

Energy Efficiency Commitment 2002-2005

Technical Guidance Manual Issue 3

July 2004

Summary

This is the third edition of the Technical Guidance Manual for the Energy Efficiency Commitment programme (EEC) for its first three-year period¹. The role of the manual is to provide information on:

- the factors taken into account in quantifying the improvement in energy efficiency to be attributed to the installation or provision of a specific measure (eg, loft or cavity wall insulation, a low energy light bulb), and
- best practice guidelines which Ofgem encourages suppliers to comply with in relation to each measure.

Chapter 1 outlines the rationale for this document and Chapter 2 explains the scheme-coding format. Chapters 3 to 8 relate to the four main types of energy efficiency measures (insulation, lighting, heating and appliances) and two more specific types of measure; Combined Heat and Power (CHP) and fuel switching. For each measure included in these chapters, information is provided on the attribution of the improvement in energy efficiency in terms of:

- the basis of the annual energy saving figures outlined in the EEC Scheme Spreadsheet,
- the lifetime of the measure over which the energy savings can be claimed, and
- the technical standards or specific requirements for the delivery or installation of the measure which must be adhered to in order for the attributed improvement in energy efficiency to be awarded.

The manual includes the most common energy efficiency measures which are capable of being qualifying action for the purposes of a supplier meeting its energy efficiency obligation under the Electricity and Gas (Energy Efficiency Obligations) Order 2001. However, the manual is not an exhaustive list of the measures which are capable of being qualifying action.

Energy saving values for insulation and heating measures have been calculated using the Building Research Establishment's Domestic Energy Model (BREDEM). These savings are displayed in an Excel spreadsheet entitled 'EEC Energy Savings Data' which is

provided to EEC obligated suppliers separately to this document. The Building Research Establishment's (BRE) assumptions for these energy saving values are detailed in full in the report contained in Appendix 1 of this document.

The Technical Guidance Manual should be used in conjunction with the 'Energy Efficiency Commitment Administration Procedures Issue 2' and the EEC Scheme Spreadsheet. The Administration Procedures document can be viewed at www.ofgem.gov.uk by selecting Energy Efficiency from the 'Ofgem's work' section. The EEC Scheme Spreadsheet is disseminated to EEC obligated suppliers.

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1. Rationale

- 1.1. The Energy Efficiency Commitment programme (EEC) is a three-year programme which forms an important part of the Government's Climate Change Programme and Fuel Poverty Strategy. The EEC began in April 2002 and follows on from the Energy Efficiency Standards of Performance (EESoP) which began in 1994. The statutory basis of the EEC is the Electricity and Gas (Energy Efficiency Obligations) Order 2001 ('the Order').
- 1.2. The Order places an energy efficiency target on any gas or electricity supply licence holder that is part of a group that supplies at least 15,000 domestic consumers. The overall target of 62 TWh, which was set by the Department of Environment, Food and Rural Affairs (Defra), has been apportioned between the obligated suppliers, each of which is required to meet its target by undertaking 'qualifying action'.
- 1.3. For the purposes of the EEC, qualifying action is activity which will lead to an improvement in energy efficiency ie, the installation or provision of energy efficiency measures within domestic properties in Great Britain.
- 1.4. An activity will not be qualifying action unless the supplier secures that at least 50% of the energy savings attributable to its total activity are achieved in relation to Priority Group consumers ie, domestic consumers receiving certain benefits or tax credits.
- 1.5. Ofgem is required to carry-out a number of determinations in the course of administering the Order. Of these, two are particularly relevant to qualifying action. First, the Order requires Ofgem to determine whether any activity proposed by a supplier is qualifying action for the purpose of achieving the whole or any part of its energy efficiency target. Second, if the proposed activity does qualify, Ofgem is required to determine what improvement in energy efficiency is to be attributed to the proposed activity.
- 1.6. To enable Ofgem to make these determinations, suppliers are required to submit information about their proposed activity to Ofgem for approval. These proposals include detailed information on:
 - which energy saving measures the supplier will be installing or providing to achieve an improvement in energy efficiency. Throughout the manual, an energy efficiency 'measure' refers to a single product eg, a low-energy light bulb

or an energy efficient fridge-freezer, or to a single installation of a product eg, the installation of insulation within a cavity wall or loft or the installation of an energy efficient boiler. Energy efficiency measures fall into four broad categories – insulation, lighting, heating and appliances. Suppliers provide Ofgem with information on the specific measures they will be delivering and the number they intend to deliver to meet their target.

- how the supplier will be carrying out the activity to achieve an improvement in energy efficiency eg, the supplier may be working with project partners (manufacturers, retailers, installers or social housing partners) to encourage domestic consumers to install energy efficiency measures within their homes. The way in which the supplier achieves the energy efficiency improvement is termed the 'delivery mechanism'.

- 1.7. For the purposes of notifying Ofgem of its activities, a supplier splits its overall activity according to product type and delivery mechanism. These are referred to as 'schemes' throughout the manual.
- 1.8. The measures included within the manual are capable of being qualifying action provided that the relevant criteria are met. However, the manual is not an exhaustive list of the measures which are capable of being qualifying action. The Order provides that activity of any description that produces, or may reasonably be expected to produce, an improvement in energy efficiency is qualifying action. Several other products have been identified as being capable of being qualifying action through the Energy Saving Trust's (EST) New Product Procedure. Further details can be found in Appendix 3.
- 1.9. The improvement in energy efficiency attributed to a measure is quantified in terms of a lifetime discounted, fuel standardised energy saving. Quantifying improvements in energy efficiency in this way is consistent with the way in which Defra has set the overall target of 62 TWh. Ofgem follows a three-step procedure to calculate the savings:
 - an annual energy saving (kWh/a) is attributed to the measure based upon information collected from recognised sources eg, the Building Research Establishment's Domestic Energy Model (BREDEM)
 - a relevant multiplier is applied to the annual energy saving attributed to the measure to reflect the fuel type which will be saved by the installation of the

measure. This provides the annual fuel-standardised energy saving (kWh/a) for the measure. Defra included a list of the 'relevant multipliers' for each fuel type in the Order.

- the annual fuel-standardised energy saving is applied over the stated lifetime of the measure and the resultant figure (kWh) is discounted by 6% annually. The use of the 6% discount factor is in accordance with Defra's target setting model for the programme. The associated lifetime for each measure is detailed within chapters 3 to 8 of the manual.

1.10. The annual energy savings (kWh/a) associated with the main insulation, lighting and heating measures are included in the EEC Scheme Spreadsheet provided to all obligated suppliers by Ofgem. The spreadsheet has the functionality to automatically calculate the lifetime discounted, fuel-standardised energy saving attributable to a measure.

1.11. There are also two uplift factors which may apply to the lifetime discounted, fuel-standardised energy saving achieved by a measure. First, the Order makes provision for a 1.5 uplift to be applied to the improvement in energy efficiency to be attributed to qualifying action which is delivered as energy services action. The criteria that must be met for activity to be defined as energy services action are set out in the Order and are outlined in the 'Energy Efficiency Commitment Administration Procedures Issue 2'. Second, in the model used for setting the overall target, Defra included a 1.6 uplift factor for A-rated cold and wet appliances. Both of these uplift factors are included in the energy saving calculations in the EEC Scheme Spreadsheet and will be automatically applied where relevant.

The role of the Technical Guidance Manual

1.12. This document sets out the technical standards which must be adhered to in order for a supplier to claim the lifetime discounted, fuel standardised energy savings calculated for a particular measure in the EEC Scheme Spreadsheet. These chapters also refer to best practice guidelines for each measure. Ofgem strongly encourages suppliers to meet these guidelines.

1.13. For each measure, the Technical Guidance Manual includes information on:

- The factors taken into account in quantifying the improvement in energy efficiency to be attributed to an activity if it is carried out as stated in the proposal, specifically:

- details of the basis of the annual energy saving figures in the EEC Scheme Spreadsheet;
 - the lifetime of the measure over which energy savings can be claimed which is used to calculate the lifetime discounted, fuel standardised energy savings; and
 - the technical standards or specific requirements for the delivery or installation of the measure which must be adhered to in order for the lifetime fuel-standardised energy saving to be claimed.
- best practice guidelines which Ofgem encourages suppliers to comply with in relation to the installation of the measure.
- 1.14. The Technical Guidance Manual should be used in conjunction with the 'Energy Efficiency Commitment Administration Procedures Issue 2', and the EEC Scheme Spreadsheet. The Administration Procedures document can be viewed at www.ofgem.gov.uk by selecting Energy Efficiency from the 'Ofgem's work' section.
- 1.15. Issue 1 of the Technical Guidance Manual was published in February 2002. Issue 2 of the document was published in September 2002. Additions and revisions included in Issue 3 are:
- The availability of spreadsheet calculators to quantify the energy savings for loft and cavity wall insulation in larger properties
 - The inclusion of additional energy savings for radiator panels
 - Matters in relation to cold and wet appliances after 30th June 2004
 - The methodology for calculating energy savings for wet appliances on a model-by-model basis
 - The improvement in energy efficiency from heating controls which are not additional to the Building Regulations 2000.
 - Further information on fuel switching
- 1.16. The Technical Guidance Manual applies only to the EEC 2002-2005. Updated guidance will be published for the EEC 2005-2008.

2. Scheme Codes

- 2.1. When submitting schemes to Ofgem for accreditation or approval, a code must be displayed to identify the supplier involved, the year of submission, the measures employed and the sequential scheme number. Each scheme must have a unique code.
- 2.2. The scheme code must be entered on the written pro forma. The format of the code shall be as follows:

AAAA BB C DD E

Where:

AAAA is the supplier code

BB is the year of submission. For example, 2002 is 02

C is the measure type

DD is the sequential scheme number. For example the first scheme submitted will be 01, the second 02 etc.

E is the spreadsheet type

- 2.3. There should be no forward slashes or any other punctuation between the different parts of the scheme code. For example, PGEN02A01.
- 2.4. The supplier codes are as follows.

Supplier	Supplier code
Amerada	AMER
Atlantic Electric and Gas	ATIC
British Gas Trading	CENT
Cambridge Gas	CAMB
Dee Valley Group	ESUK

LE Group	LOND
npower	NPOW
Opus Energy	OPUS
Powergen	PGEN
Seeboard	SEEB
Scottish and Southern Energy	SSEN
ScottishPower	SCOT
Telecom Plus	TELE
TXU Energi	TXUE

2.5. The scheme measure types are as follows.

A Appliances	L Lighting
H Heating (including boilers, fuel switching and CHP schemes)	M Mix of measure types
I Insulation	O Other
T Traded energy savings	E EESoP 3 carry-over

Scheme spreadsheet codes

2.6. Each spreadsheet must have a unique code. The spreadsheet code essentially follows the scheme code format with one extra character. The unique scheme spreadsheet characters are as follows:

C	A conventional delivery route
E	An energy services delivery route that qualifies for the 50% uplift in energy savings
N	An energy services delivery route that qualifies for, but has not been awarded, the 50% uplift in energy savings as the supplier has already reached the 10% target threshold for the uplift in savings.
T	A trade of qualifying action between suppliers.
S	Action taken during Energy Efficiency Standards of Performance (EESoP) 3 which is being carried over towards meeting the EEC target.

2.7. Schemes involving multiple spreadsheets must only involve spreadsheet types C, E and N. Trade and carry-over schemes cannot involve multiple spreadsheets.

3. Insulation Measures

Loft insulation

Attribution of improvement in energy efficiency

Annual energy savings

- 3.1. Energy savings associated with loft insulation measures have been calculated on a property type basis using the Building Research Establishment Domestic Energy Model (BREDEM). Savings have been quantified for properties heated by gas, electricity, LPG, oil and coal. Table 1 lists the installations for which energy savings can be claimed.

Table 1: Virgin and top-up loft insulation measures

Virgin	0mm to 200mm	0mm to 250mm
Top-up	25mm to 200mm	25mm to 250mm
	50mm to 200mm	50mm to 250mm
	75mm to 200mm	75mm to 250mm
	100mm to 200mm	100mm to 250mm

- 3.2. The energy savings attributable to loft insulation measures are included in the 'EEC Energy Savings Matrix' which is available from Ofgem. Energy savings for installations of, or up to, 250mm of loft insulation are included within the EEC Scheme Spreadsheet. Loft insulation measures of, or up to, 200mm should be entered in the 'Other Insulation' sections of the EEC Scheme Spreadsheet.
- 3.3. In addition, a spreadsheet calculator is available from Ofgem to quantify the energy savings for installations of, or up to, 250mm in larger properties that have more bedrooms than those stated within the EEC Scheme Spreadsheet. In order to calculate increased savings, the floor area of the property must be accurately measured. These measures should be entered into the 'Other Insulation' sections of the EEC scheme spreadsheet.

Lifetime

- 3.4. The lifetime of loft insulation is assumed to be 30 years.

Technical Standards or specific requirements

- 3.5. Loft insulation provided under EEC schemes should be installed to a depth of 250mm². Suppliers may be accredited for depths of less than 250mm in circumstances where it is physically impossible or unsafe to install 250mm or if the householder requests a lesser amount.
- 3.6. When insulating lofts, the loft hatches must be insulated and draught sealed.
- 3.7. There are two British Standards relevant to the installation of loft insulation. These are:

BS 5803 Part 1: 1985 "Thermal insulation for use in pitched roof spaces in dwellings. Specification for man made mineral fibre thermal insulation mats." This specifies the standard loft insulation materials must meet to be eligible for installation under EEC.

BS 5803 Part 5: 1985 "Thermal insulation for use in pitched roof dwellings. Specification for installation of man-made mineral fibre and cellulose fibre insulation". This standard specifies the requirements when installing loft insulation in pitched roof dwellings.

Best Practice Guidelines

- 3.8. There are two Good Practice Guides relating to best practice when installing loft insulation. These are "Energy efficiency refurbishment of existing housing" (Good Practice Guide 155, January 2003) and "Refurbishment site guidance for solid walled houses – roofs" (Good Practice Guide 296, November 2002). Both publications state that insulation above the height of the joists should be laid across the joists where appropriate.
- 3.9. The two Good Practice Guides also refer to best practice methods to avoid problems of damp and condensation. Cases of condensation in newly insulated lofts have

²The calculation of the conductivity of 'formed' loft insulation products has been revised following the implementation in March 2003 of European standards for thermal insulation products. As a consequence, the depth of insulation that a supplier would have to install to achieve a certain U-value is now different for glass wool and rock wool. As a general rule, a depth of 270mm of insulation is required for glass wool, whereas 250mm is required for rock wool. Whilst recognising this, Ofgem does not consider it appropriate to require suppliers to insulate to 270mm for the current programme because this would adversely affect the suppliers' costs. This decision does not affect manufacturers' compliance with the European standards in any way.

been identified in previous EESoP programmes. There are several factors that can lead to condensation in lofts, such as failing to draught seal the loft hatch or the blocking of loft vents with insulation. Energy suppliers should encourage their installers take care to minimise the risk of condensation when installing loft insulation.

- 3.10. Good practice suggests that all lofts insulated for EEC purposes will, where appropriate, include loft boarding in order to provide safe access to the cold water tank.
- 3.11. In addition, good practice when insulating roof spaces suggests the insulation of the cold water tank and associated pipe work. The relevant British Standard is:
- BS 5422: 2001** "Method for specifying thermal insulation materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C".

DIY loft insulation

Attribution of improvement in energy efficiency

Annual energy savings

- 3.12. Energy savings associated with DIY loft insulation schemes have been calculated on a 'per square metre' installed basis. For any particular increase in insulation (eg, the installation of 100mm insulation in a virgin loft, or the installation of top-up loft insulation from 100mm to 200mm), the energy saving per square metre is similar for different dwelling types. For this reason, energy savings have been calculated on a per-fuel basis. The energy savings are average figures which are weighted by the relative number of householders installing the specified thickness of insulation on top of various depths of existing insulation. This reflects the fact that the householder may or may not already have some insulation within their loft.
- 3.13. Two different savings have been calculated for each fuel type, one for 150mm (6") insulation and one for 100mm (4") insulation. Energy savings for 170mm and 200mm will be available by June 2004. The appropriate values for 150mm and 100mm installations are included within the EEC Scheme Spreadsheet. When available, energy savings for other thicknesses should be inserted in the 'Other Insulation' sections of the appropriate worksheet.

Lifetime

- 3.14. The lifetime of DIY loft insulation is assumed to be 30 years.

Technical standards or specific requirements

- 3.15. All loft insulation materials promoted or delivered as part of suppliers' DIY loft insulation schemes must be manufactured to British Standard **BS 5803 Part 1: 1985** "Thermal insulation for use in pitched roof spaces in dwellings. Specification for man made mineral fibre thermal insulation mats".
- 3.16. The energy savings calculated for DIY loft insulation assume that the measure will be installed to the same standard as professionally installed insulation (detailed in items 3.5, 3.6 and 3.7). Whilst a supplier cannot ensure that these standards will be adhered to in DIY schemes, best endeavours must be made to inform the householder of these installation practices.
- 3.17. If the DIY loft insulation scheme is delivered through a mail order route, the supplier must provide appropriate installation guidelines to all customers ordering loft insulation. If the DIY loft insulation scheme is delivered through a retailer, the supplier should ensure that appropriate installation guidelines are available to all consumers at the place of purchase and, if not supplied with the product, the consumer is informed of where they are located.

Best Practice Guidelines

- 3.18. Aside from being installed to the required technical standards, it is also of primary concern that the insulation is installed safely. Whilst a supplier may not be able to enforce safe installation, best endeavours should be made to encourage this.
- 3.19. If the DIY loft insulation scheme is delivered through a mail order route, the supplier should provide appropriate safety guidance to all customers ordering loft insulation. As the customer has not visited a DIY store to purchase the loft insulation and has not had access to safety equipment, the supplier should provide a face-mask, gloves and goggles at no cost to the customer. It would be preferable to include the safety equipment with each order, but if the supplier can show that the purchase is a repeat purchase and the customer has already been supplied with safety equipment, it will not be necessary to repeat the offer.

- 3.20. If the DIY loft insulation scheme is delivered through a retailer, the supplier should provide appropriate installation guidelines and appropriate safety guidance to all customers purchasing loft insulation. There is no requirement on suppliers to provide safety equipment due to the issues of repeat purchase. However, it should be emphasised that safety is an important issue when installing loft insulation and this should be reflected in the written guidance. It is strongly recommended that the written guidance is suitably close to the product and that there is clear signposting to where the safety equipment can be purchased in store.
- 3.21. The two Good Practice Guides which relate to best practice for professionally installed loft insulation also apply to DIY schemes. These are “Energy efficiency refurbishment of existing housing” (Good Practice Guide 155, January 2003) and “Refurbishment site guidance for solid walled houses – roofs” (Good Practice Guide 296, November 2002). Good Practice Guide 171 “Domestic Energy Efficiency Primer” (2003 edition) may also be helpful. The main points stated within the publications are that insulation above the height of the joists should be laid across the joists where appropriate and that care should be taken to avoid future problems of damp and condensation. Suppliers are strongly encouraged to alert householders to these issues.
- 3.22. Good practice suggests that all lofts insulated for EEC purposes will include, where appropriate, loft boarding in order to provide safe access to the cold water tank. This point should be included in the installation guidelines.
- 3.23. In addition, good practice when insulating roof spaces suggests the insulation of the cold water tank and associated pipe work. The relevant British Standard is:
- BS 5422: 2001** “Method for specifying thermal insulation materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C”.

