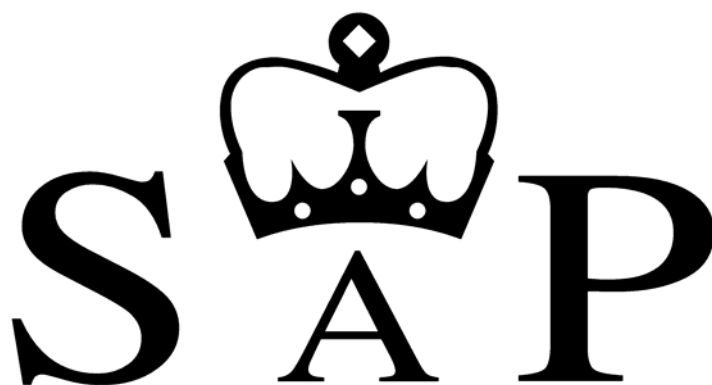


Guide to the Government's  
Standard Assessment Procedure for  
Energy Rating of Dwellings (SAP)



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# Guide to the Government's Standard Assessment Procedure for Energy Rating of Dwellings (SAP)



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This Guide is intended to provide an overview of SAP. It contains information on a number of SAP-related topics and should be useful as a standalone quick reference document.

It is hoped that it will be particularly useful to individuals who need to have a broad understanding of SAP, and an awareness of how it is used, but do not necessarily wish to concern themselves with the details.

Anyone interested in any of the detailed aspects of the SAP is advised to consult the SAP website ([www.bre.co.uk/sap2005](http://www.bre.co.uk/sap2005)), where further information, including the full specification document and contact details, can be found.

## 1 Introduction

SAP is the Government's Standard Assessment Procedure for the Energy Rating of Dwellings. Its purpose is to calculate energy performance and CO<sub>2</sub> emissions for individual self-contained dwellings in Britain. It can be applied to both newly built and existing dwellings of common types (houses, flats, bungalows, etc) in a wide range of sizes.

The main outputs are annual estimates of:

- the energy consumption per unit of floor area of the dwelling,
- energy costs (the SAP rating),
- the CO<sub>2</sub> emission rate (used for Building Regulation compliance purposes), and
- an environmental impact rating (based on CO<sub>2</sub> emissions).

SAP analyses the energy consumption of a dwelling using specific assumptions about usage and occupancy related to size. It is not a design tool. Nor is it an approvals scheme, and there is no such thing as a "SAP approved" building or product.

## 2 Usage

Currently, SAP, its derivative Reduced Data SAP (RdSAP) and the underlying model BREDEM are used to help deliver a considerable number of the Government's energy efficiency related policy initiatives. They include:

- Warm Front
- CERT
- the Carbon Calculator
- Building Regulations
- zero carbon homes stamp duty exemptions
- the Code for Sustainable Homes
- Energy Performance Certificates
- general housing stock analysis.

SAP underpins the delivery of such initiatives by assessing dwelling performance, and differentiating between dwellings.

For the purposes of the Energy Performance of Building Directive both SAP and RdSAP are cited as National Calculation Methodologies for the UK.

## 3 Methodology

SAP is derived from the Building Research Establishment Domestic Energy Model (BREDEM)<sup>1</sup> and is consistent with the European standards BS EN 832<sup>2</sup> and BS EN ISO

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<sup>1</sup> BREDEM-12 Model description. 2001 update. B R Anderson, P F Chapman, N G Cutland, C M Dickson, G Henderson, J H Henderson, P J Iles, L Kosmina and L D Shorrock. BRE Report BR 438. January 2002.

<sup>2</sup> BS EN 832:2000 Thermal performance of buildings. Calculation of energy use for heating. Residential buildings

13790<sup>3</sup>. The methodology is set out in the form of a worksheet, with accompanying tables, and the calculation can either be undertaken by hand following the steps shown, or (more usually because of the complexity), by an approved computer program that implements the worksheet. BRE approves SAP software on behalf of DECC (the Department of Energy and Climate Change), CLG (Communities and Local Government), the Scottish Executive, the Welsh Assembly Government, and the Department of Finance and Personnel in Northern Ireland. A list of approved software can be seen on the SAP website and is updated regularly.

