Department for
Business, Energy
& Industrial Strategy

PROPOSED CHANGES TO GOVERNMENT'S STANDARD ASSESSMENT PROCEDURE (SAP)

November 2016

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The consultation can be found on the BEIS section of GOV.UK:
https://www.gov.uk/beis

proposed changes to Government's Standard Assessment Procedure (SAP)

Any enquiries regarding this publication should be sent to us at buildingheat@beis.gov.uk.

Introduction

The Standard Assessment Procedure (SAP) is a methodology used to assess the energy performance of homes 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. Consultations on changes to Building Regulations will be the subject of separate consultations by the Devolved Administrations responsible. Any consultations on changes to Building Regulations will be the subject of separate consultations and decisions by the Devolved Administrations responsible. This will provide an opportunity for the public to consider further some of the impacts outlined in this consultation document in line with the proposals of each of the administrations. In England, the Government will be undertaking a review of energy performance standards for new homes, based on cost effectiveness, before making any proposals to change Building Regulations.

Reduced data SAP (RdSAP) is the methodology used to produce Energy Performance Certificates, which are required at point of sale or rental and used to support policy delivery for many Government schemes, including the Feed in Tariff and the Renewable Heat Incentive scheme. Depending on policy development, changes to SAP or RdSAP may require consequential changes to legislation, for example relating to Green Deal or the Energy Company Obligation.

SAP was last updated following a review in 2012. The current edition of SAP is known as SAP 2012. DECC undertook a review of SAP in 2014 and identified that some improvements should be made to keep pace with research, innovation and technology developments.

Help to identify the changes proposed in this consultation arose from discussions with trade associations and manufacturers in 2014, work by AECOM to review stakeholders' views in 2014 (published alongside this consultation) and the outcome of the Zero Carbon Hub's review of the Performance Gap which can be found at http://www.zerocarbonhub.org/current-projects/performance-gap.

There are a number of documents that form a part of this SAP consultation. The key one is the revised SAP specification, which is accompanied by technical documents that provide details of the reasoning behind the main changes. It should be noted that the consultation proposes revisions to the SAP specification Appendices S and T, which form the methodology for RdSAP. RdSAP may be amended separately to the rest of SAP so that there would be an amended RdSAP 2012, before SAP2016 was introduced.

The evidence behind these changes can be found in each of the technical working documents. All of these documents can be accessed at www.bre.co.uk/sap2016.

Each of the changes is presented in this consultation document together with an invitation to comment on a recommended approach.

Responses to these questions will be used to help decide on the amendments that are finally introduced into the next edition of SAP, which will be referred to as SAP 2016.

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Contents

General information

Purpose of this consultation

Seeking comments on proposed changes to the Government's Standard Assessment Procedure (SAP) for the calculation of fuel use in dwellings.

Issued: 15 November 2016

Respond by: 27 January 2017

Enquiries to:
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Department for Energy & Industrial Strategy,
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Tel: 0300 068 5124
Email: buildingheat@beis.gov.uk

Territorial extent:

The methodology is made available to administrations in England, Wales, Scotland and Northern Ireland.

How to respond

Your response will most useful it is framed in direct response to the questions posed, though further comments and evidence are also welcome. Responses should be sent to the email or correspondence address above.

Additional copies:

You may make copies of this document without seeking permission. An electronic version can be found at gov.uk.

Other versions of the document in Braille, large print or audio-cassette are available on request. This includes a Welsh version. Please contact us under the above details to request alternative versions.

Confidentiality and data protection

Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information legislation (primarily the Freedom of Information Act 2000, the Data Protection Act 1998 and the Environmental Information Regulations 2004).

If you want information that you provide to be treated as confidential please say so clearly in writing when you send your response to the consultation. It would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

We will summarise all responses and place this summary on the GOV.UK website. This summary will include a list of names or organisations that responded but not people's personal names, addresses or other contact details.

Quality assurance

This consultation has been carried out in accordance with the Government's Consultation Principles.

If you have any complaints about the consultation process (as opposed to comments about the issues which are the subject of the consultation) please address them to:

BEIS Consultation Co-ordinator
3 Whitehall Place
London SW1A 2AW
Email: consultation.coordinator@decc.gsi.gov.uk

Executive Summary

Summary of changes proposed

It is proposed to make changes in respect of the following technologies or parts of fabric of the house.

Amendment 1 – Carbon Dioxide Emission Factors

Amendment 2 – SAP Heating Regime

Amendment 3 – Distribution Loss Factors for Heat Networks

Amendment 4 – Lighting calculation

Amendment 5 – Thermal bridging

Amendment 6 – Areas next to unheated spaces

Amendment 7 – U-values to walls in existing dwellings

Amendment 8 – Hot water methodology

Amendment 9 – Summer temperatures assessment

Amendment 10 – Mechanical Ventilation systems

Amendment 11 – Chimneys

Amendment 12 – Storage heating – secondary fraction

Amendment 13 – Solid fuel heating efficiencies

Amendment 14 – Solar PV - overshading

Amendment 15 – Solar PV - diverters

Amendment 16 – Product Characteristics Database – boilers

Amendment 17 – Heat pump default values

Amendment 18 – Technology costs

Amendment 19 – Heating Controls

A final question asks about the cost to business of a revision to SAP. A version of SAP software just for the purposes of this consultation (cSAP) has been prepared with the recommended approaches built into it. This can be found at:

www.isap.org.uk

Proposed Amendment 1 - Updating Carbon Emission Factors

Current methodology

1. This is set out in Table 12 in SAP 2012. For the background see http://www.bre.co.uk/filelibrary/SAP/2012/STP11-CO204_emission_factors.pdf.