Cavity wall insulation

Attribution of improvement in energy efficiency

Annual energy savings

- 3.24. Energy savings associated with cavity wall insulation have been calculated on a property type basis using the Building Research Establishment Domestic Energy Model (BREDEM). Savings have been quantified for properties heated by gas, electricity, LPG, oil and coal. Different energy savings apply to properties constructed pre 1976 and those constructed post 1976; the energy savings achieved in properties constructed after this year are, in general, less due to the introduction of thermal insulation requirements for walls in the Building Regulations. Installers must therefore determine which of these age bands the property was built in when reporting to energy suppliers, to enable suppliers to accurately report on the energy savings from their completed schemes.
- 3.25. The energy savings attributable to cavity wall insulation are included in the 'EEC Energy Savings Matrix' and the EEC scheme spreadsheet both of which are available from Ofgem. The energy savings assume mineral wool insulation, polystyrene beads or Urea Formaldehyde (UF) foam.
- 3.26. In addition, a spreadsheet calculator is available from Ofgem to quantify the energy savings for installations in larger properties that have more bedrooms than those stated within the EEC Scheme Spreadsheet. In order to calculate increased savings, the floor area of the property must be accurately measured. These measures should be entered into the 'Other Insulation' sections of the EEC scheme spreadsheet.

Lifetime

- 3.27. The lifetime of cavity wall insulation is assumed to be 40 years.

Technical standards or specific requirements

- 3.28. Insulation materials used must be certified by the British Board of Agreement (BBA) and must conform to the following British Standards:

For mineral wool insulation, the relevant British Standard is **BS EN 13162: 2001** "Thermal insulation products for buildings. Factory made mineral wool (MW) products. Specification."

For UF foam insulation, the relevant British Standards are **BS 5617:1985** "Specification for urea-formaldehyde (UF) foam systems suitable for thermal insulation of cavity walls with masonry or concrete inner and outer leaves" and **BS 5618:1985** "Code of practice for thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with urea-formaldehyde (UF) foam systems"

- 3.29. A Cavity Insulation Guarantee Agency (CIGA) guarantee must be provided to the customer when the insulation work has been completed as the energy savings calculated are based upon installation to the technical requirements of the guarantee. The technical requirements are outlined in the following three documents published by CIGA, which can be obtained by e-mailing Peter Dicks (peter.dicks@ciga.co.uk):

"Assessor's Guide: Suitability of external walls for filling with cavity wall insulation. Part 1 existing buildings" Version 1.0, October 2003

"Technician's guide to best practice – Installing cavity wall insulation" Version 2, July 2002

"Technician's guide to best practice – Flues, chimneys and combustion air ventilators" Version 2.0, March 2002

Best Practice Guidelines

- 3.30. The Health and Safety Executive (HSE) has prepared a briefing note for installers to follow to ensure adequate precautions are taken for the safe installation of cavity wall insulation in gas-heated properties. This is included as Appendix 2 to this document.

Draught-proofing

Attribution of improvement in energy efficiency

Annual energy savings

- 3.31. Energy savings associated with draught-proofing measures have been modelled on a property type basis using the Building Research Establishment Domestic Energy Model (BREDEM). Savings have been quantified for properties heated by gas, electricity, LPG, oil and coal.
- 3.32. The energy savings attributable to draught proofing are appropriate for strip and brush-type systems applied to operable windows and external doors and are based upon an air infiltration rate at the higher end of the range. The savings are included in the 'EEC Energy Savings Matrix' and the EEC Scheme Spreadsheet both of which are available from Ofgem.

Lifetime

- 3.33. The lifetime for draught proofing measures is assumed to be 10 years.

Technical standards or specific requirements

- 3.34. As the energy savings accredited for draught proofing are based upon an air infiltration rate at the higher end of the range, the measure should be targeted at homes where windows and doors have a poor fit or seal to the frame, and where the property is particularly exposed.
- 3.35. There are two British Standards relevant to the installation of draught-proofing measures. The draught-proofing products installed must conform to **BS 7386: 1997** "Specification for draught strips for the draught control of existing doors and windows in housing". The installation of the measure must conform to the standards outlined in **BS 7880 1997** "Code of practice for draught control of existing doors and windows in housing using draught strips".

Best Practice Guidelines

- 3.36. Whilst not required to attain the energy savings associated with draught-proofing measures, it is the responsibility of the supplier to ensure that statutory requirements and guidelines for adequate ventilation are adhered to. When installing draught-proofing measures, it is important to ensure that open flue combustion appliances, such as gas fires, have an adequate direct fresh air supply for the safe operation of

the appliance. A separate provision for such a supply should be made, and a combustion spillage test undertaken when air-tightening work is being carried out.

- 3.37. As draught-proofing will lead to a reduction in ventilation, condensation and mould should not be present in rooms where draught-proofing is installed as it is highly likely that the problem will be augmented by the measure. Good Practice Guide 224 “Improving air-tightness in existing homes” is a useful reference for general draught-proofing advice, including specific information on ensuring ventilation.

External and internal solid wall insulation

Attribution of improvement in energy efficiency

Annual energy savings

- 3.38. Energy savings associated with external and internal insulation measures for solid wall properties have been calculated on a property type basis using the Building Research Establishment Domestic Energy Model (BREDEM). Savings have been quantified for properties heated by gas, electricity, LPG, oil and coal.
- 3.39. There are two different sets of savings that have been calculated for solid wall insulation. They are both based upon a specific improvement in the thermal performance of the wall (U-value). Energy savings can be claimed when improving:
- the U-value of either internal or external walls to $0.45\text{W/m}^2\text{K}$
 - the U-value of internal walls to $0.37\text{W/m}^2\text{K}$.
- 3.40. As the energy savings relate to a certain U-value being achieved, the savings can be claimed for any measure that leads to this improvement in thermal performance. Examples of insulation measures which can be used to attain these values are detailed in the following grid.

To improve the U-value of either internal or external walls to $0.45\text{W/m}^2\text{K}$:

External	35mm urethane foam and render
	45mm extruded polystyrene and render
	60mm expanded polystyrene and render
	60mm mineral wool slab and render
Internal	30mm phenolic foam and plasterboard
	35mm urethane foam and plasterboard
	47.5mm extruded polystyrene and plasterboard
	80mm mineral wool quilt, timber battens and plasterboard

To improve the U-value of internal walls to 0.37W/m²K:

100mm mineral wool quilt, timber battens

- 3.41. The stated thicknesses are for illustration only and will not necessarily lead to the required improvement. The exact thickness of insulation required will vary according to the specific manufacturer's product, the nature of the wall it is put on and the proportion of timber-work study. It is the supplier's responsibility to ensure that the required U-value is achieved.
- 3.42. The energy savings attributable to solid wall insulation measures are included in the 'EEC Energy Savings Matrix' which is available from Ofgem. The values are not included in the EEC Scheme Spreadsheet and should be inputted manually into the 'Other Insulation' sections on the relevant fuel worksheet. In addition, several solid wall insulation manufacturers have had the energy savings from their products independently quantified through the EST's New Product Procedure. For a current list of the approved measures, please contact James Russill at the EST. Relevant contact details can be found in Appendix 3 of the manual.

Lifetime

3.43. The lifetime of internal and external wall insulation is assumed to be 30 years.

Technical standards or specific requirements

3.44. The Building Regulations 2000 require reasonable provision to be made for the conservation of fuel and power in dwellings by limiting the heat loss through the fabric of the building. Approved Document L1³, issued by the Office of the Deputy Prime Minister (ODPM), provides guidance on the insulation of internal and external solid walls in existing properties. Specifically, Approved Document L1 suggests that, when work includes the substantial replacement of an exposed wall or its external rendering or internal finishes, the work to the walls should include the provision of reasonable insulation. General Information Leaflet 70 "The effect of Building Regulations (Part L1 2002) on existing dwellings" (November 2002) summarises the guidance for the insulation of solid walls.

3.45. For the purposes of the EEC, energy savings will be accredited for solid wall insulation measures which improve either:

- the U-value of either internal or external walls to $0.45\text{W/m}^2\text{K}$, or
- the U-value of internal walls to $0.37\text{W/m}^2\text{K}$.

3.46. It is the supplier's responsibility to ensure compliance with the Building Regulations 2000.

3.47. In addition, the following British Standards are relevant to the installation of solid wall insulation. These are:

BS 5262: 1991 "Code of Practice for External Renderings". This Standard specifies the materials, aspects of design, mixes and methods of application of cement-based renderings to all common types of new and old backgrounds. It also includes advice on the inspection and repair of defective renderings.

BS 8212: 1995 "Code of practice for dry lining and partitioning using gypsum plasterboard". This Standard contains recommendations for materials, design backgrounds and insulation of dry lining to walls, ceilings and partitioning.

³ "Approved Document L1, Conservation of fuel and power in dwellings" 2002 edition, Office of the Deputy Prime Minister
Revised Technical Guidance Manual Issue 3
Office of Gas and Electricity Markets

Best Practice Guidelines

3.48. For the purposes of the EEC, energy savings are accredited for solid wall insulation measures that improve the U-value of the wall to $0.45\text{W/m}^2\text{K}$ for internal or external walls, and to $0.37\text{W/m}^2\text{K}$ for internal walls. However, Best Practice guidelines for external wall insulation state a U-value of $0.35\text{W/m}^2\text{K}$ and Ofgem strongly encourages suppliers to install to this level. Good Practice Guide 155 “Energy Efficient refurbishment of existing housing” (2003) and Good Practice Guide 293 “External insulation systems for walls of dwellings” (August 2000) provide further detail on measures that can be used to attain the Best Practice improvement.

3.49. In addition, two other Good Practice Guides may be useful reference material. These are:

Good Practice Guide 297 “Refurbishment site guidance for solid-wall houses – walls” (May 2000), and

Good Practice Guide 138 “Internal wall insulation in existing housing – a guide for specifiers and contractors” (July 2003).

Hot water tank insulation

Attribution of improvement in energy efficiency

Annual energy savings

3.50. Energy savings associated with hot water tank insulation have been calculated as average savings on a fuel type basis as the dwelling type has little effect on the calculated value. The energy savings have been weighted by the relative thickness of existing hot water tank insulation across the housing stock. The energy savings are included within the EEC Scheme Spreadsheet.

Lifetime

3.51. The lifetime for tank insulation is assumed to be 10 years.

Technical standards or specific requirements

- 3.52. All hot water tank jackets provided as part of suppliers' EEC activity should be manufactured to **BS 5615: 1985** "Specification for insulating jackets for domestic hot water storage cylinders". This Standard specifies the performance, in terms of the maximum permitted heat loss, the materials, design and marking of jackets for cylinders to BS1566-2: 1984 and BS1566-1: 2002.

High efficiency hot water cylinders

Attribution of improvement in energy efficiency

Annual energy savings

- 3.53. The energy savings associated with high efficiency hot water cylinders have been calculated for existing and new build properties that heat water using gas or electricity. A modified version of the Building Research Establishment Domestic Energy Model (BREDEM) has been used to quantify the energy savings, which also takes cylinder standing losses, primary pipe-work losses and boiler losses into consideration. Primary pipe-work losses and boiler losses will not be relevant in the case of electric immersion heaters. However, they will apply to properties heating water using a gas boiler and, consequently, there are separate gas savings for instances where the primary pipe-work is and isn't insulated.
- 3.54. For existing properties, the calculations are based upon the replacement of a stock average cylinder with a high performance cylinder. For new-build dwellings, the calculations are based upon installing a high performance cylinder rather than a British Standard cylinder as specified in Approved Document L1 of the Building Regulations 2000.
- 3.55. The stock average cylinder was defined using BRE survey data on insulation levels and expert opinion on the mixture of tank types within the housing stock. The British Standard cylinder is the HR3 case defined in the General Information Leaflet 59 "Central Heating System Specifications" (July 2002). The high performance cylinder is the HR4 case defined in the General Information Leaflet 59 "Central Heating System Specifications" (July 2002).

- 3.56. The energy savings that can be claimed for high efficiency hot water cylinders in existing dwellings are as follows:

Where water is heated by a gas-fired boiler in a property with no primary pipe-work insulation, the energy saved by replacing a stock average cylinder with a high performance cylinder is **994 kWh/annum**

Where water is heated by a gas-fired boiler in a property with insulated primary pipe-work, the saving from replacing a stock average cylinder with a high performance cylinder is **533 kWh/annum**

Where water is heated by an electric immersion heater, the saving from replacing a stock average cylinder with a high performance cylinder is **181 kWh/annum.**

- 3.57. The energy savings that can be claimed for high efficiency hot water cylinders in new build properties are as follows:

Where water is heated by a gas-fired boiler, the saving from installing a high performance cylinder rather than a British Standard cylinder is **153 kWh/annum**

Where water is heated by an electric immersion heater, the saving from installing a high performance cylinder rather than a British Standard cylinder is **39 kWh/annum**

- 3.58. These energy savings values should be entered into the 'Other Insulation' section of the EEC Scheme Spreadsheet. The cylinders are classed as insulation measures, because the vast majority of the energy savings result from the high levels of insulation in their design.

Lifetime

- 3.59. A lifetime of 20 years should be assumed for this measure.

Technical Standards or specific requirements

- 3.60. Installations of hot water cylinders should meet the basic level of specification set out in General Information Leaflet 59 "Central Heating System Specifications – CheSS" (July 2002).

Radiator panels

Attribution of improvement in energy efficiency

Annual energy savings

- 3.61. Energy savings associated with radiator panels have been calculated on a 'per square metre' installed basis using the results from independent laboratory tests. Savings have been quantified for properties heated by gas, LPG and oil radiator systems. There are two different energy savings that can be claimed for radiator panels and the savings claimed depend upon:
- the type of the radiator panel
 - whether the panel is fitted on an internal or external wall, and
 - the construction type of the wall of the property.
- 3.62. If the radiator panel is to be fitted on either an internal or external wall in a property of any wall construction type, the energy saving on a 'per square metre' installed basis is **134 kWh/m²per annum** for gas, LPG and oil heated homes. This value is for radiator panels constructed in a 'louvered' or 'saw toothed' fashion (with raised ridges), which is by far the most common method of design. The saving is only applicable to panels with a reflective surface. If a panel is used which does not have a reflective surface, the energy saving should be taken as **one half** of the above value.
- 3.63. If the radiator panel is to be fitted on an external wall in a property with either unfilled cavities or solid walls, the energy saving on a 'per square metre' installed basis is **170 kWh/m²per annum** for gas, LPG and oil heated homes. This saving can only be claimed for certain manufacturers' radiator panels. To obtain a list of the panels for which this saving may be claimed, please e-mail eec@ofgem.gov.uk.
- 3.64. Suppliers can only claim one of the energy savings (**134 kWh/m²per annum** or **170 kWh/m²per annum**) per property. If a supplier uses a panel which is eligible for the higher savings (**170 kWh/m²per annum**), but also installs them on internal walls, the supplier should make an assessment of whether they want to claim **170 kWh/m²per annum** for the eligible panels only, or **134 kWh/m²per annum** for all panels.
- 3.65. Radiator panel energy savings should be calculated on a 'per panel' basis. This calculation requires the assessment of the area of the radiator panel, which should then be multiplied by the relevant value above. In submitting such schemes,

suppliers should indicate the numbers of panels forecast to be installed, therefore allowing the overall savings to be calculated. Suppliers should include a breakdown of their calculations in their scheme submission. The energy saving values and total area of panel installed should be entered into the 'Other Insulation' section on the relevant worksheet of the EEC Scheme Spreadsheet.

Example calculation

- 3.66. A radiator panel will be installed on an external wall, which has a filled cavity. It is a louvered panel with a reflective surface and has a surface area of 0.3 m². The energy savings that can be claimed for this type of panel are 134 kWh per annum on a 'per square metre' installed basis.

Total energy savings for the panel (**kWh per annum**) = 134 x 0.3

Total energy savings for the panel = 40.2 **kWh/m²per annum**

Lifetime

- 3.67. A measure lifetime of 10 years should be assumed for radiator panels.

Window glazing

- 3.68. The Building Regulations 2000 require reasonable provision to be made for the conservation of fuel and power in dwellings by limiting the heat loss through the fabric of the building. The guidance outlined in Approved Document L1⁴ suggests that compliance with the Building Regulations 2000 can be achieved by a minimum specification of double glazed low-emissivity glass for all new glazing installations. If an energy supplier wishes to undertake a glazing scheme, they should therefore ensure that the glazing installed possesses additional energy saving benefits to Approved Document L1.
- 3.69. Suppliers should discuss with Ofgem any proposed measures and energy saving values prior to submitting a scheme.

⁴ "Approved Document L1, Conservation of fuel and power in dwellings" 2002 edition, Office of the Deputy Prime Minister

4. Lighting Measures

Attribution of improvement in energy efficiency

Annual energy savings

- 4.1. The energy savings for Compact Fluorescent Lamps (CFLs) and luminaires are calculated on a wattage comparison basis against the General Lighting Service (GLS) bulb which they are assumed to replace.
- 4.2. The CFL worksheet of the EEC Scheme Spreadsheet enables the calculation of lifetime, fuel standardised energy savings arising from the provision of CFLs and luminaires to Priority households, to non-Priority households and through retail routes. Implicit in these calculations are assumptions about the annual usage of the lamp. CFLs or luminaires delivered to Priority households are assumed to be used in high-use fittings and have an annual usage of 1,250 hours. CFLs or luminaires delivered to non-Priority households or through retail schemes are assumed to be used in medium-use fittings and have an annual usage of 690 hours. This is because it is assumed that non-Priority households will already have some CFLs installed within high-use fittings.

Lifetime

- 4.3. The lifetime (in hours) of the lamp is a key part of the calculation and energy suppliers are required to enter the Energy Saving Trust's (EST) approved lifetime of the lamp onto the CFL worksheet. Where the lamp lifetime has not yet been approved by the EST, the manufacturer's claimed lifetime (eg, as shown on the packaging) should be entered into the spreadsheet.

Technical standards or specific requirements

- 4.4. All CFLs and luminaires used in EEC schemes must be included on the EST's list of approved CFLs and luminaires, and have achieved Energy Efficiency Recommended (EER) status, awarded by the EST's Endorsement Programme. The approved CFL and luminaire list is circulated on an ongoing basis, as and when revisions are necessary. For confirmation of the current version, contact James Russill at the EST. Relevant contact details are included in Appendix 3 of this document.