## 4 History

SAP was originally developed in response to the need to assess, in a consistent and reliable way, the energy efficiency of dwellings. The assessment tools available at the time were based on different assessment methods and it was not possible to achieve consistency of results. SAP was first published by the DOE (now DECC, the Department of Energy and Climate Change) and BRE in 1993. It was amended in 1994, conventions to be used with it were published in 1996 and a further amendment took place in 1997. A consolidated edition was published as SAP 1998. The 2001 edition introduced the Carbon Index as an additional output that could be used to demonstrate compliance with Building Regulations.

The next edition, SAP 2005<sup>4</sup>, was published in 2005, and was also included in the amendment to Part L of the Building Regulations for England and Wales, which came into force on 1<sup>st</sup> April 2006. SAP 2005 was subsequently extended to include a supplementary calculation for Stamp Duty Land Tax (SDLT) exemption in regard to zero-carbon homes.

SAP is cited as the only means of demonstrating compliance with Part L1A of the Building Regulations; it similarly supports the Building Regulations of the Devolved Administrations, Scotland and Northern Ireland. Consequently, subsequent revisions of the SAP will be timed to coincide with the published amendments to these Regulations, scheduled for 2010, 2013 and 2016.

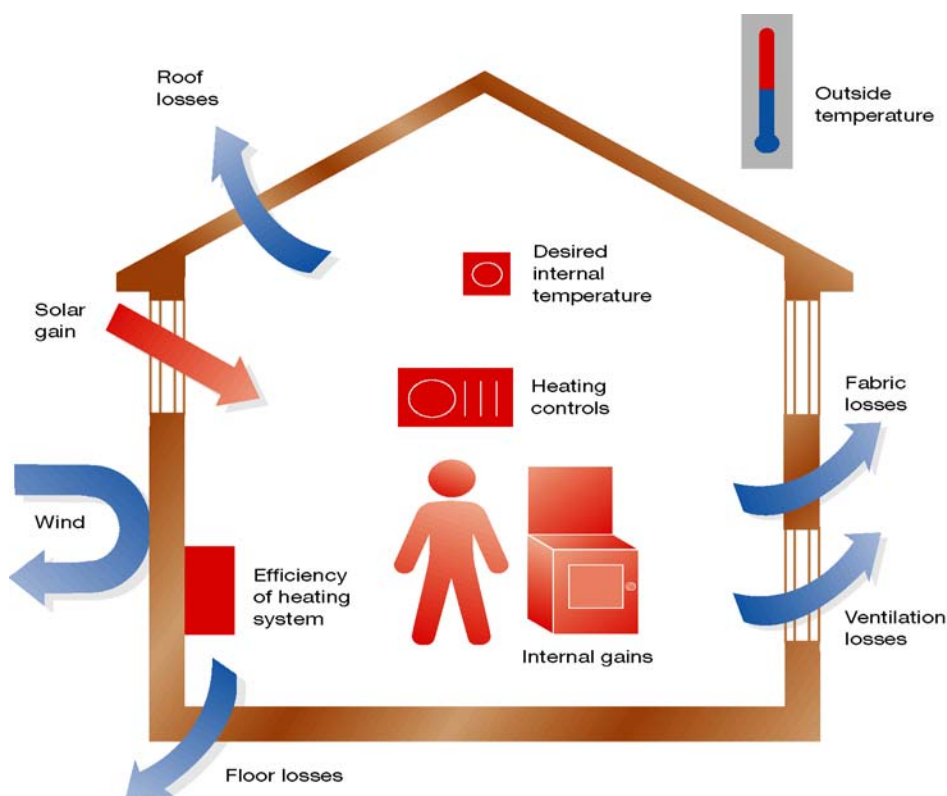
For the purposes of providing ratings on existing homes, where it may be difficult and expensive to supply the complete set of data required for a full SAP calculation, there is a reduced data route (known as Reduced Data SAP, or RdSAP), which also forms a part of the SAP 2005 specification. RdSAP consists of a system of data collection, together with defaults and inference procedures that generate a complete set of input data for the SAP calculation.

