

84

REDUCING CARBON EMISSIONS IN NEW DEVELOPMENT

Planning Advice Note

PAN 84

Reducing Carbon Emissions in New Development

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PLANNING SERIES:

- **Scottish Planning Policies (SPPs)** provide statements of Scottish Government policy on nationally important land use issues and other planning matters, supported where appropriate by a locational framework.
- **Circulars**, which also provide statements of Scottish Government policy, contain guidance on policy implementation through legislative or procedural change.
- **Planning Advice Notes (PANs)** provide advice on good practice and other relevant information.

Statements of Scottish Government policy contained in SPPs and Circulars may be material considerations to be taken into account in development plan preparation and development management.

Existing National Planning Policy Guidelines (NPPGs) have continued relevance to decision making, until such time as they are replaced by a SPP. The term SPP should be interpreted as including NPPGs.

Statements of Scottish Government location specific planning policy, for example the West Edinburgh Planning Framework, have the same status in decision making as SPPs.

The National Planning Framework sets out the strategy for Scotland's long-term spatial development. It has the same status as SPPs and provides a national context for development plans and planning decisions and the ongoing programmes of the Scottish Government, public agencies and local government.

Important Note: In the interests of brevity and conciseness, Scottish Planning Policies do NOT repeat policy across thematic boundaries. Each SPP takes as read the general policy in SPP1, and highlights the other SPPs where links to other related policy will be found. The whole series of SPPs should be taken as an integral policy suite and read together.

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ACRONYMS

BER	Building Emissions Rate
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
CO₂	Carbon Dioxide
CHP	Combined Heat and Power
DER	Dwelling Emissions Rate
LPG	Liquid Petroleum Gas
LZC	Low Zero Carbon
PAN	Planning Advice Note
PV	Photovoltaics
SAP	Standard Assessment Procedure
SBEM	Simplified Building Energy Model
SEA	Strategic Environmental Assessment
SPG	Supplementary Planning Guidance
SPP	Scottish Planning Policy
TER	Target Emissions Rate

INTRODUCTION

- 1 A key role of the planning system is to support a move towards low and zero carbon development through the use of energy efficient, micro-generating and decentralised renewable energy systems. This Planning Advice Note (PAN) provides information and guidance on implementing the target in Scottish Planning Policy (SPP) 6, Renewable Energy, which states that:

“all future applications proposing development with a total cumulative floorspace of 500 square metres or more should incorporate on-site zero and low carbon equipment contributing at least an extra 15% reduction in CO₂ emissions beyond the 2007 building regulations carbon dioxide emissions standard”
(paragraph 36).
- 2 The policy expects that proposals should incorporate low and zero carbon equipment. The target is to incorporate sufficient equipment to reduce the building’s carbon emissions by 15% more than the level set by the building standard. The policy is a material consideration for all applications which meet the threshold.
- 3 The use of planning policy to deliver low and zero carbon equipment in new buildings provides a flexible approach to choosing the most appropriate equipment for individual proposals as well as helping to stimulate development in the technology market.
- 4 Policies of this nature originated in the London Borough of Merton and are often referred to as the ‘Merton Rule’. The policy target in SPP6 has similarities in its aims but should not be directly compared as there are clear differences relating to the basis for measurement and the types of equipment applicable.
- 5 Small scale energy production is a relatively new but increasingly significant topic for many professionals. This document therefore provides information to planners, architects, developers, building standards verifiers and the public on the context, technical information and planning processes. References to further reading are also provided.
- 6 This guidance has been developed with the assistance of the Scottish Building Standards (SBS) and the Building Research Establishment (BRE).

CONTEXT

ENERGY CONSUMPTION & PRODUCTION

- 7 Energy consumption continues to grow across Scotland, the UK and the rest of the world. In producing energy greenhouse gasses are released, in particular carbon dioxide (CO₂). CO₂ is one of the major greenhouse gasses which contributes to the heating effect of the atmosphere and the earth. The changes to the climate, resulting from these processes, have been confirmed as one of the biggest global threats and we must take urgent action to reduce our energy consumption and CO₂ emissions.

SCOTLAND'S CONTRIBUTION

- 8 Scotland's net CO₂ emissions have fallen by 14% since 1990 but we cannot be complacent and much more needs to be done. Despite the progress being made, demand for energy continues to rise and the scope for reducing energy consumption and CO₂ emissions is still significant. Everyone must take responsibility by using less energy and using energy more efficiently. The ambition is to exceed Scotland's share of UK carbon savings by one million tonnes.
- 9 The Government has set an ambitious target of generating 50% of Scotland's electricity from renewables by 2020, with an interim target of 31% by 2011. The 2011 target equals 5,000 megawatts in installed capacity.

THE BUILT ENVIRONMENT

- 10 Buildings, including domestic, commercial and industrial premises, account for over 40% of our CO₂ emissions. The domestic and transport sectors have shown the most significant growth in energy consumption and CO₂ emissions.
- 11 Each household in the UK creates around six tonnes of CO₂ a year (Energy Saving Trust). Heating and lighting buildings consumes a significant proportion of energy used in the domestic sector. Typically about 60% of energy is consumed in space heating, 20% for heating water and the remainder for domestic appliances and lighting.
- 12 The design and management of new development provide an opportunity to reduce carbon emissions by improving the efficiency of buildings and utilising on-site low and zero carbon equipment.