5. Heating Measures

Boilers

Attribution of improvement in energy efficiency

Annual energy savings

- 5.1. The Building Regulations 2000 require reasonable provision to be made for the conservation of fuel and power in dwellings by providing space heating and hot water systems which are energy efficient. In the guidance provided within Approved Document L1⁵, minimum combustion efficiencies for boilers are outlined which would demonstrate compliance with the provision. The Building Regulations 2000 apply to both new-build properties and existing dwellings when a new boiler is installed.
- 5.2. For the purposes of the EEC, energy savings are calculated based upon a comparison of the combustion efficiency of the new condensing boiler against the minimum combustion efficiency outlined in Approved Document L1. Table 2 lists the minimum combustion efficiencies, expressed as SEDBUK (Seasonal Efficiency of Domestic Boilers in the UK) values, which are included in Approved Document L1.

Table 2: Minimum SEDBUK values outlined within Approved Document L1

Boiler type	Minimum SEDBUK value	Back boiler minimum SEDBUK value
Natural Gas	78%	75%
LPG	80%	77%
Oil	85%	82%
Oil – combi boiler	82%	79%

- 5.3. Table 2 includes the minimum SEDBUK efficiencies for back boilers which are also outlined in Approved Document L1. The back boiler efficiency is 3 percentage points lower than the minimum SEDBUK value for a standard boiler for each fuel type. For example, the minimum SEDBUK value required for a natural gas back

⁵ "Approved Document L1, Conservation of fuel and power in dwellings" 2002 edition, Office of the Deputy Prime Minister

boiler is 75%. Consequently, the energy saving for replacing a back boiler is based on the SEDBUK combustion efficiency of the new condensing boiler compared against the minimum required combustion efficiency for the back boiler for the relevant fuel type.

- 5.4. The energy savings attributable to the installation of a condensing boiler, either with or without heating control upgrades, are calculated automatically on the heating worksheets within the EEC Scheme Spreadsheet on a property type basis.
- 5.5. The number of boilers installed by a scheme should be entered into the relevant worksheet (there is a different heating worksheet for gas, LPG and oil and each has a separate section for conventional boilers and back boilers). The worksheets are set to a default combustion efficiency of 88% for condensing boilers. If the combustion efficiency of the boilers provided by a scheme differs from 88%, the supplier should enter the actual value. If several different boilers are installed as part of a scheme with different SEDBUK efficiencies, a weighted average combustion efficiency should be calculated based upon the relative number of measures.
- 5.6. In addition, a spreadsheet calculator is available from Ofgem to quantify the energy savings for installations of condensing boilers in larger properties that have more bedrooms than those stated within the EEC Scheme Spreadsheet. In order to calculate increased savings, the floor area of the property must be accurately measured. These measures should be entered into the 'Other Heating' sections of the EEC Scheme Spreadsheet.

Lifetime

- 5.7. The lifetime assumed for boilers is 15 years.

Technical standards or specific requirements

- 5.8. Boilers installed as part of suppliers' EEC activity must be a SEDBUK rated 'A' or 'B' model. The SEDBUK database has been set up as part of the Government's Energy Efficiency Best Practice Programme and can be viewed at <http://www.sedbuk.com/>. It indicates the combustion efficiency of all boilers currently available.
- 5.9. Installations of boilers must meet the best practice guidance set out in General Information Leaflet 59 "Central Heating System Specifications – CheSS" (July 2002). Such installations will meet the standards outlined in Approved Document L1 of the Building Regulations 2000. Suppliers should note sections 1.47 through to 1.51 of

the document which relate to the commissioning of the system and the provision of operation instructions. A guidance note, "The Domestic Heating and Hot Water Guide to the Building Regulations 2001 – Part L1"⁶, which summarises the heating aspects of Approved Document L1 can be obtained by calling the EST's Energy Efficiency Publication Hotline on 0845 727 7200.

5.10. Several British Standards also apply:

BS 5440 Part 1: 2000 "Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd and 3rd family gases). Specification for installation and maintenance of flues".

BS 5440 Part 2: 2000 "Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd and 3rd family gases). Specification for installation and maintenance of ventilation for gas appliances".

BS 6798: 2000 "Specification for installation of gas-fired boilers of rated input not exceeding 70kW net".

BS 5449: 1990 "Specification for forced circulation hot water central heating systems for domestic premises".

BS 7671: 2001 "Requirements for electrical installations, IEE wiring regulations, 16th Edition".

Best Practice Guidelines

5.11. Good Practice Guide 284 "Domestic central heating and hot water: systems with gas and oil-fired boilers" (2000) is a good overall reference for gas and oil systems.

Heating controls

Attribution of improvement in energy efficiency

5.12. In addition to outlining minimum combustion efficiencies for boilers, Approved Document L1⁷ provides guidance on space heating and hot water system controls.

⁶ "The Domestic Heating and Hot Water Guide to the Building Regulations 2001 – Part L1, The Energy Efficiency Partnership for Homes, February 2002.

⁷ "Approved Document L1, Conservation of fuel and power in dwellings" 2002 edition, Office of the Revised Technical Guidance Manual Issue 3

The guidance states that, after the 31st March 2002, zone controls, time controls and a boiler interlock should be installed whenever a new boiler or hot water cylinder is installed within a new-build property or existing dwelling. In order to claim energy savings from a measure installed as part of an EEC scheme, the supplier must demonstrate that the measure has led to an improvement in energy efficiency which is additional to that required by minimum legal requirements. Any heating control measures which are used to comply with the Building Regulations 2000 are therefore seen as being non-additional activity which can not be accredited towards a supplier's target.

- 5.13. Suppliers have agreed not to install measures which could be used to demonstrate compliance with Approved Document L1 after the 31st January 2003, unless they are being installed as part of a contract that had been agreed before this date. For measures installed as part of such contracts, Ofgem has agreed with the relevant suppliers that the measures will be accredited in line with the scheme submission.
- 5.14. Ofgem acknowledges that the Building Regulations 2000, or more specifically Approved Document L1, are not prescriptive on how compliance can be achieved. However, it is important to identify a list of measures that can be classed as additional to the Building Regulations 2000, and hence as qualifying action. This will prevent inconsistencies between the obligated energy suppliers and negate the opportunity for any supplier to be unfairly disadvantaged.
- 5.15. When heating controls are being installed or upgraded as part of a boiler replacement scheme, a supplier can be accredited with energy savings from intelligent heating controls, delayed start thermostats and all TRVs installed in existing dwellings.
- 5.16. If the heating controls are being upgraded without a boiler or hot water cylinder replacement the supplier may claim energy savings (based on a stock average boiler efficiency of 67%) for all the heating controls installed.

Annual energy savings

- 5.17. For measures installed or contracted on or before the 31st January 2003, a comparison is made between the efficiency of the existing heating system and the

efficiency of the replacement heating system taking into account any heating controls installed.

- 5.18. Measures installed or contracted after the 31st January 2003 must be additional to those stated within Approved Document L1. For these measures, the energy savings are calculated based upon a comparison between the efficiency of a heating system that would comply with Approved Document L1 and the efficiency of the replacement system.
- 5.19. The energy savings attributable to the installation of heating controls are calculated automatically on the heating worksheets within the EEC Scheme Spreadsheet on a property type basis. The spreadsheet contains options for installing heating controls in tandem with a new boiler or installing heating controls alone. For schemes which involve heating system measures installed before the 31st January 2003 or as part of contracts in place before the 31st January 2003, Version 1 of the EEC Scheme Spreadsheet should be used to calculate the energy savings. For all other heating measures, the latest version of the spreadsheet should be used.
- 5.20. In the energy saving calculations, the existing heating control packages are as detailed in Table 3. However, for replacement packages, TRVs are not included in packages C, D, E and F and these should be entered separately on the relevant fuel worksheet. Package B represents Ofgem’s interpretation of the minimum heating controls required to demonstrate compliance with Approved Document L1 of the Building Regulations 2000. Please note that Ofgem does not view Package D as complying with Approved Document L1 as it does not include a room thermostat which is required for a boiler interlock.

Table 3: Heating Control Packages

	Requirements		
Package A	Hot water tank thermostat	-	-
Package B	Hot water tank thermostat	-	Room thermostat
Package C	Hot water tank thermostat	TRVs	Room thermostat
Package D	Hot water tank thermostat	TRVs	-
Package E	Hot water tank thermostat	TRVs	Delayed start room thermostat
Package F	Hot water tank thermostat	TRVs	Intelligent heating controls

- 5.21. For clarity, a heating control or control system is classified as 'intelligent' (Package F in Table 3) if its characteristics are such that it

- controls the heating on a basis of room temperature (not system water temperature)
 - controls the temperature to within +/- 0.3 °C or better
 - anticipates the need to turn the boiler on or off by learning the response of the building, and
 - has integral timing or is linked to an independent time controller
- 5.22. This includes control systems both with and without external temperature and/or flow temperature compensation.

Lifetime

- 5.23. A lifetime of 15 years is assumed for heating controls.

Technical standards or specific requirements

- 5.24. Installations of heating controls must meet the requirements described as “Basic” in General Information Leaflet 59 “Central Heating System Specifications – CheSS” (July 2002). Such installations will meet the standards outlined in Approved Document L1 of the Building Regulations 2000. A guidance note, “The Domestic Heating and Hot Water Guide to the Building Regulations 2001 – Part L1”, which summarises the heating aspects of Approved Document L1 can be obtained by calling the EST’s Energy Efficiency Publication Hotline on 0845 727 7200.
- 5.25. It is important to note that, to demonstrate compliance with Approved Document Part L, a boiler control interlock must be included when upgrading the heating controls regardless of whether a new boiler is installed or not.
- 5.26. In addition, the measures must all be installed in line with **BS 7671: 2001** “Requirements for electrical installations, IEE wiring regulations, 16th Edition” and **BS 5449: 1990** “Specification for forced circulation hot water central heating systems for domestic purposes”.

Best Practice Guidelines

- 5.27. **Good Practice Guide 302** “Controls for domestic central heating and hot water – guidance for specifiers and installers” (September 2001) is a useful reference point

for information of the different types of controls available, including descriptions of more-advanced functions.

Electric heating controls

Attribution of improvement in energy efficiency

Annual energy savings

- 5.28. Energy savings associated with six types of storage heater controls have been calculated on a property type basis using the Building Research Establishment Domestic Energy Model (BREDEM) with independent laboratory tests. There are different energy savings for solid wall and cavity wall properties because they are related to the space heating consumption of the property. When providing or installing electric heating controls, suppliers must take note of the construction type of the walls.
- 5.29. The energy savings attributable to storage heater control measures are included in the 'EEC Energy Savings Matrix' which is available from Ofgem. The relevant values should be inserted into the 'Heating Controls' section of the electricity worksheet on the EEC Scheme Spreadsheet.

Lifetime

- 5.30. A lifetime of 15 years is assumed for electric heating controls.

Technical Standards or specific requirements

- 5.31. All electric storage heater controls should be installed in line with British Standard **BS 7671: 2001** "Requirements for electrical installations, IEE wiring regulations, 16th Edition".

Best practice guidelines

- 5.32. Good Practice Guide 345 "Domestic heating by electricity" (March 2003) outlines the general issues relating to the use of electricity for heating and also broadly defines the different functionality of storage heater controls. Good Practice Guide 302 "Controls for domestic central heating and hot water – guidance for specifiers and installers" (September 2001) discusses control functions in greater technical detail.

Solar Water Heating

Attribution of improvement in energy efficiency

Annual energy savings

- 5.33. Solar panels, used for the purposes of domestic hot water heating, are an eligible measure for use in EEC schemes. Energy savings associated with two types of solar panel – flat plate and evacuated tube varieties – have been quantified using the Building Research Establishment Domestic Energy Model (BREDEM) and independent field tests.
- 5.34. Table 4 summarises two types of energy savings that can be claimed. The main sections of the tables list energy savings for a typical installation on a property type basis for gas, electricity, LPG, oil and coal. The savings have also been calculated on an average 'per square metre' of installed panel basis for each of the different heating fuels. Suppliers should enter the measures in the 'Other Heating' sections of the EEC Scheme Spreadsheet.
- 5.35. Suppliers may find it easier to submit new schemes using the typical installation savings for the different property types. Once the measures have been installed, the supplier should report on the scheme by calculating the savings based on the total area of solar panels installed. The 'per square metre' data should be used in these calculations.

Table 4: Annual energy savings for flat plate collector and evacuated tube solar water heating

FLAT PLATE COLLECTORS		Water Heating Fuel				
		Gas	Electricity	Oil	LPG	Solid
Average kWh/yr saving per square metre of panel		454	304	400	441	553
Typical dwelling types, average occupancy levels and typical daily hot water requirements		l/day	Energy Saving (kWh/yr)			
FLAT 2.1	90.5	1791	1200	1579	1739	2182
MID-TERRACED 2.6	103	1824	1222	1608	1771	2222
END-TERRACED 2.6	103	1824	1222	1608	1771	2222
SEMI-DETACHED BUNGALOW 2.2	93	1791	1200	1579	1739	2182
DETACHED BUNGALOW 2.3	95.5	1824	1222	1608	1771	2222
SEMI-DETACHED HOUSE 2.9	110.5	1824	1222	1608	1771	2222
DETACHED HOUSE 3.3	120.5	1824	1222	1608	1771	2222

EVACUATED TUBE COLLECTORS		Water Heating Fuel				
		Gas	Electricity	Oil	LPG	Solid
Average kWh/yr saving per square metre of panel		582	390	513	565	709
Typical dwelling types, average occupancy levels and typical daily hot water requirements		l/day	Energy Saving (kWh/yr)			
FLAT 2.1	90.5	2214	1483	1952	2150	2697
MID-TERRACED 2.6	103	2284	1530	2013	2217	2782
END-TERRACED 2.6	103	2284	1530	2013	2217	2782
SEMI-DETACHED BUNGALOW 2.2	93	2214	1483	1952	2150	2697
DETACHED BUNGALOW 2.3	95.5	2284	1530	2013	2217	2782
SEMI-DETACHED HOUSE 2.9	110.5	2343	1570	2066	2275	2855
DETACHED HOUSE 3.3	120.5	2378	1593	2096	2309	2897

Lifetime

5.36. The lifetime of solar water heating is assumed to be 20 years.

Technical standards or specific requirements

5.37. The following British Standards are relevant to the installation of solar water heating.

BS 5918: 1989 "Code of practice for solar heating systems for domestic hot water."

This standard contains recommendations for the design, construction, installation and commissioning of components and systems for domestic hot water preheating for single family dwellings.

BS 6757: 1986 "Methods of test for thermal performance of solar collectors"

This standard describes the test methods for proving the performance of solar panels.

BS EN 12976-1: 2001 "Thermal solar systems and components. Factory made systems. General requirements."

Heat Recovery Ventilation

Attribution of improvement in energy efficiency

Annual energy savings

- 5.38. Energy savings have been calculated for several heat recovery ventilation units by the EST. For specific details on the models accredited and the associated energy savings and lifetimes, please contact James Russill at the EST. Relevant contact details can be found in Appendix 3 of the manual.
- 5.39. Measure data should be entered in the 'Other Heating' section of the relevant fuel worksheet on the EEC Scheme Spreadsheet.

Technical standards or specific requirements

- 5.40. All installations of heat recovery ventilation units must comply with British Standard **7671: 2001** "Requirements for electrical installations, IEE wiring regulations, 16th Edition."

Best practice guidelines

- 5.41. Good Practice Guide 268 "Energy-efficient ventilation in housing – a guide for specifiers on the requirements and options for ventilation" (February 2002) provides background information on wider ventilation issues together with more specific advice about heat recovery room ventilators

Ground Source Heat Pumps

Attribution of improvement in energy efficiency

Annual energy savings

- 5.42. When calculating the energy savings that can be accredited to ground source heat pumps, it is important to reflect whether the heat pump will replace all of the heating demand or just the majority of the heating demand from conventional electric or fossil fuelled heating systems.
- 5.43. The energy savings are based on the assumption that a dwelling needs a replacement heating system. If the ground source heat pump was not installed, the homeowner would replace their system with the same type as before – eg, if they used gas as their heating fuel, they would purchase a new gas boiler.
- 5.44. The energy required to heat standard dwelling types to a suitable level is illustrated in the spreadsheet entitled 'energy use data for heat pump calculations'. The data is shown in terms of the heat requirement of the dwellings, the amount of delivered energy needed to meet this requirement (taking into account heating system efficiency) and the delivered energy shown in EEC fuel standardised terms. The data is based on the standard dwelling types listed in the EEC Scheme Spreadsheet.
- 5.45. While the heat pump will replace most, if not all, of the energy used by the conventional heating system, it will itself use a quantity of electricity in order to operate. This electricity must be subtracted from the energy savings claimed. The efficiency of a ground source heat pump is referred to as the 'Coefficient of Performance' abbreviated as the 'CoP'. The CoP refers to the amount of useful heat, in kWh, that the pump can generate for each kWh of electricity it consumes while operating.
- 5.46. As a heat pump will usually have different efficiencies for space and water heating, an average CoP is calculated and used within the calculation. For example, a CoP of 3 for space heating and 2.4 for water heating indicates that for each kWh of electricity consumed the heat pump will generate 3kWh of space heating and 2.4 kWh of water heating. When calculating the average CoP, it is assumed that 80% of the delivered energy is for space heating and 20% is for hot water heating. The average CoP that should be used to calculate the energy savings will be:

Space heating CoP (3) multiplied by the percentage of delivered energy required for space heating (80%), which gives **2.4**

Water heating CoP (2.4) multiplied by the percentage of delivered energy required for water heating (20%), which gives **0.48**

The average CoP is therefore $2.4 + 0.48 = \mathbf{2.88}$

Lifetime

- 5.47. Evidence from the manufacturer should be provided to Ofgem to verify the lifetime of the product.

Example calculations

- 5.48. The following examples show how the energy savings would be calculated if a ground source heat pump was installed in a gas heated home, and also an electrically heated home. In both cases the dwelling type is assumed to be a three bedroom semi detached house. The first example is for a unit that is capable of providing 100% of the energy demand, and the second example is for a unit that is not capable of providing 100% of the energy demand and requires supplementary heating. A CoP of 2.88 is used in the examples.

A heat pump capable of providing 100% of the demand

- 5.49. This example is based on the assumption that the heat pump will be able to replace all of the dwelling's conventional space and hot water heating demand. In this particular example, the heat pump replaces electric storage heating.

Delivered energy to meet heat requirement (@100% efficiency): **19,877 kWh**

Fuel standardised delivered energy (multiplied by the electricity fuel standardisation factor of 0.80): **15,902 kWh**

The heat pump needs to meet 19,877 kWh heat requirement. To calculate the energy consumption of the heat pump this heat requirement should be divided by the CoP of 2.88.

