 17th April 2009, are summarised in a separate Report of Consultation. All written responses were incorporated into a Feedback Table and are the basis for additions and modifications made to this document. There has also been some updating to reflect policy developments and intelligence obtained in the interim as well as readability refinements.
- 1.9 It is noted that, although there was some concern expressed by the private sector about the viability of the further investment needed in development during a recession, there were no objections in principle to the chosen planning-led method of improving energy performance i.e. using the proposed twin-track approach for domestic and non-domestic schemes. Since planning horizons are long-term and there is growing conviction about the urgency of tackling climate change through the planning system, concerns over viability may diminish over time.
- 1.10 In response to comments received on certain points of detail, improvements have been made to the robustness of evidence in relation to the known capacity available from renewable and low carbon energy sources. Furthermore, the report indicates where additional work at local level to accord with PPS1 Supplement may prove valuable.

2. BACKGROUND

2.1 Mitigation

- 2.1.1 Since the end of 2007 when the PPS1 Supplement was published, developers have been obliged to “secure the highest viable resource and energy efficiency and reduction in emissions” (paragraph 9). This will involve integrating sustainable energy technologies, such as ground sourced heating and cooling or Combined Heat and Power (CHP), into new development involving new build or major refurbishment - in order to mitigate (or reduce) the effects of greenhouse gases entering the atmosphere. The UK has adopted a legally binding target of a 60% cut in CO₂ emissions by 2050 against 1990 levels. It is important to note however that the most recent evidence from the Tyndall Centre and IPCC (Intergovernmental Panel on Climate Change) identifies that the UK needs to be aiming at an 80-90% cut in CO₂e (CO₂ equivalent - all greenhouse gases) by 2050. Only with this level of cut, on current climate models, is there an 11% chance of avoiding 4°C climate change by the end of the century.
- 2.1.2 The necessity for an 80-90% cut is reiterated by Nicholas Stern in his paper written in conjunction with the London School of Economics, building on the original findings from The Stern Report. Aiming for this level of cut would have a profound effect on how the planning system acts to counteract emissions from development. For instance, as a minimum, buildings will need to use orientation and shading to optimise passive solar gain in winter and minimise solar gain in summer and also avoid energy-intensive measures such as mechanical air conditioning.

2.2 Adaptation

- 2.2.1 The Stern Report accepts the inevitability of some extreme climate conditions in the future; it has been estimated that, with current atmospheric greenhouse gas concentrations, even if all CO₂ emissions ceased today, the world is locked into at least 40 years of climate change impacts.
- 2.2.2 The planet is going to get hotter, with far less predictable and aggressive weather patterns. In this future climate, there will be a need for more decentralised (and yet robust) energy generation and distribution systems with a particular emphasis on integrated low carbon cooling. In the latter case, there is a danger that today's low carbon buildings, designed for heat retention, maximum air-tightness and passive heating etc, will be tomorrow's carbon criminals, using significant amounts of electricity to cool and ventilate.
- 2.2.3 The planning and design response will need to become increasingly geared to assessing risk and to ensuring that development adopts features that increase resilience to climate impacts. From a strict energy perspective, this might give precedence to measures that address drought and extreme heat (e.g. incorporating greater thermal mass, passive ventilation and shading devices).

2.3 Influencing Building Performance

- 2.3.1 Much of the early work which interpreted the provisions of PPS1 and PPS22 was undertaken by the London Borough of Merton (see also paragraph 3.4.2 below) and like minded Councils with a view to accelerating change through the planning system.
- 2.3.2 In respect of new schemes, this has entailed moving away from a common national standard to a variable approach in which development plan policies can effectively extend the technical performance of buildings to a level beyond the minimum established by the 2006 Building Regulations.
- 2.3.3 Part L of these Regulations are a key instrument for mitigating emissions since they focus on the specific minimum standard that a building's fabric and its heating and costing system(s) will have to meet. They are being progressively revised and tightened, and will fit with the higher standards being required for housing by virtue of the Code for Sustainable Homes (CSH), which envisages all new homes reaching level 6 or zero carbon by 2016. For other building types, the Government has announced an ultimate target of zero carbon by 2019 and has commenced consultation in early 2009 on the means of reaching it (See also Section 5).
- 2.3.4 Inevitably there have been variations to date in the complexity and coverage of policies designed to exceed the Regulations; there have also been variations in their speed of adoption and in the relative weight attached to them. This position will persist under the provisions of PPS1 Supplement: Planning and Climate Change (December 2007). It wants local planning authorities to exploit opportunities for setting higher target percentages than the initial 10% from on-site renewables that many have initially adopted; and also encourages them to concentrate on particular sites or development areas where such targets are likely to be more viable and deliverable.
- 2.3.5 Whatever overall targets or area targets are chosen, local policies are required to be underpinned by sufficient evidence and properly tested through the development plan process. This is a considerable challenge given the desirability of assessing a locality's decentralised energy potential and the implications of setting different targets for different areas. Thus in future, planning authorities can allow local circumstances to dictate which sites or areas will benefit from higher standards, rather than retain a 'one size fits all' approach that has been widely applied to date.

3. THE PLANNING AND ENERGY POLICY CONTEXT

3.1 National Context

3.1.1 The context for this report has been set by a number of government policy documents, notably the Energy White Papers of 2003 and 2007, the UK Sustainable Development Strategy (2005) and the Climate Change Act (2008) as well as PPS1, PPS22 and PPS1 Supplement. Most of these documents underline the need to move to a low carbon economy and to deliver more sustainable development. The latter has been a statutory requirement upon planning authorities since the passing of the Planning and Compulsory Purchase Act 2004.

3.1.2 Other relevant guidance is contained in the following policy/good practice documents:

- The Planning Response to Climate Change (2004);
- The Companion Guide to PPS22 (2005);
- Building a Greener Future Policy Statement (2007);
- Code for Sustainable Homes (2006);
- Climate Change: The UK Programme (2006) CM 6764;
- Energy by Design and Climate Change Adaptation by Design (TCPA 2006 & 2007).
- Practice Guide to PPS1 Supplement on Planning and Climate Change (2008)*.

* This is now a web-based resource hosted by the Homes and Communities Agency and the Planning Advisory Service at www.hcaacademy.co.uk/planning-and-climate-change.

3.1.3 In addition, the perceived need to progress large renewable energy projects more swiftly is addressed in the Planning White Paper ('Planning for a Sustainable Future' 2007 CM 7120) of May 2007 and there has been reinforcement of the Government's commitment to the sustainable energy agenda in the UK Renewable Energy Strategy and the UK Low Carbon Transition Plan of 2009.

3.1.4 The Government's aim in the Energy White Paper 2003, which is echoed by the White Paper of 2007, was to reduce carbon dioxide (CO₂) emissions by 60% (from a 1990 baseline) with real progress by 2020. The target has since been upgraded by the Climate Change Act (2008) in which the Government has taken on board the findings of the Stern Report (2007) and the Committee for Climate Change's first report entitled 'Building a Low Carbon Economy' (2008). The Act sets out legally binding targets for the UK to reduce CO₂ emissions by at least 80% by 2050 and 26% by 2020. Since nearly half of these emissions derive from the built environment, the improvement in buildings' performance is seen as a major contributor to real progress.

3.1.5 Spatial planning policies requiring a percentage of energy in new developments to be derived from onsite renewable sources became more widespread after the pioneering work by the London Boroughs of Merton and Croydon which received endorsement from the Government through their

unitary plan inquiry decisions in 2002-03. From there it was a short step to paragraph 8 of PPS22 and the Ministerial Statement in Parliament in mid-2006, when local planning authorities were urged to opt for a percentage from renewable sources that was higher and more challenging than the 10% Merton target which had become a de facto standard.

- 3.1.6 Over time higher percentage targets have been introduced by leading authorities and the requirement for generating energy on-site has been converted to a required percentage reduction in carbon emissions. The high point of recognition for this type of prescriptive policy came in December 2007 when the supplement to PPS1 on 'Planning and Climate Change' was issued.
- 3.1.7 Paragraph 26 of this Supplement confirms that planning has entered a post-Merton era since it includes reference to distributed or decentralised energy, to off-site supply and to low carbon (e.g. good quality CHP schemes – see para.4.3.) as well as renewable sources:

“Planning authorities should set out a target percentage of the energy to be used in new development to come from decentralised and renewable or low-carbon energy sources where it is viable. The target should avoid prescription on technologies and be flexible in how carbon savings from local energy supplies are to be secured.”

- 3.1.8 This revised approach satisfied concerns that the original Merton Rule was too inflexible by focusing solely on renewable technology thus excluding low carbon energy sources such as gas-fired CHP. The Merton Rule was also seen as potentially unrealistic in terms of the commercial availability of on-site renewable technologies.

3.2 Regional / Sub-Regional Context

- 3.2.1 The East Midlands Regional Plan (RSS), adopted in March 2009, promotes the Government's ambition of zero carbon development with strong support for incorporating renewable energy technologies at the building and development scale. The following extracts from RSS Policies 39 and 40 shows that it calls upon local authorities (as well as energy generators and other relevant public bodies) to:

- (i) Develop policies and proposals to secure a reduction in the need for energy through the location of development, site layout and building design.
- (ii) Prioritise generation from low carbon and renewable sources using a decentralised (or distributed) energy network with reference to indicative targets set for a number of renewable energy technologies.

- 3.2.2 During the process of producing the Regional Plan the case for inclusion of a specific minimum 'Merton-style' policy was not considered. However, the Adopted Plan reinforces the messages of PPS1 Supplement concerning policies in DPDs which promote and encourage a proportion of energy supply to be derived from decentralised and renewable or low-carbon sources; and,

underlining the scale of the need to find deployment opportunities, urges local emphasis on innovative technologies and micro-generation schemes.

- 3.2.3 As at October 2009, the Regional Assembly is conducting a Partial Review of the RSS which includes a new look at the veracity of renewable energy targets in the light of the Government's response to the Panel Report. This exercise has been informed by a report from Faber Maunsell / AECOM entitled 'Reviewing Renewable Energy and Energy Efficiency Targets for the East Midlands'(2009).

3.3 Current Local Experience: The Nottingham City Merton Rule

- 3.3.1 As at mid 2009, only Nottingham City Council amongst the NSEPP authorities had formally approved a Merton-style policy. The Sustainable Energy Planning Requirement was adopted by the City Council Executive Board on 22nd May 2007. The requirement states that :

"10% of energy supply (interpreted through carbon emissions) in all new developments over 1,000 square metres will be gained on-site and renewably and /or from a decentralised, renewable or low carbon, energy supply."

- 3.3.2 Nottingham City's 10% rule uses the definition "Renewable and/or from a decentralised, renewable or low carbon, energy supply" which correlates both with PPS1 Supplement and with the definition used for building regulations of 'Low or Zero Carbon' (LZC) energy sources. In practice this means any technology for heating, electricity or cooling that offers substantial reductions in CO₂ emissions against those from standard mains gas or electricity. The technologies include: gas CHP, ground sourced cooling and the city's district heating network (fuelled by municipal waste incineration and gas CHP).
- 3.3.3 Development carbon emissions in Nottingham are taken to mean operational emissions. This includes emissions covered by building regulations (regulated emissions -essentially heating and lighting) as well as emissions arising from the building use, such as powered appliances, fridges, cookers etc (unregulated emissions). It requires building CO₂ emissions, used for deriving the required 10%, to be calculated from benchmark data.
- 3.3.4 The 10% rule has so far been uncontentious. It was introduced using the draft PPS1 Supplement on Planning and Climate Change (2006) as a material consideration. The draft Supplement urged local planning authorities, as an interim, to adopt a 10% rule. While the 'interim' arrangement was changed in the final version of the PPS1 Supplement in favour of a more generalised use of the Supplement itself as a material consideration, the City is retaining the interim rule, until the 10% (or a higher appropriate target) is embedded into development plan documents.
- 3.3.5 Developers in the City are required to submit an energy statement, within the design and access statement, showing how they will achieve the 10%. Early submissions varied widely in quality and detail, with some very poor and

inaccurate assessments and some excellent well considered work. Generally the latter was provided by independent consultants. Submissions were generally not particularly easy for planning officers to understand or assess. Some submissions consisted of a single sheet, others of thick documents with options appraisals.

- 3.3.6 The London Renewables Toolkit (Faber Maunsell, Sept 2004) was originally cited as a key reference document for developers. However, the Toolkit was rapidly becoming out of date and did not prescribe a format for submissions which complicated the interaction between developers and planners. Hence Nottingham City Council commissioned Nottingham Energy Partnership to compile a standard format for the submission of energy statements including a standard protocol for required calculations and evidence of options explored.

3.4 Examples from other Authorities' Adopted Core Strategies

- 3.4.1 As more local authorities adopt their new Core Strategies towards 2012, following examination by government inspectors, they will provide a guide to currently acceptable policy content. As at September 2009, approximately 48 English local planning authorities had adopted Core Strategies with as yet none in Nottinghamshire. The larger authorities among them tend to have a multi-part policy statement or a range of policies dealing with sustainable development issues, including on renewable or low carbon energy.
- 3.4.2 The main energy policy is generally in the form of a 'Merton Rule', i.e. requiring major development (mostly to the common planning threshold—1,000 sq. m or 10 dwellings and upwards) to incorporate a percentage of its energy demand from renewable or low carbon sources. The required percentage varies from at least 10% to at least 20% and some authorities do not specify a percentage. Mid Devon Council (adopted May 2007) has no fixed requirement but states the intention to require carbon neutral developments when its SPD is issued. The requirement is expressed variably in terms of energy use or supply, reduction in 'carbon' or CO₂ emissions.
- 3.4.3 Many of the policies sit alongside others requiring greater energy efficiency expressed in terms of national standards such as the Code for Sustainable Homes or the Building Research Establishment's Environmental Assessment Method. A number of authorities have separated housing from non-housing uses, normally requiring incremental rises from CSH level 3 to 4 for dwellings, and the attainment of BREEAM 'Very Good' or better for non domestic development.
- 3.4.4 Most authorities have included renewable energy and/or climate change in their core strategies (at 2008). A typical example is Middlesbrough BC (adopted Feb 2008) whose core policy requires on-site renewable energy facilities or energy saving technologies to provide a minimum of 10%.
- 3.4.5 Others like Reading Borough Council (adopted Jan 2008) express the issue in terms of carbon reduction requiring on-site generation of energy from

renewable sources and energy efficient design to offset at least 20% of CO₂ emissions.