*The next edition of SAP is due to be published in the latter part of 2009; for Building Regulation purposes it will come into effect when the 2010 Amendment to Part L comes into force. The 2009 edition will incorporate several changes aimed at improving the accuracy of SAP assessments of very low energy dwellings that will become the norm for all new homes built to low and zero carbon targets (the higher levels of the Code for Sustainable Homes). However, the basic principles of the calculation will remain the same. The biggest change will be a monthly, rather than seasonal, calculation procedure.*

<sup>3</sup> BS EN ISO 13790:2004 Thermal performance of buildings. Calculation of energy use for space heating

<sup>4</sup> See [www.bre.co.uk/sap2005](http://www.bre.co.uk/sap2005)

## 5 Principles



The schematic above illustrates the key factors that feature in the energy balance of a dwelling. Energy losses through the building fabric are balanced by the energy supplied by the heating system, plus the internal and solar gains. It is this energy balance that is of concern to almost all building energy assessment models, including BREDEM and SAP.

The energy balance calculation takes into account a range of factors that influence energy efficiency. They include:

- materials used for construction of the dwelling
- thermal insulation of the building fabric
- ventilation characteristics of the dwelling and ventilation equipment
- efficiency and control of the heating system(s)
- solar gains through openings of the dwelling
- the fuel and power used to provide space and water heating, ventilation and lighting
- district heating services providing heat and hot water to the dwelling
- some types of renewable energy systems installed in or on the dwelling

SAP makes use of standard assumptions, so that results are independent of factors related to the individual characteristics of the household occupying the dwelling, thereby allowing different dwellings to be compared on an equal basis. For example, there are standard assumptions relating to:

- household size and composition;
- heating patterns, temperatures, and hot water demand;
- ownership and efficiency of particular domestic electrical appliances.

Results are used to develop three indicators of dwelling performance. Currently these are not affected by the dwelling's geographical location, so that a given dwelling has the same performance rating in all parts of the UK. However, this underlying principle may be changed if cooling is taken into consideration in future editions.

## 6 Steps in the procedure

The principal steps in undertaking a SAP calculation are as follows:

1. Determine the overall dwelling dimensions
2. Calculate the ventilation rate
3. Calculate the heat losses
4. Calculate the water heating energy requirements
5. Determine the internal gains
6. Determine the solar gains
7. Determine the mean internal temperature
8. Determine the degree days
9. Calculate the useful space heating requirement and then the delivered energy for this and for water heating.
10. Determine the fuel costs from the delivered energy figures
11. Calculate the SAP rating
12. Calculate the carbon dioxide emissions (and hence the Dwelling CO<sub>2</sub> Emission Rate and the Environmental Impact Rating)

Each of these steps will generally require several individual calculations, and will usually involve the use of look-up tables or extraction of relevant figures from a database. For example, the Government's Boiler Efficiency Database ([www.boilers.org.uk](http://www.boilers.org.uk)), provides seasonal efficiency figures for all current gas and oil boilers, as well as most obsolete boilers, and is updated every month; approved SAP software is generally designed to read in the Boiler Efficiency Database information automatically so that it is always using the most up-to-date figures.

The calculation procedure and conventions are described in full in the specification document (obtainable from [www.bre.co.uk/sap2005](http://www.bre.co.uk/sap2005)). The method of calculation is set out in the form of a worksheet, accompanied by a series of tables. The first page of the worksheet is shown on the following page. There are five further pages of overall similar appearance and complexity.