BUILDING STANDARDS SYSTEM: AN OVERVIEW

- 13 The current building standards system was established by the Building (Scotland) Act 2003. The purpose of the system is to protect the public interest in terms of securing health, safety, welfare and convenience, furthering the conservation of fuel and power, and furthering the achievement of sustainable development.

SCOTTISH BUILDING STANDARDS & BUILDING REGULATIONS

- 14 The 2003 Act gives powers to Scottish Ministers to make building regulations. The schedule of standards in the regulations is arranged in sections, one of which is energy (Section 6). The Scottish Building Standards (SBS) part of the Directorate for the Built Environment, provide two Technical Handbooks which give advice on ways of achieving the standards by providing methods of compliance; one covering domestic buildings and the other non-domestic buildings.
- 15 The building regulations are expressed in terms of 'functional standards'. These standards are statements of functions that the completed building must fulfil or allow. The intention is to permit a variety of ways of complying. What is needed for compliance depends on the materials chosen, the site conditions, and the use of the building. The Technical Handbooks give guidance on possible ways of complying and for most situations, designing in accordance with that guidance is the usual way of showing that the functional standards are going to be met. However, a designer or developer may put forward other ways of meeting the standards, in the form of alternative solutions.

ENERGY STANDARDS FOR BUILDINGS

- 16 On 1st May 2007 revisions to the energy standards came into effect. The principal aim of this was to reduce the CO₂ emissions that occur as a result of the energy used in heating, cooling or lighting new buildings and existing buildings that are being converted, altered or extended.
- 17 The standard on CO₂ emissions presents the overall CO₂ emissions levels for new buildings. This is measured in kilograms per square metre of floor area per annum: kgCO₂/m²/annum and each building sets its own maximum level of emissions. The standard obliges a designer to consider new buildings in a holistic way. This means that energy performance requires to be dealt with as a complete package rather than looking only at individual elements such as insulation or boiler efficiency. A building may be designed and constructed to be even more energy efficient than these standards require and may make greater use of low and zero carbon (LZC) equipment.

RELATIONSHIP BETWEEN ENERGY STANDARDS & SPP6 TARGET

- 18 The SPP6 policy concerns the integration of low and zero carbon equipment into new development to reduce CO₂ emissions. It uses the building regulations CO₂ emissions standard as a baseline. From this the separate and additional planning requirement for a reduction can be measured.

A LOW CARBON BUILDING STANDARDS STRATEGY FOR SCOTLAND – THE SULLIVAN REPORT

- 19 The Low Carbon Building Standards Strategy for Scotland, published in December 2007 and known as the Sullivan Report, makes recommendations to Scottish Ministers on a route to achieve further reductions in CO₂ emissions from buildings. The recommendations, made by a panel of experts appointed by Ministers, include an aspirational target of total life zero carbon for new buildings by 2030 and the goal of net zero carbon for heating, lighting and ventilation by 2016/2017, if practical. To meet this it advocates staged revisions to energy standards in 2010, 2013 and 2016/17.
- 20 The Report also recommends undertaking research to analyse the cost impacts on new buildings of energy standards and other sustainability measures proposed for the building regulations, including life cycle analysis techniques.

PLANNING: POLICY

SCOTTISH PLANNING POLICY (SPP) 6

- 21 SPP6, Renewable Energy, sets the target that:
- “all future applications proposing development with a total cumulative floorspace of 500 square metres or more should incorporate on-site zero and low carbon equipment contributing at least an extra 15% reduction in CO₂ emissions beyond the 2007 building regulations carbon dioxide emissions standard.”**
- 22 It continues that “the development plan process should be used to consider whether local circumstances justify going beyond 15%; below the 500 square metres threshold; and whether higher standards can be secured for particular developments, including the potential for decentralised energy supply systems based on renewable and low-carbon energy.”
- 23 Paragraph 37 of SPP6 states that “applications should only be exempt from targets where developers are able to demonstrate that technical constraints exist. In such circumstances, policies should ensure that developers meeting targets are not disadvantaged by securing from the applicant, by agreement, equivalent carbon savings elsewhere in the area.”

- 24 The SPP also states that “development plans should set out local policies on the provision of on-site low carbon and renewable sources of energy in new development. Policies should ensure that, in all instances, opportunities for incorporating these technologies are fully explored by developers as part of the planning application process.”

DEVELOPMENT PLANS & SUPPLEMENTARY PLANNING GUIDANCE

- 25 Where opportunities exist, planning authorities should update local policies ahead of the transitional arrangements for development planning being brought forward under powers in the 2006 Planning Act or produce supplementary planning guidance (SPG) to provide an interim basis for efficient and consistent decision making. Planning authorities should incorporate any non-statutory policies into their plans in due course.
- 26 The planning authority should identify its preferred procedures for compliance with policy or SPG issued on this topic. It is anticipated that SPG will be subject to Strategic Environmental Assessment (SEA).
- 27 Development plan policy should address any local requirements as highlighted in the final sentence of paragraph 36 of SPP6, which is repeated at paragraph 22 above. Variations to the policy in SPP6 should be progressed through the development plan system, allowing for independent consideration, rather than through SPG.