- 3.4.6 There are also examples of Core Strategy policies that set progressively higher standards such as at Plymouth City (adopted in April 2007). This requires on-site renewable energy production to offset at least 10% of carbon emissions up to 2010 and 15% from that date. Several authorities have indicated that they will raise the percentage for future years in a subsequent DPD.
- 3.4.7 Several Core Strategies have specified a higher percentage (30%) for large developments / urban extensions. An example is the Joint North Northampton Core Strategy (May 2008) which covers a cross-district growth point area.

3.5 The Social and Economic Case for Promoting Sustainable Energy

- 3.5.1 There are strong social and economic reasons for promoting sustainable energy in addition to the environmental/climate change benefits of reduced CO₂ emissions. Clearly sustainable energy can contribute to meeting UK energy requirements and gives added diversity and security of supply. This will be crucial in an era of higher energy costs and of transition to a society which will be markedly less reliant upon cheap fossil fuels.
- 3.5.2 World oil prices rose up to \$140 a barrel in July 2008 and were projected by some analysts to go considerably higher before the world economic downturn took effect in late 2008. At the same time, global liquid fuel (including contributions from bio fuels) production had not in fact increased from 2005 until 2008 to meet demand, despite rapidly rising prices.
- 3.5.3 Most oil industry experts and many national governments now accept that sometime within the next 10-15 years global oil production will peak and then fall; this effect is known as 'Peak Oil'. It is likely to be due to a combination of geological, geopolitical, industry investment and macroeconomic causes, rather than simply to the decline in available reserves across the globe. The decline will probably accelerate assuming ever increasing global demand, especially from the US and the emerging economies of India and China.
- 3.5.4 There are likely to be dramatic economic impacts as the production of crude oil starts to decline and its price rises substantially. The cost of electricity, gas, food and transport fuels is predicted to increase rapidly with the risk of prolonged economic recession setting in. The ensuing search for replacement fuels to meet the deficit may lead to an increase in greenhouse gas emissions especially from carbon bio-fuels and coal, with a consequent worsening of the adverse effects of climate change.
- 3.5.5 A countywide policy approach that provides the means to reduce dependence on fossil fuels and invests in sustainable energy can both protect existing jobs and provide new ones by attracting businesses that manufacture, install and maintain new technologies.

- 3.5.6 Renewables, in particular, can provide both new sources of energy in remote areas and a diversity of technologies in well connected areas which enable both individual buildings and small communities to be more energy self-sufficient. In this way it can substitute for imported energy and give some protection from rising energy costs and fuel poverty.
- 3.5.7 Although there are significant capital costs associated with installing renewable and CHP systems etc, they can show medium/long term savings through local decentralised distribution and lower running costs which includes reduced maintenance commitments. There is potential for improved comfort and health through the appropriate integration of such technologies into properties with the likely bonus of improved capital value over time, especially if schemes involve prestigious and innovative designs (See also section 7).
- 3.5.8 Business benefits may include enhanced corporate social responsibility, exemption from climate change levy, local job stability, enhanced resource efficiency and the possession of valuable, tradable renewable obligation certificates (ROCS). There may be a surge in business confidence sufficient to trigger further investment.
- 3.5.9 The Regional Energy Strategy 2005 (Part 1) identifies a challenge for the East Midlands to *“take a lead in moving towards a low carbon future that benefits our economy, protects our environment and supports our communities”*.
- 3.5.10 In this way it echoes the guiding principles of the UK Sustainable Development Strategy “Securing the Future” (DeFRA 2005) which are set out in the left hand column of Table 3.1.

Table 3.1: Key Benefits delivered by Sustainable Energy

Government Sustainable Development Themes	Key Benefits
Ensuring a Strong, Healthy and Just Society	<ul style="list-style-type: none"> • Encouraging greater self sufficiency, particularly for isolated communities or farms / estates with grid connection difficulties • Providing opportunities for more local ownership of generation • Facilitating greater community involvement or control with associated benefits for community empowerment and fostering of community spirit • Creating educational assets – raising the profile of clean energy generation and enabling people to take responsibility for contributing towards their own energy needs
Living within Environmental Limits	<ul style="list-style-type: none"> • Displacing energy generation from finite fossil fuels and saving on associated CO₂ emissions • Reducing need for other large scale energy developments e.g. fossil fuel and nuclear power stations
Achieving a Sustainable Economy	<ul style="list-style-type: none"> • Facilitating development of the renewable energy technologies sector (including firms involved in the design, manufacture, supply, construction and maintenance of renewable energy schemes) • Providing a new impetus for rural diversification and regeneration through job creation from the above as well as in the delivery of related services • Multiplier effect of re-circulation of income in local area (local shops, schools, post office, pubs etc.). • Opportunity for community enterprise development through community finance initiatives
Promoting Good Governance	<ul style="list-style-type: none"> • Improving local government finance from job creation and local investment • Contribution to security of energy supply • Helping to reduce fuel bills thereby helping to eradicate fuel poverty
Using Sound Science Responsibility	<ul style="list-style-type: none"> • Responding to the fast developing science of climate change

4. COUNTYWIDE SUSTAINABLE ENERGY POTENTIAL

4.1 Assembling Information to Assess Potential

- 4.1.1 If the onus is on local planning authorities to actively support the deployment of renewable and low-carbon energy technologies in new development, including through safeguarding zones and allocating sites, then, in accordance with paragraph 26 of PPS1 Supplement, they need to be aware of:

“...the local feasibility and potential for (such) technologies, including microgeneration, to supply new development in their area”.

- 4.1.2 The Practice Guide to PPS1 Supplement (Dec 2008) explores how to assess local potential for decentralised renewable low carbon energy in a detailed checklist (see: www.hcaacademy.co.uk/planning-and-climate-change). It recognises that there will be different ways of realising such potential in different areas, contrasting urban areas where there is more scope for decentralised energy, and thus for linking existing and new development together (e.g. via heat networks), with rural areas where there is normally greater opportunity to exploit traditional renewable energy sources
- 4.1.3 This section intends to give an overview of the known energy sources that can be utilised in the county; these are drawn from existing resource studies conducted at regional, sub-regional and city level as well as from planning decisions and on-site observation. Data collected in this way is likely to be accommodated in supplementary or development plan documents and will lend itself to GIS mapping.
- 4.1.4 The county's sustainable energy resources can be split into two broad categories: those which are area constrained and others which are development constrained.
- 4.1.5 **Area constrained** resources are based upon a specific identified energy source such as a weir suitable for hydropower, a viable wind resource, a landfill site or a district heating plant / network. These sites or areas can be mapped to provide evidence for development plan documents. Most can be further evaluated for their potential in respect of their energy and carbon (CO₂) saving potential within associated prospective development zones. Appropriate carbon target levels can be set within these zones to ensure that area constrained resources are developed.
- 4.1.6 **Development or building constrained** resources may be added to almost any site; however the likelihood of their deployment will be constrained by the type of end use, energy demand, layout, design and/or budget of the development. Solar technologies, gas-fired Combined Heat and Power (CHP), biomass heating, ground source heat pumps and new district heating schemes are more likely to fall into this category. A different mix may be appropriate for each site. Where specific identified resources are locally

scarce, general district or citywide targets can ensure that development constrained resources are maximised.

- 4.1.7 A detailed research study was carried out for EMRA in 2005-6 to re-assess the sustainable energy resource in the East Midlands. Entitled 'Regional Targets and Scenarios for Renewable Energy', this study and its findings were re-visited in 2008-9 in a report commissioned from Faber Maunsell/AECOM principally to inform the Partial Review of the Regional Plan. Whilst the focus of earlier studies was on grid connected electrical energy from renewable sources with a small amount of work on CHP, the Faber Maunsell/AECOM report (March 2009) has given specific attention to CHP, district heating and waste heat sources.
- 4.1.8 It appears, therefore, that there is sufficiently robust local information to map the principal areas of constrained resources in the county, and to evaluate the merits of safeguarding such resources for use in forthcoming development. Initial work has already been carried out to clarify the extent of both renewable and low carbon schemes that are installed or planned, with the results set out in Table 4.1. The known operational technologies have been plotted diagrammatically on the Renewable and Low Carbon Energy Schemes Map (November 2009) which is inserted inside the back cover.
- 4.1.9 In assessing the potential for sustainable energy across the county, the most significant renewable energy technologies suitable for further mapping will be the hydro, large landfill or wind sites which are area or location constrained. Whilst constraints for wind sites can now be more comprehensively sieved, the availability of land for some of the better sites for generation is not always discernible so that potential must be treated as latent rather than known. It is noted that two wind farms have received planning approval in 2009, one at Bilsthorpe and a second south of Mansfield. A third major farm near Cottam is in the planning process and, if all three are constructed and commissioned, would give a total installed county capacity of 58MW.

Table 4.1: Estimated Renewable/ Low Carbon Capacity in Nottinghamshire 2009

All figures in Megawatts (MW) (MWe for technologies capable of CHP operation)	Nottinghamshire		Output type	Potential Further Uptake by 2021 /26
	Current Installations	Proposed or in planning		
Regional scale renewable technologies				
Hydro	1.7	3.0	Electricity	5
Geothermal energy	0.0	0.0	Heat	
Biomass (heat)	11.2	7.1	Heat	
Biomass (electricity)	0.0	0.0	Electricity	
Wind (onshore)	2.0	20.0	Electricity	60-80
Anaerobic digestion	0.0	2.0	Electricity and heat	8-10
Landfill gas	11.1	0.0	Electricity and heat	10
Sewage gas	3.3	0.0	Electricity and heat	2
Total County	29.4	32.1		
(total regional)	(209.2)	(363.2)		
Other low carbon technologies				
Biomass (co- firing) (circa 5% of the total plant capacity)	300.0	Not known	Electricity	
Energy from waste	6.6	13	Electricity and heat	
Combined Heat & Power (gas burning)	59.4	Not known	Electricity and heat	
Coal Mine Methane	14.31	0.0	Electricity	10-15
Total County	380.31			

N.B. Micro-generation capacity is not reflected in the table or the accompanying Renewables and Low Carbon Map due to insufficient data.

Sources 1) Reviewing Renewable Energy and Energy Efficiency Targets for the East Midlands'. Faber Maunsell/ AECOM (March 2009). Report to East Midlands Regional Assembly (Extracted and interpreted from table 4 and Chapter 3).

2) Nottinghamshire County Council Communities Department: planning records

- 4.1.10 There are other data sets which also merit more detailed investigation in the form of heat mapping:
- **Significant energy users:** sites or areas of significant heat, cooling and electricity demand. For example, if a large heat or electricity demand is identified next to a development area this could help make the case for CHP and possibly a district heating extension.
 - **Significant heat sources:** There are many untapped low or high grade waste heat sources - for example from industrial processes or from existing or planned electricity generation plant. If one of these is located near a new development area, waste heat and heat demand could potentially be matched, and linked up via district heating and cooling networks if appropriate.
- 4.1.11 Table 4.1 above indicates the 2009 capacity (existing and proposed with permission or in planning system) for electricity and heat from renewable and low carbon sources. For the most part this capacity has been plotted from the Faber Maunsell / AECOM report (2008) with the addition of data on gas CHP and on coal mine methane (in which the county is the region's chief producer). A figure for potential uptake of some technologies by 2021-6 has been derived from the Report and from County Council monitoring. This can be used as the basis for fuller estimates of potential resources, including those from waste heat that may be undertaken at a local authority level.
- 4.1.12 It should be emphasised that for maximum effect, the majority of technologies are best combined with energy efficiency measures in buildings which would include the selection of best performing appliances. There are also significant unquantifiable (or unquantified opportunities) for renewable heat and renewable cooling together.

4.2 Biomass

- 4.2.1 Nottinghamshire has a large rural area with some poor soils and is thus potentially well suited to providing biomass for energy generation. However the AECOM Report (see 4.1.7) warns that biomass is a finite resource and that future limitations of local supply should be considered in energy planning. There is concern that excessive specification of biomass technologies will lead to either long-distance importing or the sacrifice of food-producing arable land. All biomass has associated externalities related to transportation and processing that must be taken into account, but it will normally outperform fossil fuels in terms of cost, energy security and carbon emissions, especially if locally sourced.
- 4.2.2 The County Council has put in place a successful wood heat scheme for schools (and other public buildings); as at November 2009, nearly 50 boilers had been installed with support given to the establishment of a wood pellet mill to supplement local supply. In addition, Strawson Energy manages a large area of willow coppicing at East Drayton in Bassetlaw that is converted into wood chip for co-firing with coal in nearby power stations.

4.3 Combined Heat and Power

- 4.3.1 The efficiency of the combustion for electricity generation can be greatly improved through the use of Combined Heat and Power (CHP). However, the application of CHP requires that the heat users be in reasonably close proximity to the combustion plant and in a sufficient density to enable cost effective district heating. Viable CHP, especially with modern low heat demand housing, often requires the incorporation of some sort of large heat sink such as a swimming pool or large thermal store to take excess (off-peak) heat. Connection of excess heat supply with nearby older housing, which will have higher heat demands, can utilise additional heat load as well as giving social and economic benefits.
- 4.3.2 Natural Gas CHP is potentially viable at any site connected to the gas mains and, depending on the density and energy demand profile of the development, can offer a fairly efficient method of supplying heat, power and potentially low carbon absorption led cooling. There is approx. 60 MWe of CHP already established in the county with relatively large plants at Queen's Medical Centre, Boots and Imperial Tobacco sites in Nottingham and at British Sugar in Newark.
- 4.3.3 The potential capacity for most non-mains gas CHP applications is likely to be area constrained to some extent and will depend on local availability of landfill gas, coal mine/ bed gas reserves, poultry litter or other biomass.