The worksheet is both a form to capture the data and definition of the calculations. It is mainly intended for use when implementing the calculations in computer software, but it could be used to calculate the SAP outputs manually (not recommended because of the complexity). For compliance with Building Regulations and the Energy Performance of Buildings Directive, assessments should be produced by a qualified assessor using approved SAP software.

**1. Overall dwelling dimensions**

	Area (m <sup>2</sup> )	Average storey height (m)	Volume (m <sup>3</sup> )
Ground floor	<input type="text"/> (1a)	× <input type="text"/>	= <input type="text"/> (1)
First floor	<input type="text"/> (2a)	× <input type="text"/>	= <input type="text"/> (2)
Second floor	<input type="text"/> (3a)	× <input type="text"/>	= <input type="text"/> (3)
Third and other floors	<input type="text"/> (4a)	× <input type="text"/>	= <input type="text"/> (4)
Total floor area (1a) + (2a) + (3a) + (4a) =	<input type="text"/> (5)		
Dwelling volume		(1) + (2) + (3) + (4) =	<input type="text"/> (6)

**2. Ventilation rate**

	m <sup>3</sup> per hour
Number of chimneys	<input type="text"/> × 40 = <input type="text"/> (7)
Number of open flues	<input type="text"/> × 20 = <input type="text"/> (8)
Number of intermittent fans or passive vents	<input type="text"/> × 10 = <input type="text"/> (9)
Number of flueless gas fires	<input type="text"/> × 40 = <input type="text"/> (9a)
Infiltration due to chimneys, flues and fans = (7)+(8)+(9)+(9a) =	<input type="text"/> ÷ box (6) = <input type="text"/> (10)

If a pressurisation test has been carried out, proceed to box (19)

Number of storeys in the dwelling	<input type="text"/> (11)
Additional infiltration	$[(11) - 1] \times 0.1 =$ <input type="text"/> (12)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal use 0.35	<input type="text"/> (13)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	<input type="text"/> (14)
If no draught lobby, enter 0.05, else enter 0	<input type="text"/> (15)
Percentage of windows and doors draught stripped	<input type="text"/> (16)
Window infiltration	$0.25 - [0.2 \times (16) \div 100] =$ <input type="text"/> (17)
Infiltration rate	$(10) + (12) + (13) + (14) + (15) + (17) =$ <input type="text"/> (18)

If based on air permeability value, then  $[q_{50} \div 20] + (10)$  in box (19), otherwise (19) = (18)

Air permeability value applies if a pressurisation test has been done, or a design or specified air permeability is being used

Number of sides on which sheltered (Enter 2 in box (20) for new dwellings where location is not shown)	<input type="text"/> (20)
Shelter factor	$1 - [0.075 \times (20)] =$ <input type="text"/> (21)
Adjusted infiltration rate	$(19) \times (21) =$ <input type="text"/> (22)

Calculate effective air change rate for the applicable case:

If balanced whole house mechanical ventilation	air throughput (in ach, see 2.6.6) =	<input type="text"/> (22a)
If balanced with heat recovery	efficiency in % allowing for in-use factor =	<input type="text"/> (22b)
a) If balanced mechanical ventilation with heat recovery	$(22) + (22a) \times [1 - (22b) \div 100] =$	<input type="text"/> (23)
b) If balanced mechanical ventilation without heat recovery	$(22) + (22a) =$	<input type="text"/> (23a)
c) If whole house extract ventilation or positive input ventilation from outside if (22) < 0.25, then (23b) = 0.5; otherwise (23b) = 0.25 + (22)	<input type="text"/> (23b)	
d) If natural ventilation or whole house positive input ventilation from loft if (22) ≥ 1, then (24) = (22); otherwise (24) = 0.5 + [(22) <sup>2</sup> × 0.5]	<input type="text"/> (24)	
Effective air change rate - enter (23) or (23a) or (23b) or (24) in box (25)	<input type="text"/> (25)	

## 7 Reduced data SAP for existing dwellings (RdSAP)

As indicated earlier, a SAP calculation requires a considerable amount of data and some of this information will only be known for certain when undertaking an assessment of a new dwelling where the plans and construction details are all available. For example, the presence of floor insulation could not normally be ascertained in a site survey of an existing home, but for a new home the plans will include the relevant details. Similarly, determining dimensions for all elements is feasible when plans are available but would be unduly laborious in an existing dwelling. RdSAP offers a simple alternative to carrying out a full SAP assessment, and is applicable to existing homes only.