PLANNING: DESIGNING FOR REDUCED ENERGY DEMAND

- 28 Good, careful design at the outset will minimise the total energy demand for the lifetime of a development. Design considerations for a development as a whole and for the individual buildings will help to increase the efficiency of energy use.
- 29 Designing Places (2004) confirms that design is a material consideration. It highlights the opportunity for making efficient use of resources from an early stage in the design of development. SPP6 refers to this in terms of locational, siting and design considerations (paragraph 35).



LOCATION

- 30
- **Proximity** to a variety of uses, such as retail, leisure and offices, will encourage people to walk, cycle and use public transport rather than their car.
 - **Higher density** development in suitable well-connected locations will use land more efficiently.
 - **Re-use** of existing buildings will reduce requirements for new materials which are often energy intensive to manufacture.

SITING

- 31
- **Shelter** from the elements provided by land form, trees and other buildings will reduce exposure and loss of energy from buildings.
 - **Orientation** of buildings to maximise solar gain will reduce energy demand.
 - **Passive measures**, such as those above can also reduce maintenance costs.

BUILDING DESIGN

- 32
- **Layout** of rooms within buildings: habitable rooms should be located to the south.
 - **Adaptable**: buildings that can be adapted to a variety of future uses.
 - **Materials**:
 - re-use materials and select materials which can be re-used.
 - use materials which have high performance standards, e.g. timber frames, wall insulation and glazing.
- 33
- The inclusion of the above measures in the design of developments, in particular those directly associated with individual buildings, will reduce their total energy demand and CO₂ emissions so that the actual amount which the 15% represents will be proportionally reduced. This will result in less low and zero carbon equipment being necessary, though options for incorporating such equipment will need to be considered at the design stage.

PLANNING: INCORPORATING LOW & ZERO CARBON EQUIPMENT

- 34
- To move to a low carbon economy, more clean energy must be created to produce heat and electricity in buildings. The policy target in SPP6, re-stated overleaf, encourages opportunities for incorporating low and zero carbon equipment to be fully explored by developers as part of the planning application process.

“all future applications proposing a development with a total cumulative floorspace of 500 square metres or more should incorporate on-site zero and low carbon equipment contributing at least an extra 15% reduction in CO₂ emissions beyond the 2007 building regulations carbon dioxide emissions standard.”

ALL FUTURE APPLICATIONS

- 35 SPP6 was issued in March 2007. For planning applications submitted after this date, the SPP is a material consideration which planning authorities should take into account in their determination. The SPP is likely to be particularly important where there are no up-to-date development plan policies in place (SPP6 paragraph 45).

DEVELOPMENT

- 36 The term ‘development’ refers to that defined by the Planning etc. (Scotland) Act 2006 which can be measured by the software programs, SAP and SBEM. **The section ‘Calculations & Worked Example’ provides further information on these software programs.**
- 37 The policy cannot be applied to a ‘change of use’. This is because a ‘change of use’ in planning terms equates to a ‘conversion’ under the building regulations. The CO₂ emissions standard does not apply to a ‘conversion’ under these regulations. The ‘conversion’ would therefore not have to be considered for compliance with SAP or SBEM. As there is no baseline for measurement an assessment of compliance with the planning policy also cannot also be made. Nevertheless planning authorities may seek to secure inclusion of LZC equipment in change of use proposals through the inclusion of appropriate policies in development plans.

CUMULATIVE FLOORSPACE OF 500 SQ M OR MORE

- 38 A development of over 500 square metres may contain more than one dwelling or building, such as a block of flats or a housing development, in which the aggregate floor area of all the proposed dwellings exceeds the threshold. The policy target is a material consideration for developments exceeding this threshold. **The section ‘Calculations & Worked Example’ provides guidance on calculations where there is more than one building.**

ON-SITE

- 39 The equipment may be attached to the building or within the site boundary as shown on the planning application. This allows for the LZC equipment to benefit more than one building and being sited to maximise energy gain.

ZERO AND LOW CARBON EQUIPMENT

- 40 Low and zero carbon (LZC) equipment comprises a broad range of technologies. It incorporates both micro-generation and micro-renewable technologies, including some fossil fuels.

Figure 1. Definitions

Low Zero Carbon Equipment

Development wide, on-site, or building integrated technologies that use renewable sources or fossil fuels (low CO₂ emissions), or use only renewable sources (zero CO₂ emissions).

Micro-renewables

On-site or building integrated equipment using renewable sources only.

Micro-generation

On-site or building integrated equipment that generates electricity but could include the use of fossil fuels.

- 41 LZC equipment provides flexibility in that equipment can be chosen to suit different circumstances and purposes. The target also allows for reductions in CO₂ emissions to be achieved by a single measure or by two or more in combination. Figure 2 below identifies eligible LZC equipment.