4.4 Heat Pumps

- 4.4.1 There is the potential across the entire county, in almost any development type, to use heat pumps (air, water or ground source) to extract heat from the environment in order to provide primarily space heating in domestic developments or heating and cooling in non-domestic developments. Canals, lakes and non-navigable rivers can be targeted for suitable sites.
- 4.4.2 If supplying heat and cooling, heat pumps offer very significant cost, energy and carbon savings against mains gas and electricity systems. Systems designed for heating and cooling are more efficient than heat only systems. This has been the choice of King's Mill Hospital (Mansfield) where the nearby reservoir has been used to install a 5MWth scheme to replace less efficient conventional heating and cooling systems.
- 4.4.3 There are a whole range of types of heat pumps. Some technologies, particularly open loop ground source systems, will require prior examination of ground water levels and mining records to ascertain their feasibility.

4.5 Solar Water Heating

- 4.5.1 All sites that have a hot water demand are potentially viable for some proportion of solar water heating. While the energy savings from solar water schemes are fairly low, in the context of a very energy efficient modern building, Solar panels can make a significant proportional contribution.

4.6 Photovoltaics

- 4.6.1 Photovoltaic cells placed on roofs or in arrays can convert sunlight directly into electricity. The revised RSS target estimated their potential on the basis of photovoltaics (PVs) being installed on half of all new properties. While all sites are potentially able to integrate PVs, with proper consideration to roof orientation, the limiting factor is normally the high cost which has tended to restrict the use of PVs to date.
- 4.6.2 In schemes where the developer will continue to manage the buildings and have responsibility for the energy bills, PVs have more potential as they do offer a minimum maintenance route to fairly significant CO₂ savings. PVs also do not require any additional land, and have lower visual impact and less planning considerations than most other renewable technologies. With rising energy costs and the potential for a future grid feed-in tariff for distributed electricity generation, the net present value and simple payback for this technology are both improving rapidly.

4.7 Coal Mine Methane

- 4.7.1 There is considerable potential for extracting coal mine methane (CMM) from the five sites in the county identified on Table 4.2. Methane is the most damaging greenhouse gas and its leakage from worked out/closed mine sites is particularly prevalent as a legacy of deep mining. As well as controlling the potential danger of explosion, the capture of methane as the most damaging of greenhouse gases, is vital in the fight against global warming.
- 4.7.2 Whilst there are four existing plants operating in the county which contribute electricity to the grid, there are some doubts about the effectiveness of the technology employed by this resource especially since it is not eligible for Renewable Obligation Certificates (ROCs).

Table 4.2: CMM: 2009 Nottinghamshire Capacity

Location	Capacity (MW)	CO2 saved per annum (tonnes equivalent)
Bilsthorpe	4.5 mw	estim 140,000
Bevercotes	4.1 mw	138,155
Mansfield	3.7 mw	126,216
Sherwood	0.66 mw	20,467
Warsop	1.35 mw	46,052
Total	14.31 megawatts	480,000 estim

Source: Alkane Energy: Green tech article (9/09) & 2008 Annual Report

4.8 Local Heat Sources

- 4.8.1 There has been little survey work to assess the available waste heat sources across the county and the potential for these to be linked with the demands of new heat consumers (notably industrial premises or large leisure facilities).
- 4.8.2 Any site that requires cooling will be dumping heat into the ground, air or water which may be detrimental to the natural river environment. An example is the Ratcliffe-on-Soar Power Station which uses the River Soar for cooling, thus raising the temperature of the water by several degrees. This means that even if there is not potential for a new development scheme to harvest heat directly from the cooling towers, the water downstream may represent a heat reservoir for water source heat pumps.
- 4.8.3 There is thus merit in preparing a regional or countywide inventory of such heat sources in order to inform both developers and planners, initially without regard to the feasibility of connection.

4.9 Small/Micro Wind Power

- 4.9.1 Micro wind power refers to systems which give less than 1.5 kw output, generally the type of turbines that could be suitable for mounting on buildings. They will normally meet a small proportion of the energy demand for a single building, farm or other small business.
- 4.9.2 Small wind power refers to turbines between 1.5 kw and 100 kw which can be pole or tower mounted away from buildings and suitable for domestic to small community scale applications. These are often single stand alone turbines sized appropriately to match or balance a local energy demand. They require careful siting as they can have adverse impacts of noise, vibration and light flicker in close proximity to occupied buildings.
- 4.9.3 Micro wind power is very limited in its applicability especially in built up areas where low efficiencies tend to be recorded for roof mounted applications. However new development sites can achieve a viable small wind resource in beneficial circumstances i.e. If they should have unobstructed wind flow and the typical speeds of 5-6 metres per second (average annual mean) found across the county –which are relatively low level.
- 4.9.4 Tower mounted wind turbines, which can also operate at low wind speeds, can make a considerable contribution to reducing the CO₂ emissions of a new development. A cluster of three or four 5kw turbines could offset a significant proportion of the emissions from a medium-large scale scheme, potentially contribute to the powering of community infrastructure and even earn income for the upkeep of community facilities. This would require the early setting aside of a piece of land within the development area where there is a suitable wind regime and south west aspect.

4.10 Hydro Power

- 4.10.1 Previous studies have identified a number of weirs on the River Trent in the county where there is sufficient fall of water for small-scale power generation. These sites are listed in table 4.3 below with an estimate of their potential output. They are perhaps the easiest source of potential renewable energy supply to pinpoint in the county.
- 4.10.2 A hydro-electric plant at Beeston Weir, which has already been operating successfully for over 10 years, has an installed capacity of 1.7 MW that is fed to the grid. The other potential weirs where there is a sufficiently high volume of water passing through are relatively remote from existing or proposed development. One of the largest potential outputs can be found at Holme Pierrepont Sluice, closer to urban and leisure activities, which has a lapsed planning permission for 0.89 MW.

Table 4.3: Weirs with Hydro Potential (River Trent)

Weir	Location (Grid Ref.)	Potential Output (MW)
Thrumpton Weir	SK 497 309	0.95
Holme Pierrepont Sluice	SK 615 393	0.89
Stoke Bardolph Weir	SK 650 405	0.47
Gunthorpe Weir	SK 689 437	0.47
Hazelford Ferry Weir	SK 732 495	0.66
Averham Weir	SK 770 535	0.54
Newark Nether Weir	SK 801 554	0.59
Cromwell Weir	SK 809 612	1.16

Source: Viewpoints on Sustainable Energy in the East Midlands. A Study of Current Projects and Future Prospects for the Regional Assembly. Land Use Consultants. March 2001

4.11 Energy-from-Waste

- 4.11.1 Appendix 4 charts the role of municipal solid waste (MSW) in generating heat for a district heating scheme and power for the grid (and for a private wire system) through incineration. With land filling as the other main disposal option, landfill gas recovery has for many years been the most prolific of the county's energy sources that qualify for ROCs; as at 2009, a total 11.1 MWe was generated from six landfill sites across the county. As tighter EU regulations and rises in landfill tax begin to bite, there is little prospect for capacity growth in the long term.
- 4.11.2 Whilst waste reduction and recycling rates will have to improve over time as landfill declines, there will still need to be a significant future contribution from

energy- from- waste technologies, notably the thermal treatment options of direct incineration, gasification or pyrolysis. These can be valuable in offsetting fossil fuel use and reducing any damaging methane gas leakage.

4.11.3 There is likely to be an increasing role for anaerobic digestion which is viewed by the Faber Maunsell / AECOM report as “*a key waste management process for the biodegradable fraction of MSW from homes and businesses*”. The process of digestion can involve feedstock/food waste, farm slurry and sewage sludge; the latter will be form part of the process to be used by a 2MW crop digester scheme under construction (as at autumn 2009) at Stoke Bardolph Sewage Treatment Works.

4.12 Conclusion

4.12.1 There is a great deal of evidence of proven renewable and low carbon technologies working effectively to provide electricity and/or heat, supplying both the grid, individual users/schemes and one district heating system. This is reassuring for those authorities proposing to set higher planning led standards in LDFs, although it is clear that there is a very considerable contribution from biomass consumed in the Trent Valley power stations (co-firing) which outstrips all others, including the non-renewable but low carbon technologies that are also listed in Table 4.1.

4.12.2 Finally, it is not feasible to estimate the installed capacity of all energy from micro-generation sources, such as from photovoltaics, heat pumps and solar thermal panels -which are normally building based. Here there is a range of products and suppliers with no requirement to record or register installations in a central database. Thus there will inevitably be uncertainty about the scale of contribution from micro-generation, and even the forthcoming feed-in tariff will only enable monitoring of surplus supply to the grid. That is not to imply that in total these technologies will not be very influential in enabling new schemes to meet targets and thus in raising overall capacity.

5. FUTURE CONTROLS OVER BUILDING PERFORMANCE

- 5.1.1 The Government is keen that the planning system should support the delivery of carbon emissions reductions from domestic and non-domestic buildings. PPS1 Supplement confirms that a progressive tightening of Buildings Regulations is underway initially prompted by the Code for Sustainable Homes (Dec 2006). New homes are now required to reach zero carbon emissions by 2016 with new non-domestic buildings to follow by 2019 on a timetable that the Government has yet to announce.
- 5.1.2 A third document entitled “Building a Greener Future: Towards Zero Carbon Development” was published in July 2007, and was accompanied by a ‘forward look’ paper. It sets the future direction of Building Regulations in respect of the energy performance of homes until 2016. Table 5.1 below summarises the three stages of moving towards zero carbon homes. It indicates the level of carbon emissions reduction required in future revisions of Part L of the Building Regulations, based on the current 2006 revision, and places it alongside the equivalent energy standard in the Code for Sustainable Homes.

Table 5.1: The Raising Of Residential Emission Standards

Date	Reduction in Carbon Emissions (from 2006)	Equiv Energy Standard in the Code
2010	25%	Code Level 3
2013	44%	Code Level 4
2016	Zero Carbon*	Code Level 6

Source: The Energy Savings Trust, Planning for Climate Change Briefing Note (January 2008)

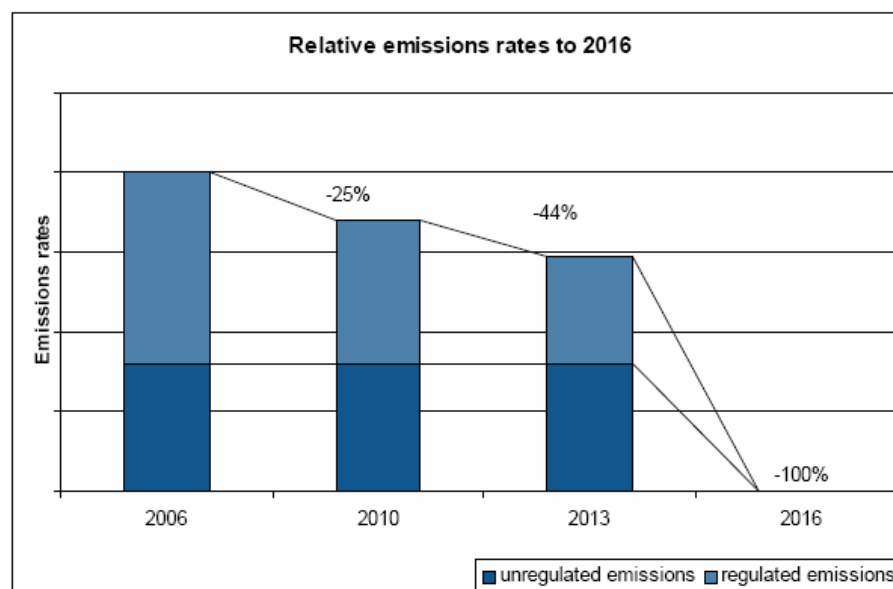
*Zero Carbon is here defined as net zero carbon emissions produced (over the year) from all energy use in the home; i.e. the use of all electrical appliances as well as space heating, cooking, ventilation, lighting and hot water.

N.B. The 2016 targets cover both regulated and unregulated emissions. See 5.1.3 below. The Code also includes other measures of a buildings’ performance in advancing sustainability.

- 5.1.3 There is a distinction to be drawn between regulated and unregulated emissions from buildings which have implications for the interpretation of the modelling exercise in Section 6. Regulated emissions are those reported for building control approval and mainly cover heating and lighting; unregulated emissions are dictated by the property user and include the choice of appliances for refrigeration, cooking, home entertainment etc. Unregulated are thus mainly operational emissions which in domestic buildings typically represent 40% of total CO₂ output (applying the 2006 Building Regulations).

- 5.1.4 PPS1 Supplement's Practice Guide encourages policy planners to base zero carbon targets for 2016 on both regulated and unregulated emissions. Indeed both emission types are included in the requirements for Nottingham City's 10% Rule (ref sub-section 3.3) and feature in the London Renewables Toolkit through the use of benchmark data for assessing building energy use.
- 5.1.5 In addition, work is underway to establish a similar series of steps to raise energy standards for non-domestic buildings to zero carbon by 2019, which will be subject to consultation in 2009. The Government is keen to achieve substantial reductions in carbon emissions for new build in the commercial and industrial sectors over the next decade and for many to achieve zero carbon for operational i.e. for non-process related emissions. In the 'Planning for a Sustainable Future' White Paper of 2006, it is suggested that *"Buildings outside of dense urban areas and those with low appliance energy requirements, such as warehouses, distribution centres and some retail outlets, should be able to be built to a zero carbon specification more easily. Other building types may take longer to get there."*
- 5.1.6 In order for any policy intervention to have a sustained impact, it must not be assumed that carbon emissions from new buildings would stay as they are now; the intention is that they would change in the future to parallel future improvements to the Building Regulations.