Proposals

2. We propose updating the carbon emission factors for fuels using broadly the same methodological approach used for the SAP 2012 version of SAP. Technical Working Paper CONSP-07 sets out the methodology.

Discussion

3. The key data sources used to determine the emission factors are:

- Government's conversion factors – June 2015
- Digest of United Kingdom Energy Statistics – July 2015
- DECC's Updated Energy and Emissions Projection – September 2014 (to be reviewed)

4. For most fossil fuels the changes in emission factors are small and result primarily from variations in the average composition for each fuel type. For biofuels there have been some significant decreases in the emission factors compared to the 2012 values. Emissions from biofuels are more variable than those for other fuels. This is because there is much greater variation in the production and processing methods; and because of different distances travelled and modes of transport in the supply chain.

Impacts

5. The most significant impact of the proposed change is that it would reflect progress to date in decarbonising the electricity grid. For electricity the emission factor for SAP 2016 is 23% lower than the value used in SAP 2012. This is due to two key changes:

- An increase in the proportion of conventional (thermal) electricity generated from natural gas compared to coal arising from anticipated lower prices of gas relative to coal; and
- An increase in the amount of renewable energy in the generation mix.

Consultation Question

1.	Do you agree with the proposal to use the methodology set out in the technical working paper for calculating carbon emission factors and update the figures?

Proposed Amendment 2 – SAP heating regime

6. A key principle of SAP is that a standard heating regime is used to calculate energy consumption. This allows a fair comparison between different dwellings to be made regardless of occupant. The assumed heating regime has not been amended since the first edition of SAP in the mid-1990s to ensure consistency between assessments.

7. The Energy Follow-Up Survey (EFUS) 2011, published in January 2014, collected new data on domestic energy use, based on detailed temperature measurements at 20 minute intervals over one year in over 800 households, and on householder interviews to investigate aspects of energy modelling in need of review. See Technical Working Paper CONSP-01.

Current methodology

8. SAP presently assumes:

- All the rooms of a house are heated
- A demand temperature of 21°C in the living area and 18°C elsewhere
- A weekday heating pattern of 2 hours on, 7 hours off, 7 hours on, 8 hours off (two heating periods
- A weekend heating pattern of 16 hours on, 8 hours off (one heating period)

Discussion

9. The key differences found in EFUS were:

- The most striking difference is that for centrally heated households that have two heating periods, the hours of heating during weekdays are similar to the weekend. SAP assumes two heating periods on weekdays and a single, longer heating period at weekends.
- Of the centrally heated households that heat regularly, householder interviews indicate that 21% have one heating period all week. In addition, of non-centrally heated households that heat regularly, 81% also have one heating period. The dominance of central heating means the combined value shows that 28% of households that heat regularly have one heating period. This is discussed in the conclusions.
- The overall length of time for both those who use two heating periods and those who use one heating period is one to two hours shorter than in SAP. However a majority of households use one to two hours of additional heating, so the total time is close to the SAP assumptions.

- Regardless of the type of heating, 65% of households have one or more rooms not heated by the main heating system.
- The average achieved temperature in the living room is around 20^{o}C compared to 21^{o}C assumed in SAP. The temperature elsewhere is within the range assumed in SAP.

10. Approximately 60% of the centrally heated households have two heating periods and approximately 30% have a single longer heating period. These two patterns thus cover a total of 90% of centrally heated households.

11. So, it could be argued that the SAP assumption of five days of two heating periods and two days of a single heating period in a week therefore provides a good representation overall of the approximate 5/7 (71%) of households with two heating periods all week, and 2/7 (29%) of households with a single heating period all week.

12. Alternatively, the heating patterns could be changed in line with the research to reflect a more typical pattern of having two heating periods every day of the week including weekends. If SAP's heating period assumptions were altered to reflect the average position as under EFUS, the impact would be typically a 3-4% reduction in the assumed heat demand in terms of kWh/per year. cSAP has been amended in line with this proposal.

Proposal

13. The issue for consultation is whether to amend heating patterns or not. They are fixed to provide continuity and consistency between assessments as the test is one of relative performance. However, given the use of this fixed assumption for modelling and policy delivery purposes, should it now be altered to reflect the research?

Consultation Question	
2.	Should we keep the current set of heating patterns set out in SAP or move to using two heating periods every day of the week? Please provide supporting information for your view.

Proposed Amendment 3 – Distribution loss factors for heat networks

Current Methodology

14. SAP accounts for heat loss from heat distribution in a communal heat network by increasing the total heat supplied by the network via a Distribution Loss Factor (DLF). The DLF is defined as the total heat supplied to the network by the heat generator(s) divided by the sum of the heat delivered to all network connections, e.g. individual dwellings.

15. Table 12c of SAP 2012 contains default values for the DLF for communal heat networks. For new networks (1991 or later), whether supplying new or existing dwellings, the default values range from 1.05 to 1.10 depending on the temperature at which water flows through the network. Default values for older networks (1990 or earlier) range from 1.10 to 1.20.

Proposals

16. Analysis of feedback from stakeholders has indicated that the default DLF may be unrealistic, particularly when supplying dwellings with low space heating demand, e.g. new build apartments. Internal heat losses from pipes within apartment blocks and corridors are included when determining the DLF, since these losses are not designed for and cannot therefore be considered useful to the dwelling.