Figure 2. LZC Equipment

- | | |
|-----------------|----------------------------------|
| • Biomass | • Geothermal |
| • Fuel cells | • Ground source heat pumps |
| • Photovoltaics | • Water source heat pumps |
| • Micro-hydro | • Air source heat pumps |
| • Micro-wind | • Combined heat and power (CHP) |
| • Solar Power | • Heat exchange recovery systems |

EXTRA 15% REDUCTION IN CO₂ EMISSIONS BEYOND THE 2007 BUILDING REGULATIONS CARBON DIOXIDE EMISSIONS STANDARD

- 42 The planning policy uses the building regulations CO₂ emissions standard as a baseline for calculating the percentage reduction. However, the planning policy is a separate requirement to the building standard.
- 43 The applicant has to provide the necessary information to demonstrate that the proposal complies with the policy target when submitting a planning application or discharging a planning condition. A statement should include an indication of the LZC equipment being incorporated and a table of the results of 5 calculations, as in Figure 3. Figure 4 summarises the calculations and process. **The section 'Calculations & Worked Example' provides more detailed technical information on the required calculations alongside worked examples.**
- 44 Generally, planning authorities should be able to accept the calculations provided by the applicant in the same way as other information, such as the proposed materials, are accepted. It is not expected that planning officers will carry out the calculations.
- 45 The 5 calculations are necessary to establish that not only does the proposal meet the target percentage reduction in CO₂ emissions but that the target percentage reduction is specifically achieved through the incorporation of LZC equipment.

ENVIRONMENTAL PERFORMANCE ASSESSMENT METHODS

- 46 Methods of assessment are available which describe a building's **environmental performance**, for example BREEAM¹ and EcoHomes. These methods consider a broad range of environmental concerns (including energy, transport, pollution, health and well being), some of which are optional, to arrive at an overall score. This makes the methods very flexible for designers.
- 47 The policy target in SPP6 however, is specific to CO₂ emissions from the **energy performance**. The assessment approach in this guidance therefore relates directly to this. Given the differences, it would be inappropriate to provide equivalent performance levels for the alternative methods in this PAN.
- 48 Local authorities should detail in their policies any alternative or substitute methods of assessment. In the absence of any methodologies set out in such guidance, weight should be given to this PAN in decision making.

¹ Building Research Establishment Environmental Assessment Method.

Figure 3. Example Calculations to be Submitted to the Planning Authority.

Calculation		Figures
1	2007 Building Regulations CO ₂ Emissions Standard ¹	23.01 ²
2	Actual Emissions Rate Using LZC Equipment	18.45 ²
3	Percentage Reduction	19.8%
4	Actual Emissions Rate Without LZC Equipment	22.41 ²
5	Percentage Reduction Due to LZC Equipment	17.2%

¹ Varies with building type, form, geometry etc.

² kgCO₂/m²/annum.

Figure 4. Summary of Calculations and Process

1	The appropriate software program (SAP/SBEM) is used to calculate the 2007 Building Regulations CO ₂ Emissions Standard. This is the Target Emissions Rate (TER).
2	The appropriate software program (SAP/SBEM) is used to calculate the actual emissions rate for the development, including the low and zero carbon equipment. This is the Dwelling or Building Emissions Rate (DER/BER).
3	Calculate the percentage reduction from step 1 to step 2: (100 – (step 2 ÷ step 1 × 100))
4	The appropriate software program (SAP/SBEM) is used to calculate the actual emissions rate for the development without the low and zero carbon equipment. This is a re-calculation of the DER/BER.
5	Calculate the percentage reduction due to the low zero carbon equipment: ((step 4 – step 2) ÷ step 1) × 100)

TECHNICAL CONSTRAINTS

- 49 It will be exceptional to find that all types of LZC equipment are technically constrained on a site. Examples of technical constraints that may limit the application of LZC equipment are listed below, however, this is not exhaustive. On their own, financial considerations do not constitute a technical constraint.
- Areas where the supply of natural energy sources may be obstructed by another building or structure (e.g. over-shadowing or wind-screening).
 - Areas where space is limited for: storage (e.g. for wood pellets); transport/delivery of fuel; or space for pipes.
 - Locations which restrict particular emissions (e.g. air quality management areas).
 - Locations with an unsuitable type of ground or building for the location of the equipment.
 - Buildings with limited roof/wall areas or angles suitable for the equipment.
- 50 Information on the issues relevant to particular technologies can be found in related Planning Advice Notes:
- PAN 45 Renewable Energy Technologies (2002): for micro-hydro.
 - PAN 45 Annex, Planning for Micro-Renewables (2006): for micro-wind, solar, heat pumps and biomass.

POLICY CONSTRAINTS

- 51 Whilst not specifically referred to in SPP6, constraints may also be imposed by other material considerations, such as designations which require stricter management, for example built heritage designations; listed buildings or conservation areas.
- 52 These constraints should be considered in relation to the merits of individual applications. Judgement will be required in ensuring that the policy target is to be applied in a way which does not compromise the reason for designation. Planning authorities should also identify whether the principle of making equivalent carbon savings elsewhere could apply in these situations.