Figure 5.1: Declining Targets for Emissions from Housing



Source: Working draft of Practice Guidance to support PPS 1 Planning and Climate Change (2008)

6. OUTCOME OF THE MODELLING EXERCISE

6.1 Background

- 6.1.1 In 2007/08, NSEPP employed consultants ecsc (Energy Centre for Sustainable Communities) to provide advice and modelling work as part of developing targets for raised (building) performance standards. ecsc's work was taken forward and interpreted by the Nottingham Energy Partnership (NEP) whose contribution has shaped much of the text and tables of this Report and its Appendices. The approach is in accordance with the expectations of the finalised PPS1 Supplement on 'Planning and Climate Change (2007)'.
- 6.1.2 The outcome has produced a robust evidence base to support a policy that can deliver higher planning-led standards than those normally applied to development proposals through the standard Building Regulations. It includes an assessment of the effects that adoption of such a policy will have both in terms of environmental impact (i.e. CO₂ reduction) and economic impact (i.e. cost to the developer).
- 6.1.3 The ecsc modelling exercise takes seven typical development types in Nottinghamshire (all approved post April 2006) and gauges how they would perform against each of five different scenarios which were chosen as potential energy policies. These scenarios included the 'Merton Rule' policy which requires a scheme to achieve a 10% reduction in energy consumption from the deployment of renewable energy technologies (See Table 6.1, Scenario 1 below).
- 6.1.4 The outcomes of each scenario upon each of the chosen development types, concentrating on CO₂ savings and developer cost, are outlined in the full ecsc Report of Modelling (available on request as a separate background document -see page 55 for details), the analysis of which is explained in the sections below.
- 6.1.5 The findings of the ecsc modelling exercise together with the subsequent NEP interpretation provide the basis for the suggested policy targets in this framework document. A summary of the ecsc report which outlines the methodology used and compares the individual scheme analyses appears in Appendix 2.

Table 6.1: The Chosen Scenarios

Scenario 1	10% reduction in energy consumption from the use of renewable energy technologies
Scenario 2	10% reduction in CO ₂ emissions from the use of renewable energy technologies
Scenario 3	20% reduction in CO ₂ emissions from the use of renewable energy technologies
Scenario 4	25% reduction in CO ₂ emissions from the use of sustainable energy technologies (equivalent to CSH level 3 for energy)
Scenario 5	44% reduction in CO ₂ emissions from the use of sustainable energy technologies (equivalent to CSH level 4 for energy)

CSH = Code for Sustainable Homes (2006)

6.2 Policy Scenario Analysis

- 6.2.1 The ecsc study not only looked at 5 scenarios as possible policy targets and modelled these on 7 development examples, but it also built in a range of technology options to this analysis. The technologies, such as biomass boilers or wind turbines, were sized in order to deliver the requisite amount of the electricity or heat demand for the development.
- 6.2.2 A limitation was that the model only calculated percentage targets based on regulated CO₂ emissions (as explained in section 5.1.3). Scenarios 1-3 mainly feature the deployment of renewable energy (arising from solar, wind, water and biomass sources) whilst Scenarios 4-5 covers sustainable energy options which include CHP and energy efficiency as well as renewable technologies. The latter can also be described as low carbon scenarios.

6.3 Scenarios 4 and 5

- 6.3.1 Whilst energy efficiency represents the most cost effective way of cutting CO₂, NEP indicated that problems can arise if the mode of implementation is via the planning system. Prior to submitting for planning approval, developers are highly unlikely to have carried out any detailed modelling of their buildings, and thus will have little knowledge of how and where energy efficiency improvements can be made and the consequent potential savings.
- 6.3.2 Even if a statement of intended savings was made, and approval gained with energy performance covered by planning condition, it would be difficult for local authorities to assess and enforce retrospectively.
- 6.3.3 PPS1 urges against any attempt through planning to affect building fabric performance and recommends that, for maximum effect, energy focussed planning controls should concentrate on promoting and ensuring the integration of available local low or zero carbon energy sources and infrastructure.

- 6.3.4 The potential energy and carbon savings associated with low carbon energy sources are more easily estimated at planning stage from benchmark energy use data. Benchmark data (derived from an average of previously recorded emissions for different building types) can be used before detailed energy modelling has been undertaken for building control.
- 6.3.5 In summary, NEP has found that Scenarios 4 and 5 do not perform well in their current format and should be excluded since it is more effective to set and enforce building fabric energy efficiency measures through the Building Regulations.

6.4 Scenario 1

- 6.4.1 Scenario 1, which is based entirely on renewables, can be seen to have minimal effect in terms of carbon reduction. Electricity is far more carbon intensive than heat, so a heat source technology may meet a 10% energy target, while falling far short of a 10% carbon target. Electricity generating technologies cost more per unit of energy generated, but less per unit of carbon saved, so they would be unduly penalised in the development process (See Appendix 1).
- 6.4.2 In conclusion, Scenario 1 should be excluded because it can be demonstrated that there are more effective carbon saving solutions; certainly, a carbon based target, for a policy aimed at cutting carbon emissions, will produce a more effective outcome.

6.5 Scenarios 2 And 3

- 6.5.1 PPS1 Supplement urges that a proportion of the energy supply of new development is “*secured from decentralised and renewable or low-carbon energy sources*”. A renewable energy only policy will rule out the use of low or zero carbon energy sources such as landfill gas, abandoned mine or coal mine methane, direct gas CHP or district heating powered by gas or energy from waste CHP. This is clearly undesirable since, although they are non-renewable, these energy sources offer a valuable and often very cost effective way of cutting CO₂ emissions.
- 6.5.2 While natural gas CHP systems are low rather than zero carbon, there is a potential fallback to zero carbon biogas; should such biogas become available at a later stage, it could utilise any district heating network then in place. This could in time offer more affordable community options.
- 6.5.3 In summary, while Scenarios 2 and 3, referring solely to renewable energy technologies, may represent a deliverable solution, the range of accepted technologies needs to be extended to match current PPS1 Supplement and building regulations definitions in order to ensure affordability, consistency and breadth of choice.

6.6 Incorporating Unregulated Emissions

- 6.6.1 The planned 2016 targets for zero carbon homes in the CSH cover both regulated and unregulated emissions and indeed the Practice Guide to PPS1 Supplement encourages authorities to base targets on both types. Regulated and unregulated emissions are included in Nottingham City's 10% rule through benchmark data for building energy usage. Unregulated emissions in domestic buildings typically represent around 40% of total CO₂ emissions in a building built to conform to 2006 regulations.
- 6.6.2 The ecsc analysis omitted any allowance for unregulated emissions, so that its calculations for required measures to achieve the stated percentage reductions across the modelled scenarios will tend to be underestimates. This will also be the case for the capital cost estimates i.e. the measures will be under-costed.
- 6.6.3 In summary, any percentage targets adopted in a policy should be based on regulated and unregulated emissions and would need to include calculations of baseline CO₂ emissions in accordance with a list of benchmark data for different building types that developers have been previously supplied with.

7. KEY DEVELOPER COST ISSUES

- 7.1.1 Criteria in PPS22 indicate that policies on on-site renewable installations should not render development unviable or place “undue burden” on developers. Viability is affected by the prevailing cost of installing new technologies as well as by the incidence of waste heat (e.g. from power stations, incinerators and other industrial processes), especially where it can be adapted for use with minimal new infrastructure.
- 7.1.2 The London Renewable Toolkit (2004) indicates that the likely cost implication of meeting a 10% renewable energy target will not exceed 4% of building costs and is often below 1%. A key issue for viability is the extent to which any additional build cost for developers can be factored into the price they pay for the land. If developers can deduct extra build cost from the land value, then the prospect of bearing extra “burden” will be minimized as will the need for any additional cost to be passed on to the building purchasers/occupiers.
- 7.1.3 Although developers may hold options on land several years in advance, the final land deal is often only agreed just before on-site works commence when planning permissions and heads / terms of Section 106 agreements have been completed, so that any “abnormal” factors can be built into the price.
- 7.1.4 Another issue is the growing recognition that greener, more innovative properties are synonymous with quality, and should be attracting increased value and marketability to outweigh any marginal additional cost involved in their getting designed and built. For instance, BREEAM ‘Excellent’ is increasingly being used as a marketing feature for commercial property and two 2007 reports have indicated that building efficiency, including energy performance, is an increasingly important aspect of value for commercial and educational properties.
- 7.1.5 A report sponsored by the Royal Institute of Chartered Surveyors (RICS), in collaboration with partner organisations in Canada, entitled ‘Green Value: Green Buildings, Growing Assets’ (2005), pointed to the success of green rating schemes but noted that valuers have been slow to register green building benefits. A Study by the UK Green Building Council on ‘Carbon Reductions in Non-Domestic Buildings’ concluded that there are early signs that the market is changing such that occupiers or investors may be more prepared to pay a higher price for low (or zero) carbon buildings. A later 2009 Analysis of the Financial Performance of Green Office Buildings in the USA (available from RICS Research) concludes that office buildings which receive the Energy star certification can achieve a significantly higher premium in rents (up to 6% per sq ft over that of an otherwise identical building) and in selling price (averaging 16% per sq ft).
- 7.1.6 It is pertinent to consider to what extent the different policy scenarios will give rise to additional capital costs and whether these are viewed as reasonable. PPS1 Supplement indicates that any policy set out in a DPD “*should ensure that what is proposed is evidence-based and viable, having regard to the*

overall costs of bringing sites to market (including the costs of any necessary infrastructure)”.

7.1.7 Table 7.1 below has used the data from the ecsc report as a base; it has been adjusted by NEP to add percentage uplift to the costs of different energy measures to allow for the inclusion of unregulated emissions in the carbon footprint (see Appendix 1).

7.1.8 Three domestic development sites were modelled by ecsc. For each site three technology options per policy scenario were used to meet the target. These options were costed against the full build cost of the development. The outcome is set out in the table below, with the figures showing how additional costs for installing the chosen energy generating and/or saving technologies score against a range of build cost percentages. In essence, each column shows how many of the costed scenarios fit within certain points of a typical cost range i.e. demonstrating the estimated percentage increase above normal benchmark build costs.

Table 7.1: Additional Costs over Build Cost (Domestic)

Policy	<1%	< 5%	5-10%	10-15%	15-20%	>20%	Actual Average Extra Build Cost
Scenario 1:	3	6	0	0	0	0	2.13%
Scenario 2:	2	7	0	0	0	0	2.62%
Scenario 3:	0	6	3	0	0	0	5.17%
Scenario 4:	1	2	6	0	0	0	5.57%
Scenario 5:	0	1	1	2	5	0	12.47%

Source: ecsc data with NEP adjustments (see Appendix 1).

7.1.9 From the scenarios modelled (see Table 6.1), the spread of additional build cost on domestic properties shows that even up to a 20% CO₂ reduction from renewable energy technologies can normally be met at less than 10% additional build cost. At this level, a fair amount of the extra cost is likely to be easily absorbed into land value. By widening the eligible energy technologies to low or zero carbon, it appears that a 20% carbon reduction policy is achievable at well under 10% additional build costs and more typically around 5%.

Table 7.2: Additional Costs over Build Cost (Non-Domestic)

Policy	<1%	<5%	5-10%	10-15%	15-20%	>20%	Actual Average Extra Build Cost
Scenario 1	0	8	1	1	0	2	7.27%
Scenario 2	0	7	2	2	1	0	6.23%
Scenario 3	0	4	2	2	1	3	12.02%
Scenario 4	0	6	3	0	2	1	8.50%
Scenario 5	0	0	5	3	2	2	14.22%

Source: ecsc data with NEP adjustments (see Appendix 1).

- 7.1.10 For the non-domestic properties modelled the picture is less clear due to the high variability of building types and functions and thus of baseline costs. The outcome coincides with the UK Green Building Council Report in suggesting that the cost premium for non domestic sites is generally more expensive than domestic, ranging from 5% to over 25% according to building type and chosen technology. Table 7.2 shows that whilst a 10% renewables / sustainable energy policy would normally be met for less than 10% additional cost, a 20% policy may be very expensive to implement in some situations.
- 7.1.11 Work by Faber Maunsell for the South West Regional Development Agency suggested that in the south west the impact of extra build costs of up to 15% for city infill and market town developments may potentially be accommodated by a reduction in land value of 10-15%. Discussion with local stakeholders suggested that this would be a reasonable limit for reduced land value. For large urban extensions, an additional build cost of 10% would require the same 10-15% reduction in land value. However, the figures for a market town development in Cornwall suggest that an extra build cost of 5% might be a more appropriate limit to what could be absorbed by land value in that location. The sensitivity of land values in the East Midlands and Nottinghamshire will be different; however, the work in the south west makes a useful point of reference.
- 7.1.12 While the ecsc report identifies percentages of additional build costs for a number of local examples, it does not take into account the application of a percentage rule to both regulated and unregulated emissions. The inclusion of unregulated emissions is likely to add some cost to all the ecsc scenarios, with the increase being accounted for, at a level indicated in the PPS1 Practice Guide, through NEP adjustments to ecsc data.
- 7.1.13 The potential impact of any additional costs on development viability for each scheme is acknowledged, but based upon the modelling outcomes, is not likely to be excessive. It may be appropriate for the relevant local authority to enter into discussions prior to any application being submitted to ensure flexibility in its negotiations on specific sites.

8. PROPOSED POLICY APPROACHES: MAIN FRAMEWORK

8.1 Introduction

- 8.1.1 This section of the document outlines the suggested policy approach which local planning authorities across Nottinghamshire may take forward into spatial planning policies within local development documents as part of the process of preparing their Local Development Framework. It is underpinned by the Government's policy in PPS1 Supplement on Planning and Climate Change, and by the policies in the Regional Plan that promote a step change towards greater use of renewable and low carbon energy generation in the East Midlands region.
- 8.1.2 In order to achieve more sustainable forms of development across the County and to deliver a high level of sustainable, low carbon buildings, the document proposes a set target percentage(s) of the energy to be used in new development to come from decentralised and renewable or low carbon energy sources. Since not all energy is equal in terms of its CO₂ emissions, the suggested approach focuses on CO₂ rather energy saved i.e. in kWh.
- 8.1.3 In addition, the suggested policy approach provides a platform from which local planning authorities can consider the opportunities for greater use of decentralised and renewable or low carbon energy sources within their area which would support the case for setting a higher percentage CO₂ reduction target(s) for specific development areas or sites as advocated by the PPS1 Supplement.