Heat requirement (19,877) divided by CoP (2.88): **6,902 kWh**

Fuel standardised energy consumption of the heat pump (multiplied by the electricity fuel standardisation factor of 0.80): **5,522 kWh**

The energy savings are calculated by comparing the amount of energy that would be consumed by an electric heating system to the energy consumed by the heat pump.

The difference in this example, and therefore the energy saving is:

15,902 kWh - 5,522 kWh: **10,380 kWh per annum**

A heat pump that requires supplementary heating

- 5.50. Some heat pumps may only replace 70 - 80% of the total demand. If this is the case, then it must be assumed that the conventional system will fulfil the remainder. In this example, the heat pump can provide 80% of the space and hot water requirements. Supplementary heating will be provided by a gas boiler with the minimum combustion efficiency outlined in Approved Document L1.

Annual heat requirement with gas boiler: **16,313 kWh**

In this example, the heat pump would only be meeting 80% of the demand (**13,050 kWh**) and the remaining 20% (**3,263kWh**) would be met by the gas boiler.

The energy savings would therefore be calculated as follows:

Annual kWh heat requirement with gas boiler: **16,313 kWh**

Delivered energy to meet requirement (@78% efficiency): **20,914 kWh**

Fuel standardised delivered energy (multiplied by the gas fuel standardisation factor of 0.35): **7,320 kWh**

To calculate the electrical energy consumption of the heat pump, the proportion of the heat requirement which is being met by the heat pump should be divided by the CoP of 2.88.

Heat requirement (13,050 kWh) divided by CoP (2.88): **4,531 kWh**

Fuel standardised energy consumption by heat pump (multiplied by the electricity fuel standardisation factor of 0.8): **3,625 kWh**

Twenty percent of the demand, 3,263 kWh will still need to be met by the gas boiler. When this is divided by the efficiency of the boiler (78%), this equates to 4,183 kWh. In fuel standardised terms (multiplied by the gas fuel standardisation factor of 0.35) this equates to **1,464 kWh**.

The total energy consumption will be the energy consumption of the heat pump (3,625 kWh) plus the energy consumed by the gas boiler (1,464 kWh): **5,089 kWh**

The energy savings in this example are calculated by comparing the amount of energy that would be consumed by a gas boiler (7,320 kWh) to the energy consumed by the combination of heat pump and gas boiler (5,089 kWh).

The difference in this example, and therefore the energy saving is:

7,320 kWh - 5,089 kWh: **2,231 kWh per annum**

Best practice guidelines

- 5.51. There are three publications which provide good background information to the installation of ground source heat pumps:

Technical Note TN 18/99 Ground source heat pumps - a technology review, R H D Rawlings, BSRIA, July 1999 (ISBN 0 86022 506 2) can be obtained from <http://www.bsria.co.uk/bsriabshop/system/index.html>

Good Practice Guide 339 "Domestic Ground Source Heat Pumps: Design and installation of closed-loop systems", January 2003.

General Information Leaflet 72 "Heat pumps in the UK - a monitoring report", March 2000.

6. Energy Efficient Appliances

Cold and wet appliances

Attribution of improvement in energy efficiency

- 6.1. This section covers the energy savings, lifetimes, specific requirements and best practice guidelines associated with the promotion of cold appliances (eg, fridges, freezers) and wet appliances (eg, dishwashers, washing machines). There are several different ways in which suppliers can deliver appliances and the energy savings associated with the measures are dependant upon the type of appliance as well as the way in which it is delivered to the consumer. In addition, the supplier has the option of claiming average energy savings, which are model-weighted based upon historical retail trends, or model specific savings, which are based upon the energy consumption of the specific model.
- 6.2. The remainder of this section provides details on the different calculation methodologies and specific requirements associated with different delivery mechanisms. The first subsection covers the delivery of cold and wet appliances through incentive and trade-in routes and the second subsection covers fridgesaver schemes.
- 6.3. The energy savings for appliance schemes should be entered in the 'cold/wet appliance' section on the electricity worksheet of the EEC Scheme Spreadsheet. The supplier also has to enter the lifetime of the measure and this is dependant upon how the appliance is being delivered and the Priority eligibility of the consumer. Further information on the calculated average energy savings and appliance lifetimes is included within this section.
- 6.4. When setting the overall energy efficiency target, Defra included an uplift factor of 1.6 for A-rated cold and wet appliances in their illustrative mix of measures. To ensure consistency with the target setting model, this factor is automatically incorporated into the calculations within the EEC Scheme Spreadsheet.

Cold and wet appliance incentive and trade-in schemes

- 6.5. There are two principal delivery mechanisms for cold and wet appliances:
- an incentive to purchase a more efficient appliance, and
 - a trade-in of a working appliance.
- 6.6. Consumers in the market for a new appliance normally buy the average product in terms of the energy consumption detailed on the European Community energy label. In incentive schemes the supplier incentivises the consumer to purchase a more efficient appliance than they would have otherwise purchased. Savings for incentive schemes are the difference between the sales-weighted average energy consumption for the particular type of appliance and the energy consumption of the promoted appliance.
- 6.7. Under trade-in schemes, consumers are able to trade in a working appliance for a more efficient appliance. To qualify, the appliance is assumed to be working at the time of trade-in and then be destroyed (in an environmentally acceptable manner as set out in 6.23 to 6.25) to avoid entry into the second hand market.
- 6.8. In trade-in schemes, there is a two-fold saving - firstly, by removing the existing, inefficient appliance from the market, the consumption over the remainder of the product life is avoided; and secondly, a more efficient appliance is purchased than would normally be the case. The energy savings accredited to trade-in appliances are the difference between the existing stock-weighted average energy consumption and the energy consumption of the promoted appliance applied for two thirds of the appliance lifetime. This is to reflect the fact that the supplier has persuaded the consumer to purchase a new appliance prematurely, after two thirds of the lifetime of their existing appliance.

Calculation of annual average energy savings

- 6.9. The shaded columns in Table 5 show the average annual energy savings for cold and wet appliance trade-in and incentive schemes. The figures are based on average A-rated appliance energy consumption, average sales-weighted energy consumption and the existing stock-weighted average energy consumption.

Table 5: Average energy consumption and savings (kWh/a) by appliance and energy label

	Annual energy consumption (kWh)			Annual energy savings (kWh)	
	'A' rated	Sales weighted average	Existing appliances	Incentive	Trade-in
Fridge Freezer (Standard)	259	438	785	179	526
Fridge Freezer (Frost Free)	295	516		221	490
Chest Freezer	150	306	559	156	409
Upright Freezer	193	353	594	160	401
Refrigerator (Icebox)	138	214	390	76	252
Refrigerator (Larder)	127	227		100	263
Washing Machine	165	210	237	45	72
Dishwasher (full size)	228	297	415	69	187
Dishwasher (slim line)	176	233	N/A	57	-
Dishwasher (tabletop)	140*	244		104	-

Source: GfK Q4 2001 sales data for the average 'A' rating and sales weighted average; DEFRA Market Transformation Programme website 2002.

Existing appliances assume a new appliance was purchased in 1990 (Lower Carbon Futures, Environmental Change Institute, Oxford, 2000)

*Currently only one A rated model available.

Calculation of annual model-specific energy savings for cold appliances

- 6.10. If a supplier wishes to claim energy savings on a model-by-model basis, information on the actual energy consumption for each specific model within a scheme will be required. This information can be obtained from the manufacturer and will also be detailed on the European Community energy label for the appliance. For cold appliances, the energy consumption will be in kWh/a.
- 6.11. To calculate the energy savings for an incentive cold appliance, the annual energy consumption of the specific model should be subtracted from the sales-weighted average annual energy consumption detailed in table 5.

Model-specific incentive-scheme example calculation

- 6.12. An A-rated frost free fridge freezer has an annual energy consumption of **295 kWh**

From table 4, the sales-weighted average energy consumption for a frost-free fridge freezer is **516kWh**

The energy saving will be the difference between these two figures:

516 kWh - 295 kWh =

221 kWh per annum

The savings figure to be entered into the EEC Scheme Spreadsheet will therefore be 221kWh/a. The 1.6 uplift factor will automatically be applied to this figure.

Model-specific trade-in scheme example calculation

6.13. To calculate the energy savings for a trade-in cold appliance, the annual energy consumption of the specific model should be subtracted from the existing stock-weighted average energy consumption for the type of appliance, for two thirds of the appliance lifetime.

6.14. An A-rated frost free fridge freezer has an annual energy consumption of **295 kWh**

From table 5, the existing stock-weighted average energy consumption for a frost-free fridge freezer is **785kWh**

The energy saving will be the difference between these two figures:

785 kWh - 295 kWh =

490 kWh per annum

This energy saving is claimed for two thirds of the appliance lifetime, which have been calculated and are detailed in table 5. In this example, the savings figure to be entered into the EEC Scheme Spreadsheet will therefore be 490kWh/a with a lifetime of 10 years. The 1.6 uplift factor will automatically be applied to this figure.

Calculation of annual model-specific energy savings for wet appliances

6.15. A different methodology is used to calculate the energy savings for wet appliances on a model-by-model basis as energy consumption data for wet appliances is on a 'per cycle' basis as opposed to an annual figure. The methodology for both washing machines and dishwashers is in accordance with guidance issued by the Environmental Change Institute (ECI). All usage figures are based on results of the ECI's Domestic Equipment and Carbon Dioxide Emissions (DECADE) model, Run 5.

Washing machines

6.16. When calculating the energy savings for washing machines, two issues have to be taken into consideration:

- there are three main wash temperatures: 40°C, 60°C and 90°C,
- many washing machines are attached to the hot water supply and so will require a lower energy input to reach the required wash temperature. For the purposes of calculating energy savings for the EEC, the assumptions made are in line with those used by the ECI. It is assumed that 83% of machines are attached to a hot water supply and no hot water is taken in by the machine for 40°C washes.

6.17. To calculate the energy savings for washing machines, suppliers should first obtain the energy consumption per 60°C cycle from the manufacturer. This should then be multiplied by the relevant scaling factors and the annual number of uses to calculate the annual energy consumption for 40°C, 60°C and 90°C washes. Table 6 includes a full list of the relevant scaling factors and annual number of uses for the different wash temperatures. The total annual energy consumption of the washing machine will be the sum of these three figures. To calculate the annual energy saving, this figure should then be subtracted from either the sales-weighted average energy consumption for incentive savings or the stock-weighted average energy consumption for trade-in savings.

Table 6: Annual usage figures and scaling factors

Wash temperature (°C)	Number of washes a year	Temperature scaling factor	Hot water supply scaling factor
40	179	0.6	1
60	89	1	0.7
90	6	1.67	0.7

Model specific incentive washing machine example calculation

The supplier's scheme provides a washing machine with a manufacturers' claimed energy consumption of **0.95 kWh/cycle at 60°C**

To calculate the annual energy consumption of the washing machine for 40°C cycles, the energy consumption at 60°C must be multiplied by the annual number of 40°C washes (179), the temperature scaling factor (0.6) and the hot water supply scaling factor (1).

Annual energy consumption for 40°C cycle: $0.95 \text{ kWh/cycle} \times 179 \times 0.6 \times 1 =$

102.03 kWh/a

This calculation should then be repeated for 60°C and 90°C washes.

Annual energy consumption for 60°C cycle: $0.95 \times 89 \times 1 \times 0.7 =$ **59.185 kWh/a**

Annual energy consumption for 90°C cycle: $0.95 \times 6 \times 1.67 \times 0.7 =$ **6.663 kWh/a**

The total annual energy consumption of the model will equal the sum of these three figures.

Total annual energy consumption: $102.03 + 59.185 + 6.663 =$ **168 kWh/a**

To calculate the energy savings for an incentive scheme, the total annual energy consumption of the model should be subtracted from the sales-weighted average energy consumption.

From table 5, the sales-weighted average energy consumption for a washing machine is **210kWh/a**

The energy saving will be the difference between these two figures:

$210 \text{ kWh/a} - 168 \text{ kWh/a} =$ **42**

kWh/a

The savings figure to be entered into the EEC Scheme Spreadsheet will therefore be 42kWh/a. The 1.6 uplift factor will automatically be applied to this figure.

Model specific trade-in washing machine example calculation

To calculate the energy savings for a trade-in scheme, the total annual energy consumption of the model should be subtracted from the existing stock-weighted average energy consumption.

From table 5, the sales-weighted average energy consumption for a washing machine is **237kWh/a**

The energy saving will be the difference between these two figures:

$237 \text{ kWh/a} - 168 \text{ kWh/a} =$ **69**

kWh/a

The savings figure to be entered into the EEC Scheme Spreadsheet will therefore be 69kWh/a. The 1.6 uplift factor will automatically be applied to this figure.

Dishwashers

- 6.18. In a similar manner to washing machines, different wash temperatures must also be taken into account when calculating the energy savings for dishwashers on a model specific basis. These are 55°C and 65°C.
- 6.19. To calculate the energy savings for dishwashers, suppliers should first obtain the energy consumption per 65°C cycle from the manufacturer. This should then be multiplied by the relevant temperature scaling factor and the annual number of uses to calculate the annual energy consumption for 55°C and 65°C washes. Table 7 lists the relevant scaling factors and annual number of uses for the two wash temperatures. The total annual energy consumption of the dishwasher will be the sum of these two energy consumption figures. To calculate the annual energy saving, this figure should then be subtracted from either the sales-weighted average energy consumption for incentive savings or the existing stock-weighted average energy consumption for trade-in savings.

Table 7: Annual usage figures and scaling factors

Wash temperature (°C)	Number of washes a year	Temperature scaling factor
55	93	0.7
65	157	1

Model specific incentive dishwasher example calculation

The supplier's scheme provides a dishwasher with a manufacturers' claimed energy consumption of **1.24 kWh/cycle at 65°C**

To calculate the annual energy consumption of the dishwasher for 55°C cycles, the energy consumption at 65°C must be multiplied by the annual number of 55°C washes (93) and the temperature scaling factor (0.7).

Annual energy consumption for 55°C cycle: $1.24 \text{ kWh/cycle} \times 93 \times 0.7 =$

80.724 kWh/a

This calculation should then be repeated for the 65°C wash.

Annual energy consumption for 65°C cycle: $1.24 \times 157 \times 1 =$ **194.68 kWh/a**

The total annual energy consumption of the model will equal the sum of these two figures.

Total annual energy consumption: $80.724 + 194.68 =$ **275.404 kWh/a**

To calculate the energy savings for an incentive scheme, the total annual energy consumption of the model should be subtracted from the sales-weighted average energy consumption.

From table 5, the sales-weighted average energy consumption for a full size dishwasher is **297kWh/a**

The energy saving will be the difference between these two figures:

$297 \text{ kWh/a} - 275 \text{ kWh/a} =$ **22**

kWh/a

The savings figure to be entered into the EEC Scheme Spreadsheet will therefore be 22kWh/a. The 1.6 uplift factor will automatically be applied to this figure.

Model specific trade-in dishwasher example calculation

To calculate the energy savings for a trade-in scheme, the total annual energy consumption of the model should be subtracted from the existing stock-weighted average energy consumption.

From table 5, the sales-weighted average energy consumption for a full size dishwasher is **415kWh/a**

The energy saving will be the difference between these two figures:

$415 \text{ kWh/a} - 275 \text{ kWh/a} =$ **140**

kWh/a

The savings figure to be entered into the EEC Scheme Spreadsheet will therefore be 140kWh/a. The 1.6 uplift factor will automatically be applied to this figure.

Lifetime

6.20. The lifetime that can be claimed for appliances is dependant upon the type of measure, the type of promotion (incentive or trade-in) and whether the householder is in the Priority group. Table 8 shows the lifetimes that should be entered onto the EEC Scheme Spreadsheet.

Table 8: Measure lifetime (years) by scheme and customer type

	Appliance Type		
	Freezers and Fridge Freezers	Refrigerators and Larders	Washing Machines and Dishwashers
Incentive Scheme			
Non-priority lifetime	15	12	15
Priority Lifetime	15	15	15
Trade-in scheme			
Non-priority lifetime	10	8	10
Priority Lifetime	10	10	10
Fridgesaver scheme			
Priority Lifetime	15	15	-

Technical standards or specific requirements for incentive or trade-in schemes

- 6.21. All cold and wet appliances delivered before the 1st July 2004 must be at least A-rated and must also have achieved Energy Efficiency Recommended (EER) status, awarded by the EST's endorsement programme. A list of EER appliances can be viewed on the EST's website at <http://www.saveenergy.co.uk>. Energy suppliers should contact the EST if further details of the endorsement programme are required or if an appliance they wish to use in a scheme does not appear on the EST's website. The EER application process for new appliances is straightforward and qualifying products that have not yet applied can quickly and easily do so, providing they meet the required standards.
- 6.22. On the 1st July 2004, the EST will tighten the EER classification to A+ rated for cold appliances and AAA for washing machines. There will be no reclassification of dishwashers. All cold appliances and washing machines delivered on or after the 1st July 2004 must be at least A-rated, but do not have to be EER. Dishwashers should continue to be at least A-rated and EER.
- 6.23. To claim trade-in savings for a cold or wet appliance, the supplier should ensure that the old appliance is suitably disabled or removed from the consumer's property. Due to new European legislation concerning ozone depleting substances and their

disposal, appliance retailers or delivery agents may no longer remove the old cold appliance when delivering the new one.

- 6.24. If the supplier, or their partner, is unable to dispose of the appliance it will have to remain with the consumer. There is considerable risk of these appliances entering the second hand market, even when collected by a Local Authority. To ensure that this does not happen the appliance must be disabled by the following method:
- the appliance's electricity supply cable must be cut, as close to the body of the appliance as possible, or alternatively pulled out of the appliance;
 - the gasket (the seal running around the door) must be removed. As this may mean that the door cannot close, the door should be taped or tied shut.
- 6.25. Despite the legislation, Local Authorities will still have a responsibility to remove domestic appliances from consumers' homes. The energy supplier should provide the consumer with the relevant contact details.

Fridgesaver schemes

- 6.26. Fridgesaver schemes operate in a similar vein to trade-in schemes, through which Priority group consumers trade-in an inefficient cold appliance for an A-rated model. The energy savings which can be claimed for Fridgesaver measures are considerably higher than those for standard trade-in schemes. This is because the householder's existing cold appliance must be in a suitably bad condition to be eligible for the scheme. The condition of the appliance is assessed by a standard scoring system, which is illustrated in Table 8. The fridge or fridge-freezer must score three points or above on the protocol.