EQUIVALENT CARBON SAVINGS ELSEWHERE

- 53 Provision of equivalent carbon savings elsewhere in the area will apply where the planning authority agrees that there are technical constraints to achieving the emissions reduction target on-site. These should normally be secured by a Section 75 Legal Agreement and may involve the installation of equipment on another site or building, offsetting (e.g. planting trees) or payment into a local authority fund which is used to reduce carbon emissions.
- 54 The amount of carbon emissions to be saved elsewhere will be 15% of the 2007 building regulations CO₂ emissions standard, the Target Emissions Rate, for the application site. This is established using the programs detailed in the section 'Calculations & Worked Example', which can also be used to measure the emissions at an alternative site.

PLANNING: DEVELOPMENT MANAGEMENT PROCESS

PRE-APPLICATION DISCUSSION

55 Early discussions with the applicant to highlight the requirements of the policy target and its implications will provide greater clarity for all parties on the issues raised by the particular application, e.g. possible technologies and potential constraints.

OUTLINE PLANNING APPLICATIONS

56 The developer may provide a statement of the intended LZC equipment to meet the target percentage reduction policy, rather than finalise the details of the actual building(s). The statement should include information on:

- the **types** of equipment,
- the **scale** of the equipment in relation to proposed buildings,
- where the equipment is to be **located** on-site,
- the **issues** the equipment is likely to raise (e.g. visual or archaeological).

57 A condition should then be attached to the consent, which would reserve the details of the measures to achieve CO₂ emission targets for later agreement between the applicant and the planning authority. The condition would require the submission of details to the planning authority of the LZC equipment to be incorporated; the predicted carbon emission calculations; and that the completed development accords with these details. Sufficient detail should be submitted with the planning drawings to avoid the need for later variation.

DETAILED PLANNING APPLICATIONS

58 Once the applicant completes the design of the development they should submit the energy calculations, as per figure 3, with the application to the planning authority. Whilst this requires the building(s) to be designed in detail at the application stage, it increases certainty for the developer as it reduces the need for later work.

CONDITIONS

59 Any condition should comply with Circular 4/1998, which requires conditions to be necessary, relevant to planning, relevant to the development to be permitted, enforceable, precise and reasonable in all other respects. The standard which is to be achieved must be known at the time the condition is imposed, and either stated, or a reference to its source in Council guidance provided. The condition cannot create a moving target. Changes in policy cannot be applied retrospectively.

MODEL CONDITIONS

60 Detailed: The development hereby permitted shall not be brought into use until the zero and low carbon equipment shown on the approved plans is installed.

Reason: To ensure this development complies with the on-site carbon emissions target of [the Local Plan/Supplementary Planning Guidance/SPP6].

61 Outline: Before development commences details of the zero and low carbon equipment to be incorporated into the development and predicted carbon emissions, using SAP or SBEM calculations, shall be submitted to and approved by the planning authority, and the completed development shall accord with those details.

Reason: To ensure this development complies with the on-site carbon emissions targets of [the Local Plan/Supplementary Planning Guidance/SPP6].

DEEMED COMPLIANCE WITH THE POLICY TARGET

62 Under the building regulations an approach has been developed allowing a form of 'elemental compliance' with the standards for individual dwellings where a particular package of measures is used. Planning authorities are advised not to follow such an approach, which would lead to deemed compliance with the policy target. Whilst this may be technically possible for dwellings, it would be necessary to undertake extensive work which would be limited in its relevance. For non-domestic buildings the variety is so wide that each development would need to be considered separately.

WORKING WITH BUILDING STANDARDS VERIFIERS

63 Planning authorities may wish to reach agreement with their respective building standards verifiers on the way in which applications are processed, including if and when building standards colleagues are consulted. Where detailed information is given at the application stage, the building standards verifier could be a consultee in the consideration process. It should always be borne in mind that the verifier is duty bound to grant a building warrant application that demonstrates compliance with Scottish Building Regulations. In all cases it is the responsibility of the applicant to ensure that the emissions requirements of both the building regulations and the planning policy are satisfied.

CALCULATIONS & WORKED EXAMPLE

PROGRAMS

- 64 Software programs have been developed which predict the energy performance of buildings. The programs have been adopted to assess compliance with the building standards. They can be used by building designers to prepare material to support planning applications. It is not intended that planners should use the programs but familiarity with the relevant terms and processes is encouraged.
- 65 The software programs² relate to the building type.
- For **Dwellings**: **SAP2005**
Standard Assessment Procedure, 2005 Edition.
 - For **Non-Domestic Buildings**: **SBEM**
Simplified Building Energy Model.

EMISSIONS RATE TERMINOLOGY

- 66 These programs are used to predict:
- The **Target Emissions Rate** (TER) of a 'notional' dwelling or building. This is the 2007 building regulations CO₂ emissions standard.
 - The **Dwelling or Building Emissions Rate** (DER/BER) of a dwelling or building as it is designed.
- 67 Emissions rates are measured in kilogram's per square metre of floor area per year, **kgCO₂/m²/annum**.
- 68 The software programs incorporate a range of factors which influence energy use to predict the overall CO₂ emission levels. The building designer selects and inputs details of the design of the building into the relevant program which then calculates the predicted emissions. This provides the designer with the flexibility to vary technologies to achieve the policy target. At this stage location, siting and building design should also be considered. This will reduce the overall energy requirements of the building and therefore the contribution from LZC equipment that is needed to meet the percentage reduction target.
- 69 The following example calculations provide the detailed technical information omitted from the summary earlier at Figures 3 and 4.