8.2 Maintaining the Carbon Saving

- 8.2.1 It is important for developers and planning authorities to recognise that delivering a series of reductions to the carbon footprint of new developments is now inevitable over the next ten years, especially with Code level 3 being implemented from 2010 (see Table 5.1).
- 8.2.2 If a fixed percentage CO₂ target is set in a planning policy, the estimated CO₂ savings for that target should be calculated from a known benchmark. This benchmark can be derived from the typical carbon footprint for a new development at the time of planning submission. As building regulations steadily reduce the carbon emissions of new buildings, the fixed percentage saving will result in less and less real CO₂ saved. For instance, applying a 10% Merton Rule type policy to a building with a carbon footprint of 10 tonnes in 2008 would require 1 tonne saved by renewables. If a building of the same type is built in 2010 to the same planning policy, but now with a footprint of 7.5t because of more stringent building regulations, a 10% policy would only require 750kg to be saved from deploying renewable/low carbon energy.

- 8.2.3 In summary, if the evidence base supports the affordability of gaining say one tonne of savings from renewables, it makes sense to ensure that, whatever happens to the building regulations and the underlying carbon footprint of a building type, one tonne is still saved. Options for achieving these savings are explored in the next section.

8.3 Considering the Options

- 8.3.1 Analysis was conducted by Nottingham Energy Partnership (NEP) into the best way of saving one tonne of CO₂ by deploying renewable / low carbon energy. It was concluded that either or both of the following options should be considered:

- a. Fix the percentage rate of the low / zero carbon contribution and also set the benchmark data from which the CO₂ target is calculated. For instance, this might involve maintaining a constant 10% target and employing published 2005 BRE benchmark data as a constant building emissions baseline. This would be the optimum route for non-domestic buildings, as there is a huge range of available benchmark data for different land use activities, which is less regularly updated due to its complexity.
- b. Set a rising percentage to be met from sustainable forms of energy, with increments timed to coincide with the phased tightening of building regulations. This will ensure that the investment in renewable technologies etc. stays at least the same as supported by the evidence base, or grows over time. Furthermore it will be a simple route for domestic buildings to follow, as the timescale and increments for building regulations are already set. It should be stressed that the role of benchmark data will decline as the Regulations minima are raised (i.e. performance improves), so that incrementally rising percentage targets for carbon savings can be set accordingly. This will also send out a strong signal to emphasise a local authority's commitment to sustainable development.

- 8.3.2 NEP concluded that there was merit in adopting a carbon-based Merton Rule type policy and in taking forward both options (a) and (b) above on a twin-track basis with different targets for domestic and non-domestic buildings. This view was influenced by the differences in energy performance expectation between housing and, say, industrial or commercial schemes, as dictated by the 2006 Building Regulations (and anticipated changes to them). A twin-track approach will give a stepped programme for any authority-wide domestic target that exceeds the Regulations (until 2016) and a less steeply stepped path for non-domestic schemes (until 2019).

8.4 Domestic Development Schemes

- 8.4.1 In the light of the build cost outcome in Table 7.1, it is desirable initially to set a 20% carbon reduction target in any renewable/ low or zero carbon policy for domestic developments. This percentage should be calculated from pre-set domestic benchmarks for 2010 and 2013 in line with the known future trajectory of Building Regulations for emissions from housing (see table 5.1) as introduced by the Code for Sustainable Homes (2006).
- 8.4.2 The actual amount of CO₂ to be saved annually through the use of low or zero carbon energy (LZC) sources will be calculated by applying policy specified percentages to the expected carbon footprints of buildings. These carbon footprints will be calculated from policy specified benchmark CO₂ emissions (kg/m²/year) for building type, multiplied by building floor area.
- 8.4.3 The 20% figure in table 8.1 should rise to 23.5% in 2010 and 27% in 2013 as the benchmark emissions fall, which will ensure that renewables / low carbon energy investment is maintained at the level supported by the ecsc report. A higher target can be set if there is evidence of local energy resources able to support it, such as a district heating network. (See paragraph 8.6.3&4).

Table 8.1: Domestic

For domestic developments, it would be appropriate to set a rising percentage to be met from low or zero carbon energy sources, with increments timed to match the incremental tightening of Building Regulations. Proposed Domestic Requirement:

Time Periods	Current-2010	2010-2013	2013-2016	2016 onward
% Low/Zero Carbon Contribution for new development¹	20%	23.5%	27%	100%⁶

Benchmark CO₂ emissions for setting a scheme's target (kgCO₂/m²/year)²	36.7	31.2	27	-
Of which regulated emissions (kg CO ₂ /m ² /year) ³	22	16.5 (25% x 22kg)	12.32 (44% x 22kg)	-
Of which unregulated emissions (kg CO ₂ /m ² /year) ⁴	14.7	14.7	14.7	-
Expected annual carbon saving in kg CO ₂ m ² /year ⁵	7.34	7.34	7.34	
Balance between regulated and unregulated emissions	60:40	53:47	46:54	-

Footnotes

¹ The 20% is the preferred policy approach for residential development until 2010. 23.5% and 27% are step changes designed to maintain the 20% LZC contribution once the stricter energy performance measures are introduced via building regulations in 2010 and 2013.

²The 36.7 kgCO₂ is derived from the sum of the average regulated and unregulated carbon emissions per dwelling for the UK. See following footnotes.

³The 22kgCO₂ is the average regulated emissions for UK dwellings as derived from publications quoted in Appendix 3.

⁴ The draft Companion Guide to PPS1 Supplement (2008) indicates that typically for new homes 40-50% of total carbon emissions are from unregulated sources. In consequence 14.7kgCO₂/m² has been calculated as 40% of 36.7kgCO₂/m² to arrive at a final CO₂ emissions figure. This represents a 40:60 split between unregulated and regulated emissions.

⁵ This represents the likely actual carbon saving that each scheme will aspire to. It is a constant saving of 7.34 kgCO₂/m²/year achieved by the proposed policy's percentage being applied to the benchmark

⁶ From 2016, all dwellings will be required to be true zero carbon or Code 6 under the Code for Sustainable Homes and thus all CO₂ emissions generated by their occupiers will need to be offset within the development. This will only be possible through the installation of LZC technologies which will necessitate a 100% policy to apply to the entire residual carbon footprint from that date.

- 8.4.4 It is important to set the benchmarks from which developers can calculate their development's carbon footprint at the same time as setting the targets. In this way, it is simple to determine the CO₂ to be saved from LZC sources which allows a predictable outcome up to 2016 from when 100% adherence will be the norm.
- 8.4.5 Subsequent tighter building regulations will ensure that the carbon footprint of all new schemes will fall in stages towards 2016 when the zero carbon standard is due to be adopted. In effect the narrower footprint will lead to progressively less CO₂ saving from and investment in LZC technologies over the time period.
- 8.4.6 This approach will ensure that the investment in low and zero carbon energy stays at least at the same level of commitment as supported by the evidence base, or grows over time. As such it will be a straightforward route for domestic buildings to follow, as the timescale and increments for building regulations are already set.

8.5 Non Domestic Development Schemes

- 8.5.1 A huge diversity of buildings is covered by 'non-domestic' and they give rise to an even wider range of potential carbon footprints and build costs. The scope for setting a percentage target that does not place 'undue burden' on developers is thus more finely judged. The Study's evidence base points to a 10% target for non-domestic buildings being achievable at current (2009) building regulations.
- 8.5.2 The proposal opts to derive a building's carbon footprint from fixed benchmark emissions data that gives rise to a fixed 10 % carbon reduction target. This is considered to be the optimum route for non-domestic buildings to follow, since the extensive range of stock and hence of benchmark data poses a considerable challenge for energy performance analysis and hence of policy development. In practice, whilst the percentage rate does not increase over time, it will result in more than a 10% carbon saving from low or zero carbon technologies because buildings will actually become more efficient against the 2005 benchmark emissions data (as shown in the table below).

Table 8.2: Non-Domestic

N.B. The worked example in the following table is based upon a typical building emitting 100 tonnes of CO₂ per year. It assumes a 25 - 44 -100% carbon saving trajectory as per the domestic requirement (see Table 8.1), a constant 40% contribution from unregulated emissions and an even stepping of new targets until 2019 (when available).

For non-domestic developments, it is considered that a fixed percentage rate could be used linked to fixed benchmark data from which the CO₂ target is calculated; i.e. maintaining a constant 10% rule and consistently applying 2005 BRE benchmark data to the building emissions baseline below/overleaf.
Proposed Non-Domestic Requirement:

Time Periods	Current 2011	2011-2015	2015-2019	2019 onward
% Low/Zero Carbon Contribution from New Development¹	10%	10%	10%	100%⁷

Worked example

CO ₂ emissions footprint per yr, if based on static 2005 benchmark (tonnes) ²	100	100	100	-
Carbon saved (tonnes) ³	10	10	10	+10

Expected actual total footprint as Bu Regs tighten (tonnes) ⁴	100	85	73.6	
Of which regulated emissions (tonnes) ⁵	60	45 (25% of 60t)	33.6 (44% of 60t)	-
Of which unregulated emissions(tonnes) ⁵	40	40	40	-
Actual % saved ⁶	10%	11.8%	13.6%	100%

Footnotes

¹ The preferred policy approach for non-domestic development until 2010 is a 10% contribution (ie. the target is fixed at 10% carbon footprint reduction from low or zero carbon energy sources).

² With benchmark data for assessing a new development's carbon footprint fixed to 2005 Building Research Establishment benchmarks, the same building type would have the same footprint, for calculation purposes all the way through to 2019. 100 tonnes has been selected for ease of calculation. The savings for whole buildings are best described in tonnes rather than kg/co₂.

³ In this example, applying 10% to 100 tonnes would place a constant requirement to install LZC energy sources to cut the buildings footprint by 10 tonnes, irrespective of how energy efficient the building actually is.

⁴ If building regulations for non-domestic follow the same path as domestic, with regulated emissions cut by 25%, 44% and 100% towards 2019, this would be the actual expected footprint of this building type over this time scale.

⁵ The actual total footprint is made up of both regulated emissions (falling in line with building regulations) and unregulated emissions, which generally represent around 40% of current total emissions.(see Domestic footnote 4) Unregulated emissions are not expected to fall appreciably.

⁶ By comparison to the 10% policy target, the actual achieved percentage CO₂ is improved as a result of the tightening of the building regulations in the stated periods.

⁷ From 2019 when all non-domestic buildings will be required to become true zero carbon such that all CO₂ emissions from that use will need to be offset within the development site. This will only be possible if the entire remaining CO₂ emissions are mitigated by the installation of low or zero carbon technologies – which implies a 100% policy from that date, irrespective

- 8.5.3 The proposed timescale aims to follow the incremental tightening in building regulations illustrated in Figure 8.1. As previously noted, the series of stepped rises that the Regulations will impose has not yet been finalised for non-domestic buildings, although the end point is to reach zero carbon by 2019. It is suggested that, even if this deadline should extend beyond 2019, the retention of the proposed planning policy time period in Table 8.2 is still appropriate.
- 8.5.4 The use of a fixed percentage target and fixed benchmarks is designed to ensure a consistent spend on low or zero carbon energy sources. As indicated in 8.3.1(a), the vast range of benchmarks (reflecting the diversity of non-domestic building stock) would be unwieldy to keep updated.
- 8.5.5 Keeping a fixed percentage target and fixed benchmark will in effect mean that as Building Regulations tighten, and with buildings actually becoming more energy efficient, the real contribution from renewable / low carbon energy resulting from a 10% policy will be higher than 10%. In addition there is perhaps scope to opt for an even higher percentage baseline target for non-domestic buildings if there is an identified evidenced local energy resource, such as a district heating network, able to support it (See also Appendix 4).
- 8.5.6 In order to monitor the impact of this policy, it is desirable that all non-domestic building should also be required to fit smart metering with remote web monitoring on all installed gas and electricity meters. Access to the arising data stream would need to be granted to the local authority. This will enable assessment of actual achieved percentage reductions and the subsequent mapping of installed sustainable energy capacity.

8.6 Local Development Areas

- 8.6.1 Developers can be encouraged to achieve the above recommended emissions targets by using whichever energy generating technology it is feasible/efficient to deploy -whether renewable or low carbon, or mix of technologies - as long as the proposed scheme provides a source of electricity and / or heat and cuts CO₂ emissions, rather than simply makes an energy

efficient improvement. This will enable new schemes to benefit from both on-site and off-site energy supplies.

- 8.6.2 However, PPS1 Supplement anticipates that there will be some situations “where there are particular and demonstrable opportunities for greater use of decentralised and renewable or low carbon energy than the target percentage” and that local authorities will then need to establish “development area or site-specific targets to secure this potential” (paragraph 26). These opportunities are likely to be centred upon a known local low carbon resource, perhaps with a pre-existing infrastructure, or upon a new resource for an urban extension or other large development site.
- 8.6.3 For example, the proximity of a district heating network, a viable site for a large wind turbine or a coal mine methane plant could merit employing different types of target. In general, the percentage should be achievable according to the type of adjoining development proposed and the potential scale of savings offered by the technology. There should be a separate specific evidence base for each site where a higher target is set. It may be appropriate again to set different targets for domestic and non-domestic or mixed use developments within the same area or site.
- 8.6.4 In accordance with PPS1 Supplement, local authorities can set higher specific requirements for new developments within a definable catchment area of an existing or proposed decentralised supply of renewable or low carbon energy. The requirements should set carbon targets which relate to the levels of carbon output of the primary supply source to which the development schemes are expected to connect. Whilst PPS1 Supplement maintains the flexibility for developers to use alternative LZC sources of energy, those must effectively be capable of matching the primary identified source in its carbon content. A prime example could be where proposed sites are in proximity to the Nottingham City District Heating (DH) Scheme – which is a major energy generator and heat supplier. The example is explored further in Appendix 4.