17. This analysis and modelling suggests that SAP significantly underestimates distribution losses. A series of changes is therefore recommended to SAP to adjust the DLF related to the heat demand of the property, dependent on its age. Full details are in the Technical Working Paper CONSP-04 but to note in general:

    - Evidence will be needed at design stage and as-built to support the DLF used. Lower defaults may be available for as-built assessments when designed and commissioned in accordance with CIBSE/ADE Heat Networks: Code of Practice for the UK

    - Where full details of the heat network are available via the Products Characteristics Database the calculated DLF would be multiplied by an in-use factor of 1.15.

    - For undertaking RdSAP assessments of existing dwellings, SAP 2016 Table 12c would be amended to specify DLF by dwelling age, which accordingly relates to dwelling heat load and therefore implied network heat density. This would impact more on newer build properties. Because of the efficiency savings from heat networks overall, and the higher build standards for newer dwellings, modelling to date suggests very few properties on this methodology would have their SAP rating band revised to fall below E.

Impact

18. Where default values are used, it will be assumed that losses from distribution are higher than currently assumed, making heat networks look less attractive. This would be mitigated against if performance data (either design or measure) of the heat network is submitted to the Products Characteristics Database (assuming performance is better than the default) OR if the network is compliant with the CIBSE/ADE code of practice.

Consultation Question	
3.	Do you agree with the proposal to amend default Distribution Loss Factors for Heat Networks?

Proposed Amendment 4 – SAP's lighting calculation including RdSAP

Current Methodology

19. SAP currently accounts for 'Low Energy Lighting' as a percentage reduction to overall lighting demand.

Proposals

20. Stakeholders have suggested that SAP's lighting calculation is too simplistic because it:

- does not differentiate between different types of 'low energy lights'; and
- does not take account of the provision of excessive (or insufficient) lighting.

21. Technical Working Paper CONSP-05 sets out our proposals to revise the calculation of energy demand so that it is based on the amount and efficiency of fixed lighting provided. We propose separate approaches for new build and existing housing.

22. In both cases, this would replace the concept of "Low Energy Lighting" in the model, calculated as a percentage reduction to overall lighting demand.

Impact

23. The aim of the changes is to encourage the provision of more innovative energy efficient lighting. However, it does mean for existing dwellings that assessors will have to collect data on the number of lights that are low energy and to differentiate between different types of lighting – for example compact fluorescent lighting and light emitting diodes.

Consultation Question	
4.	Do you agree with the proposal to change the way that lighting is calculated in SAP?

Proposed Amendment 5 – Treatment of thermal bridges

24. As dwellings have become better insulated, the importance of thermal bridging (a cold area where there is a higher rate of heat transfer, for example areas around windows or where the wall meets the roof) has increased. In well-insulated dwellings, the effect that thermal bridging can have on the overall thermal performance of a dwelling can be very significant. Recent research undertaken has shown that thermal bridging can be responsible for up to 30% of a dwelling's heat loss in highly insulated dwellings. There are two ways to calculate such losses – by using a generic value called a "y-value" or calculating Ψ–values for each part of each element. A Ψ–value measures how much heat can escape through junctions, measured in watts per metre Kelvin (W/mK).

Current methodology

25. The use of the default y-value of 0.15, which is multiplied by the sum of total area of external elements, is a potential method for both new and existing dwellings where the details of the thermal bridges are not known, or not specified for the SAP assessment. For new build, details of each junction should be available as part of the design process, so the use of this data should be encouraged in as many cases as possible.

26. The current method also enables the utilisation of out-of-date 'approved' values and 'default' values, which reduces the robustness of the input information. The 'approved' values are taken from the Part L Accredited Construction Details, which were developed in 2002.

27. The 'default' values that are currently listed in Table K1 of SAP were expanded for SAP 2012, but not revised from the 2009 figures.

Discussion

28. Research has shown that a significant difference in Ψ–value should be assumed for different wall types, even with the same target U-value in each element surrounding it.

29. We had considered continuing to allow the y-value approach. However, stakeholders have pointed out that it is readily possible to design a dwelling where using the more detailed Ψ-value approach gives a worse resulting heat loss than would be obtained using the default y-value. Where this is the case, there would be a temptation to use the latter approach to knowingly obtain an unrealistically better result.

30. In due course, it would make sense to worsen the default y-value to 0.2 to make this situation much less likely to arise. This figure is based on a series of examples set out in Technical Working Paper CONSP-06. However, this would be conditional on further sets of proposals to change the relevant Approved Documents. At present the Approved Documents in England, Wales and Northern Ireland permit the use of y = 0.15 for new dwellings.

Proposals

31. In the meantime, to make it easier to use a more accurate Ψ-value approach, it is proposed that the ‘approved’ column is removed from Table K1. The ‘current’ details in England were developed in 2002, and are now considerably out of date. Scotland and Ireland have their own details in any case.

32. It is proposed that the ‘default’ values should be updated based on comparisons with a range of details that are currently used in practice. We also propose to allow the use of data from external online databases known to contain reliable and independently assessed data on specific junctions to make the process easier for assessors.

Impact

33. The change should simplify SAP and encourage the use of more up to date and accurate accredited construction details outside SAP.

Consultation Question	
5.	Do you agree with the proposal to remove the default values in Table K1, review default values as proposed, and recognise Certified Thermal Details and Products schemes? Do you agree with the proposal in due course to amend the default y-value to 0.2?