² Further information on the methodologies can be found at www.bre.co.uk/sap2005 and www.ncm.bre.co.uk.

CALCULATION 1: 2007 BUILDING REGULATIONS CO₂ EMISSIONS STANDARD

70 Before the precise details of a building can be designed to meet the target the building designer selects and inputs more general information about the proposed 'notional' dwelling or building into the relevant program to determine a **Target Emissions Rate** (TER) that should be achieved. This general information includes:

- Geometry: Dimensions: size and shape.
- Performance Standards: Specified performance values of building elements and systems.
- Typical Use Pattern: Non-domestic only, e.g. factory, office, hotel etc.
- Principal Fuel Type: For the main space heating as different fuels result in different CO₂ emissions.
 For *dwelling*s this may be mains gas, liquid petroleum gas (LPG), oil, solid mineral, biomass (see para. 72 below) or electricity.
 For *non-domestic* this may be mains gas, if supplied to the site, or oil.

71 **The result of this calculation for the notional dwelling or building, the TER, is the 2007 building regulations carbon dioxide emissions standard.** The aim of the target in SPP6 is to reduce this emissions figure by 15% using on-site low and zero carbon equipment.

Box 8.1: Target Emissions Rate

Example development comprises:

4 detached dwellings, each with a floor area of 100 sq m

2 semi-detached dwellings, each with a floor area of 80 sq m

The total floor area is 560 sq m, therefore the SPP6 policy target is a consideration when determining the applications.

Methodology:

SAP 2005 calculations are undertaken for both dwelling types providing the following result for the 2007 building regulations carbon dioxide emissions standard, the TER.

Notional Dwelling	Detached	Semi-detached
TER	23.13 kgCO ₂ /m ² /annum	22.72 kgCO ₂ /m ² /annum

- 72 Where a notional *dwelling* is heated mainly by biomass a special calculation is necessary for the Target Emissions Rate. This is because SAP 2005 includes a biomass option, so a comparison with the dwelling as designed will show no benefit. It is proposed that a special Target Emissions Rate is calculated by the building designer based on the main heating being mains gas with a 90% efficient boiler. The 15% reduction in CO₂ emissions is then assessed by special reference to this special Target Emissions Rate.

CALCULATION 2: ACTUAL EMISSIONS RATE USING LOW AND ZERO CARBON EQUIPMENT

- 73 Once a Target Emissions Rate (TER) has been established the building designer must consider the potential for incorporating low and zero carbon equipment. The designer then inputs specific details of the equipment, including their relevant values and efficiencies, which they estimate is required to achieve the reduction in CO₂ emissions, into SAP 2005 or SBEM. This will establish the Dwelling or Building Emissions Rate (DER/BER) of a dwelling or building as it is designed, including the low and zero carbon equipment.

Box 8.2: Dwelling Emissions Rate with LZC Equipment

Continuing with the example...

SAP 2005 calculations are undertaken again for both dwelling types providing the following result for the Dwelling Emissions Rate (DER) of the dwellings as they are designed, including the low and zero carbon equipment.

Low & Zero Carbon Equipment:

- Detached: Ground source heat pumps for space heating
Solar collectors for water heating.
- Semi-detached: Air source heat pumps for space heating
Solar photovoltaic arrays.

Designed	Detached	Semi-detached
DER (LZC)	19.77 kgCO ₂ /m ² /annum	15.16 kgCO ₂ /m ² /annum

CALCULATION 3: PERCENTAGE REDUCTION

- 74 To establish whether the building(s) as designed, including low and zero carbon equipment, meets the target percentage reduction in CO₂ emissions, the percentage reduction between the Target Emissions Rate (TER) and the Dwelling or Building Emissions Rate (DER/BER) must be calculated.
- 75 To calculate the percentage, the DER or BER for the dwelling or building as designed, including the low and zero carbon equipment, should be divided by the TER and multiplied by 100. To determine the percentage reduction, the result is then subtracted from 100. The result should be equal to or greater than the percentage target of the policy. However, this does not establish that the policy has been met.

Box 8.3: Percentage Reduction

Continuing with the example...

Designed	Detached	Semi-detached
TER	23.13 kgCO ₂ /m ² /annum	22.72 kgCO ₂ /m ² /annum
DER	19.77 kgCO ₂ /m ² /annum	15.16 kgCO ₂ /m ² /annum
Percentage:	$\frac{19.77}{23.13} \times 100$	$\frac{15.16}{22.72} \times 100$
Percentage	85.5%	66.7%
Percentage:	100 – 85.5	100 – 66.7
Percentage Reduction	14.5%	33.3%

CALCULATION 4: ACTUAL EMISSIONS RATE WITHOUT LOW AND ZERO CARBON EQUIPMENT

- 76 A re-calculation of the Dwelling or Building Emissions Rate (DER/BER) is required to establish if the building(s) as designed meet the target percentage reduction in CO₂ emissions **specifically due to the low and zero carbon equipment**.
- 77 Instead of inputting details of the proposed low and zero carbon equipment, the building designer carries out a re-calculation without them.
- Where the low and zero carbon equipment is to **generate electricity**, the re-calculation will be for the same building without the equipment; without the low and zero carbon equipment the electricity concerned would be taken from the grid.
 - Where the low and zero carbon equipment is to **provide heat** a basis has to be assumed for an alternative, non-low zero carbon means of providing an equivalent quantity of heat.
- 78 Figure 5 details the alternatives to be substituted.