Annual energy savings

- 6.27. Fridgesaver energy savings can be claimed for A-rated refrigerators and fridge-freezers only. The energy savings accredited are the difference between the energy consumption of the specific model provided to the consumer (to which a factor of 0.71875) has been applied, and the energy consumption of either a fridge or fridge-freezer which would meet the scoring protocol requirements.
- 6.28. The 0.71875 adjustment factor is based upon the results of EESoP 1 and 2 energy monitoring, which showed that the eligible consumers used their fridge or fridge-freezer less (in terms of opening and closing the appliance door, etc.). The

adjustment factor is applied to reduce the energy consumption of the replacement appliance in line with the research. The monitoring also concluded that the

- energy consumption of a standard fridge-freezer which would meet the fridgesavers protocol is **983 kWh/a**
- and, the energy consumption of a refrigerator which would meet the fridgesavers protocol is **603 kWh/a**

Table 9: Fridgesavers scoring protocol system

Fridge Freezers	Score
Fridge compartment	
Door	
Minor damage to seal	1
Major damage to seal	2
Door not closing properly	2
Internal damage	1
External damage	1
Body (walls excluding door)	
External damage	1
Internal damage	1
Thermostat not working/missing/damaged	1
Fittings damaged/missing (e.g. shelves/vegetable box)	1
Icing up	1
Freezer compartment	
Door	
Minor damage to seal	1
Major damage to seal	2
Door not closing properly	2
Internal damage	1
External damage	1
Body	
External damage	1
Internal damage	1
Refrigerators	Score
Door	
Minor damage to seal	1
Major damage to seal	2
Door not closing properly	2
Internal damage	1
External damage	1
Body (walls excluding door)	
External damage	1
Internal damage	1
Thermostat not working/missing/damaged	1
Fittings damaged/missing (e.g. shelves / vegetable box)	1
Icing up	1
Icebox	

Icebox door missing	3
Icebox door does not close	2
Icebox door has crack / hole	2

Example calculation

- 6.29. The supplier's scheme provides a fridge-freezer with a manufacturer's claimed energy consumption of **250 kWh/a**

The annual consumption should be multiplied by the fridgesaver factor (0.71875) to calculate the adjusted energy consumption.

$$250\text{kWh/a} \times 0.71875 = \mathbf{179.68\text{ kWh/a}}$$

The energy consumption of a standard fridge-freezer which would score at least three points on the fridgesavers protocol is **983 kWh/a**

The annual energy saving will be the difference between these two figures:

$$983\text{ kWh/a} - 179.68\text{ kWh/a} = \mathbf{803.32}$$

kWh/a

In this example, the savings figure to be entered into the EEC Scheme Spreadsheet will therefore be 803kWh/a. The 1.6 uplift factor will automatically be applied to this figure.

Lifetime

- 6.30. The lifetime that can be claimed for the measure is dependant upon the type of measure. Table 8 shows the lifetimes that should be entered onto the EEC Scheme Spreadsheet.

Technical standards or specific requirements for Fridgesaver schemes

- 6.31. To claim fridgesaver appliance savings for a measure, a supplier must ensure that the old appliance scores 3 or more on the fridgesaver protocol illustrated in Table 9.
- 6.32. The fridge and fridge freezer models provided as part of a fridgesaver scheme must be A-rated and EST Energy Efficiency Recommended (EER) in accordance with trade-in and incentive schemes as outlined in points 6.21 and 6.22.
- 6.33. The appliances must also be disabled or removed from the consumer's home in accordance with trade-in schemes as outlined in points 6.23 to 6.25.

Jug Kettles

Attribution of improvement in energy efficiency

Annual energy savings

6.34. The energy savings derived from the provision of a jug kettle have been calculated as the result of energy monitoring carried out under EESoP I. The result of this monitoring has shown the saving to be 71.9 kWh per annum, if the following criteria are followed:

- The customers targeted should fall within the priority group or be a pensioner.
- The jug kettle must replace a traditional electric kettle (i.e. a kettle that does not have a water meter on the side)
- Advice on the use of the new kettle should be provided (e.g. that the kettle can be used for boiling just one cup of water)

6.35. The Defra factor of 1.6 as used for cold and wet appliances does not apply to jug kettles.

Lifetime

6.36. A lifetime of 8 years should be assumed for kettles.

Technical standards or specific requirements

6.37. To be accredited with energy savings for jug kettles, the supplier must ensure that a traditional electric kettle is surrendered for each measure claimed.

7. Combined heat and power (CHP)

- 7.1. Ofgem has provided a separate spreadsheet for the calculation of the energy savings arising from the installation of CHP systems, which includes instructions to explain the methodology used.
- 7.2. Opportunities for EEC CHP schemes are likely to arise as a result of the government funded Community Energy Programme. Where a supplier is providing EEC funding for a CHP scheme that will also be funded by the Community Energy Programme, a different methodology for calculating and apportioning the resultant energy savings should be used. Further guidance on this methodology is provided within the “Energy Efficiency Commitment Administration Procedures”. The latest version of this document can be viewed on the Ofgem website – www.ofgem.gov.uk – by selecting Energy Efficiency from the ‘Ofgem’s work’ section.
- 7.3. Further details on the Community Energy Programme can be found at <http://www.est.co.uk/communityenergy/index.cfm>.

8. Fuel switching

Attribution of improvement in energy efficiency

- 8.1. The 'EEC Administration Procedures Issue 2' includes a number of principles which are considered when determining whether an activity has led to an improvement in energy efficiency. For fuel switching schemes, a number of specific principles apply in order for the appropriate improvement in energy efficiency to be demonstrated. This chapter defines fuel switching activity, describes the four different scenarios through which fuel switching may be delivered and outlines the specific principles to be demonstrated by the supplier.
- 8.2. Suppliers may claim energy savings where their funding allows domestic consumers to switch the fuel type of their heating system. Fuel switching activity relates to the switching of the primary heating fuel and would not include a property which had an open fire in one room with gas-fired central heating in all other rooms.
- 8.3. Some properties have multiple sources of heating and it may be more difficult to identify the primary heating fuel in such cases. For the purposes of EEC accreditation, the primary fuel is the fuel used to heat zone 1 of the property, which is considered to be the lounge or living room. For example, if a house had a gas focal point fire in the living room and electric panel heating in the bedrooms, it would be considered to be a gas heated home. If a house had both a focal point fire (using any fuel) and an electric storage heater in zone 1, it would be considered to be an electrically heated home.
- 8.4. In the majority of cases, fuel switching will involve switching from coal or electricity to gas although switching to LPG may also occur. Coal and electric heating systems can be covered in three broad categories:
 - electric storage heating,
 - other electric systems, and
 - coal wet systems.
- 8.5. For all electric heating systems it is assumed that the whole system needs replacing. Whilst, there are examples of wet based electrical systems, these are very rare. If a

supplier is fuel switching from a wet electric system, it will need to specify whether the whole system requires replacing.

- 8.6. Coal-fired systems are based on a wet system and are likely to be old and contain too much water for a new gas-fired boiler. It is therefore likely that the whole system would need replacing. In addition, most coal-fired systems are gravity fed and may pose problems in terms of compliance with Approved Document L1. If a supplier intends to carry out a scheme where the whole coal system does not need replacing it must inform Ofgem and give full reasoning.

Types of fuel switching scheme

- 8.7. There are four scenarios in which energy savings could arise as a result of fuel switching.

Preventing like-for-like replacements (Scenario 1)

- 8.8. When replacing heating systems many Social Housing Providers (SHP) operate a system of replacing like-for-like. The cost associated with such schemes is high, but not as high as replacing, for instance, an electric system with a gas-fired system. If a supplier ties in with a SHP preventing the like-for-like replacement and providing financial assistance to allow the social landlord to replace electric heating with gas-fired heating, there is clear additionality. In this case, the supplier can be accredited with all the measures installed.
- 8.9. At scheme submission the supplier should indicate the percentage cost contribution to the marginal cost of the fuel switch. If a scheme covers activity with multiple SHPs, all with different cost contributions, the minimum percentage cost contribution to the marginal cost of the fuel switch should be given. This information should be detailed on the EEC Scheme Spreadsheet. The usual SHP declaration will be required to confirm additionality at scheme completion or banking of savings.

Partnership with SHPs in a fuel switching only scheme (Scenario 2)

- 8.10. Where a SHP is looking to extend its programme of providing fuel switching to gas-fired central heating to its residents, requiring the installation of a boiler and radiators, additionality is difficult to demonstrate. The cost effectiveness of the measure suggests that the supplier would require the housing provider to pay the majority of the cost of the installation.

8.11. If suppliers wish to tie in with a SHP fuel switching scheme they must ensure that they demonstrate additionality in the work that they carry out. Ofgem has already expressed to suppliers that it does not consider it likely that this type of work could be carried out cost effectively and consequently is very concerned about the additionality levels suppliers could demonstrate for this type of scheme. If a supplier plans to carry out any of this type of work it must be submitted on an individual SHP basis. At the scheme submission stage, the supplier is required to indicate the full financial cost of the project and the contribution the supplier would be making to the work. In addition, the SHP should provide full written details of the proposed work including a breakdown of the additional work that the supplier funding will lead to. This information would need to be verified at scheme completion.

Fuel switching as part of larger energy efficiency schemes with SHPs (Scenario 3)

8.12. This scenario involves fuel switching work being carried out as part of a larger energy efficiency programme with one or several SHPs. For this scenario, the energy savings arising from the fuel switching measures must not account for more than 20% of the overall energy savings of the scheme. If a scheme will involve multiple SHPs, the 20% fuel switching applies to each SHP and not just the scheme overall. This does not mean to say that fuel switching must be limited to 20% of the savings resulting from measures installed with each SHP. If a supplier does wish to undertake work with SHPs where fuel switching measures will account for more than 20% of the energy savings, there are two options available:

- If the fuel switching savings are likely to account for the minority of the savings from work with a SHP, but this proportion is higher than 20%, it may be appropriate to increase the threshold. The supplier should demonstrate why in this case. It might, for instance, have a programme of work with a LA that could include like-for-like replacement systems and insulation.
- If the fuel switching savings are likely to account for a considerably higher proportion, the measures can be split between two different schemes. Effectively, a separate scheme should be submitted for the fuel switching measures and the additional insulation, heating and/or lighting measures should be claimed under an existing SHP scheme.

8.13. Suppliers must keep clear records of their activity with each SHP so that the level of fuel switching activity with each SHP could be verified if the scheme was audited.

Additionality in these schemes should be demonstrated through the use of the standard SHP pro forma.

Fuel switching in private households (Scenario 4)

- 8.14. This scenario involves suppliers installing fuel switching measures in private households. To demonstrate clear additionality, the supplier should fully detail their marketing and promotion plans at scheme submission. Ofgem will also require suppliers to carry out customer satisfaction monitoring on all recipients. This survey should ask whether the household would have carried out this measure without the suppliers input.

Annual energy savings

- 8.15. The energy savings derived for fuel switching are based on the comparison between the energy consumption of the existing heating system and the replacement system, in fuel standardised terms. The EEC scheme spreadsheet should be used to calculate the energy savings for a scheme. The number of measures for each type of fuel switch should be entered on the fuel switching worksheet. These values then automatically link to the appropriate worksheet, where the supplier should enter information on the supplier, customer and other party percentage cost contribution.
- 8.16. The energy savings within the spreadsheet are based upon a D-rated replacement boiler. If a supplier wishes to install an A or B rated boiler, intelligent heating controls or TRVs, these should be claimed as separate measures using the relevant heating worksheet.

Partial Heating

- 8.17. In situations where the property is only partially heated, different energy savings should be claimed. These savings are also included in the EEC scheme spreadsheet, in the focal-point sections on the fuel switching worksheet. Calculations by the EST for Ofgem have demonstrated that partial heating that involves heating in the living area, the kitchen and the downstairs hall could use almost as much energy as a full heating system. Therefore, where there is a central heating system (including storage heater systems) even if it does not heat the whole house the supplier will be accredited with the full energy saving. Focal point savings should be claimed only for properties that either have no formal heating system or are reliant on focal point fires.

- 8.18. The energy savings derived for fuel switching in a partially heated house are based on the comparison between 75% of the energy consumption of the existing heating system and 75% of the energy consumption of the replacement system, in fuel standardised terms. Data presented in 'UK Energy Sector Indicators 2001' – DTI suggest that roughly 80% of households have gas central heating, 10% of the remainder have coal, oil, or electric central heating and the remaining 10% are unclassified. Ofgem is concerned about the fuel use in this third category and it is highly possible that some of the remainder will be using focal point fires. It is likely that the fuel consumption in these properties will be less than the full BREDEM figures. Therefore it is appropriate to accredit suppliers with reduced energy savings for fuel switching carried out in a property that relies on focal point fires for heating.
- 8.19. It is acknowledged that requiring this level of detail increases the bureaucracy of these schemes. It is therefore proposed to closely monitor this activity and if it occurs at a very low level, because for instance most of this work is carried out by Warm Front and the devolved equivalents, then it might be appropriate to drop this level of reporting. Suppliers therefore carrying out fuel switching schemes must submit a banking report for their scheme on 28th February 2004.
- 8.20. To ensure energy savings are accredited suppliers, and especially their contractors, are required to fill in the data truthfully. It will therefore be important for suppliers to maintain a record of the survey carried out on the house so that it can be checked if the scheme is audited.

Lifetime

- 8.21. A lifetime of 15 years is assumed for fuel switching.

Technical standards or specific requirements

- 8.22. All heating measures installed as part of fuel switching schemes must be compliant with the Building Regulations 2000. Boilers and heating control measures should fulfil the technical standards or specific requirements outlined in points 5.8 to 5.10 and 5.24 to 5.26.
- 8.23. Several British Standards also apply:

BS 5440 Part 1: 2000 “Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd and 3rd family gases). Specification for installation and maintenance of flues”.

BS 5440 Part 2: 2000 “Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd and 3rd family gases). Specification for installation and maintenance of ventilation for gas appliances”.

BS 6798: 2000 “Specification for installation of gas-fired boilers of rated input not exceeding 70kW net”.

BS 5449: 1990 “Specification for forced circulation hot water central heating systems for domestic premises”.

BS 7671: 2001 “Requirements for electrical installations, IEE wiring regulations, 16th Edition”.

- 8.24. In addition, any heating control measures must be installed in line with **BS 7671: 2001** “Requirements for electrical installations, IEE wiring regulations, 16th Edition” and **BS 5449: 1990** “Specification for forced circulation hot water central heating systems for domestic purposes”.

Best Practice Guidelines

Good Practice Guide 284 “Domestic central heating and hot water: systems with gas and oil-fired boilers” (2000) is a good overall reference for gas and oil systems.

Good Practice Guide 302 “Controls for domestic central heating and hot water – guidance for specifiers and installers” (September 2001) is a useful reference point for information of the different types of controls available, including descriptions of more-advanced functions.

9. New or innovative measures

- 9.1. Suppliers are encouraged to develop schemes involving new or innovative measures that do not currently have an EEC score. Where a supplier wishes to adopt a new or innovative measure, Ofgem requires the supplier to provide independent verification of the energy savings. The procedure is outlined in Appendix 3 of this document.

10. Energy service action

- 10.1. The Order provides for attribution of improvements in energy efficiency on a different basis in the case of “energy services action”. Further information about energy services actions can be found in the ‘Energy Efficiency Commitment Administration Procedures Issue 2’ which can be viewed on the Ofgem website – www.ofgem.gov.uk – by selecting Energy Efficiency from the ‘Ofgem’s work’ section.
- 10.2. Where suppliers undertake energy service actions, the qualifying action making up that energy service action will be accredited with an additional 50% of energy savings. The EEC Scheme Spreadsheet includes functionality that allows a supplier to classify measures as energy services activity and choose whether or not to apply the 50% uplift to the savings.
- 10.3. If a supplier wishes to carry out energy service action, they must ensure that the relevant spreadsheet type has been selected on the scheme summary worksheet. An "Energy Services with Uplift" scheme spreadsheet will automatically apply the 50% uplift, but the scheme savings must not exceed 10% of a supplier group's target. If a supplier wishes to submit an energy services scheme which will exceed 10% of a supplier group's target then the scheme must be submitted on two different spreadsheets, one for the "Energy Services with Uplift" element and one for the "Energy Services without Uplift" element.
- 10.4. It is strongly advisable for all energy services schemes to separate the energy services activity on to two spreadsheets, one for "Energy Services with Uplift" and one for "Energy Services without Uplift". If a supplier has completed energy services work equal to 10% of their supplier group target, the supplier group will be accredited with the full uplift in savings regardless of whether the scheme was submitted on an “Energy Services with Uplift” or “Energy Services without Uplift” spreadsheet.

Best practice guidelines

- 10.5. To be included in the definition of energy service action, the relevant action must be undertaken in pursuance of an agreement between a supplier (or a person acting on its behalf) and a domestic consumer, the terms of which require the supplier to undertake an assessment of the energy efficiency of the consumer’s property and the provision of advice based upon this assessment. An example of the kind of

questionnaire that could be used to fulfil this requirement is shown in Appendix 4 of this document.

Appendix 1 BRE Report - 'Energy Efficiency

Commitment: BREDEM calculation of energy saving matrix' (October 2001)

Executive Summary

The 'Energy Efficiency Commitment' scheme (EEC), to be introduced in 2002, will build on the achievements of the present 'Standards of Performance Energy Efficiency 2000-2002' scheme for promoting and funding energy efficiency in domestic dwellings. As for the Standards of Performance 2000-2002 scheme, the Energy Supply Licence obligations for EEC will allow electricity and gas energy efficiency measures, and also energy efficiency improvements for oil and coal heated dwellings.

- For the purposes of advising DEFRA in setting target energy savings, the Energy Saving Trust requires information about the energy savings resulting from a range of energy efficiency measures, for a variety of dwelling types.
- BRE has provided and updated this information for past schemes using the BRE Domestic Energy Model (BREDEM), which is uniquely suited to this type of application. The energy savings for various measures and house types have been tabulated and presented in the form of a matrix.
- This report describes background information to the calculations, and the various assumptions that have been made. The energy savings are given for eight typical dwelling types. Each dwelling type is tabulated for a number of different floor areas, notionally related to the number of bedrooms. The 'base parameters' for the calculations (e.g. amount of insulation, heating controls, etc.) are for a typical existing dwelling, and are drawn from extensive survey data which BRE has access to.
- The results are consistent with the previous matrix (Feb 2000), and incorporate three recent developments: (1) Cavity wall insulation savings are calculated for a cavity width of 65mm (previously 50mm). (2) Loft

insulation saving results have been extended to include an additional depth category, 250mm. (3) The boiler efficiency used for gas central heating is an estimate of the average of the current stock, which recent work has indicated as 69%. (The BREDEM calculations include a penalty for a proportion of the stock not having a boiler interlock, and use a value of 67%). In the previous Standards of Performance scheme the efficiency assumed was that predicted for 2010 of 75%.

- The matrix of these energy savings is presented in Annexe 3. Many parameters affect energy savings, so, in general, the parameters selected for tabulation are among those which have the most significant effect on the energy saved, given the assumptions made.
- These various assumptions, about the dwelling type, size, level of insulation, heating type, and other parameters used in the BREDEM calculation, must be kept in mind when using the values in the matrix. The savings in the matrix are typical for the situations described, but may be very different for situations which differ significantly from the assumptions made.