9. IMPLEMENTATION




9.1 Realising Opportunities for Sustainable Energy

- 9.1.1 The inevitable consequence of embracing the policy approach of section 8 is that planners and developers will have to become considerably more familiar with how renewable and low carbon technologies perform and are assessed. This will involve overcoming an evident knowledge gap within planning teams so that professional staff will become able to select, discuss and apply such technologies to suit different areas or sites. Hence it is important to ensure that appropriate training opportunities are provided for planning officers in the respective partner local authorities which will subsequently be bringing forward any sustainable energy planning policies that are informed by this document. NSEPP is preparing the groundwork for a number of sessions in 2010, initially with the assistance of emda funding, and recognises that there may be a need to co-ordinate further sessions in the years beyond.
- 9.1.2 The Practice Guide to PPS1 Supplement (2008) notes that “the suitability of renewable or low carbon technologies for particular development sites will depend not only on the location and nature of the site but also on the proposed building types, size, density, ownership and occupiers”. Ideally, each major development brief would need to clearly specify the most appropriate sustainable energy provision. As PPS1 Supplement indicates, there will normally be a number of different options and the onus is upon the developer to investigate and select the mix of feasible renewable and/or low carbon technologies that minimises CO₂ emissions most effectively. Each new development proposed represents an opportunity, not to be missed at the planning stage, to exceed minimum requirements and extend the capacity of decentralised energy supplied in the UK.
- 9.1.3 The heating, cooling and electricity demand profiles of different types of development (residential / commercial etc.) will lend themselves to different renewable or low carbon solutions. Developers will often need to take into account, as the PPS1 Supplement Practice Guide suggests a menu of potential technologies that can be adapted to suit different types of building scheme. Planning authorities are urged to be flexible rather than prescriptive in how carbon savings are to be secured but where there is an exploitable pre-existing source, they can “set specific requirements to facilitate connection” (para.28 of PPS1 Supplement). Thus development plan documents are likely to contain general or criteria based policies to assist developers in choosing appropriate and viable solutions as well as more precise policies to designate development areas or energy action areas after a full assessment has shown them to be merited.
- 9.1.4 Supporting material can be provided in supplementary planning documents: they could include plan area mapping to indicate where sustainable energy can be sourced and a presentation of the evidence underlying the designation of development areas (or energy action areas). An initial examination for this Study of existing provision and of possible sources has given rise to the indicative countywide map located inside the back cover.

- 9.1.5 An important part of ensuring a smooth planning experience is the ease with which information obtained from developers can be interpreted – that in turn depends upon its quality and clarity. Government advises that, for planning purposes, energy information is collected through Design and Access Statements (DAS).
- 9.1.6 A number of authorities, including the City Council, now require energy statements as a means of standardising the energy data required for the planning process and these can be requested within or as an adjunct to the DAS. See also paras 3.3.5-3.3.6. The aim is to find out how much energy will be consumed by the development (when operational), to predict carbon dioxide emissions and to consider ways in which those emissions can be minimised through design geared to less energy use, more energy efficient measures and the deployment of renewable and low carbon energy.
- 9.1.7 Figure 9.1 (see below) has been prepared as a simple illustration of the additional processes required by developers in realising opportunities for sustainable energy generation.

Figure 9.1: Steps for Prospective Developers

Stage	What do I need to do?	Reason
1) Analysis of the proposed site	Describe the site and analyse the character and features of the surrounding area, incl. landform, and landscape, water courses, building styles / heights, wind speeds and direction.	Conducting such an exercise will help identify sustainable energy prospects which will influence design choices e.g. by maximising the number of southward facing properties.
		
2) Identify baseline energy consumption for the proposed development	Work out the energy requirements of the building both in terms of regulated emissions, i.e. the amount of energy needed to heat and run the building and unregulated emissions i.e. emissions that will arise from the activities of the building occupants notably from the use of electrical appliances.	Conducting such an exercise will ensure that decisions made in the next stage are the most appropriate. NB: This assessment should be based on the levels of consumption which would be required to meet Building Regulations minimum standards.
		

<p>3) Analyse potential renewable/ low carbon technologies available</p>	<p>Using the information gained in stages 1 and 2, analyse the potential feasibility of different types of energy provision by reference to calculations of sustainable energy that each system can generate. Ensure initially that emissions are minimised through energy efficiency measures esp. passive solar design.</p>	<p>To meet the obligations of PPSI Climate Change Supplement and any local area target set by the planning authority.</p>
		
<p>4) Select preferred approach/approaches</p>	<p>Using the analysis in stage 3, select the preferred sustainable energy technology/technologies for the proposal and explain reasoning.</p>	<p>To meet the obligations of PPSI Supplement and any local area target set by the planning authority.</p>
		
<p>5) Present findings</p>	<p>Present findings in pre-application discussions and planning submission as part of (or in an annex to) the Design and Access Statement.</p>	<p>To allow local planning authority scrutiny of the sustainable energy element of the proposal and of the alternatives considered.</p>
		
<p>6) Consider Management</p>	<p>For large sustainable energy systems serving significant development, esp. where phased, it is wise to employ an ESCo (energy services company) or a public/private partnership to implement/manage a scheme</p>	<p>To assist in ensuring that costs/ benefits are fully assessed, and that the chosen system(s) is well installed and reliably run.</p>

9.2 Providing Relevant Energy Information at the Planning Stage

- 9.2.1 Much of the performance material to be collected by developers at the planning stage is also required for building control applications which are submitted at a more detailed level, and often after planning approval has been gained. Local planning authorities will need to provide applicants with clear guidance on any local targets they intend to impose, the level of detail required (including say, which CO₂ calculation methodology is preferred) and which format to be followed. It is suggested that the CO₂ emissions calculations for dwellings should be based on the indicators and the calculation methodology (SAP 2005) adopted in the 2006 Buildings Regulations; and that the BREEAM or SBEM methods could be employed for non domestic buildings.
- 9.2.2 Energy Statements will in effect provide a baseline for annual CO₂ emissions arising from fossil fuel energy use within new buildings i.e. emissions that are described as regulated and unregulated, but which exclude industrial process, transport or embodied energy. They will measure compliance with a local sustainable energy target before any on-site renewable energy generation (including solar panels) is considered – but after the application of additional measures (e.g. more efficient glazing/ insulation/ boilers) to reduce energy use.
- 9.2.3 PPS1 Supplement indicates that DPDs should set out “how they (planning authorities) intend to advise developers on the implementation of the local requirements, and how these will be monitored and enforced”. Certainly local planning authorities should set out the type and size of development to which any approved target will be applied. They will also need to ensure that outline planning applications fully address energy measures in the same way as full applications, and that they are prepared to negotiate/include off-site provision or infrastructure connection within a Section 106 agreement.
- 9.2.4 The feasibility of supplying a proportion of renewable energy may depend on technical or financial issues, and what is feasible is likely to change as energy prices vary, new technology emerges, the costs of technologies and the availability of grants changes and new legislation is adopted. Developers can be expected to demonstrate that they have explored all on-site and potential off-site renewable and low carbon energy options and then designed their schemes accordingly. For large sites it is advisable to explore this energy source potential at or before master planning stage, especially if there is no local authority assessment or development area designation. Many energy sources can be made unviable if introduced later than this early planning stage.
- 9.2.5 For example, one of the lowest cost low/zero carbon sources would be a community wind turbine; however siting constraints in relation to the rest of the development may mean that an opportunity is lost if the potential is only assessed once the final layout is being discussed. Similarly with ground source heat pumps, some configurations require significant land area for heat

harvest; or solar technologies where a development may be required to incorporate a high proportion of south facing roofs.

- 9.2.6 In cases where a developer does not consider that it is feasible to meet the required percentage target, a DAS should incorporate a detailed explanation. The decision on what is feasible will rest with the local planning authority. In the event that overriding circumstances prevent compliance with the policy, it may be reasonable for the local planning authority to seek a commuted payment towards the provision of a larger community based renewable (or low carbon) source for the area (e.g. a proposed and locally agreed wind turbine). PPSI Supplement encourages planning authorities to give positive consideration to the use of local development orders (LDO) to secure renewable and low carbon supply systems.
- 9.2.7 In cases where a large new energy plant or system is being introduced, perhaps to serve a substantial phased urban extension, the planning and implementation process may be best managed by an Energy Services Company (ESCo).

9.3 Energy Services Companies

- 9.3.1 There will be circumstances, mainly in local development areas, where local authorities may need to take steps to ensure that:
- an existing major local energy source is utilised more effectively (for example a District Heating Scheme), or
 - a new Energy Centre, often CHP, is successfully introduced, perhaps in harness with phased development over many years.
- 9.3.2 For large new build or redevelopment schemes, the deployment of a stand-alone energy source and/or connection to a separate energy network will normally involve agreement at the pre-application or master planning stage. In these cases, the setting up of a private/public partnership company and/or the engagement of an Energy Services Company (ESCo) can be valuable in enabling delivery.
- 9.3.3 The role of ESCos in financing and implementing a range of schemes is expected to grow, since very few developers will want to retain liability for energy generation, its infrastructure and fuel supply. There are several models for ESCos which range from facilities management only (i.e. performance control) through to long-term involvement from survey/design stages through funding to installation and operation.
- 9.3.4 Most forms of micro-generation need careful design, build and ongoing management to perform well, and therefore do not suit the current volume builder business model which is to design, build and finance developments only, recovering that investment by a quick sale with no contractual links to the project. To create a new or involve an existing ESCo would require a new approach to volume building. Nonetheless, developers may be increasingly attracted by the opportunity to contract out the whole energy infrastructure process.

- 9.3.5 ESCos are most appropriate for large scale, mixed-use schemes, such as high density, high rise apartments/flats where CHP is effective in replacing expensive electric heating. An ESCo providing microgenerated energy (electricity) could provide significant gains in environmental terms for new and refurbished high density building. Locally supplied combined heat and power (CHP) can provide efficiencies of up to 90%, compared to central power stations / national grid system which can be as little as 22% efficient at the point of use (due to heat wasted at power stations and losses in transmission).
- 9.3.6 ESCos can be included in the design and marketing of such schemes, by ensuring investment in enhanced energy efficient measures, both building components (esp high insulation levels) and appliances and light fittings(A++ models). An 'A' rated home endorsed and guaranteed by the involvement of an ESCo could be a key part of the marketing.
- 9.3.7 They can also assist by sourcing micro-generation technologies (eg.pvs or heat pumps) for new build where economies of scale can be obtained by mass installations in one operation (NB: discounts of up to 30% were achieved at the innovative BedZED development in South London). A further benefit is that an ESCo can aggregate the excess electricity generated by individual buildings and export it via a single contract at improved rates.

9.4 Monitoring

- 9.4.1 It may become apparent that elements of the Policy Framework, such as the modelling or the assessment of existing sustainable energy sources, will require updating once LDF policies are in operation. NSEPP will need to keep a watching brief and decide which aspects of that updating will be best handled in partnership and which data should be collected for monitoring purposes.

APPENDICES

1. Technical background to Sections 6 & 7: Developer Costs

2. Summary of Report of Modelling commissioned from Energy Centre for Sustainable Communities (ecsc) February 2008 (revised 12/08)

(NB. the Main Report is available on request as a separate document from Nottinghamshire County Council's NSEPP Co-ordinator: tel 0115 9774538)

3. Technical background to Section 8: Explaining Table 8.1.

4. Nottingham City District Heating Scheme

APPENDIX 1

Technical Background to Sections 6 & 7: Developer Costs

Subsequent adjustments to the data received from Energy Centre for Sustainable Communities in order to account for unregulated emissions

As the main report emphasises in 5.1.3 and 6.6.1-3, carbon emissions from a development scheme fall into 2 categories:

1. Regulated emissions:

Those that are due to building fabric, heating system, lighting, insulation levels and so on. These are defined by the structure of the building and are stipulated by UK Building Regulations.

2. Unregulated emissions:

Emissions that are due to the activities of the building occupant who may deploy small appliances, white goods, plug-in heaters, dehumidifiers, fans etc.

“Unregulated emissions typically represent around 40-50% of the total CO₂ emissions of new homes in the UK.”(Practice Guidance to support the Planning Policy Statement: Planning and Climate Change)

Since the ecsc report was written, PPS1 Supplement and its Practice Guide have been published; they effectively refine the definition of countable emissions in calculating percentage targets, especially since they encourage the inclusion of both regulated and unregulated emissions.

The ecsc report detailed calculations relating to the cost of meeting several percentage energy and carbon savings scenarios solely based on regulated emissions. For greater accuracy, it is necessary to adjust the calculation of additional capital costs in order to include unregulated emissions.

Taking the above 40% figure for unregulated emissions as standard throughout the period until 2019, the costs of measures have been increased by 66.7% to account for the need to meet a total carbon target 66.7% higher, i.e. with 40% of emissions unregulated and 60% regulated. It has been assumed that this balance of 40:60 will be similar in non-domestic schemes. While NEP has used the bottom end of the 40-50% range for unregulated emissions, it has suggested that this will be balanced to some extent by the likely economies of scale (that have not been counted) to be gained from larger systems.

The following tables show the outcome when each option/scenario is worked through for each of the 7 selected sites(as per the data set out in tables 6.1-6.7 of the ecsc Report of Modelling), using the corrected build cost estimates since supplied by ecsc.