Proposed Amendment 6 – Treatment of areas next to unheated spaces

Current methodology

34. The current methodology is set out on page 15 of SAP 2012.

Proposal

35. This proposal would update the treatment of U-values for elements adjacent to unheated spaces; and makes recommendations for the treatment of Ψ-values of elements adjacent to unheated spaces.

36. The following procedure is proposed for calculating adjusted U-values for dwelling elements adjacent to typical unheated spaces (garages, corridors, stairwells).

$$U = \frac{1}{\frac{1}{U_0} + R_u} \quad (1)$$

Where:

U = resultant U-value of element adjacent to unheated space, W/m^2K

U_0 = U-value of the element between heated and unheated spaces calculated as if there were no unheated space adjacent to the element, W/m^2K

R_u = effective thermal resistance of unheated space from the appropriate table.

37. Further details of the R values are set out in Technical Working Paper CONSP-09.

38. A new formula is introduced to calculate a Ψ-value adjustment for an unheated space.

$$F_\Psi = \Sigma AU / \Sigma AU_0$$

Where:

ΣAU = sum of areas of elements multiplied by the U-value corrected to take account of the effect of unheated space

ΣAU_0 = sum of areas of elements multiplied by the U-value before the corrections

39. Technical Working Paper CONSP-09 contains tables shows calculated FΨ values proposed for SAP 2016.

Impact

40. The proposed change should enable better modelling of the likely heat losses of elements next to unheated spaces.

Consultation Question	
6.	Do you agree with the proposals to adjust U-values and Ψ-values for elements next to unheated spaces?

Proposed Amendment 7 – U-Values for walls in existing dwellings – RdSAP

Proposal

41. We propose amendments to tables S6, S7 and S8 in SAP to bring the default U-values assumed in RdSAP assessments into line with the findings from the latest studies, which show that solid walled properties do not lose as much heat as previously assumed. More details of these studies can be found in the attached Technical Working paper CONSP-16. Changes are highlighted below.

Table S6 – Wall u values England

Age band	A	B	C	D	E	F	G	H	I	J	K	L
Wall type												
Stone: granite or whinstone as built	a	a	a	a	1.7 b	1.0	0.60	0.60	0.45	0.35	0.30	0.28
Stone: sandstone or limestone as built	a	a	a	a	1.7 b	1.0	0.60	0.60	0.45	0.35	0.30	0.28
Solid brick as built	1.7	1.7	1.7	1.7	1.7	1.0	0.60	0.60	0.45	0.35	0.30	0.28
Stone/solid brick with 50 mm external or internal insulation	0.55	0.55	0.55	0.55	0.55	0.45*	0.35*	0.35*	0.30*	0.25*	0.21*	0.21*
Stone/solid brick with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.32*	0.24*	0.24*	0.21*	0.19*	0.17*	0.16*
Stone/solid brick with 150 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	0.15*	0.14*	0.14*
Stone/solid brick with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.12*
Cob (as built)	0.80	0.80	0.80	0.80	0.80	0.80	0.60	0.60	0.45	0.35	0.30	0.28
Cob with 50 mm external or internal insulation	0.40	0.40	0.40	0.40	0.40	0.40	0.35*	0.35*	0.30*	0.25*	0.21*	0.21*
Cob with 100 mm external or internal insulation	0.26	0.26	0.26	0.26	0.26	0.26	0.24*	0.24*	0.21*	0.19*	0.17*	0.16*
Cob with 150 mm external or internal insulation	0.20	0.20	0.20	0.20	0.20	0.20	0.18*	0.18*	0.17*	0.15*	0.14*	0.14*
Cob with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.16	0.15*	0.15*	0.14*	0.13*	0.12*	0.12*
Cavity as built	1.5	1.5	1.5	1.5	1.5	1.0	0.60	0.60	0.45	0.35	0.30	0.28
Unfilled cavity with 50 mm external or internal insulation	0.60	0.53	0.53	0.53	0.53	0.45	0.35*	0.35*	0.30*	0.25*	0.21*	0.21*
Unfilled cavity with 100 mm external or internal insulation	0.35	0.32	0.32	0.32	0.32	0.30	0.24*	0.24*	0.21*	0.19*	0.17*	0.16*
Unfilled cavity with 150 mm external or internal insulation	0.25	0.23	0.23	0.23	0.23	0.21	0.18*	0.18*	0.17*	0.15*	0.14*	0.14*
Unfilled cavity with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.12*
Filled cavity	0.7	0.7	0.7	0.7	0.7	0.40	0.35	0.35	0.45†	0.35†	0.30†	0.28†
Filled cavity with 50 mm external or internal insulation	0.31	0.31	0.31	0.31	0.31	0.27	0.25*	0.25*	0.25*	0.25*	0.21*	0.21*
Filled cavity with 100 mm external or internal insulation	0.22	0.22	0.22	0.22	0.22	0.20	0.19*	0.19*	0.19*	0.19*	0.17*	0.16*
Filled cavity with 150 mm external or internal insulation	0.17	0.17	0.17	0.17	0.17	0.16	0.15*	0.15*	0.15*	0.15*	0.14*	0.14*
Filled cavity with 200 mm	0.14	0.14	0.14	0.14	0.14	0.13	0.13*	0.13*	0.13*	0.13*	0.12*	0.12*