1.Introduction

The 'Standards of Performance for Energy Efficiency' scheme in the UK, now called the 'Energy Efficiency Commitment' (EEC), requires Energy Suppliers to fund energy efficiency schemes. To enable targets to be set, and individual projects to be evaluated, information about typical energy savings from a range of energy efficiency measures, for a variety of domestic dwelling types and constructions is required. This is provided in this report.

BRE has provided and updated this information for previous Standards of Performance schemes, most recently in February 2000 for 'Standards of Performance 2000-2002'. The BRE Domestic Energy Model, BREDEM, was used to calculate the energy consumption, and hence savings. A matrix was developed which tabulated the savings resulting from a range of energy efficiency measures, for a variety of typical domestic dwellings.

BREDEM is a well established and thoroughly verified model which has been developed and tested by BRE over the past 16 years, and is uniquely suited to this type of requirement. The new 'Energy Efficiency Commitment' requires similar information to that provided for the previous schemes. As for 'Standards of Performance 2000-2002', 'Energy Efficiency Commitment' obligations will allow electricity and gas energy efficiency measures to be implemented, and also energy efficiency improvements for oil and coal heated dwellings. As a result, the information in the matrix shows the savings resulting from energy efficiency measures related to electric, gas, oil and coal heated dwellings.

The results in the matrix for gas and electrically heated homes are consistent with those for 'Standards of Performance 2000-2002', and incorporate the following three developments.

Recent data indicates 65mm as an appropriate value for a typical cavity width in these calculations. Cavity wall insulation energy savings have therefore been calculated using 65mm cavity width. (This replaces the calculations based on 50mm in the previous report)

A loft insulation depth of 250mm is gaining acceptance in terms of cost effectiveness; for example, this depth will be necessary to meet the proposed

Elemental Method U-values in the draft Part L of the Building Regulations . Following this development, loft insulation results now include savings for installations to 250mm.

Calculations for gas central heating are based on a boiler efficiency which is an estimate of the average of the existing stock, of 69%. (The BREDEM calculations include a penalty for the proportion of the stock which does not have a boiler interlock, and as a result, a value of 67% is used in the calculations). In the previous Standards of Performance scheme an efficiency of 75% was used, representing the estimated efficiency in 2010.

2. Description of the project

2.1 *Aim*

The aim of this work is to indicate the delivered energy savings associated with a range of typical energy efficiency measures for various typical dwelling types and sizes.

The energy savings are presented as a matrix of measures, dwelling types and sizes, taking account of factors which have a significant effect on the energy saved. Factors which have smaller effects on the amount of the delivered energy saved are generally not tabulated in the matrix.

2.2 *Base Parameters*

2.2.1 *Dwelling Types*

The energy savings are based on the following eight dwelling types. These cover the main dwelling types found in Great Britain, which is the area relevant to the Energy Efficiency Commitment scheme.

Flat with 3 external walls	Semi-detached bungalow
Flat with 2 external walls	Detached bungalow
Mid-terrace house	Semi-detached house
End-terrace house	Detached house

BRE has developed drawings of typical dwellings of these types, and the dimensions of the external walls, roof, floor, windows and doors are used in the BREDEM calculations. For each dwelling type, the energy savings are calculated for the 'base case' floor areas from the drawings. These are then adjusted in the ratio of the floor areas to give savings for other dwelling sizes. The effect of top, mid and ground-floor flats has also been considered, and this is discussed in Annex 1.

The base parameters for the calculations are those for a typical existing dwelling, unless otherwise stated or required by the calculation. These parameters include the following, and were chosen on the basis of extensive survey data which BRE has access to.

2.2.2 Insulation levels

- Roof insulation U-value 0.25 (150mm insulation depth)
- Wall insulation U-value 1.5 (unfilled cavity wall pre-1976)
- Single glazed wooden frame windows with draught-stripping on all external doors and windows

2.2.3 Heating systems (see Annexe 2 for further detail)

(a) Gas and oil central heating

- Hot water heated from the boiler in a separate tank.
- Boiler efficiency of 69% assumed for gas central heating. For the BREDEM calculations a penalty for a proportion of the stock not having boiler interlock is included, and a value of 67% is used.
- Boiler efficiency of 77% assumed for oil central heating, with a penalty for no interlock reducing this to 76%.
- Boiler with radiators, room thermostat control and boiler interlock. (Boiler interlock turns the boiler off when there is no demand for heat).
- Cylinder thermostat present, primary pipework not insulated.

In addition to the calculations for gas central heating, one set of calculations estimates savings from replacing a gas room heater; details for this are given later.

(b) Electric storage heating

- Hot water heated in a tank by electric immersion heater.
- Modern (slim) storage heaters with manual charge control.

- 10% of the space heating is supplied by on-peak electric.

(c) Solid fuel central heating

Note that estimated efficiency is approximate and varies greatly with type (see annexe 2)

- Assumes an open coal fire with back boiler (efficiency 55%) and radiators and whole house heating.
- Hot water heated from the back boiler in a separate tank.

2.2.4 Heating pattern

The calculated savings are for a standard heating pattern (morning and evening during the week, all day at the weekend), and whole house heating (except for gas room heater savings, for which details are given later).

2.3 Savings Matrices

2.3.1 Loft insulation

The effect of the different wall types (solid or cavity) is small; less than 2%.

The effect of the number of external walls (e.g. a flat with 2 external walls compared with 3 external walls, a mid-terrace compared with end-terrace) is also small; less than 5%.

- The matrix shows savings for the different dwelling types (with the 2 flat types described above - but note that only a top-floor flat is appropriate) and sizes.
- The savings for loft insulation improvement to 150mm, 200mm and 250mm depth include insulation of, and draught-sealing, the loft hatch. (Even where there is draught-sealing before installation, it is likely to be in need of replacement). The U-values used take account of thermal bridging by the joists, and represent laying between the joists at all depths (this allows for safe access to the loft). This is a conservative assumption, which can be considered to take account of the effect of

compacting and/or dislodging, for example due to boarding the loft, on the insulation performance.

2.3.2 Cavity wall insulation

Cavity wall savings are clearly affected by both the U-value of the cavity wall filled, and the number of external walls.

A pre-'76 U-value of 1.45 W/m²K was calculated for a wall with a brick outer leaf, 65mm cavity, and brick inner leaf finished with a dense plaster, thought to be typical of post-war construction. This gives a U-value of 0.466 W/m²K when the cavity is filled with blown mineral fibre.

Post-'76 Building Regulations required U-values of 1.0 W/m²K; such a 65mm cavity wall gives a U-value of 0.407 W/m²K when filled with blown mineral fibre.

- The matrix shows savings for the different dwelling types and sizes. The results for flats may be applied to top-floor, mid-floor, and ground-floor flats, since the difference in results is less than 1%.

2.3.3 Solid wall insulation

As with cavity walls, savings are affected by the before and after U-value and the number of external walls.

A solid wall is assumed to have a U-value of 2.1 W/m²K before it is insulated. Internal or external insulation can be applied to decrease the U-value. Two values were used for insulated walls, 0.45 and 0.37 W/m²K. Using mineral wool, thicknesses of 80 and 100mm respectively would be needed to achieve these reductions in heat loss. Using other insulants this thickness could be significantly less (see notes to the matrix for details).

The matrix shows savings for the different dwelling types and sizes. The results for flats may be applied to top-floor, mid-floor, and ground-floor flats, since the difference in results is less than 1%.

2.3.4 Draught-stripping

These are obviously affected by the dwelling type and size. Draught-stripping of windows and external doors is calculated. Draught-sealing the hatch gives savings from BREDEM which are 15% of the saving in the matrix for draught-stripping windows and external doors.

BREDEM takes account of draught-stripping by modifying the amount of air infiltration, by an amount based on work carried out in the 1980's. This work found that there are a large range of air infiltration routes (such as dry lining on dabs or battens, cracks, gaps and joints in the structure, joist penetrations of external walls, timber floors, internal stud walls, electrical components and service ducts, and areas of unplastered masonry).

Openable doors and windows are therefore only one of many routes. Results were obtained for good quality draught-stripping of openable doors and windows (excluding the kitchen and bathroom, as is normal practice), for a representative range of dwellings. The BREDEM calculations for the matrix are consistent with these results.

Because of the nature of air infiltration measurements, it is impossible to be precise about what should be taken as a baseline, that is, the air infiltration before draught-stripping. For this work it was agreed that the savings should be based on initial ventilation rates at the higher end of the range, consistent with the data available. This reflects the principle that Energy Efficiency Commitment should be targeting draught-stripping at such properties. In addition, the BREDEM ventilation algorithm assumes that if air infiltration is low, occupants will open windows. Because of this, draught-stripping savings become small if too low an air infiltration baseline is used.

A higher baseline is readily achieved by selection of a number of options in the 'ventilation' and 'location' BREDEM inputs. Under the 'ventilation' inputs, two extract fans and one unrestricted chimney were assumed for all cases. For the 'location' inputs, 'sheltered on 1 side', and 'above average site exposure' was selected in all cases; although it may not be realistic for a mid-terrace house or a flat with two outside walls, it may be taken as a proxy for a number of other contributing factors, such as a leakier-than-average structure.

The matrix shows savings for the different dwelling types and sizes. The results for flats may be applied to top-floor, mid-floor, and ground-floor flats.

2.3.5 Hot water tank insulation

Different types and sizes of dwellings have little effect. Less than 3% differences were obtained. For all dwelling types, the energy savings are as follows, using boiler efficiency values given in Annexe 2.

(a) Gas centrally heated dwellings

None to 75mm jacket 2370 kWh/yr.

25mm to 75mm jacket 1010 kWh/yr.

50mm to 75mm jacket 260 kWh/yr.

Taking account of the relative numbers of dwellings in the building stock with 50mm, 25mm, and no tank jacket (Domestic Energy Fact File, 1998) gives a weighted average of

800 kWh/yr (this is tabulated in the matrix at Annexe 3).

(b) Electric storage heated dwellings:

None to 75mm jacket 1310 kWh/yr.

25mm to 75mm jacket 580 kWh/yr.

50mm to 75mm jacket 140 kWh/yr.

Taking account of the relative numbers of dwellings in the building stock with 50mm, 25mm, and no tank jacket (Domestic Energy Fact File, 1998) gives a weighted average of

450 kWh/yr (this is tabulated in the matrix at Annexe 3).

(c) Oil centrally heated dwellings:

None to 75mm jacket 2090 kWh/yr.

25mm to 75mm jacket 890 kWh/yr.

50mm to 75mm jacket 230 kWh/yr.

Taking account of the relative numbers of dwellings in the building stock with 50mm, 25mm, and no tank jacket (Domestic Energy Fact File, 1998) gives a weighted average of

700 kWh/yr (this is tabulated in the matrix at Annexe 3).

(d) Solid fuel heated dwellings:

For an open fire with back boiler when heating water with an efficiency of 55%, the following results were obtained

None to 75mm jacket 2620 kWh/yr.

25mm to 75mm jacket 1120 kWh/yr.

50mm to 75mm jacket 270 kWh/yr.

Taking account of the relative numbers of dwellings in the building stock with 50mm, 25mm, and no tank jacket (Domestic Energy Fact File, 1998) gives a weighted average of

880 kWh/yr (this is tabulated in the matrix at Annexe 3).

2.3.6 Floor insulation

Calculations are for 100mm depth of insulation (mineral fibre 0.04 W/m²C). This is often the maximum practicable depth, and insulating to this depth is considered worthwhile considering the disruption and labour cost associated with installing this measure. Different wall types have a small effect, less than 7%. However, house size and type have a significant effect.

The matrix shows savings for the different dwelling types (note: only a ground-floor flat is appropriate) and sizes.

2.3.7 Block skirting gaps and seal floorboards

Different wall types have a small effect, less than 8%. However, dwelling size and type have a significant effect.

The matrix shows savings for the different dwelling types and sizes. The results for flats may be applied to top-floor, mid-floor, and ground-floor flats.

2.4 Gas and Oil Matrices

2.4.1 Hot water tank thermostat and primary pipe insulation

Different types and sizes of dwellings have little effect. Boiler efficiencies used are described in Annexe 2.

Modelling a boiler of 69% efficiency, reduced to 67% for gas and 77%, reduced to 76% for oil to allow for a proportion of boilers in the existing stock with no boiler interlock (see Annexe 2), gives the following results.

Gas:

If there is no tank thermostat or primary pipe insulation,

- the saving from one of these measures is 560 kWh/yr
- the saving from both of these measures is 800 kWh/yr

If one measure is installed, the saving from the other measure is 240 kWh/yr.

Oil:

If there is no tank thermostat or primary pipe insulation,

- the saving from one of these measures is 490 kWh/yr
- the saving from both of these measures is 700 kWh/yr

If one measure is installed, the saving from the other measure is 210 kWh/yr.

2.4.2 Boiler replacement, efficiency and controls

A generalised calculation method is given for flexibility, which enables estimated savings to be calculated using appropriate boiler efficiencies and heating system controls. Either an average seasonal efficiency, or a seasonal efficiency of an individual boiler, may be used. Both of these are now available

as a result of the new SEDBUK (Seasonal Efficiency of Domestic Boilers in the UK) method, which is described in Annexe 2.

- The matrix shows the 'heat required', given a particular set of heating controls, for each dwelling type and size (see Annexe 1 regarding flat types). The 'heat required' divided by the boiler efficiency value will give the delivered fuel consumption. The difference of two such calculations, firstly for the initial heating controls and efficiency value, secondly for the new heating controls and efficiency value gives the energy saving.

The energy saving from changing either the heating controls alone, or the boiler alone, may of course be calculated by keeping the other the same. Note that the 'heat required' includes energy for hot water as well as heating, since this is also affected by the boiler efficiency.

For an initial boiler efficiency value E1, and a new boiler efficiency value E2, the energy saving is then as follows.

$$([\textit{heat required with initial controls}] / E1) - ([\textit{heat required with new controls}] / E2)$$

Note that if the boiler has no interlock (that is it continues to run when there is no demand for heat), the efficiency value must be reduced by 5 percentage points. Thus for a boiler efficiency of 69% with no boiler interlock, an efficiency of 64% must be used in the above calculation.

For example, the delivered energy saving resulting from replacing

- a gas boiler with no controls or programmer only (efficiency 69% reduced by 5 percentage points because there is no boiler interlock),
- by a new boiler with efficiency 80% and new controls (with a boiler interlock, i.e. there is no 5 percentage point penalty) is then as follows.

$$([\textit{heat required with no controls}] / 0.64) - ([\textit{heat required with new controls}] / 0.8)$$

Recent work suggests that the average seasonal efficiency of gas boilers in the existing housing stock is around 69%. (The penalty for no boiler interlock must be applied to this if appropriate). Existing oil boilers are likely to be more efficient, the average seasonal efficiency in the housing stock being currently around 77%.

As regards new boilers currently being installed in the UK, information from the SEDBUK project (Annexe 2) has shown that a typical efficiency is 88% for condensing gas boilers, and 78% for non-condensing boilers. For oil, typical condensing boiler efficiency is 92% and non-condensing, 85%. These efficiencies, and/or the seasonal efficiency of an individual boiler from the SEDBUK internet site (www.sedbuk.com), can be used in the equation above as required.

'Heat required' is tabulated in the matrix for the following control options. Note that all controls packages may or may not have a programmer (no energy savings are attributed to this).

- None: No controls, and no hot water tank thermostat
- Package A: Only hot water thermostat
- Package B: Roomstat *
- Package C: Roomstat and TRVs *
- Package D: TRVs without a roomstat (note that boiler interlock is not possible unless a flowswitch is present)*
- Package E: Delayed start roomstat and TRVs *
- Package F: Intelligent heating controls and TRVs *

**these control options include a hot water tank thermostat*

TRVs are assumed to be fitted on all radiators in the property

For 'Commitment' target setting purposes, it is necessary to assume a basis from which gas and oil heating controls are upgraded. A situation of 'Limited Controls' has therefore been defined. Central heating systems in existing dwellings have the following controls.

- 16% have no thermostatic control.
- 53% have a wall thermostat (no TRVs)
- 14% have TRVs (no wall thermostat)

- 15% have a wall thermostat and TRVs

The 'Limited Controls' case (Package L) was defined by taking an average, weighted by the above values of 16 and 53%, of the 'heat required' for (a) 'no controls' and (b) 'Programmer and roomstat'.

2.4.3 Renewing gas room heaters

Different dwelling types and sizes (see annex 1 regarding flat types) have a significant effect on the savings from replacing an old gas fire, efficiency 50%, with a new gas fire with an open flue, efficiency 60%. A dwelling with typical insulation was assumed.

The aim is to estimate savings for replacing one gas fire; hence whole house heating is not appropriate. Savings were calculated for two situations.

(a) Only the living area is heated by the gas room heater.

(b) The dwelling is heated by gas central heating, with a gas room heater providing 50% of the heat to the living area. This is a common configuration where a gas room heater is present.

2.4.4 Radiator foil

An assessment of the savings has been undertaken by BRE which is based on test data, and which provides a best estimate of savings at present. This has been used to inform the savings credited to this measure in the present Standards of Performance. However, at present the savings credited go beyond the results of the BRE assessment, to allow further installation and monitoring to take place. Depending on the results from this monitoring, the assessment of savings by BRE will be revised if appropriate for use in the evaluation of individual EEC schemes.

2.5 *Electricity Matrix Only*

2.5.1 Storage heater controls

The energy savings from 6 types of electric storage heater controls have been investigated, and the results expressed as a percentage of the space heating energy for a dwelling. The values in the matrix are derived by applying these percentages to the space-heating requirement for each dwelling type, as calculated using BREDEM.

The savings that result from storage heater controls are therefore directly related to the delivered energy required to heat the dwelling. Dwelling type, size, and the level of insulation will affect the savings (see Annexe 1 regarding flat types). Savings in the matrix are calculated for three wall types with different U-values, solid wall, cavity wall pre-76 and cavity wall post-'76, for a dwelling with a typical level of loft insulation (150mm).

2.6 Solid Fuel Matrix

By their nature, most solid fuel heating systems are not controllable other than manually; therefore no attempt to attribute savings to controls is made.

3. Conclusion and recommendations

A matrix has been developed which tabulates the estimated energy savings for a large range of energy measures, and typical dwelling types and sizes. In general, factors which have a significant effect on the savings have been tabulated. In an exercise of this kind, assumptions have to be made about various parameters (for example, the heating pattern), and typical values have been used, the most important of which have been stated at the start of this report.

These assumptions need to be kept in mind when using the values in the matrix. The savings given are typical for the situations described, but may be very different for situations which differ significantly from the assumptions made.

4. References

The Government's Standard Assessment Procedure for Energy Rating of Dwellings. SAP 1998. Published on behalf of DETR by BRECSU, BRE.

Domestic Energy Fact File, 1998. L D Shorrock and G A Walters. BRE Report 354.

