DEPARTMENT OF ENERGY & CLIMATE CHANGE

A consultation on proposed changes to the Government's Standard Assessment Procedure (SAP)

4 January 2012

Introduction

The Standard Assessment Procedure (SAP) is used to assess the energy performance of dwellings and thereby helps deliver many of Government's energy and environmental policy objectives.

For new dwellings SAP is used as the vehicle for demonstrating compliance with the relevant building regulations for England and for the Devolved Administrations. Energy standards for new homes are to be amended in 2013 in England and Wales (Part L), in Scotland (Section 6) and later in Northern Ireland (TB F). Such proposed changes will be the subject of separate consultations by the Administrations responsible.

The forthcoming 2013 Amendment to Part L of the Building Regulations for England (conservation of fuel and power), which is a step towards delivering zero carbon homes in 2016, will be subject to a separate consultation. DECC has undertaken a review of the SAP to support the Amendment. This review has indicated that some improvements should be made to keep pace with developments of technology and to provide support for Green Deal and the Renewable Heat Incentive. The current edition of SAP is known as SAP 2009 and the subject of this review will be known as SAP 2012.

There are a number of documents that form a part of this SAP consultation. The key one is the revised SAP specification but there are also some technical documents that provide details of the reasoning behind the main changes.

All of these documents can be accessed at www.bre.co.uk/sap2012.

Five main amendments to SAP, with 21 associated questions, are presented in this consultation document. Responses to these questions will be used to help decide on the amendments that are finally introduced into SAP 2012. Further minor amendments are listed at the end of this document. Should respondents have any comments on these they can be made via question 21.

Looking ahead / SAP Integrity Group

A further review of SAP is envisaged in 2015 primarily to address improvements to the procedure to take account of developments in technology and to incorporate experience gained from the application of SAP to very low energy dwellings. Improvements may be possible also through the availability of new data. Topics that are anticipated for consideration in the further review in 2015 include the following:

- Overheating and space cooling
- Use of solar panels for space heating
- Different types of low energy lighting
- Assumptions about heating patterns and internal temperatures (using evidence from the English Housing Survey's energy follow-up survey).
- Introduction of a community heating database
- Low temperature circulation to heat emitters in domestic heating systems
- A review of the treatment of heating controls
- A review of different types of ventilation systems
- In-use factors applied to individual technologies
- Annual performance method for micro-CHP devices that provide hot water services only
- A review of occupancy factors

Progress on all of these will, of course, be entirely dependent on the availability of adequate evidence [1].

In this regard, DECC is proposing to establish a SAP Integrity Group. It is anticipated that this independent advisory group will consist of six to eight individuals with expertise relating to energy modelling and the application of SAP, whose role will be to advise on SAP development and to protect its scientific integrity. This group will also be used to make recommendations for Green Deal such as adding new measures to RdSAP and reviewing the evidence and assumptions that it uses.

Membership of the group is not yet decided but it is clear that all members will necessarily have to be free of any commercial interests. It is anticipated that this group will be set up shortly and that it will play a role in considering the responses to the current SAP consultation.

Another issue that is likely to receive attention in the near future concerns the U-values that are used in SAP calculations. There is quite strong evidence that measures such as cavity wall insulation do not in practice achieve the predicted savings. This is often taken into account retrospectively via the application of "in-use" factors (e.g. for schemes such as CERT and Green Deal). There could be various reasons for the shortfall, including occupants taking some of the savings as comfort improvements, but a part of it could be to do with the thermal characteristics of the wall not being as theory would suggest.

---

[1] Some of the topics noted in this list are related to issues that have been raised by various bodies including the Zero Carbon Hub and the micro-generation industry. A separate document has been prepared which provides responses to these various issues. This document is not formally a part of the SAP consultation. Nonetheless, for those who may be interested, it is available to download along with the various consultation documents.

In this regard, the area of greatest concern is new build walls into which insulation is blown following completion, as the implication is that the U-values required to comply with Building Regulations may not always be achieved in practice. DECC intends to review the available evidence and address this at the earliest possible opportunity. Furthermore, work is currently underway to investigate this issue further by measuring wall U-values in the field and it is possible that this could in the longer term lead to a recommendation to amend the U-values that are applied in SAP for a range of other situations as well.

Amendment 1 – Carbon Dioxide Emission Factors

It is desirable to revise the existing methodology for determining carbon dioxide emission factors to provide more comprehensive coverage of emission impacts and greater equity between fuel types and energy saving opportunities. Therefore we propose the following specific changes be made to the existing methodology.

- **Include CO_2 and other energy related greenhouse gases emissions, specifically CH_4 and N_2O.**

  SAP 2009 emission factors only include CO_2.

  Expanding consideration to CH_4 (methane) and N_2O (nitrous oxide) will provide a more comprehensive assessment of the environmental impact of energy use.