Age band	A	B	C	D	E	F	G	H	I	J	K	L
external or internal insulation												
Timber frame as built	2.5	1.9	1.9	1.0	0.80	0.45	0.40	0.40	0.40	0.35	0.30	0.28
Timber frame with internal insulation	0.60	0.55	0.55	0.40	0.40	0.40	0.40†	0.40†	0.40†	0.35†	0.30†	0.28†
System build as built	2.0	2.0	2.0	2.0	1.7	1.0	0.60	0.60	0.45	0.35	0.30	0.28
System build with 50 mm external or internal insulation	0.60	0.60	0.60	0.60	0.55	0.45	0.35*	0.35*	0.30*	0.25*	0.21*	0.21*
System build with 100 mm external or internal insulation	0.35	0.35	0.35	0.35	0.35	0.32*	0.24*	0.24*	0.21*	0.19*	0.17*	0.16*
System build with 150 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	0.15*	0.14*	0.14*
System build with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.12*

[* - means that the wall may have had internal or external insulation when originally built; this applies only if insulation is known to have been increased subsequently (otherwise ‘as built’ applies)]

Table S6 – Wall u –values Scotland

Age band	A	B	C	D	E	F	G	H	I	J	K	L
Wall type												
Stone: granite or whinstone as built	a	a	a	a	1.6 b	1.0	0.60	0.45	0.45	0.30	0.25	0.22
Stone: sandstone or limestone as built	a	a	a	a	1.5 b	1.0	0.60	0.45	0.45	0.30	0.25	0.22
Solid brick as built	1.7	1.7	1.7	1.7	1.7	1.0	0.60	0.45	0.45	0.30	0.25	0.22
Stone/solid brick with 50 mm external or internal insulation	0.55	0.55	0.55	0.55	0.55	0.45*	0.35*	0.30*	0.30*	0.21*	0.19*	0.17*
Stone/solid brick with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.32*	0.24*	0.24*	0.21*	0.19*	0.17*	0.14*
Stone/solid brick with 150 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	0.15*	0.14*	0.12*
Stone/solid brick with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.10*
Cob as built	0.80	0.80	0.80	0.80	0.80	0.80	0.60	0.60	0.45	0.30	0.25	0.22
Cob with 50 mm external or internal insulation	0.40	0.40	0.40	0.40	0.40	0.40	0.35*	0.35*	0.30*	0.21*	0.19*	0.17*
Cob with 100 mm external or internal insulation	0.26	0.26	0.26	0.26	0.26	0.26	0.24*	0.24*	0.21*	0.19*	0.17*	0.14*
Cob with 150 mm external or internal insulation	0.20	0.20	0.20	0.20	0.20	0.20	0.18*	0.18*	0.17*	0.15*	0.14*	0.12*
Cob with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.16	0.15*	0.15*	0.14*	0.13*	0.12*	0.10*
Cavity as built	1.5	1.5	1.5	1.5	1.5	1.0	0.60	0.45	0.45	0.30	0.25	0.22
Unfilled cavity with 50 mm external or internal insulation	0.60	0.53	0.53	0.53	0.53	0.45	0.35*	0.30*	0.30*	0.25*	0.19*	0.17*
Unfilled cavity with 100 mm external or internal insulation	0.35	0.32	0.32	0.32	0.32	0.30	0.24*	0.21*	0.21*	0.19*	0.17*	0.14*
Unfilled cavity with 150 mm external or internal insulation	0.25	0.23	0.23	0.23	0.23	0.21	0.18*	0.17*	0.17*	0.15*	0.14*	0.12*
Unfilled cavity with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.10*
Filled cavity	0.7	0.7	0.7	0.7	0.7	0.40	0.35	0.45†	0.45†	0.30†	0.25†	0.22†
Filled cavity with 50 mm external or internal insulation	0.31	0.31	0.31	0.31	0.31	0.27	0.25*	0.25*	0.25*	0.25*	0.25*	0.17*
Filled cavity with 100 mm external or internal insulation	0.22	0.22	0.22	0.22	0.22	0.20	0.19*	0.19*	0.19*	0.19*	0.19*	0.14*
Filled cavity with 150 mm external or internal insulation	0.17	0.17	0.17	0.17	0.17	0.16	0.15*	0.15*	0.15*	0.15*	0.15*	0.12*
Filled cavity with 200 mm external or internal insulation	0.14	0.14	0.14	0.14	0.14	0.13	0.13*	0.13*	0.13*	0.13*	0.12*	0.10*
Timber frame as built	2.5	1.9	1.9	1.0	0.80	0.45	0.40	0.40	0.40	0.30	0.25	0.22
Timber frame with internal insulation	0.60	0.55	0.55	0.40	0.40	0.40	0.40†	0.40†	0.40†	0.30†	0.25†	0.22†

Age band	A	B	C	D	E	F	G	H	I	J	K	L
System build as built	2.0	2.0	2.0	2.0	1.7	1.0	0.60	0.45	0.45	0.30	0.25	0.22
System build with 50 mm external or internal insulation	0.60	0.60	0.60	0.60	0.55	0.45	0.35*	0.30*	0.30*	0.21*	0.19*	0.17*
System build with 100 mm external or internal insulation	0.35	0.35	0.35	0.35	0.35	0.32*	0.24*	0.24*	0.21*	0.19*	0.17*	0.14*
System build with 150 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	0.15*	0.14*	0.12*
System build with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.10*