Site 1: Class C3 Apartments

Site	Scenario	Option	Capital Cost (£)	Build cost	Capital cost + factor for 40% from unregulated emissions)	Corrected % of build cost for Capital cost (+ factor for 40% from unregulated emissions)	Average % over	less than 1 %	less than 5%	5 to 10%	10 to 15%	15 to 20%	over 20%
1	1	1	48,000	3565000	80,016	2.24%			1				
1	1	2	79,200	3565000	132,026	3.70%			1				
1	1	3	9,696	3565000	16,163	0.45%	2.13%	1					
1	2	1	89,000	3565000	148,363	4.16%			1				
1	2	2	42,000	3565000	70,014	1.96%			1				
1	2	3	19,393	3565000	32,328	0.91%	2.34%	1					
1	3	1	168,000	3565000	280,056	7.86%				1			
1	3	2	61,000	3565000	101,687	2.85%			1				
1	3	3	29,090	3565000	48,493	1.36%	4.02%		1				
1	4	1	103,408	3565000	172,381	4.84%			1				
1	4	2	201,600	3565000	336,067	9.43%				1			
1	4	3	178,250	3565000	297,143	8.34%	7.53%			1			
1	5	1	330,950	3565000	551,694	15.48%						1	
1	5	2	165,000	3565000	275,055	7.72%				1			
1	5	3	67,876	3565000	113,149	3.17%	8.79%		1				

Build cost assumptions for standardised build cost = from ecsc 3565m² @ £1000 per m²

Site 2: Class C3 Conversion to Residential

Site	Scenario	Option	Capital Cost (£)	Build cost	Capital cost + factor for 40% from unregulated emissions)	Corrected % of build cost for Capital cost (+ factor for 40% from unregulated emissions)	Average % over	less than 1 %	less than 5%	5 to 10%	10 to 15%	15 to 20%	Over 20%
2	1	1	56,000	2811000	93,352	3.32%			1				
2	1	2	23,868	2811000	39,788	1.42%			1				
2	1	3	13,200	2811000	22,004	0.78%	1.84%	1					
2	2	1	72,800	2811000	121,358	4.32%			1				
2	2	2	55,877	2811000	93,147	3.31%			1				
2	2	3	17,400	2811000	29,006	1.03%	2.89%		1				
2	3	1	145,600	2811000	242,715	8.63%				1			
2	3	2	110,262	2811000	183,807	6.54%				1			
2	3	3	25,867	2811000	43,120	1.53%	5.57%		1				
2	4	1	115,395	2811000	192,363	6.84%				1			
2	4	2	92,872	2811000	154,818	5.51%				1			
2	4	3	25,862	2811000	43,112	1.53%	4.63%		1				
2	5	1	280,550	2811000	467,677	16.64%						1	
2	5	2	265,243	2811000	442,160	15.73%						1	
2	5	3	166,243	2811000	277,127	9.86%	14.08%			1			

Build cost assumptions for standardised build cost = from ecsc 2811m² @ £1000 per m²

Site 3: Class A1 Retail

Site	Scenario	Option	Capital Cost (£)	Build cost	Capital cost + factor for 40% from unregulated emissions)	Corrected % of build cost for Capital cost (+ factor for 40% from unregulated emissions)	Average % over	less than 1 %	less than 5%	5 to 10%	10 to 15%	15 to 20%	Over 20%
3	1	1	66,400	544902.09	110,689	20.31%							1
3	1	2	18,000	544902.09	30,006	5.51%				1			
3	1	3	10,620	544902.09	17,704	3.25%	9.69%		1				
3	2	1	49,800	544902.09	83,017	15.24%						1	
3	2	2	13,200	544902.09	22,004	4.04%			1				
3	2	3	10,620	544902.09	17,704	3.25%	7.51%		1				
3	3	1	99,600	544902.09	166,033	30.47%							1
3	3	2	33,000	544902.09	55,011	10.10%					1		
3	3	3	10,620	544902.09	17,704	3.25%	14.60%		1				
3	4	1	87,248	544902.09	145,442	26.69%							1
3	4	2	24,248	544902.09	40,421	7.42%				1			
3	4	3	16,010	544902.09	26,689	4.90%	13.00%		1				
3	5	1	126,820	544902.09	211,409	38.80%							1
3	5	2	37,620	544902.09	62,713	11.51%					1		
3	5	3	26,790	544902.09	44,659	8.20%	19.50%			1			

Build cost assumptions for standardised build cost = from ecsc 354m² @ average £1539 pm²

Site 4: Mixed use of retail Class A1 with apartments class C3, 23 apartments

Site	Scenario	Option	Capital Cost (£)	Build cost	Capital cost + factor for 40% from unregulated emissions)	Corrected % of build cost for Capital cost (+ factor for 40% from unregulated emissions)	Average % over	less than 1 %	less than 5%	5 to 10%	10 to 15%	15 to 20%	Over 20%
4	1	1	59,446	2067996.27	99,096	4.79%			1				
4	1	2	27,415	2067996.27	45,701	2.21%			1				
4	1	3	61,546	2067996.27	102,597	4.96%	3.99%		1				
4	2	1	93,046	2067996.27	155,108	7.50%				1			
4	2	2	64,839	2067996.27	108,087	5.23%				1			
4	2	3	47,566	2067996.27	79,293	3.83%	5.52%		1				
4	3	1	200,400	2067996.27	334,067	16.15%						1	
4	3	2	65,700	2067996.27	109,522	5.30%				1			
4	3	3	12,667	2067996.27	21,116	1.02%	7.49%		1				
4	4	1	41,086	2067996.27	68,490	3.31%			1				
4	4	2	50,087	2067996.27	83,495	4.04%			1				
4	4	3	20,100	2067996.27	33,507	1.62%	2.99%		1				
4	5	1	210,110	2067996.27	350,253	16.94%						1	
4	5	2	157,300	2067996.27	262,219	12.68%					1		
4	5	3	153,500	2067996.27	255,885	12.37%	14.00%				1		

Build cost assumptions for standardised build cost = from ecsc 2137m² @ £967.7 pm² (1677m²@1000pm² domestic + 460m² @ 850pm² retail)

Site 5: Class C3 Housing scheme 32 dwellings

Site	Scenario	Option	Capital Cost (£)	Build cost	Capital cost + factor for 40% from unregulated emissions)	Corrected % of build cost for Capital cost (+ factor for 40% from unregulated emissions)	Average % over	less than 1 %	less than 5%	5 to 10%	10 to 15%	15 to 20%	Over 20%
5	1	1	61,600	2892000	102,687	3.55%			1				
5	1	2	20,826	2892000	34,717	1.20%			1				
5	1	3	12,600	2892000	21,004	0.73%	1.83%	1					
5	2	1	78,400	2892000	130,693	4.52%			1				
5	2	2	41,652	2892000	69,434	2.40%			1				
5	2	3	16,800	2892000	28,006	0.97%	2.63%	1					
5	3	1	162,400	2892000	270,721	9.36%				1			
5	3	2	108,065	2892000	180,144	6.23%				1			
5	3	3	37,800	2892000	63,013	2.18%	5.92%		1				
5	4	1	136,854	2892000	228,136	7.89%				1			
5	4	2	90,106	2892000	150,207	5.19%				1			
5	4	3	9,254	2892000	15,426	0.53%	4.54%	1					
5	5	1	306,987	2892000	511,747	17.70%						1	
5	5	2	268,581	2892000	447,725	15.48%						1	
5	5	3	182,179	2892000	303,692	10.50%	14.56%				1		

Build cost assumptions for standardised build cost = from ecsc 2892m² @ £1000 pm²

Site 6: Class D2 Leisure centre

Site	Scenario	Option	Capital Cost (£)	Build cost	Capital cost + factor for 40% from unregulated emissions)	Corrected % of build cost for Capital cost (+ factor for 40% from unregulated emissions)	Average % over	less than 1 %	less than 5%	5 to 10%	10 to 15%	15 to 20%	Over 20%
6	1	1	2,585,600	17434521.4	4,310,195	24.72%							1
6	1	2	1,288,000	17434521.4	2,147,096	12.32%					1		
6	1	3	170,316	17434521.4	283,917	1.63%	12.89%		1				
6	2	1	1,131,200	17434521.4	1,885,710	10.82%					1		
6	2	2	1,444,800	17434521.4	2,408,482	13.81%					1		
6	2	3	227,088	17434521.4	378,556	2.17%	8.93%		1				
6	3	1	2,262,400	17434521.4	3,771,421	21.63%							1
6	3	2	2,940,000	17434521.4	4,900,980	28.11%							1
6	3	3	454,176	17434521.4	757,111	4.34%	18.03%		1				
6	4	1	1,591,975	17434521.4	2,653,822	15.22%						1	
6	4	2	2,041,575	17434521.4	3,403,306	19.52%						1	
6	4	3	343,938	17434521.4	573,345	3.29%	12.68%		1				
6	5	1	1,959,938	17434521.4	3,267,217	18.74%						1	
6	5	2	2,359,938	17434521.4	3,934,017	22.56%							1
6	5	3	684,570	17434521.4	1,141,178	6.55%	15.95%			1			

Build cost assumptions for standardised build cost = from ecsc 8348m² @ average £2088 pm²

Site 7: Class B1 Offices

Site	Scenario	Option	Capital Cost (£)	Build cost	Capital cost + factor for 40% from unregulated emissions)	Corrected % of build cost for Capital cost (+ factor for 40% from unregulated emissions)	Average % over	less than 1 %	less than 5%	5 to 10%	10 to 15%	15 to 20%	Over 20%
7	1	1	26,384	1256502.56	43,982	3.50%		1					
7	1	2	20,000	1256502.56	33,340	2.65%		1					
7	1	3	10,594	1256502.56	17,660	1.41%	2.52%	1					
7	2	1	35,296	1256502.56	58,838	4.68%		1					
7	2	2	20,000	1256502.56	33,340	2.65%		1					
7	2	3	11,423	1256502.56	19,042	1.52%	2.95%	1					
7	3	1	62,658	1256502.56	104,451	8.31%				1			
7	3	2	99,400	1256502.56	165,700	13.19%					1		
7	3	3	18,160	1256502.56	30,273	2.41%	7.97%	1					
7	4	1	38,711	1256502.56	64,531	5.14%				1			
7	4	2	55,336	1256502.56	92,245	7.34%				1			
7	4	3	26,159	1256502.56	43,607	3.47%	5.32%	1					
7	5	1	55,630	1256502.56	92,735	7.38%				1			
7	5	2	51,980	1256502.56	86,651	6.90%				1			
7	5	3	60,101	1256502.56	100,188	7.97%	7.42%			1			

Build cost assumptions for standardised build cost = from ecsc 1228m² @ average £1023pm²

APPENDIX 2

Summary of Report of Modelling carried out by Energy Centre for Sustainable Communities (ecsc). Feb 2008 (and updated Dec 2008)

Contents

List of Abbreviations

1. Executive Summary
2. Background to the Project
3. Methodology

Modelling: Aidan Dunsdon and Mary Rawlinson

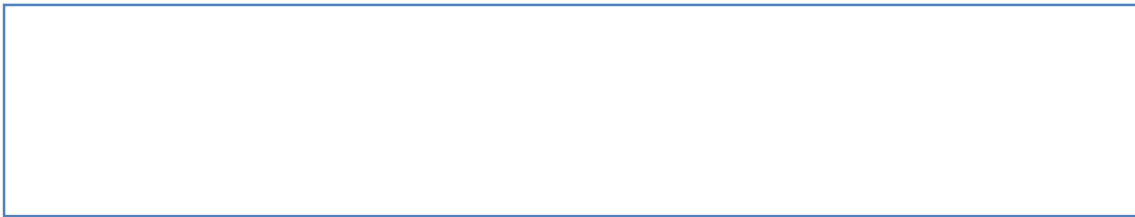
Report written by Laura Russell

Report reviewed by Andrew White

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This report is made on behalf of ecsc Ltd. By receiving the report and acting on it, Nottinghamshire County Council and partners, or any third party relying on it, accepts that no individual is personally liable in contract, tort or breach of statutory duty (including negligence).

Incorporating Sustainable Energy into New Build – a Modelling Exercise to inform Planning Policy in Nottinghamshire



Executive Summary



Updated February 2009

List of abbreviations

CE	Community Energy
CHP	Combined Heat and Power
CO₂	CO2 Dioxide
CSH	Code for Sustainable Homes
EE	Energy Efficiency
ESCO	Energy Services Company
GCC	Ground Coupled Cooling
GIFA	Gross Internal Floor Area
GSH	Ground Source Heat
GSHP	Ground Source Heat Pump
GWh	Gigawatt hour
HVAC	Heating, Ventilation and Air Conditioning
kWh	Kilowatt hour
kWh/yr	Kilowatt hours per year
LDF	Local Development Framework
LPA	Local Planning Authority
MWh	Megawatt hour
m/s	Metres per second
NPV	Net Present Value
PPS	Planning Policy Statement
PV	Solar Photovoltaic
RE	Renewable Energy
SBEM	Simplified Building Energy Model
SHW	Solar Hot Water (aka Solar Thermal)
SPD	Supplementary Planning Document
SPG	Supplementary Planning Guidance
TER	Target Emission Rate
UDP	Unitary Development Plan

Executive summary

Spatial Planning Policies requiring that a percentage of energy in new developments be derived from on-site renewable sources are becoming more widespread. Nottinghamshire Local Planning Authorities are keen to introduce renewable energy policies and have commissioned this piece of work to inform the Local Development Framework process and, in the interim, a framework Supplementary Planning Document on renewable energy in new development.

Five policy scenarios (shown in table 1) were modelled for seven developments typical of the Nottinghamshire area.

Table 1: Policy scenarios used in the modelling exercise

Scenario 1	10% reduction in energy consumption from the use of renewable energy technologies
Scenario 2	10% reduction in CO ₂ emissions from the use of renewable energy technologies
Scenario 3	20% reduction in CO ₂ emissions from the use of renewable energy technologies
Scenario 4	25% reduction in CO ₂ emissions from the use of sustainable energy technologies (equivalent to CSH level 3 for energy)
Scenario 5	44% reduction in CO ₂ emissions from the use of sustainable energy technologies (equivalent to CSH level 4 for energy)

The modelling was a “What if...” process i.e. what would be the impact if development x had to comply with policy scenario y. The effects were analysed in terms of CO₂ saved, capital cost and life cycle cost. Planning issues are also discussed.

There are a number of conclusions that can be drawn from the modelling, as detailed below.