Box 8.4: Dwelling Emissions Rate without LZC Equipment

Continuing with the example...

SAP 2005 calculations are undertaken again for both dwelling types providing the following result for the Dwelling Emissions Rate (DER) of the dwellings as they are designed but without the low and zero carbon equipment and instead using appropriate alternatives.

Designed	Detached	Semi-detached
DER (no LZC)	22.32 kgCO ₂ /m ² /annum	22.62 kgCO ₂ /m ² /annum

Figure 5. Alternatives to Low and Zero Carbon Equipment

Source	Alternatives	
	Use	Instructions for Without LZCT
Biomass	Dwelling main heating.	Gas boiler to minimum building regulation specification (86% efficiency, programmer, thermostat and TRVs or time and temperature zone control if more than 150m ²).
	Dwelling secondary heating.	Electric secondary heating per building regulations (There must always be secondary heating for this calculation).
	Non-domestic.	Gas boiler to minimum building regulation specification efficiency and controls.
Fuel Cells		Same as biomass.
Photovoltaics		No photovoltaics.
Hydro	Small-scale hydro-electric e.g. from river.	No hydro system.
Wind		No wind turbine.
Solar Power		No solar collector.
Geothermal		No geothermal source, all heat provided by alternative system proposed for the building, or if none follow rules for biomass.
CHP	Dwelling/micro-CHP	Boiler using the same fuel as the micro-CHP.
	Community CHP for dwellings.	Boiler using the same fuel as CHP plant. If the latter is biomass change to mains gas (see biomass above).
	Non-domestic.	Boiler using the same fuel as CHP plant. If the latter is biomass change to mains gas (see biomass above).
Ground Source Heat immersion.	Dwelling.	Air source heat pump providing space heating only. Domestic hot water by electric Pump
	Non-domestic.	Gas boiler, as per rules of biomass.
Water Source Heat Pump immersion.	Dwelling.	Air source heat pump providing space heating only. Domestic hot water by electric
	Non-domestic.	Gas boiler, as per rules of biomass.
Air source Heat Pump	Dwelling.	Air source heat pump providing space heating only. Domestic hot water by electric immersion.
	Non-domestic.	Gas boiler, as per rules of biomass.
Heat Exchange/ Recovery Systems	Dwelling.	Natural ventilation with intermittent extract fans (3 fans for total floor area up to 80 m ² , 4 fans if greater than 80 m ²).
	Non-domestic.	Mechanical ventilation without heat recovery, specific fan power of ventilation system 80% of that for the proposed building.

CALCULATION 5: PERCENTAGE REDUCTION DUE TO LOW AND ZERO CARBON EQUIPMENT

- 79 To determine whether the building(s) as designed meets the target percentage reduction in CO₂ emissions specifically due to the LZC equipment, the percentage reduction between the Target Emissions Rate (TER) and the Dwelling or Building Emissions Rate (DER/BER) without the low and zero carbon equipment must be established.
- 80 To calculate this the difference between the two DER figures should be established. This should then be divided by the TER and multiplied by 100. The result should be equal to or greater than the percentage target to demonstrate that the policy has been met in that the percentage reduction is directly attributable to the LZC equipment.

Box 8.5: Percentage Reduction due to LZC Equipment

Continuing with the example...

Designed	Detached	Semi-detached
TER	23.13 kgCO ₂ /m ² /annum	22.72 kgCO ₂ /m ² /annum
DER	19.77 kgCO ₂ /m ² /annum	15.16 kgCO ₂ /m ² /annum
DER (no LZC)	22.32 kgCO ₂ /m ² /annum	22.62 kgCO ₂ /m ² /annum
Difference in DER	2.55 kgCO ₂ /m ² /annum	7.46 kgCO ₂ /m ² /annum
Percentage:	$\frac{2.55}{23.13} \times 100$	$\frac{7.46}{22.72} \times 100$
Reduction due to LZC equipment	11%	32.8%

CALCULATIONS FOR DEVELOPMENT CONSISTING OF MULTIPLE DWELLINGS

- 81 A development of over 500 square metres may contain more than one dwelling or building, as is shown throughout the example.
- 82 Where each building individually fulfils the percentage target, the development as a whole will fulfil the policy target. Using the example given as a basis, if a development comprised only the semi-detached type of house and 8 in number, this would meet the policy target.
- 83 Where individual buildings do not fulfil the percentage target, as would be the case for a development comprising only the detached units in the example above, the average emissions of the buildings as designed (DER/BER) may be compared to the average target emissions (TER) for the site. This will involve determining the DER for each dwelling and/or the BER for each building and then an area weighted average over all the dwellings and/or buildings.

Box 8.6: Area Weighted Averages

Concluding the example....