Table S8 – Wall u-values Northern Ireland

Age band	A	B	C	D	E	F	G	H	I	J	K	L
Wall type												
Stone: granite or whinstone as built	a	a	a	a	1.6 b	1.0	0.60	0.45	0.45	-	0.30	0.28
Stone: sandstone or limestone as built	a	a	a	a	1.6 b	1.0	0.60	0.45	0.45	-	0.30	0.28
Solid brick as built	1.7	1.7	1.7	1.7	1.7	1.0	0.60	0.45	0.45	-	0.30	0.28
Stone/solid brick with 50 mm external or internal insulation	0.55	0.55	0.55	0.55	0.55	0.45*	0.35*	0.30*	0.30*	-	0.21*	0.21*
Stone/solid brick with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.32*	0.24*	0.24*	0.21*	-	0.17*	0.16*
Stone/solid brick with 150 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	-	0.14*	0.14*
Stone/solid brick with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	-	0.12*	0.12*
Cob as built	0.80	0.80	0.80	0.80	0.80	0.80	0.60	0.60	0.45	-	0.30	0.28
Cob with 50 mm external or internal insulation	0.40	0.40	0.40	0.40	0.40	0.40	0.35*	0.35*	0.30*	-	0.21*	0.21*
Cob with 100 mm external or internal insulation	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	-	0.21*	0.16*
Cob with 150 mm external or internal insulation	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	-	0.20	0.14*
Cob with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.16	0.15*	0.15*	0.14*	-	0.12*	0.12*
Cavity as built	1.5	1.5	1.5	1.5	1.5	1.0	0.60	0.45	0.45	-	0.30	0.28
Unfilled cavity with 50 mm external or internal insulation	0.60	0.53	0.53	0.53	0.53	0.45	0.35*	0.35*	0.30*	-	0.21*	0.21*
Unfilled cavity with 100 mm external or internal insulation	0.35	0.32	0.32	0.32	0.32	0.30	0.24*	0.24*	0.21*	-	0.17*	0.16*
Unfilled cavity with 150 mm external or internal insulation	0.25	0.23	0.23	0.23	0.23	0.21	0.18*	0.18*	0.17*	-	0.14*	0.14*
Unfilled cavity with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	-	0.12*	0.12*
Filled cavity	0.7	0.7	0.7	0.7	0.7	0.40	0.35	0.45†	0.45†	-	0.30†	0.28†
Filled cavity with 50 mm external or internal insulation	0.31	0.31	0.31	0.31	0.31	0.27	0.25*	0.25*	0.25*	-	0.25*	0.21*
Filled cavity with 100 mm external or internal insulation	0.22	0.22	0.22	0.22	0.22	0.20	0.19*	0.19*	0.19*	-	0.19*	0.16*
Filled cavity with 150 mm external or internal insulation	0.17	0.17	0.17	0.17	0.17	0.16	0.15*	0.15*	0.15*	-	0.15*	0.14*
Filled cavity with 200 mm external or internal insulation	0.14	0.14	0.14	0.14	0.14	0.13	0.13*	0.13*	0.13*	-	0.12*	0.12*
Timber frame as built	2.5	1.9	1.9	1.0	0.80	0.45	0.40	0.40	0.40	-	0.30	0.28
Timber frame with internal insulation	0.60	0.55	0.55	0.40	0.40	0.40	0.40†	0.40†	0.40†	-	0.30†	0.28†
System build as built	2.0	2.0	2.0	2.0	1.7	1.0	0.60	0.45	0.45	-	0.30	0.28
System build with 50 mm external or internal insulation	0.60	0.60	0.60	0.60	0.55	0.45	0.35*	0.30*	0.30*	-	0.21*	0.21*
System build with 100 mm external or internal insulation	0.35	0.35	0.35	0.35	0.35	0.32*	0.24*	0.24*	0.21*	-	0.17*	0.16*
System build with 150 mm	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	-	0.14*	0.14*

Age band	A	B	C	D	E	F	G	H	I	J	K	L
external or internal insulation												
System build with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	-	0.12*	0.12*

42. The most significant change proposed is the move from assuming older solid walls have a U-value of 2.1 to 1.7 W/m²K.

Impact

43. The energy consumption of a dwelling predicted using SAP is very sensitive to wall U-values. The proposed changes to the default wall U-values will therefore result in significant changes to the predicted dwelling performance and in particular to the savings from insulating walls.

44. We expect the proposed changes to have the following impacts:

- The SAP rating and EPC band for existing dwellings with uninsulated walls will improve. For example, some solid walled homes in bands F or G will rise to a higher band. The deemed heat demand of these houses will fall, affecting applications for the Renewable Heat Incentive.
- The apparent cost-effectiveness of insulating solid walls will potentially be made worse. However, where Government schemes use 'in-use factors'[1], any impact may be mitigated through adjustment of these factors where there is better evidence.

Consultation Question

7.	Do you agree with the proposal to change the default U-values for walls for existing buildings in RdSAP?

[1] See for example, http://www.legislation.gov.uk/uksi/2012/3018/schedule/3/made

Proposed Amendment 8 – Hot Water methodology in SAP

Current Methodology

45. Currently the volume of hot water SAP assumes that a house needs is a function of the number of occupants (N) as below:

Volume of hot water (litres per day) = (25 * N) + 36

46. The volume of hot water used has a significant impact on energy yields from solar water heating (SWH) and waste water heat recovery (WWHR). In particular their performance is significantly affected by the type of shower used in the home.