1.1 Sustainable energy¹ vs. renewable energy

- It is often more cost effective to meet a scenario that demands a reduction from a combination of SE technologies than RE technologies alone.
- A combination of EE and SHW is a cost effective way of meeting scenario 1.
- Where feasible, the inclusion of EE and wind and is a cost effective means of meeting scenario 2, 3 & 4.
- The inclusion of best or advanced practice EE and biomass is an effective way of meeting scenario 5 in domestic developments.
- CHP combined with EE is also cost effective means of meeting scenario 5.
- It is generally more cost effective to meet a greater CO₂ reduction through SE technologies than meeting a solely RE based policy e.g. scenario 4 can generally be achieved at a lower cost than scenario 3 but deliver greater CO₂ savings

1.2 CO₂ vs. Energy

- A policy demanding x% CO₂ reduction is not the same as a policy demanding x% energy reduction, as electricity production is more CO₂ intensive per kWh than gas and therefore technology choice (i.e. heat or electricity producing) will affect CO₂ emissions achieved

¹ Sustainable energy is taken to be energy efficiency, efficient means of generating energy e.g. CHP, and renewable energy.

- Heat saving technologies e.g. SHW and biomass are more cost effective at meeting an energy based target
- Electricity saving technologies e.g. solar PV and wind are more cost effective at meeting a CO₂ based target

1.3 Capital costs

- There is a wide variation in the capital cost to meet a given scenario
- The cost is dictated more by the technology choice than the policy scenario chosen
- Biomass is a cost effective way of reaching the higher RE targets such as in scenario 5. However, capital costs associated with biomass may be substantially increased above those indicated here by the cost of additional fuel storage and shared infrastructure requirements which are not within the scope of this study.
- EE combined with CHP or CE CHP is a cost effective way of meeting SE targets in schemes where there is sufficient heat demand to make CHP viable.

1.4 Life cycle costs

- RE technologies generally have a positive lifecycle cost i.e. they do not reach 'payback' in their lifetimes
- EE (particularly in commercial developments) can have a negative lifecycle cost i.e. reach 'payback' in its lifetime
- CHP and CE CHP can have a negative life cycle cost i.e. reach 'payback' in its lifetime

2 Background to project

Spatial Planning Policies requiring that a percentage of energy in new developments be derived from on-site renewable sources are becoming more widespread. Ground breaking prescriptive targets originally introduced by local authorities in London such as Merton and Croydon have now effectively been endorsed by central government through development plan inquiry decisions and PPS 22 (paragraph 8) and the supplement to PPS 1 on Planning and Climate Change.

In order to adopt such a policy, as emphasised in the PPS on Planning and Climate Change, it is necessary that a robust evidence base is compiled. This will include assessing the effects that adoption of such a policy will have both in terms of environmental impact (i.e. CO₂ reduction) and economic impact (i.e. cost to the developer). The basis of this study is to take seven typical developments in Nottinghamshire and five scenarios that have the potential to be adopted as policy; each development is modelled to show what effect each of the scenarios would have, were it to be adopted. By studying the outcomes, e.g. CO₂ savings and cost to the developer, it is possible to select an appropriate target for inclusion in a framework SPD and LDF core strategies. This modelling exercise can contribute towards the evidence base for the chosen policy.

3 Methodology

ecsc has modelled seven developments typical of development in Nottinghamshire, shown in table 2-2, for the five different policy scenarios shown in table 2-1.

Table 2-1: Policy scenarios used in the modelling exercise

Scenario 1	10% reduction in energy consumption from the use of renewable energy technologies
Scenario 2	10% reduction in CO ₂ emissions from the use of renewable energy technologies
Scenario 3	20% reduction in CO ₂ emissions from the use of renewable energy technologies
Scenario 4	25% reduction in CO ₂ emissions from the use of sustainable energy technologies (equivalent to CSH level 3 for energy)
Scenario 5	44% reduction in CO ₂ emissions from the use of sustainable energy technologies (equivalent to CSH level 4 for energy)

As there are a number of different technologies that can be used to meet a particular target, up to three options have been provided for each development for each policy scenario. Each modelling option is detailed in appendix 1.

Table 2-2: Developments used in the modelling exercise

Site no.	Development type (RIBA development classes)	Gross Internal Floor Area (m ²)	Local Planning Authority	Description
1	Class C3 - Apartments	3565	Broxtowe	Block of 52 apartments
2	Class C3 - Conversion to residential	2810	Mansfield	Conversion of 18 th Century Hall into 23 apartments

3	Class A1 - Retail	354	Newark and Sherwood	Convenience food store and associated parking and service area
4	Mixed use of retail (class A1) with apartments (Class C3)	2137	Harrow, London	Five floor development with retail on ground floor and 23 apartments on other four floors
5	Class C3 - Housing scheme	2892	Mansfield	Residential development of 32 dwellings
6	Class D2 - Leisure facility	8348	Ashfield	Public leisure facility
7	Class B1 - Offices	1228	Mansfield	Office development

The modelling was completed using ecsc's compliance assessment tool³ that is based on using benchmarked data to determine the feasibility and capacity of renewable energy technology required to meet a particular energy scenario.

³ The compliance assessment tool is part of the CPlan suite of services; more information can be found at www.carbonplanner.co.uk

APPENDIX 3

Technical Background to Section 8:

Table 8.1: Points Explained

- a. Latest figures indicate that regulated emissions under the 2006 Building Regulations (Part L) result in average regulated carbon emissions for UK dwellings of around $22\text{kgCO}_2/\text{m}^2/\text{year}$. The publication 'A Cost Review of the Code for Sustainable Homes: A Report for English Partnerships and the Housing Corporation. February 2007' written by Cyril Sweett, calculated typical domestic per m^2 regulated CO_2 emissions for a range of Part L 2006 compliant house types with an average of $22.19\text{kgCO}_2/\text{m}^2/\text{year}$.
- b. The benchmark of $36.7\text{kgCO}_2/\text{m}^2/\text{year}$ is derived from the sum of the average regulated and unregulated CO_2 emissions per dwelling for the UK, unregulated emissions having been calculated in accordance with Footnote 4 of Table 8.1 of the Main Report.
- c. 20% of $36.7\text{kgCO}_2/\text{m}^2/\text{year}$ is $7.34\text{kg}/\text{m}^2/\text{year}$. This is the amount that the ecsc and NEP data shows is justifiable to ask developers to save by installing low or zero carbon technologies, without causing undue burden. When the Building Regulations tighten in 2010, 23.5% of 31.2 are still 7.34, .as will 27% of 27 be in 2013. The rising percentage target ensures that the policy enforces a constant additional commitment to renewables with the tightening regulations.

APPENDIX 4

Example of how an existing low carbon energy source could be used to require a higher target percentage from new development.

Nottingham District Heating Scheme.

- a. PPS1 Supplement encourages planning authorities, in considering development areas or site-specific targets, to utilise existing or proposed renewable or low carbon energy supply systems and to require proposed developments to connect to the system or be capable of connection in future. The example supply system used here is the Nottingham District Heating Scheme.
- b. The Eastcroft waste incinerator in Nottingham is one of the largest waste-to-energy plants in Europe. It was established in the 1970s and now burns 155,000 tonnes of waste to generate 292,000 mw of energy in the form of steam which is then passed to the EnviroEnergy plant where it is converted the District Heating Scheme (DHS).
- c. The DHS is a major local source of energy for both heat and electricity. Its heat network provides the heating for 4,600 homes as well as major City Centre buildings such as Victoria and Broadmarsh Shopping Centres, National Ice Centre, Inland Revenue HQ, Capital One, Nottingham Trent University and the City Council main buildings. It also provides electricity for commercial customers through a private wire system.
- d. The DHS is capable of more extensive use within its wider catchment area and is well positioned to service the City's Eastside and Southside Regeneration Zones. The heat source is low carbon but not zero carbon as it is derived from natural gas CHP plus energy from waste.
- e. The DHS will immediately allow any newly connecting domestic developments to save at least 26% of their CO₂ emissions (if it is used to supply 100% of the heating and hot water). As building efficiency improvements reduce heating demand towards 2016, the carbon saving contribution from the heat network will drop, as the balance of carbon emissions in new dwellings moves towards those due to electricity use. This has implications for setting a local development area target within the DHS catchment area.
- f. It would be appropriate to set a domestic carbon target of 26% for all new housing within a definable catchment of the Nottingham DHS network and hold it at 26% until 2013 when it would need to rise to 27% with the preferred overall policy target (See section 8). The local catchment area target from 2013 could be raised higher than 27% if the DHS incorporates more energy from low carbon sources to reduce its carbon emissions factor.
- g. It may be possible also to require that up to 80% of all energy consumed within domestic developments (measured in kilowatt hours-kwhs) comes from low or zero carbon energy sources. In effect the only ways to achieve this would be by

connection to the DHS or by installing independent biomass or CHP heating systems to meet 100% of the heating and hot water requirements of the development.

- h. For non-domestic buildings within definable catchments of the DHS network, maintaining the static target of a 10% reduction in CO₂ emissions from low or zero carbon energy sources (with emissions calculated on fixed 2005 benchmark data) should be consistently achievable. The lower target reflects the fact that most non-domestic developments have a higher proportion of electricity use to gas use than domestic schemes; these cannot be easily offset by a heat network that displaces gas heating.
- i. In addition, it may be possible to require that up to 40% of all energy consumed within non-domestic developments (measured in kWhs) derives from low or zero carbon energy sources, thus encouraging developers to use the DHS network. If they were to choose not to connect with the DHS network, they would probably need to install an independent biomass or CHP heating system to meet 100% of the heating and hot water requirements of any new scheme.

GLOSSARY

Benchmark

An adopted reference point in any given (energy) field that sets a standard against which to measure performance.

Biogas

Agricultural, sewage, landfill and industrial organic wastes produce a methane gas that can be collected and burnt to produce electricity. Whilst burning the gas gives off carbon dioxide emissions, this is preferable to methane which is a much more potent greenhouse gas.

Biomass

The biological material in the form of solids (eg. forest thinnings), liquids and gases (often agricultural residues or municipal wastes) that can be converted to produce electricity, heat and biofuels. Biofuels are also derived from dedicated cereal crops.

Carbon Footprint

A measure of total carbon emissions from fossil fuel use over a year. It can be calculated for a building, an organisation, a household or an individual and is often used as a baseline in efforts to reduce emissions.

Co-firing

The burning of mixed fuels. It typically refers to the use of biomass in coal-fired power stations.

Combined Heat & Power (CHP)

A system which utilises waste heat from electricity production, to provide hot water and space heating, for neighbouring buildings.

Decentralised energy supply

Energy supply from local renewable and low carbon sources, (i.e. on-site and near-site, but not remote off-site) usually on a relatively small scale. Decentralised energy is a broad term used to denote a diverse range of technologies, including micro-generation, and any local infrastructure, which can serve an individual building, development or wider community and includes heating and cooling energy.

District Heating

Heating systems which distribute steam or hot water to a number of buildings across a district. Heat can be provided from variety of sources, including geothermal, CHP plants, waste heat from industry and purpose built heating plants.

Emissions

The release of greenhouse gases, into the earth's atmosphere. They include carbon dioxide (CO₂), methane, nitrous oxide and fluorinated gases. Carbon dioxide is the main greenhouse gas in the UK by volume.

Geopolitical

Refers to a political issue of worldwide significance

Heat Pumps

An efficient form of heating and cooling for buildings. They mainly work like a fridge in reverse, using compression and expansion of gases or liquid to draw heat from the natural energy stored in the ground or air, but they also supply cooling in fridge mode.

Hydro

Hydropower schemes can use a dam or weir or simply the natural flow of water in a 'run of the river' system to generate electricity.

Life-cycle Costs

Life-cycle assessment tracks the emissions generated and materials consumed for a system / product over its entire life-cycle, from cradle to grave, and estimates the costs of the consequent impacts.

Low/Zero Carbon Development

Development which dramatically limits its carbon emissions through design and in the course of annual use. *(NB. The Government has consulted in 2008 on a legal definition of zero carbon homes and non-domestic buildings).*

Mitigation

Involves taking action to reduce the impact of human activity on the natural and climate systems, primarily through reducing greenhouse gas emissions.

Photovoltaic Cells / Arrays (PV)

Solar panels that produce electricity from light, rather than heat – and thus work even if the sun is not shining. 'Photo' refers to light, and 'voltaic' means they turn it into volts which are measures of electric current.

Renewable Energy

Energy derived from natural processes that are replenished constantly. They include geothermal, solar, wind, tide, wave, hydropower, biomass and bio fuels.

Renewable Obligation Certificate (ROC)

A requirement upon licensed electricity suppliers to source a specific and annually increasing percentage of the electricity they deliver from renewable sources.

Smart Meters

New compact meters that convey more detailed information on energy use and its costs than previous meters. They enable 2-way communication, with customers able to see real-time readings and suppliers able to remotely check and calculate bills.

Standard Assessment Procedure (SAP)

The Building Regulations approved method for estimating energy use and emissions from new dwellings.

Sustainable Energy

See Introduction

Zero Carbon Emission

In general terms, it represents a site or building or activity that has no net CO₂ outputs over the course of a year, but it can be defined in a number of different ways as the DCLG Consultation of 2008 indicates.

List of Abbreviations

BREEAM	Building Research Establishment Environmental Assessment Method
BedZED	Beddington Zero Energy Development, Merton, South London
CHP	Combined Heat and Power
CO₂	Carbon Dioxide
CSH	Code for Sustainable Homes
ESCO	Energy Services Company
ecsc	Energy Centre for Sustainable Communities
DAS	Design and Access Statement
kWh	Kilowatt hour
kWh/yr	Kilowatt hours per year
LDF	Local Development Framework
LDD	Local Development Documents
MWe	Megawatts of electric power, equal to 1000 KW
MWh	Megawatt hour
MWth	Megawatts of heat
NEP	Nottingham Energy Partnership
NPV	Net Present Value
RSS	Regional Spatial Strategy
PPS	Planning Policy Statement
PV	Photovoltaic (solar)
SBEM	Simplified Building Emissions Model
SPD	Supplementary Planning Document
TCPA	Town & Country Planning Association