RdSAP was developed by Government to help deliver Energy Performance Certificates (a requirement of the Energy Performance of Buildings Directive) when an existing dwelling is put up for sale or rent. RdSAP enables an assessment to be made on the basis of a site survey, when the complete set of data for a SAP calculation would be difficult and expensive to obtain. RdSAP is described in Appendix S of the SAP 2005 specification.

## 8 What SAP provides as output

SAP supplies an energy rating for a dwelling. It is important to understand that the energy rating procedure applies to the whole dwelling rather than its components.

*SAP needs to have performance information on all the products and materials that may be used in the construction of a dwelling. However, a SAP rating only provides information on the overall energy performance of a dwelling. Although the individual features and products contribute to the overall energy performance, there is no SAP rating for them individually. For example, there is no such thing as a SAP rating for a boiler or a window (although there may be other schemes that provide ratings for these particular products).*

*Government relies on industry to provide product performance data in the form that is needed by SAP. Where this is not available a conservative view on the performance of products and materials has to be taken.*

The current SAP specification includes the calculation of various indicators of energy performance. They are:

- energy consumption per unit floor area,
- an energy cost rating (the SAP rating),
- an Environmental Impact rating (based on CO<sub>2</sub> emissions),
- a Dwelling CO<sub>2</sub> Emission Rate (DER), and
- a Target CO<sub>2</sub> Emission Rate (TER) to test compliance with building regulations.

**Energy consumption per unit floor area** is the most fundamental indicator of energy efficiency. This particular metric is used directly for energy rating purposes in the procedures of many other countries. Although this is the most fundamental measure of energy efficiency it is, nonetheless, difficult for householders to interpret and research has shown that they most associate energy efficiency with low running costs. Thus, a fuel cost-based rating of

energy efficiency has always been preferred in the UK as the primary indicator of energy performance.

The **SAP rating** is based on the energy costs associated with space heating, water heating, ventilation and lighting, less cost savings from energy generation technologies. It is adjusted for floor area so that it is essentially independent of dwelling size for a given built form. The SAP rating is expressed on a scale of 1 to 100: the higher the number the lower the running costs. A rating of 100 represents zero energy cost for the energy uses that are considered – there would, of course, generally be costs associated with other end uses. Figures higher than 100 are achievable by dwellings that are net exporters of energy.

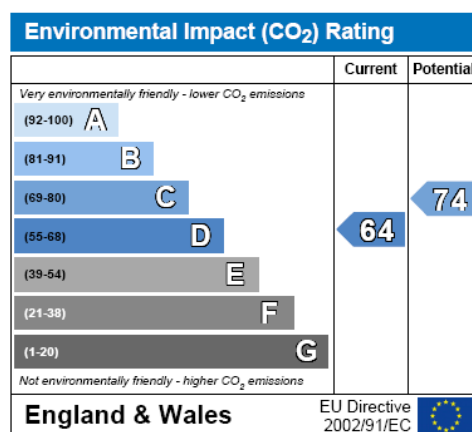
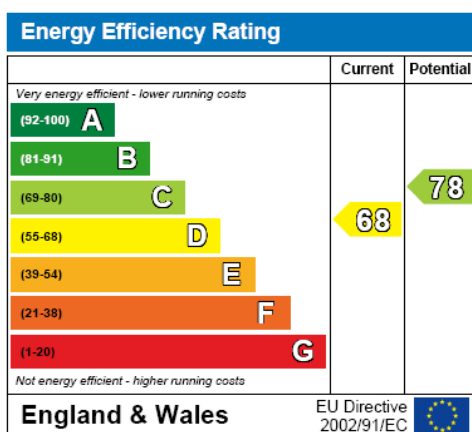
The **Environmental Impact rating** is based on the annual CO<sub>2</sub> emissions associated with space heating, water heating, ventilation and lighting, less the emissions saved by local energy generation systems that are associated with the dwelling. It is adjusted for floor area so that it is essentially independent of dwelling size for a given built form. The Environmental Impact rating is expressed on a scale of 1 to 100: the higher the number the lower the carbon emissions. A rating of 100 is achieved at zero net emissions.