47. The present hot water calculation

- doesn't take account of shower type despite this being one of the most important fixed and accessible features of a dwelling affecting hot water consumption;
- contains inconsistencies in approach which effectively use a different hot water demand for the SHW and WWHR calculations in an attempt to correct for shower type not being taken into consideration in the main hot water demand calculation; and
- doesn't take proper account of the electricity used by electric showers.

Proposals

48. It is proposed that a daily hot water requirement in litres/day (Vd) is calculated separately for three categories of use:

- Hot water required for showers, Vd,shower
- Hot water required for baths, Vd,bath
- Hot water required for other uses, Vd,other

49. These would then be combined to give a total daily hot water demand for each month.

Vd,average (litres/day) = Vd,shower + Vd,bath + Vd,other

50. More details are in Technical Working Paper CONSP-08 on how the hot water requirement rate would be calculated.

Impact

51. The main impacts of the changes proposed are as follows:

- The volume of hot water required will vary considerably with shower type.
- Consequently the predicted energy consumption associated with water heating will vary far more from home to home. Two homes which currently have the same Dwelling Emissions Rate or SAP rating, but have different shower types, would receive different ratings in future.
- The savings from SWH and WWHR will be either higher or lower than at present due to their performances being highly dependent on the hot water demand. Savings from WWHR will be higher (since they are used with higher than average flow rate showers). Saving from SWH will be higher than at present if showers with high flow rates are used and lower if lower flow rate showers are used.

52. The proposed changes will more accurately reflect the performance of the dwelling than the present calculation, which should help encourage better decisions to be made by those building or retrofitting homes. However more assessor time will be needed to count the number of showers.

Consultation Question	
8.	Do you agree with the proposal to amend the hot water methodology in SAP?

Proposed Amendment 9 – Summer temperatures assessment (Appendix P)

Current Methodology

53. Appendix P in SAP, “Assessment of internal temperature in summer”, was developed as a simple means of assessing the risk of high summer internal temperatures occurring in dwellings. Recent evidence has indicated that the Appendix P assessments may be under-reporting the risk of high internal temperatures, so there is a need to review the methodology or consider other options, such as its removal.

54. The risk assessment currently does not undertake an hourly calculation and is not specific to any particular parts of a dwelling (in common with the rest of the SAP methodology). Such calculations are beyond the current capability of SAP.

55. If stakeholders consider that more complex assessments are required to demonstrate that they have properly considered the issue, then they would have to be derived using industry-provided simulation software or some other more complex estimation of the overheating potential in the dwelling.

Proposals

56. The proposed amendment set out in more detail in Technical Working Paper CONSP-14 relates solely to improvements in data entry of the Appendix P methodology; it does not consider modifications to the fundamental procedure.

57. The following elements of the methodology are considered:

- Questioning on the potential for SAP to take account of natural ventilation to guard against overestimating it.
- Evidence that mechanical ventilation systems have the capability to purge vent the dwelling to the capacity required.
- Assumptions on the amount of time that blinds are closed during the day.

Impact

58. The general impacts associated with the proposed changes to Appendix P set out in the technical working document are:

- It is easier and quicker to see if a dwelling is likely to be at risk of high summer internal temperatures.
- It is more difficult to estimate non-conservative figures for natural ventilation
- It will be more likely that a calculation gives a higher overheating risk
- It will be more accurate in assessing specific ‘problem locations’ with security, noise or pollution issues - with a higher likelihood of a naturally ventilated dwelling showing higher summer temperatures.

Consultation Question	
9.	Do you agree with the proposals to change the questions in the assessment of internal temperature in summer (Appendix P)?

Proposed Amendment 10 – Mechanical Ventilation Systems

Current methodology

59. This is set out in section 2.6 of SAP 2012.

Proposal

60. Decentralised mechanical extract ventilation fans are widely used in new dwellings, but it has been found that the test methodology may be being used to tune products. Once installed this skews their performance, both aerodynamically and in terms of electrical power. In addition duct lengths and the number of bends have been found to be greater in actual installations than specified in the test methodology.

61. It is proposed that the SAP 2016 dMEV test methodology includes a much wider assessment of performance. In addition, it is proposed that the duct lengths and number of bends in the test configuration be increased.

62. The current dMEV test duct lengths are just over 2m and include two 90° bends. It is proposed that the ‘in-room’ and ‘in-duct’ test duct lengths be increased to 5 m and includes four 90° bends. This will increase the system pressure drop and be a more realistic representation of many of the installation designs reviewed recently.

63. To ensure that a dMEV fan meets a dwelling’s ventilation needs, it is proposed to test the operation of these fans at a wider range of air flow rates, from 5 to 16 litres per second. At each of these test points it is proposed that the wind back pressure test should align with that defined in EN13141-6:2014, Clause 5.2.4.1.2, on wind conditions. This means that to test the wind effect, a counter-pressure of + 20 Pa at the exhaust shall be added to the normal conditions at the point of connection to the roof/wall outlet.

64. More details are in Technical Working Paper CONSP-10.

Impact

65. This would provide greater resolution of in-use factor options, whilst ensuring best practice is recognised in SAP calculations.

66. This would encourage the measurement and reporting of fan power. This may encourage performance optimisation.

67. This would decrease the performance assumptions of dMEV units to reflect the UK’s experience of installation of these products.

Consultation Question	
10.	Do you agree with the proposal to amend the treatment of Mechanical Ventilation Systems in SAP?