- **Include indirect[2] upstream[3] emission sources associated with transporting energy**

  SAP 2009 emission factors included indirect upstream emissions associated with extraction/cultivation, production, processing and distribution of energy, but excluded emissions associated with transportation of fuels.

  Including transport emissions will provide a more comprehensive assessment of the carbon impacts of imported fuels and provide equitable treatment across all energy sources.

- **Take full account of the upstream emissions which arise from energy production outside of the UK.**

  With the exception of electricity imports from France (which is mostly nuclear generation), where these emissions are specifically accounted for, the SAP 2009 emission factors took no account of differences in the energy supply chain overseas compared to that in the UK.

  The new approach will include emissions such as those associated with compression and leakage of liquefied natural gas (LNG) imports which are considerably higher than those for natural gas piped directly from the North Sea. Therefore extending consideration of upstream emission sources overseas to all fuels will provide a more comprehensive assessment of the carbon impacts of imported fuels and provide equitable treatment across all energy sources.

---

[2] Direct emissions arise directly at the point of use, e.g., from fuel combustion, whilst indirect emissions are those which arise elsewhere as a consequence of the energy use.

[3] Upstream emissions are those which arise before the energy reaches the end user

- ## Apply system average values to both energy consumption and exports to the grid for electricity and other grid supply fuels

  In SAP 2009 a system average emission factor is applied to electricity use by a dwelling, whilst a marginal value is applied to electricity exported to the grid, e.g., from onsite renewable electricity generation.

  Applying a system average value to both exports and imports for grid supply fuels will provide an equitable treatment for renewable generation and energy efficiency options. It will also take full account of the losses avoided during transmission and distribution of electricity and provide an equitable treatment across all energy sources.

  In contrast, the use of marginal factors is recommended for both energy consumption and exports to the grid by the ZCH[4]. Whilst the use of marginal values is valid for assessing additional energy savings e.g., from carbon reduction programmes, they are not applicable for carbon measurement and do not provide an equitable means for assessing emissions across all end users.

  Therefore, the recommended option is to use a system average value for both energy consumption and exports to the grid for electricity and other grid supply fuels.

- ## Revise the time period over which predicted emission factors are calculated

  The SAP 2009 emission factors are based on the projected average values over the five year period from the date revised Building Regulations come into force. This period was chosen to reflect the time over which the emission factors will actually be applied to new build , e.g., for the three year compliance period plus an additional two years to allow for time lags between approval and building completion.

  There are arguments for projecting emission factors over shorter or longer time periods.

  Revising the methodology to use projected average values over the three years that the Approved Document is in force would provide the best estimate of what the actual emission impact will be at the time an assessment is made. This is particularly relevant for existing buildings, which account for the bulk of SAP assessments. Furthermore, the emphasis on SAP being used for existing buildings will increase when the Green Deal (which will require a SAP assessment to be carried out for all participating properties) is introduced from 2012.

[4] Zero Carbon Hub, Carbon Compliance for Tomorrow's New Homes: A review of the modelling tool and assumptions, An Overview of Findings and Recommendations, July 2010

The ZCH recommends the adoption of a 15 year projected value on the basis that this will reflect the operational life of the heating system installed and hence the expected lifetime emissions for a new installation[5]. However, there is considerable uncertainty associated with long term projections, and so they are inevitably much less reliable than short term projections.

Given the high level of uncertainty associated with long term projections and the focus on existing buildings, the adoption of a three year projection period is recommended as the option that is appropriate for the primary uses of SAP (e.g. for EPCs).

In addition, however, it is also recommended that a 15 year projection figure should be available for use in considering longer term impacts.

- **Continue to exclude carbon dioxide emissions from combustion of biogenic fuel sources**

SAP 2009 excludes carbon dioxide emissions that arise directly from the combustion of biogenic materials[6].

Carbon dioxide emissions of biogenic origin are excluded because they are part of the carbon cycle and (provided they are from sustainable sources) will not lead to a net increase in atmospheric CO_2. This practice is in line with most major end user carbon accounting methodologies e.g., GHG reporting protocol[7].

It should be acknowledged that, in implementing the proposed methodology, inevitably there will be some areas where full data is not available and in these instances suitable estimates will have to be made.

SAP technical paper STP11/CO204 provides details of the rationale behind the proposed amendments relating to carbon dioxide emission factors.

[5] The ZCH recommendations also proposed that predicted emission factors for future compliance periods will be provided and updated annually, in order to provide an indication of the direction of travel. It is proposed that that future emission factors be published annually in line with this recommendation.

[6] Derived from plant or animal sources

[7] Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, World business Council for Sustainable Development and the World Resources Institute

Consultation Questions

Q1: Do you agree that the carbon dioxide emission factors should include energy related CH_4 and N_2O emissions, quantified as CO_2 equivalent?