The **Dwelling CO<sub>2</sub> Emission Rate (DER)** is a similar indicator to the Environmental Impact rating. It is used for the purposes of showing compliance with Building Regulations. It is equal to the annual CO<sub>2</sub> emissions per unit floor area for space heating, water heating, ventilation and lighting, less the emissions saved by local energy generation systems that are associated with the dwelling, expressed in kgCO<sub>2</sub>/m<sup>2</sup>/year.

SAP also provides confirmation of zero carbon status for the purpose of qualifying for Stamp Duty Land Tax exemption (see section 10).

## 9 Energy Performance Certificates

Three of the indicators of performance (Energy consumption per unit floor area, SAP rating, and Environmental Impact rating) are needed to produce Energy Performance Certificates. The energy cost (the SAP rating) and the Environmental Impact rating have been mapped on to an A to G label format, similar to that for white goods, in order to improve their visibility and as an aid to understanding. An example of how these ratings appear on an Energy Performance Certificate is shown below.



## 10 Zero-carbon homes

New zero-carbon homes, i.e. homes built to level 6 of the Code for Sustainable Homes, can qualify for relief from Stamp Duty Land Tax (SDLT)<sup>5</sup> and for this purpose SAP methodology has been extended to include the CO<sub>2</sub> emissions associated with appliances and cooking and to allow for site-wide electricity generation technologies.

The first step is to determine the dwelling CO<sub>2</sub> emissions as for Building Regulations compliance (i.e. calculate the DER). If the DER for the dwelling is less than or equal to zero the dwelling may then be assessed for net CO<sub>2</sub> emissions. The conditions for SDLT relief are:

- The heat loss parameter must be no greater than 0.8 W/m<sup>2</sup>K
- The DER must be no greater than zero
- The net CO<sub>2</sub> emissions must be no greater than zero.

Details of the relevant calculation extensions and spreadsheets may be accessed via the SAP website. Commercial SAP software should already incorporate the necessary elements to undertake this extended SAP assessment.

## 11 Updating of SAP

It will be appreciated from the above that there is a very wide range of issues that must be addressed in undertaking a SAP calculation. Thus, over time it is likely that amendments will be required to reflect various changes. Consequently, the data tables, product performance information, assumptions and algorithms in the specification may be periodically updated to take account of the latest available information. For example, for SAP 2010, this will include changes to the lights and appliances assumptions to reflect current understanding, and revising the water heating algorithms to take account of the findings of recent actual demand and boiler performance measured in trials of over one hundred dwellings.

However, the fact that SAP is used in support of the Building Regulations means that there are limitations on how and when these updates can be introduced. In practice, significant updating of elements relating to the underlying calculation methodology and product performance data can only take place when Part L of the Building Regulations is to be amended.

Previously Part L was amended at intervals of about five years. This will reduce to three years to 2016, but still restricts the opportunities for innovation. Appendix Q of SAP was introduced in the 2005 edition to alleviate this problem, by providing a means for SAP to access new and revised product performance data without the need to revise SAP itself.