SEDBUK (Seasonal Efficiency of Domestic Boilers in the UK. www.sedbuk.com)

Annexe 1 - Effect of flat type on savings

A flat of a given size and shape can be top-floor, mid-floor, or ground-floor, with different numbers of external walls. Each combination of these parameters will result in a different energy consumption.

Moreover the savings from different energy saving measures are affected by different parameters. For example, the number of walls affects the savings resulting from cavity wall insulation, floor insulation and draught-stripping, but does not significantly affect savings resulting from the other insulation measures considered.

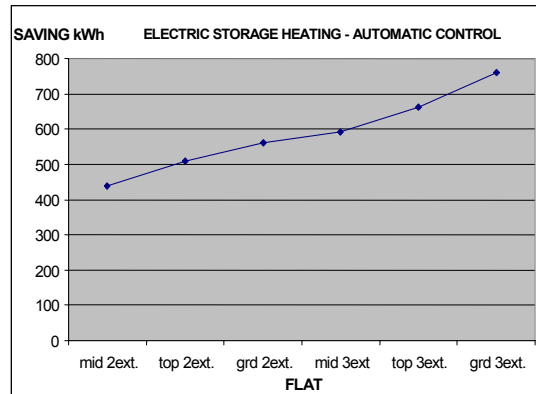
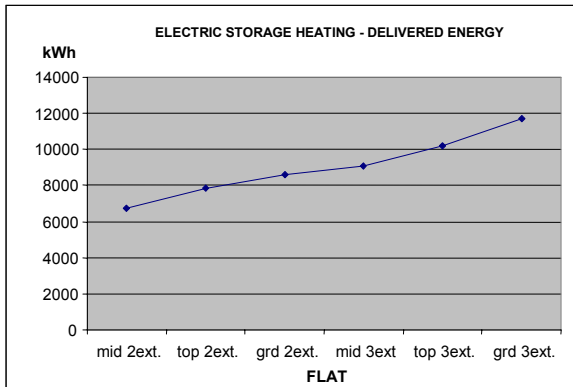
Energy Efficiency Measure	Top/Mid/Ground Floor Flat	Number of External Walls
Loft insulation	Top-floor flats only	Insignificant effect
Floor insulation	Ground-floor flats only	Significant effect
Cavity wall insulation	Insignificant effect	Significant effect
Draught stripping	Insignificant effect	Significant effect
Double glazing	Insignificant effect	Insignificant effect
Seal skirting and floorboards	Insignificant effect	Insignificant effect
Boiler replacement, efficiency & controls	See below	
Renewing gas room heaters		
Storage heater controls		

The energy savings resulting from the last three measures in this table, that is

- boiler replacement, efficiencies and controls
- renewing gas room heaters
- electric storage heater controls

are dependent on the space heating energy consumption of the flat. The savings will therefore be affected both by the number of external walls, and whether it is a top, mid, or ground floor flat.

The following graphs show, for an electric storage heating system, the effect of both of these factors on (a) the space heating energy consumption, and (b) the saving achieved by automatic controls.



- It can be seen that the number of external walls has a significant effect on energy consumption and savings. The effect of whether it is top, mid or ground floor is less significant. Therefore, in the matrix, separate results have been calculated for flats with two, and three external walls.
- It can also be seen that the top-floor flat is intermediate in energy consumption between the ground-floor and mid-floor flat, and the difference is relatively small (especially in relation to the effect of the amount of loft and wall insulation). For the matrix, calculations have therefore been undertaken for top-floor flats only. Savings for mid-floor and ground-floor flats will be similar.

(It could be argued that mid-floor flats should be used on the basis that these are the most common type, however, while this is true in high rise buildings, there are a large number of blocks which are three or fewer storeys high for which this is not true.)

Graphs of energy consumption and savings relating to the replacement of boilers, boiler controls, and gas room heaters show the same results, and the same conclusions can be drawn. For this reason, the energy savings resulting from the measures:

- boiler replacement, efficiencies and controls
- renewing gas room heaters
- electric storage heater controls

have been calculated for the two cases:

- top-floor flat with 2 external walls
- top-floor flat with 3 external walls

It should be appreciated that the savings resulting from these three measures are significantly dependent on the heat required and therefore the level of insulation in the dwelling (as well as other factors such as the heating pattern). This contrasts with insulation measures (for example, loft insulation) where savings are not strongly dependent on the level of insulation in the rest of the dwelling, except for very poor, or very good, insulation levels.

The savings for the three measures above have been calculated using the base parameters specified on page 2 of this report.

Annexe 2 - Boiler efficiencies and SEDBUK

Gas and oil boilers

A method for estimating a realistic 'seasonal' domestic boiler efficiency, representing an average efficiency in domestic conditions over a seasonal cycle in the UK, has been incorporated into the calculation of SAP energy ratings (Appendix D of SAP 1998). The method involves a number of equations that use the measured full load and part load efficiency of a boiler to estimate its seasonal efficiency in typical UK conditions.

The method results from a research project supported by DETR, BRECSU, British Gas Research & Technology, and manufacturers of boilers and other products for the heating industry. The method has been agreed by all those involved, and is referred to as 'SEDBUK' (Seasonal Efficiency of Domestic Boilers in the UK).

SEDBUK values for many boilers currently available have been published on an internet web site www.sedbuk.com. In addition, from real product data that BRECSU holds, it has been possible to use SEDBUK to estimate typical UK seasonal efficiency values of different types of boilers.

Typical values for gas boilers that will be being sold and installed are as follows.

Non-condensing gas boiler - 78%

Condensing gas boiler - 88%

For oil fired boilers typical values are:

Non-condensing oil boiler - 85%

Condensing oil boiler - 92%

The energy savings calculated in Annexe 3 of this report use estimates of the average seasonal efficiency of gas and oil boilers in the existing UK stock. BRE's UK National Boiler Energy Model indicates this being 69.2% for gas and 77.4%. For BREDEM calculations, a penalty of 5 percentage points is deducted where there is no boiler interlock. There is very little data on the proportion of the existing stock that do not have interlocks. However, about 30% of boiler systems

do not have a room thermostat, and this indicates that at least 30% do not have any interlock. Estimating that about 50% of boiler systems do not have an interlock indicates an average penalty of 2.5 percentage points for gas. This results in a rounded value of 67%, which is used in the BREDEM calculations. For oil, it is estimated that a higher percentage of systems have an interlock, around three quarters. This indicates a suitable reduction of 1.25%, giving a rounded value of 76%.

Values used in this matrix are therefore

- Gas 69%, reduced by 2% to 67%
- Oil 77%, reduced by 1% to 76%

Solid fuel heating

There are many different configurations for solid fuel heating. For example, an open or closed fire may have a back boiler, in which case this may supply radiators, or alternatively an independent solid fuel boiler may supply a central heating system. Estimated efficiency values are approximate and vary depending on the configuration, from 32% for an open fire with no throat restrictor and no back boiler, to 65% for a closed fire with a back boiler, or an independent boiler with an autofeed system.

In addition BREDEM calculations take account of 'responsiveness' on a scale of 0 (unresponsive) to 1 (responsive). Open and closed solid fuel fires are attributed a responsiveness of 0.5, while independent boilers are attributed a responsiveness of 0.75.

Note that this variability in evaluating energy for solid fuel systems is exacerbated when considering cost and energy CO₂ emissions (these are not calculated in this report). Open fires may use house coal, or smokeless fuel if required, which have different costs and CO₂ emission values (£4.25/GJ and £7.11/GJ, and 81 kg CO₂/GJ and 109 kg CO₂/GJ respectively; SAP 1998 values).

The most common solid fuel heating system is an open fire with a back boiler and radiators, though closed fires with back boiler and radiators are also common, and also open and closed fires of all other configurations. There are a

smaller, but still significant, number of independent boilers supplying central heating systems.

For the calculations in this matrix, approximate typical values of efficiency and responsiveness have been used. That is,

- a responsiveness of 0.5 and an efficiency of 55%, which corresponds to an open coal fire with a back boiler

Appendix 2 HSE advice on potential risks to safety of combustion appliances from the installation of cavity wall insulation (May 2000)

What is the purpose of this advice?

This advice:

- highlights the potential hazard of cavity wall insulation work adversely affecting the safety of combustion appliances and the importance of ensuring air supply vents and flues are always checked by a competent person after this work
- gives general guidance on the action required, further details of which are given in the Cavity Insulation Guarantee Agency (CIGA) guide 'Flues, Chimneys and Combustion Air Ventilators'
- is addressed to all concerned with the management, control and installation of cavity wall insulation under energy efficiency schemes
- is targeted both at those involved with the installation of cavity wall insulation and the running of specific schemes such as DEFRA's Home Energy Efficiency Scheme (HEES), those run by Energy Suppliers and Transco (Affordable Warmth)), as well as initiatives run by local authorities
- updates and replaces an earlier HSE advice sheet on this subject.

What is the hazard?

This guidance is about the way in which incorrect installation of cavity wall Insulation can adversely affect the safety of gas, oil and solid fuel appliances.

The main concerns are:

- (a) possible blockage of air supply vents with insulation material if the vents are not ducted across the cavity, and
- (b) possible flue damage (eg by accidental drilling) or blockage (ie by insulating material entering a flue through the damaged area).

Either, or both of these could cause appliances to operate unsafely, and produce amounts of carbon monoxide (CO) that could cause death of occupants.

These are not just theoretical risks. Although the industry safety record is accepted to be generally very good, a few residents recently had their ventilation/flues completely blocked by insulation material, as a result of cavity wall insulation work, and this was not detected in the normal way by the installer because the established industry safety procedures were not followed. This presented a major potential risk of CO poisoning to these tenants, and it was fortunate that the problem was otherwise noticed, as death or serious injury might have resulted.

What action is required?

In view of the above, there is an urgent need for all parties involved to give early consideration to the possible effects that the insulation work might have for the safety of appliances in the houses they are working on, however they are fuelled. Any guidance and contract conditions should call for safety management systems that include thorough checks before work starts, eg on whether air vents are sleeved through the cavity wall, and the type/location of appliances and run of flues provided for them. This is essential to identify appliances and flues 'at risk' and for planning work to minimise the risk of damage or blockage.

It is particularly important that landlords such as local authorities are forewarned of any work to be carried out, so that they are given the opportunity to carry out their own checks on work to discharge their own legal responsibilities to their tenants.

What precautions are necessary?

The following is a summary of the main areas to be addressed. Detailed guidance is given in the Cavity Installation Guarantee Agency (CIGA) Best Practice Guidance document and relevant British Standards on cavity wall insulation. Further information regarding safety checks on gas appliances may be obtained from the Council for Registered Gas Installers (CORGI).

(a) *safety management.*

All cavity wall insulation work must be properly managed and controlled to ensure safe systems of work are used, which effectively address the risks involved. Suitable guidance and training should be given to all concerned that stresses the possible effects of the work for the safety of occupants from interference with ventilation and flueing, and the action required to address these risks (see below).

(b) *safety checks after installation of cavity wall insulation.*

Before combustion appliances are recommissioned/retaken into use, the following checks for safety should be carried out:

(i) *Air supply vents*

A visual examination should be carried out of all air vent openings, whether for supply of combustion air to appliances or for cooling air of compartments housing appliances, to ensure there is no blockage or interference by insulating material. This applies to air vents serving all types of combustion appliance, whether flueless, open-flued or room sealed. Further information on air supply requirements is given in Approved Document J 'Heat Producing Appliances' under the current Building Regulations (and Technical Standards in Scotland). Further information in respect of air supply requirements for gas appliances is contained in British Standard 5440 Part 2: 2000.

(ii) *Flue examination/testing*

The following examinations and tests should be carried after installation of cavity wall insulation, except for those flues **known** not to be at risk of damage or blockage from cavity wall insulation work (eg where no part of a flue is run along or adjacent to a cavity wall). A decision on this should be made by a

competent person after inspecting the flue run. In **any** case of doubt, it should be assumed that flue damage/blockage is possible, and that examinations/tests need to be carried out. These are identified below.

Appliances other than room sealed appliances

The flue should be visually examined for any damage or blockage caused by the cavity wall insulation work, which would prevent safe transfer of combustion products to the open air. This will involve external visual examination of the flue along its whole length, including loft spaces.

After the visual examination, further assessment should be made to establish whether there is any indication of possible flue damage or blockage. This will involve a smoke spillage test (to check that combustion products are being safely removed with the appliance connected) and visual inspection for any signs of incomplete combustion (eg yellowing of burner flame and soot deposits). Further investigation, including a flue flow test (to establish whether combustion products are capable of being safely transferred to the open air) **must** be carried out if there is **any** doubt or suggestion of flue damage or interference.

Further information on flue requirements, including examination/testing, is given in Approved Document J 'Heat Producing Appliances' under current Building Regulations (and Technical Standards in Scotland). Further information on flues for gas appliances is contained in British Standard 5440 Part 1: 1990⁸.

Room sealed appliances

No flue flow or spillage test is required for room sealed appliances, however, a visual external examination of the flue path (eg to ensure there is no flue damage) and checks as in (i) earlier, on air vents providing cooling air for any compartment housing such an appliance are still required. Further information is given in the CIGA guide.

(iii) Examination of appliance safe functioning.

⁸Under revision when this advice was prepared. Revised standard expected to be published later this year (2000).

After any 'work' on an appliance, including 'disconnection' and 'reconnection', it should be checked that the appliance functions safely. Examinations for gas appliances are specified in regulation 26(9) of the Gas Safety (Installation and Use) Regulations 1998 (GSIUR).

Action in case of a 'dangerous appliance'

Where there is any doubt about safety, arrangements should be made for the appliance to be disconnected (with the owner's consent, as necessary) and a warning notice attached, pending further investigation and remedial work. If the owner does not agree to disconnection of a dangerous gas appliance, Gas Emergency Freephone 0800 111 999, or in the case of LPG the gas supplier, should be contacted for further action to make safe.

Who may carry out safety examinations?

The examinations described earlier must only be carried out by a person who has been adequately trained and possesses the required competence, eg for proper conduct and interpretation of safety checks. The smoke spillage test is appliance specific and specialist training is essential to perform this correctly, in accordance with manufacturers instructions.

In the case of gas, any disconnection of appliances (eg as normally required for the flue flow test) constitutes 'work on a gas fitting'⁹ and may only be carried out by a CORGI registered installer, holding a current certificate under the 'ACoPS' or Accredited Certification Scheme (ACS), covering the work involved. Further advice may be obtained from CORGI (tel: 01256 372200).

May carbon monoxide detectors be used?

⁹'work in relation to a gas fitting' as defined in GSIUR covers a wide range of activities including (but not limited to) installing; disconnecting; removing; re-connecting; or (where a fitting is not readily movable), changing its position. However, it does not cover separate activities which might affect gas safety but are not directly associated with a gas fitting/appliance, such as installation of cavity wall insulation.

If carbon monoxide detectors/alarms are used, they must **never** be regarded as a substitute for primary safeguards, eg safe installation and maintenance of gas appliances. Similarly, use of CO detectors must **not** be regarded as a substitute for flue/combustion air checks by a competent person, after completion of cavity wall insulation (as earlier). If detectors are used as part of a safety check regime, they must only be used to **indicate or confirm a hazardous situation**; they must **never** be relied upon to prove safety or to contradict evidence of a possible problem, where a flue spillage test is inconclusive or suggests flue blockage.

What are the relevant legal requirements?

The main legal requirements for protection of the general public and employees in these situations are the general provisions of the Health and Safety at Work etc 1974 (HSWA), and related legislation, including the Management of Health and Safety at Work Regulations 1999, which require a 'risk assessment' and plan of protective measures to be drawn up, as well as appointment of competent persons to ensure that safety requirements are effectively met.

In the case of gas, specific requirements also apply under the Gas Safety (Installation and Use) Regulations 1998. In particular, regulation 8(1) effectively prohibits any person from making an alteration to premises¹⁰ (including cavity wall insulation) which would adversely effect the safety of a gas fitting installed at those premises and cause it no longer to comply with the Regulations, eg because combustion air supply or fluing is no longer adequate.

These duties for ensuring safety of combustion appliances extend beyond installers themselves to include managing contractors and others involved in planning heat efficiency schemes. Further information on controls and responsibilities under GSIUR is given in the Health and Safety Commission (HSC) Approved Code of Practice 'Safety in the installation and use of gas fittings and appliances', (ISBN: 0-7176-1635-5) available from HSE Books (tel 01787 881165)

¹⁰The prohibition extends to a wide range of activities which might affect the safety of a gas appliance (or gas storage vessel) on the premises, including installation of double glazing, building extension, modifications to chimneys etc.

Appendix 3 New or Innovative Measure

Procedures

These guidelines specify the information required by the Energy Saving Trust from product manufacturers or energy suppliers that wish to have a new energy saving product assessed for use in the Energy Efficiency Commitment 2002-05 (EEC) or EST energy efficiency programmes. Assessment of energy savings refers solely to the fact that a product is acceptable to EST for use in energy efficiency schemes.

The EST assesses new energy efficiency products to verify their energy savings. This recognition of measure savings by EST does not permit the use of any logo or device for product endorsement, nor does it mean that EST, Ofgem or Department of Food, Environment and Rural Affairs (DEFRA) recommends the product in any way. If product endorsement is sought via the use of the "Energy Efficiency Recommended" logo, a separate application procedure direct from the Energy Saving Trust is required.

As part of the EST's role as Ofgem's advisory agent, Ofgem can also use this information to determine possible energy savings under the EEC. EST approval does not guarantee that new products will be used by suppliers in delivering their EEC programme.

The Energy Efficiency Commitment 2002-05

The Energy Efficiency Commitment (EEC) is a three-year programme that requires obligated suppliers to meet an overall energy saving target of 62TWh by improving energy efficiency within households.

The overall target is set by the DEFRA and is administered by Ofgem. The EEC requires energy suppliers with at least 15,000 domestic consumers to develop and implement schemes, approved by Ofgem, aimed at making improvements in energy efficiency. At least 50 per cent of the energy savings must result from schemes targeted at customers receiving income-related benefits or tax credits. The EEC is instrumental in the Government's Climate Change Programme and is highlighted in the Fuel Poverty Strategy. Because suppliers have flexibility in the measures they use to meet their energy saving targets they have shown an interest in the new measures that are coming to market.