Yes ☐ No ☐

Please provide any additional information here:

Q2: Do you agree that the carbon dioxide emission factors should include transport related emissions?

Yes ☐ No ☐

Please provide any additional information here:

Q3: Do you agree that the carbon dioxide emission factors should include energy supply chain emissions in instances when they occur outside of the UK?

Yes ☐ No ☐

Please provide any additional information here:

Q4: Do you think the emission factor for both consumption and export of grid supply fuels should be calculated on a system average or a marginal basis? Please indicate either (a) the system average value for both consumption and exports to the grid, (b) the marginal value for both consumption and exports to the grid, or (c) retaining the SAP 2009 methodology (system average value for consumption and marginal value for exports to the grid).

Select option

Please provide any additional information here:

Q5: Do you agree with the recommendation that the principal time period over which emission factors should be projected for use in SAP should be 3 years, but that a 15 year option should also be provided for consideration of longer term impacts?

Yes ☐ No ☐

Please provide any additional information here:

Q6: Do you agree that the emission factors should continue to exclude direct CO_2 emissions from biogenic (renewable) sources?

Yes ☐ No ☐

Please provide any additional information here:

Q7: Are there any additional energy sources that you think emission factors should be provided for in SAP 2012? If so please state.

Please provide information here:

Q8: Do you have any information that could be used to address areas where there is missing data and thereby further improve the proposed emission factors? If so please state.

Please provide information here:

Amendment 2 – use of regional weather data

For the purposes of building regulations compliance and producing the SAP Rating and Environmental Impact Rating, SAP uses only UK average weather data. SAP does, however, use regional weather data for some calculations, particularly for estimates of running costs for Energy Performance Certificates. Hitherto this has been based on regional temperatures and solar radiation, and it is now proposed to include regional variations in wind speed.

Also solar radiation data is used for photovoltaics and solar panels, for which radiation for different roof pitches is needed. A revised basis for calculating solar radiation from horizontal values based on orientation and pitch has been developed.

SAP technical papers STP11/WD01 and STP11/SR01 describe in detail the proposed methods for dealing with wind speeds and solar radiation respectively.

Consultation Questions

Q9: Do you agree that wind speed should be taken into account on the basis of dwelling location? Yes ☐ No ☐

Please provide any additional information here:

Q10: Do you agree with the proposals for calculating solar radiation based on orientation and pitch? Yes ☐ No ☐

Please provide any additional information here:

Amendment 3 – heating and hot water systems with boilers

A number of aspects have been reviewed. For some of them it was concluded that no changes are justified at present. Aspects for which changes are proposed in SAP 2012 include the boiler efficiency test conditions expected to be introduced under the European eco-design regulations and the heat losses from storage combi boilers that have not been tested for hot water performance.

Section D3 of SAP Appendix D provides a form of words for boiler manufacturers wishing to declare the SEDBUK and seasonal efficiency values of their products. It is proposed this should be deleted from SAP 2012, as SAP requires boiler data in addition to efficiency and should use only authenticated figures available from the Product Characteristics Database (PCDB).

In the case of heating controls a number of possible revisions have been considered, but none brought forward as proposals for change at this stage. It has proved difficult to confirm the benefits of controls in trials, and it is recommended that the treatment of all heating controls is reviewed critically in time for the subsequent edition of SAP.

At present SAP gives credit for time and temperature zone control in all dwellings regardless of size, whereas the benefits reduce with smaller floor areas and become insignificant in small dwellings. Responses are invited on how this should be handled by SAP in future; ie, what formula should be applied to relate the benefit to the floor area.

It is intended that the adjustments to SAP calculations in respect of heating controls in SAP 2009 should remain unchanged in SAP 2012. However, it is proposed that certain controls (weather compensator and enhanced load compensator) should be recognised by SAP only when product details have been entered in the Product Characteristics Database (PCDB); this is to ensure they conform strictly to the definitions and mode of operation assumed in the SAP analysis. In the case of time and temperature zone control it is proposed that the definition is widened to include communicating TRV systems with a central controller, subject to certain conditions.

The background and details of the review, including reasons for the proposed changes, are set out in SAP technical paper STP11/B09.

Consultation Questions

Q11: Do you agree that SAP should anticipate the changes in test conditions likely to be introduced under the European eco-design regulations?

Yes ☐ No ☐

Please provide any additional information here:

Q12: Do you agree that the default values for heat losses from storage combi boilers should be amended in the light of the results from recent test programmes?

Yes ☐ No ☐

Please provide any additional information here:

Q13: Do you agree that sections D3 and D6 (in respect of declaring SEDBUK and seasonal efficiency values for boilers) of SAP Appendix D should be deleted?