## 12 Appendix Q: new and revised product performance information

Appendix Q of SAP (“Special features and specific data”) allows the performance of new energy-saving technologies, and advanced versions of existing technologies, to be evaluated so that it may be taken into account in a SAP assessment.

To maintain the integrity of SAP, any new technology or product must:

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<sup>5</sup> Regulations have been made under sections 58B and 58C of Finance Act 2003 to permit relief from Stamp Duty Land Tax for zero-carbon new homes.

- be classified using a non-proprietary description;
- have an energy evaluation method agreed, accepted and published.

Individual products within the class must be submitted for recognition, and are subject to the provision of satisfactory independent evidence of performance relevant to the evaluation method. Once accepted the product performance information will be added to the searchable database on the Appendix Q website. This website is an integral part of the SAP, and may be accessed from [www.bre.co.uk/sap2005](http://www.bre.co.uk/sap2005).

**The SAP Appendix Q procedure must not be used for any product unless energy calculations have been undertaken as specified for its type and it has been listed on the Appendix Q website.**

To have a technology considered for inclusion on the Appendix Q website, an application form (available on the Appendix Q website) should be completed and emailed to [sapq@bre.co.uk](mailto:sapq@bre.co.uk). The completed form should contain details on the following:

- A brief description of the technology, specifying the scope of its application, and the mechanism by which it operates
- How the product is to be identified during a SAP assessment;
- Any relevant standards
- Any limitations as to its application
- Key parameters which will affect the energy use
- Any additional information

Unless the technology has already been analysed and recognised by SAP, an initial meeting will normally be needed to discuss ways in which savings may potentially be characterised, and the requirements for testing. Suitable research, testing, and/or modelling that will enable a technology to be evaluated and added to the SAP Appendix Q website will be identified. Designers and manufacturers should not embark on substantial test programmes in advance of such discussions, as the test methods and measurements to produce relevant data for SAP should be determined first.

It should be appreciated that in considering technologies, the SAP calculation method must maintain fairness and impartiality, and analytical treatment must remain proportionate to the scope, purpose, and resolution of SAP, and not conflict with existing SAP methodology. The inclusion of additional technologies is subject to the approval of DECC. They must not add substantially to the work needed to carry out a SAP assessment, nor call for special skills that an assessor is not expected to possess. A permanent label, or other means of identification, of the product may be needed, remaining visible after installation without the aid of tools. Other assumptions in the evaluation analysis may have to be confirmed in the form of an agreement with the manufacturer or certificate from the installer.

The process for getting a new technology recognised via Appendix Q is summarised below.

- 1 Manufacturer completes SAP Q application form and sends to BRE.
- 2 If not covered by an existing product classification, a preliminary meeting (max. 2 hours) may have to be arranged to discuss the product in question and scope for recognition under SAP Appendix Q.
- 3 A proposal for the analytical work needed is formalised.
- 4 DECC approval of the stated methodology (in principle) is sought.
- 5 Development of test methodology and scope.
- 6 Development of data and test requirements.
- 7 Tests and measurements. This may be done by any competent and independent testing organisation.

- 8 Data and test results obtained from independent sources is analysed; an algorithm produced for implementation in SAP; regression coefficients or other technical descriptors are devised for application to the particular product tested.
- 9 Acceptance confirmed by DECC of the SAP Appendix Q methodology, and the method published.
- 10 Agreement is reached for product identification, label and change control rules, and any restrictions on installation.
- 11 SAP Appendix Q website is expanded to include product data, calculation spreadsheet and Installation Guidance document for use by SAP Assessors.
- 12 Final report produced to summarise all testing work and reasoning behind recognised 'in-use' rating.
- 13 Sample dwellings are analysed for accredited savings in CERT (optional additional step, if required).

The final stage listed above relates to CERT (the Carbon Emissions Reduction Target) accredited savings. SAP and CERT are entirely separate but are sometimes confused.