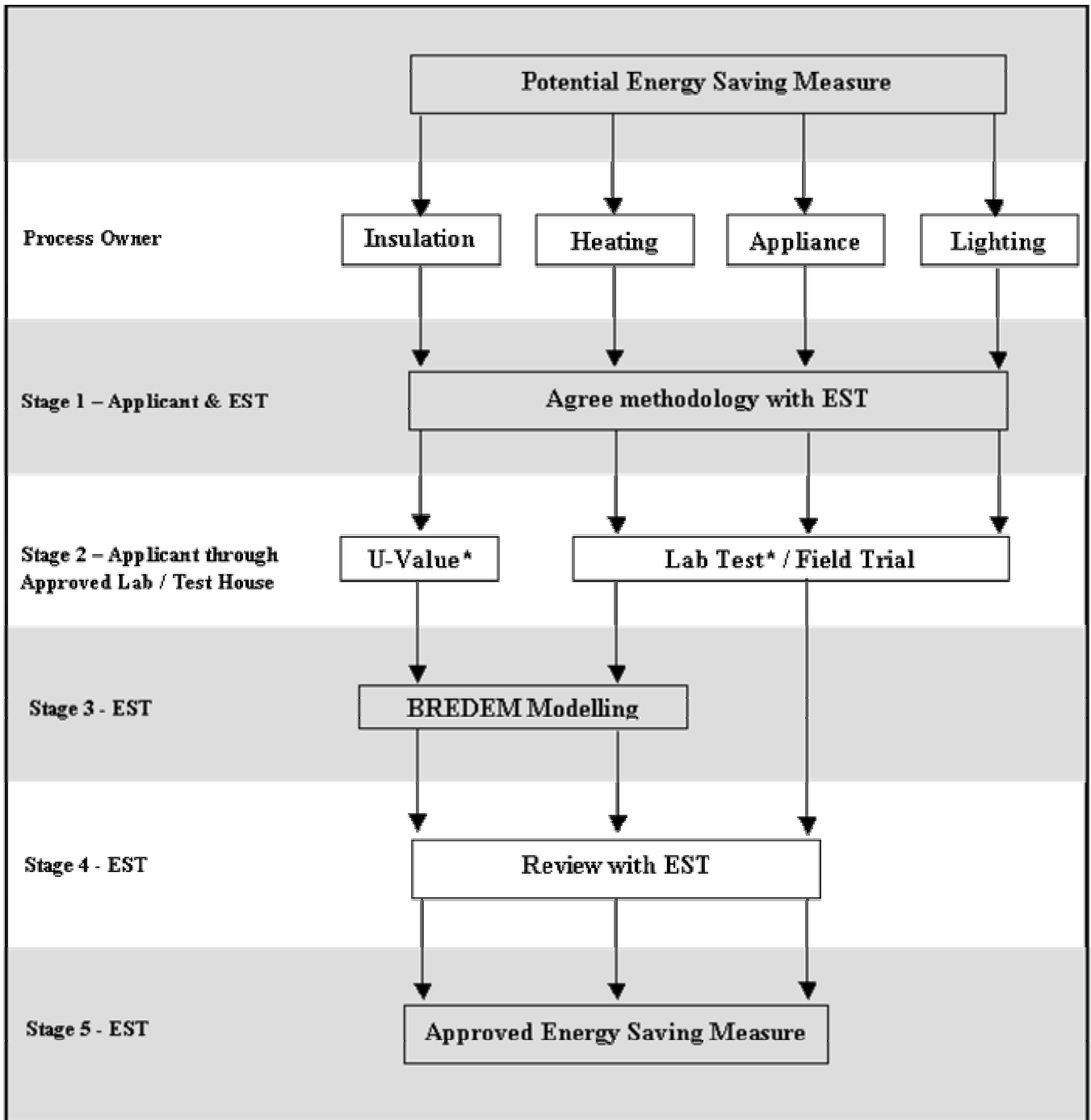
The savings attributed within EEC are calculated *ex-ante* or in advance of the measures installed, as opposed to *ex-post* or after completion. Therefore, it is necessary that the

savings themselves, as well as the calculations and assumptions behind them are as robust as possible. Where savings are obtained without field trials (generally for insulation and some heating measures), the BREDEM-12 model will be used to ascertain savings.

Overall Procedure Flow Chart

The procedure for product approval depends on the product type as illustrated in the flow chart overleaf:-

Table 1: Flowchart of approvals process



Information on Approved Laboratories and Test Houses is shown in Appendix A. When viewed electronically the hyperlinks are active to provide more information via the UKAS website.

Stage 1

Applicant to contact the Energy Saving Trust to agree methodology and testing requirements as follows:

Mr James Russill
Energy Saving Trust
21 Dartmouth Street
London
SW1H 9BP
Tel: 020 7222 0101
Email: newproducts@est.co.uk

Stage 2

Applicant to arrange for suitable testing through approved Test House, laboratory testing process or Field Trial process as agreed with EST. Appendix A provides details of Approved Laboratories and Test Houses.

Stage 3 and 4

Applicant to submit results from product testing to EST. The EST reviews the test results and/or undertakes energy modelling (as necessary). The possible EEC accreditation score is calculated and passed to Ofgem for information. If there are any legal implications for a measure the EST will liaise with Ofgem before any testing takes place.

Stage 5

Should a product be suitable for approval, the EST will issue a letter to the applicant stating that the product is acceptable as an energy saving measure. The EST in its advisory role will also notify Ofgem and energy suppliers of the energy savings creditable for the new measure.

Procedure for Each Product Type

Standard Information Requirements For All Product Types

Details of the following must be provided and justified where appropriate for all measure types before an application for approval of savings can be considered.

- Typical product and installation costs of the measure

- Details of any Standards (British/European/Industry) to which the product and its installation conform to or must conform to. This must include specific reference to any relevant safety Standards and legislation that the product should meet. The EST will expect, where appropriate, that the independent test house involved in the application process will provide confirmation that the product meets all relevant Standards and legislation.
- Details of any requirements for specific skills/equipment for professional installation and for DIY installation (if appropriate).
- Typical product/measure lifetime.
- Information on the likelihood of any drawbacks or potential problems associated with the installation and/or use of the product (e.g. end of life disposal problems, energy/natural resource intensive production methods etc).
- An indication of any other benefits that could be accrued through the installation of the product/measure.
- Details of comparisons with 'standard'/non-energy saving products should be provided where possible/relevant.
- Typical installation and any specific usage instructions.

Specific Information for individual Product Types

In addition to the previous information, specific details are also required for individual product types as listed below: -

Thermal insulation measures

Verification of the thermal conductivity (lambda value) of the product is required. This verification must be provided in the form of a test certificate from a UKAS accredited testing laboratory or another approved by the EST. Should a product possess a British Board of Agrément (BBA) certificate, the stated thermal conductivity on this Certificate will be used.

Before undertaking any work, the methodology for the tests or field trials must be agreed with the EST. This is to ensure that the subsequent results are suitable for use in BREDEM-12 energy modelling. This will provide energy savings for the standard dwellings and fuel types used within the EEC.

Once the thermal properties and standard thickness installed have been established, EST will undertake energy modelling using the BREDEM-12 model and existing EEC assumptions to enable assessment with existing EEC measures to be made. This will provide energy savings for the standard dwelling and fuel types used within the EEC.

The savings listed in the EEC Technical Guidance Manual and EEC Matrices are for 'generic products', for example, for loft insulation the savings provided are for mineral fibre (thermal conductivity of 0.04W/mK). Should an insulant have a similar thermal conductivity and if it is used in a similar way to the 'generic' insulant then the product can be approved without further energy modeling and the existing savings provided in the EEC Matrix can be used. However, should the thermal properties or method of use be different, revised savings figures to take into account these differences should be calculated and used instead.

Heating Measures

Verification of the heating energy savings is by laboratory test or field trial is required. This must be provided in the form of a test report from a UKAS accredited testing laboratory or another approved by the EST.

Before undertaking any work, the methodology for the tests or field trials must be agreed with the EST. This is to ensure that the subsequent results are suitable for use in BREDEM-12 energy modelling. This will provide energy savings for the standard dwellings and fuel types used within the EEC.

Appliances

Verification of the electrical savings by laboratory test or field trial is required. This evidence must be provided in the form of a test report from a UKAS accredited testing laboratory or another approved by the EST.

Before undertaking any work, the methodology for the tests or field trials must be agreed with the EST. This is to ensure that the subsequent results are suitable for use.

Lighting

To have a lighting measure (CFLs and Luminaires) on the EST approved list please refer to the latest version of the EST Test Specifications (available from James Russill at the above address). The EST will seek assurance that all lamps meet the relevant standards for: Safety, Quality, Lifetime and lumen output.

For any other lighting related measure, the information requirements would follow that of electrical measures.

All Products

Once the energy savings from the product have been verified and discussed with the applicant and the product approved, the EST will issue a letter to the applicant stating that the product is acceptable as an energy saving measure. The EST will also notify Ofgem and energy suppliers of the new measure and the energy savings creditable.

Cost of Applications

The Energy Saving Trust will levy an administration fee for each test procedure. The fee will be charged to cover internal costs of processing applications such as participant liaison, reviewing and agreeing testing methodologies, approval of test results, modelling/calculation of savings and attending meetings etc. The level of fee will vary according to the quantity of EST work involved to process the application submission from receipt of the application to a letter of acceptance as an energy saving measure. The minimum charge will be £500 and the scale of charges will vary up to a maximum of £3000 per product. The fee will be agreed with the applicant and must be received prior to the application being processed.

This fee does not cover any costs incurred as a result of any laboratory testing or field trials that may be required as part of Stage 2 of the approvals process.

In the event that a product does not require energy modelling for the calculation of savings since it's properties are similar to existing approved products, then the minimum

administration fee of £500 will be levied. The administration fee is to be paid upon application and any reduced fee will apply once the EST has ascertained that no modeling work is required.

Approved laboratories and Test Houses

This list contains details of UKAS and other recognised laboratories and test houses. The listing is not exhaustive, and does not preclude the ability of test houses listed under one category to conduct testing in other areas. For updated information on UKAS accredited laboratories please visit www.ukas.org

Testing for Electrical Energy Consumption

[ITS Testing & Certification](#)

Davy Avenue, Knowhill, Milton Keynes, MK5 8NL
+44 (0)20 7770 7759

[EA Technology Ltd.](#)

Capenhurst, Chester, CH1 6ES
+44 (0)151 339 4181

Testing of Insulation/Construction Materials

[CERAM](#)

(CERAM Research Limited), Queens Road, Penkhull, Stoke-on-Trent, Staffordshire, ST47LQ
+44 (0) 1782 764444

[British Board of Agreement](#)

PO Box 195, Bucknalls Lane, Garston, Watford, Hertfordshire, WD259BA
+44 (0)1923 665300

[Building Investigation and Testing Services \(Redhill\) Ltd](#)

Trowers Way, Holmethorpe Industrial Estate, Quarryside Business Park, Redhill, Surrey, RH12LH
+44 (0)1737 765432

[BSI Product Services](#)

Maylands Avenue, Hemel Hempstead, Hertfordshire, HP24SQ
+44 (0) 1442 230442/278535

[Pattinson & Stead](#)

Westside House, Marton, Middlesborough, Cleveland, TS78BG
+44 (0) 1642 317034

[BRE](#)

Bucknalls Lane, Garston, Watford, WD259XX
44+ (0)1923 664334

Thermal testing of construction materials

[CERAM](#)

(CERAM Research Limited), Queens Road, Penkhull, Stoke-on-Trent, Staffordshire, ST47LQ
+44 (0) 1782 764444

[Stanger Testing Services Ltd](#)

Cambuslang Laboratory, Bogeshole Road, Cambuslang, Glasgow, G727DD
+44 (0) 141 641 3623

[British Board of Agrement](#)

PO Box 195, Bucknalls Lane, Garston, Watford, Hertfordshire, WD259BA
+44 (0)1923 665300

[Building Investigation and Testing Services \(Redhill\) Ltd](#)

Trowers Way, Holmethorpe Industrial Estate, Quarryside Business Park, Redhill, Surrey, RH12LH
+44 (0)1737 765432

[Marley Building Materials](#)

Birmingham Laboratory, Canton Lane, Hams Hall Distribution Park, Coleshill, Birmingham, B461AQ
+44 (0) 1675 468 038

[University of Salford](#)

Thermal Measurement Laboratory, School of Acoustics and Electronic Engineering , Salford, M54WT
+44 (0) 161 295 5172/3114

[National Physical Laboratory](#)

Queens Road, Teddington, Middlesex, TW110LW
+44 (0)20-8943 6880

[IRTU](#)

17 Antrim Road, Lisburn, BT28 3AL
+44 (0)28 9262 3000

Heating and Fossil fuel burning appliances

[Advantica Technologies Ltd](#)

Certification Services, Ashby Road, Loughborough, Leicestershire, LE113GR
+44 (0)1509 282066

[BSI Product Services](#)

Maylands Avenue, Hemel Hempstead, Hertfordshire, HP24SQ
+44 (0) 1442 230442/278535

[GASTEC at CRE LIMITED](#)

PO Box 279, Cheltenham, Gloucestershire, GL524ZJ
+44 (0)1242 677877

[ITS Testing & Certification Ltd](#)

Unit D, Imperial Park, Randalls Way, Leatherhead, Surrey,
+44 (0)1372 370900

[BSRIA Limited](#)

Old Bracknell Lane West, Bracknell, Berkshire, RG127AH
+44 (0)1344 426511

[ITS Testing & Certification Ltd](#)

ITS House, Cleeve Road, Leatherhead, Surrey, KT227SB
+44 (0)1372 370900

[ITS Testing & Certification Ltd](#)

Blackwood EMC Facility, Unit 8, Woodfield Business Park, Pontlanfraith, Blackwood, Gwent, NP12 2DG



21 Dartmouth Street
London SW1H 9BP
Tel: 020 7222 0101
Fax: 020 7654 2444
Web Site: <http://www.est.org.uk>

Date

To whom it may concern

Recognition of XXXXXXXXXX as an Energy Saving Measure.

The Energy Saving Trust have recognised XXXXXXX as providing energy savings when installed according to the manufacturers instructions. The lifetime of the energy savings has been set at XX years.

Please note that this letter does not constitute an endorsement or recommendation of this product in any way, purely recognition that it can be used as an energy saving measure.

For further information regarding these savings please contact the Energy Saving Trust at the above address.

Yours faithfully

James Russill

Evaluation Manager



The Energy Saving Trust Limited, Registered Office: 21 Dartmouth Street London SW1H 9BP. Registered in England and Wales No. 2622374.



Appendix 4 Energy Efficiency Assessment

Questionnaire

A. CUSTOMER DETAILS

A1. Title: Mr Mrs Ms Miss

Other

A2. First Name / Initial:

A3. Surname:

A4. Address:

A5. Postcode:

A6. Contact tel. no:

● A7. In what year was your house built? (Mark one.)

Before 1900 <input type="checkbox"/>	1966 – 1975 <input type="checkbox"/>
1900 – 1918 <input type="checkbox"/>	1976 <input type="checkbox"/>
1919 – 1929 <input type="checkbox"/>	1977 – 1980 <input type="checkbox"/>
1930 – 1944 <input type="checkbox"/>	1981 <input type="checkbox"/>
1945 – 1949 <input type="checkbox"/>	1982 – 1990 <input type="checkbox"/>
1950 – 1964 <input type="checkbox"/>	1991 – 1995 <input type="checkbox"/>
1965 <input type="checkbox"/>	1996 or later <input type="checkbox"/>

● A8. Property type? (Mark one.)

Detached <input type="checkbox"/>	Mid terrace with passage <input type="checkbox"/>
Semi-detached <input type="checkbox"/>	Top floor flat <input type="checkbox"/>
End terrace <input type="checkbox"/>	Middle floor flat <input type="checkbox"/>
Mid terrace <input type="checkbox"/>	Ground floor flat <input type="checkbox"/>

● A9. Do you own your home or do you rent?

Own / buying on mortgage

Renting from council

Renting from housing association

Renting privately

Tied house / other

B. PROPERTY DETAILS

IF YOU LIVE IN A FLAT

B1a. What type of building is it in?

Tower block (six or more storeys)

Custom block (five or less storeys)

Above shop or office

Divided house

B1b. Is there a roof directly above your flat?

Yes, sloping (pitched)

Yes, flat

Yes, part sloping (pitched) and part flat

Only part of the flat has a roof

No

FOR ALL TYPES OF HOME

● B2. Does your home have a loft?

Yes No

B3. If yes, is there a heated room that's in regular use within the loft?

Yes No

B4. How many floors does your home / flat have? (Excluding loft rooms or cellars.)

One (e.g. bungalow) Four

Two Five

Three More

B5. How many bedrooms do you have?

One Three Five

Two Four Six

More

B6. How many living or dining rooms do you have? (Include study / playrooms etc.)

None Two Four

One Three More

B7. Is your building listed or in a conservation area?*

Yes, listed Yes, conservation area

No

C. INSULATION DETAILS

● C1. How much loft insulation do you have?*

(If this is going to prove difficult, please take an educated guess. You can use the ruler provided to help you visualise the depth of insulation.)

None <input type="checkbox"/>	150mm (6 inches) <input type="checkbox"/>
25mm (1 inch) <input type="checkbox"/>	200mm (8 inches) <input type="checkbox"/>
50mm (2 inches) <input type="checkbox"/>	No Loft <input type="checkbox"/>
75mm (3 inches) <input type="checkbox"/>	Don't know <input type="checkbox"/>
100mm (4 inches) <input type="checkbox"/>	

C2. Does your loft have any flooring?*

Yes No

C3. What type of outside walls do you have?*

- Solid brick
- Solid concrete
- Solid stone
- Cavity – insulated
- Cavity – uninsulated
- Mixed
- Modern timber framed
- Don't know

C4. Which type of windows do you have?

- All single glazed
- Some double or secondary glazed
- Most double or secondary glazed
- All double or secondary glazed

C5. Is there any draught proofing on windows and external doors? (Assume sealed double glazed windows to be draught proofed.)

- None draught proofed
- Some draught proofed
- Most draught proofed
- All draught proofed

D. HEATING AND HOT WATER

D1. What is your main heating system?

- Boiler and radiators
- Electric storage heaters
- Warm air system
- Room heaters or fires
- Other

D2. What is your main heating fuel?

- Mains gas Solid fuel
- Electricity Bottled gas
- Oil L.P.G. (bulk)

D3. Do you have a separate fire that you use regularly?

- Yes, electric No
- Yes, solid fuel Yes, gas

D4. What heating controls do you have?*

(Mark all that apply.)

- None
- Programmer / timer
- Room thermostat
- Thermostatic radiator valves
- Storage heater dials

D5. If you have a boiler, how old is it?

- Less than five years old
- Five to ten years old
- Eleven to fifteen years old
- Over fifteen years old

D6. Which of your radiators have foil behind them?*

None All Some

D7. Do you have a condensing boiler?*

(If you are not sure, please mark 'no'.)

Yes No

D8. How is your hot water usually provided?*

- From central heating system
- Gas instantaneous / combi boiler
- Electric instantaneous
- Electric immersion (on peak)
- Electric immersion (off peak)
- Dual electric immersion
- Gas, oil or coal range (e.g. AGA-Rayburn)
- Back boiler
- Other

D9. How would you describe your hot water tank insulation?

- No tank
- Solid foam insulation
- Jacket (no gaps around jacket)
- Jacket (with gaps around jacket)
- No insulation

D10. If you have a hot water tank, is there insulation on the pipes between the boiler and the tank?

- Yes Can't see pipes
- No Don't know