Yes ☐ No ☐

Please provide any additional information here:

Q14: The benefit of dual zone time and temperature control diminishes as floor area reduces. At what floor area do you think the current benefit should start to be reduced, and at what floor area should it become zero?

Please provide information here:

Q15: Do you agree that the PCDB should be used to hold details of advanced heating controls recognised by SAP?

Yes ☐ No ☐

Please provide any additional information here:

Amendment 4 – Insulation and extent of primary pipe work

The table in SAP containing loss rates from primary pipe work was reviewed, with the intention of adding extra categories, for example to deal with partially insulated pipe work. A simple calculation procedure was developed to generate the necessary figures. However, it is proposed that the calculation procedure itself be included in future versions of SAP to give increased flexibility and allow more options in future without using increasingly large tables.

One option the method potentially allows is for the actual measured length of primary pipe work to be entered into SAP. However, this is not proposed for SAP 2012 for the following reason. If primary pipe work losses were based on actual lengths but secondary (distribution) losses were not – and at the moment there is no method for their calculation – there is a risk designers might reduce primary pipe work at the expense of longer runs of secondary, potentially leading to poorer design. It is therefore only appropriate to introduce varying lengths into both at the same time. Any evidence on secondary pipe work losses would be gratefully received from consultees, to help make this possible in a future version of SAP.

Details of the review and the method developed are described in the supporting document STP11/DHW02.

Consultation Questions

Q16: Do you agree with the proposed treatment of primary pipe work losses? If not, what alternative approaches could be used?

Yes ☐ No ☐

Please provide any additional information here:

Q17: In future, should the actual length of pipe work be used in the calculation of primary and secondary losses? Yes ☐ No ☐

Please provide any additional information here:

Amendment 5 – default seasonal performance factors for heat pumps

The seasonal performance factors for heat pumps contained in Table 4a of SAP were originally *typical* values, based on discussions with the industry and intended to represent average performance. Average performance is appropriate in the absence of using measured data since that helps to minimise potential errors in any particular instance.

However, as SAP is able to utilise actual measured data, and such data is now available, it follows that the performance values tabulated in SAP should become *default* values, representing the likely minimum performance that can be expected. Otherwise, poor performing heat pumps could hide behind and benefit from overly generous default values. Default values are over-ridden by measured data whenever possible.

A recent report on field trials of domestic heat pumps has provided information on in-use performance[8] from which suitable default values can be determined. Examination of the data in the report suggests that the default seasonal performance factors in SAP should be reduced from their present values. Details are in the supporting document STP11/HP01

Consultation Questions

Q18: Does the approach taken in document STP11/HP01 for determining the default values seem appropriate and reasonable?

Yes ☐ No ☐

Please provide any additional information here:

Q19: If so is it reasonable to discount the lower values as being unrepresentative?

Yes ☐ No ☐

Please provide any additional information here:

Q20: If not what criteria would you recommend using to determine the default values?

Please provide information here:

[8] Getting warmer: a field trial of heat pumps, Energy Saving Trust, September 2010

Consultation Question

Q21: Do you have any comments relating to the proposed SAP amendments which are not covered by the above? If so, please elaborate below.

Please provide information here:

Other amendments

- For the purposes of assessing waste water heat recovery systems (WWHRS), shower assumptions have been amended following review of the available data. The shower flow rate was 9.5 litres/minute and is now 11 litres/minute, shower duration was 7.9 minutes and is now 6 minutes, shower water temperature was 41°C and is now 40°C. These changes have a small effect on the savings from WWHRS.
- The height above sea-level, which has a small effect on external temperatures, was previously assumed to be zero. This has been adjusted to 50 metres. This figure was based on averaging the heights above sea-level of major UK settlements.
- The table of default U-values for windows, doors and roof windows (Table 6e) has been slightly amended.
- Appendix K has been extended to provide default values for further types of thermal bridge.
- Fuel prices and primary energy factors have been revised.
- Climate regions have been defined by postcode.
- Heating season length amended so as to cater for different climate regions (this is relevant only to the costs and savings that are calculated for Energy Performance Certificates).
- Adjustment to heat loss from solar collectors so as to account for the second order heat loss coefficient.
  Note. A report on field trials of solar water systems has been published by EST and will be taken into account in a future review.
- Two additional control options for community heating
- The CO_2 emission offset from biomass community CHP can be carried forward in all calculations if the fabric energy efficiency conforms with the requirements of building regulations.
- Where photovoltaic (PV) panels on blocks of flats are connected to the landlord supply rather than to the individual flat the Energy Performance Certificate for that flat will include the relevant share of the carbon savings from the PV panels, but no cost savings will be attributed to the flat.

Department of Energy & Climate Change
3 Whitehall Place
London SW1A 2AW
www.decc.gov.uk

URN 11D/926