**SAP**, as explained in this Guide, is a procedure for assessing the energy performance of dwellings in the UK. Responsibility for SAP rests with the Government (principally DECC, but CLG is also a major stakeholder). The process above illustrates the involvement of DECC. BRE provides technical input throughout, analyses the data, decides test methods and data measurements, and devises the relevant algorithm for use in SAP.

**CERT** is a scheme to reduce household carbon emissions in Great Britain (Northern Ireland has a separate scheme). Energy suppliers are obliged to meet a target for the reduction in carbon emissions over a three year period (currently April 2008 to March 2011, though a further similar supplier obligation is expected to apply after this date). Suppliers comply with their obligations by promoting energy efficiency and other carbon saving measures (eg, insulation, improved heating, lighting, appliances) to households. Each action must have accredited savings, which can be counted towards a supplier's carbon emissions reduction target. Responsibility for administering this scheme rests with Ofgem. (Setting the overall target and policy are the responsibility of DECC.)

Reductions in carbon emissions for insulation and heating actions are usually calculated using BREDEM (on which SAP is based). Recognition of a product in SAP, via Appendix Q, may provide the algorithms by which CERT accredited savings can be calculated, hence the optional final stage in the above process. In other cases assessments may be made at a more fundamental level outside any model. For further information about the CERT scheme and accredited savings please contact Ofgem.

Recognition via Appendix Q is likely to be a temporary position for any particular technology. Generally, it is intended to incorporate the algorithms for such technologies within the main SAP worksheet and tables when next updating SAP. (It is possible that for some products this would not be practical, and they will remain within the Appendix Q recognition scheme.)

### 13 SAP developments and information needs

SAP, and the various uses of it described in this guidance document, have a role in promoting energy efficiency improvements within the UK housing stock and should be seen as an aid to policy development. Government sets the underlying policies to promote energy

efficiency, and relies to a large extent on the actions of others (industry, energy suppliers, householders, etc) to make these policies work effectively.

Industry in particular has an important role to play in providing product performance information that might allow the SAP model to be developed and improved. If industry believes that the treatment of a particular type of product is in need of amendment this can only be pursued if there is suitable independent evidence available. When considering any such amendments then, as with SAP Appendix Q, fairness and impartiality must be maintained and treatment must be proportionate to the scope, purpose, and resolution of SAP, avoiding conflict with existing SAP methodology for other products.

It is impossible to give universal guidance on the exact nature of the independent evidence that would be required. This would depend on the relative importance of the product or particular feature in question. Something that could potentially make a large difference to SAP ratings would obviously need to be investigated rather more thoroughly (eg, via large scale field trials) than something that might only make a fairly small difference to SAP ratings (for which a robust test procedure and independent third party testing would probably suffice). However, something that made only a fractional difference might not be worth considering at all (ie, it would simply not be “proportionate to the scope, purpose and resolution of SAP”).

Many of the amendments requested fall into the “small difference” category. Factors that make a large difference are, by definition, major items that the SAP model should already recognise and deal with adequately. That is not to say that they should not be reviewed periodically and updated when new information is obtained – a recent example of this being the revision of the water heating algorithms to take account of the findings of measurements in over 100 actual dwellings, as mentioned earlier.

For “small difference” amendments a robust test specification, agreed with BRE and DECC, followed up with independent third party testing should be adequate to provide the required evidence<sup>6</sup>. If the findings indicate that the differences can be quantified reliably and that an amendment to SAP is worthwhile, it will be incorporated at the next opportunity. Nevertheless it must be remembered that the primary requirement is for SAP to provide the Government, and those who contract with an organisation for the production of a dwelling energy performance assessment (whether linked to the production of an EPC or not), with a fair and reasonable assessment of the energy performance of individual dwellings. This must be done without imposing an undue burden on those who have to pay for the assessment procedure, and commercial objectives are not allowed to over-ride this.

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<sup>6</sup> Evidence already gathered in some other way may still be useful and usable. It would be considered on its individual merits, though would not be taken into account if deemed to be insufficiently conclusive.