Designed	Detached	Semi-det.	Total	Average
Dwellings				
Number (<i>n</i>)	4	2		
Floor Area (<i>A</i>)	100	80		
Sum Floor Areas (<i>n</i> x <i>A</i>)	400	160	560	
TER	23.13	22.72		
Area weighted TER (<i>n</i> x <i>A</i> x TER)	9252	3635.2	12887.2	23.01
With LZC Equipment				
DER	19.77	15.16		
Area weighted DER (<i>n</i> x <i>A</i> x DER)	7908	2425.6	10333.6	18.45
% reduction on TER (As Box 8.3)	14.5%	33.3%	19.8%	
Without LZC Equipment				
DER	22.32	22.62		
Area weighted DER (<i>n</i> x <i>A</i> x DER)	8928	3619.2	12547.2	22.41
Difference DERs	1020	1193.6	2213.6	
% reduction on TER (As Box 8.5)	11%	32.8%	17.2%	

- 84 Where the site is assessed as a whole using area weighted figures, as in the example above, and the average reduction in emissions for the site exceeds the percentage target, then the policy criteria has been achieved.

CONCLUSIONS & KEY MESSAGES

Introduction

- The SPP6 target is material in the consideration of all applications which meet the threshold.
- The SPP6 policy target is precisely worded and is not necessarily identical to other Merton Rule type policies.

Context

- The Government has set an ambitious target of generating 50% of Scotland's electricity from renewables by 2020.
- The built environment contributes a significant proportion of CO₂ emissions therefore the design and management of new development provide an opportunity to reduce them.

Building Standards System – An Overview

- An appreciation of the building standards system is beneficial as the policy uses building regulations as a baseline to enable measurement.

Planning: Policy

- A key role of the planning system is to support a move towards low and zero carbon development.
- Planning authorities should update local policy, either through the development plan process or by SPG.

Planning: Designing for Reduced Energy Demand

- Good design can significantly reduce the amount of energy demand and the LZC equipment necessary to achieve the percentage target.

Planning: Incorporating Low & Zero Carbon Equipment

- The onus is on the applicant to provide the necessary information to demonstrate that the proposal complies with the policy target.

Planning: Process

- The policy provides scope for planning authorities to develop ways to comply with the target which are appropriate to local circumstances.

Calculations & Worked Examples

- Is not intended that planners should have to use the SAP & SBEM programs. That responsibility lies with applicants.
- Understanding of the relevant terms and processes is encouraged.

ENQUIRIES

85 Enquiries about the content of the Planning Advice Note should be addressed to either Nick Evans or Carrie Smith, Scottish Government, Directorate for the Built Environment, Area 2-H, Victoria Quay, Edinburgh, EH6 6QQ or by email to nick.evans@scotland.gsi.gov.uk or carrie.smith@scotland.gsi.gov.uk.

REFERENCES & FURTHER READING

Introduction

- <http://www.themertonrule.org/>
- www.bre.co.uk

Context

- Energy Efficiency & Micro-generation Strategy, Draft for Consultation:
• <http://www.scotland.gov.uk/Resource/Doc/169519/0047225.pdf>
- <http://www.scotland.gov.uk/News/Releases/2007/11/27095600>
- <http://www.energysavingtrust.org.uk/>
- The Government Economic Strategy
<http://www.scotland.gov.uk/Publications/2007/11/12115041/0>

Building Standards System

- SBSA: www.sbsa.gov.uk.
- Domestic & Non-Domestic Technical Handbooks
- <http://www.sbsa.gov.uk/sullivanreport.htm>

Planning: Policy

- SPP6: <http://www.scotland.gov.uk/Publications/2007/03/22084213/0>

Planning: Designing for Reduced Energy Demand

- Designing Places:
<http://www.scotland.gov.uk/library3/planning/dpps-00.asp>
- PAN45, Renewable Energy Technologies:
<http://www.scotland.gov.uk/Publications/2002/02/pan45/pan-45>
- PAN45 Annex, Planning for Micro-Renewables: Guidance on the siting and design of micro-renewables:
<http://www.scotland.gov.uk/Publications/2006/10/03093936/0>

- Architecture Statement (February 2007)
<http://www.scotland.gov.uk/Publications/2007/02/19145552/0>

Planning: Incorporating Low & Zero Carbon Equipment

- BREEAM: <http://www.breeam.org/>
- EcoHomes: <http://www.breeam.org/page.jsp?id=21>

Planning: Process

- Circular 4/1998: The Use of Conditions in Planning Permissions:
<http://www.scotland.gov.uk/Publications/1998/02/circular-4-1998/circular-4-1998->

Existing Policy & Guidance

86 There are very few Scottish examples of policy and guidance relating to this issue. In preparing their own policies, planning authorities may wish to refer to the links below, however inclusion in this list does not infer compliance with the 15% policy target in SPP6.

- City of Edinburgh Council
http://www.edinburgh.gov.uk/internet/environment/planning_buildings_i_i_/planning/planning_policies/CEC_edinburgh_standards_for_sustainable_buildings
- Midlothian Council
<http://www.midlothian.gov.uk//Article.aspx?TopicId=12&ArticleId=20982>
- Scottish Borders Council
<http://www.scotborders.gov.uk/life/planningandbuilding/plansandresearch/20328.html>
- Aberdeenshire Council
<http://www.aberdeenshire.gov.uk/planning/supplementary/index.asp>

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