Proposed Amendment 11 – Chimneys

Current methodology

68. Ventilation rates are set out in Table 2.1 of SAP 2012.

Proposal

69. Technical working paper CONSP-15 sets out the evidence base. As a consequence, the consultation proposes changing the assumed air flow rate and establishing new categories for chimneys and flues.

70. It is proposed that:

- the chimney flow rate be increased from 40 to 80 m^3/hr.
- A flow rate of 35m^3/hr is proposed for an appliance flue with a diameter of less than 200mm.
- A flow rate of 10m^3/hr is proposed for wood or solid fuel stove flues.
- A flow rate of 20m^3/hr is proposed for wood or solid fuel boiler flues.
- It is proposed that 'Chimney fitted with a damper' is counted as a full chimney flue with a flow of 80m^3/hr.
- Retaining a flow rate of 20m^3/hr is proposed for a permanently blocked chimney.
- Retaining a flow rate of 10m^3/hr is proposed for an intermittent extract fan.
- Retaining a flow rate of 10m^3/hr is proposed for a Passive Stack Vent.
- Retaining a flow rate of 40m^3/hr is proposed for a flueless gas fire.

Impact

71. This will increase assumed heat loss through chimneys and flues. Doubling of the chimney ventilation rate will typically result in a worsening of the SAP rating by 1 or 2 points per chimney.

Consultation Question	
11.	Do you agree with the proposal to change the assumed air flow rate for chimneys and flues in SAP?

Proposed Amendment 12 – Secondary Fraction from Storage Heating

Current methodology

72. A storage heater system is generally designed such that it should be able to supply around 90% of the space heating requirement of a dwelling using off-peak electricity. The rest of the space heating requirement (referred to here as the secondary fraction) is usually supplied by separate direct acting electric heaters using on-peak electricity. SAP ratings are based on the cost of meeting a standard assumption for the energy demands of a dwelling, so the large difference between the cost of on-peak and off-peak electricity means that the assumptions about the secondary fraction are quite critical to the rating that is achieved.

73. SAP assumes that for a “standard” storage heater system (one which, like most currently installed, lacks fan assistance) the secondary fraction is 0.15. This means that 15% of the space heating demand is assumed to be met by on-peak electricity and 85% by off-peak electricity. Stakeholders have suggested that this fraction, which is meant to represent what can typically be achieved in a system that is being used broadly as intended, might be too high (i.e. that a figure of around 0.1, consistent with the design principle noted above, might be more appropriate). A figure of 0.1 is already used in SAP for fan assisted and high heat retention storage heater systems, and also for integrated storage/direct heaters, which it is recognised ought to be better than standard storage heaters in this respect.

Discussion

74. The technical working paper CONSP-03 aims to examine the secondary fraction of “standard” storage heater systems. It does this by using data from homes with such storage heater systems and extracting the secondary fractions that were achieved in practice.

75. The overall conclusion of this analysis is that the SAP assumption of a secondary fraction of 0.15 is consistent with the possible range of the average value (between 0.11 and 0.16) derived from the available data.

Proposal

76. In the absence of more recent monitored data, we have insufficient evidence to alter the assumption used in SAP and propose that the assumption in SAP is not altered.

Consultation Question	
12.	Do you agree with the proposal not to alter assumptions on storage heating secondary fractions in SAP?

Proposal Amendment 13 – Solid fuel heating efficiencies

Current methodology

77. See Table 4a of SAP.

Proposals

78. Technical Working Paper CONSP-11 sets out the findings of a review into the default efficiencies for solid fuel technologies. It concludes that they are broadly consistent with those stated as minimum values in HETAS, the Domestic Building Services Compliance Guide, and the Microgeneration Certification Scheme.

79. However some revisions to SAP efficiency values have been proposed. Firstly for pellet fired stoves and boilers in the light of recent HETAS revisions and SAP test results. Secondly, for independent boilers, where it is proposed that we remove the distinction of being in a 'heated space' or 'unheated space' - again this is due to recent HETAS revisions.

80. Solid fuel efficiency values in SAP were based on HETAS minimum appliance values, which have since been revised. The HETAS minimum efficiency used to be 65%. This has been revised to the following current values:

Pellet Fired Stoves without boiler:

70% (nominal load), 65% (part load)

Pellet Fired Stove with boiler:

75% (nominal load), 70% (part load)

Automatic feed independent boiler fired by wood pellets/chips:

75% (nominal load), 70% (part load)

81. The Products Characteristics Database currently lists 104 pellet fired independent boilers or stoves with boilers, the lowest seasonal efficiency being 77.8%. This suggests that the HETAS figures are suitably conservative for use as SAP defaults for new units.

82. It is proposed that SAP is amended to reflect the following default efficiencies:

Pellet fired independent boilers, and stoves with boiler:

75% (70% if not HETAS approved)

Pellet fired stoves without boiler:

70% (65% if not HETAS approved)

83. In addition, HETAS solid fuel minimum efficiencies used to include losses from the case (“case loss”) as a heat gain to the dwelling. In SAP, for other fuels, the efficiency values disregard case loss heat gain. It was therefore decided that there should be two values in SAP for independent solid fuel boilers (manual and auto feed): the HETAS value, if it was located in a heated space; and a 5 percentage point reduction applied if it was located in an unheated space.

84. Since then, HETAS has adopted European, instead of British, standards and the case losses are now excluded from the efficiency values. The values remained the same, so the effect was to improve the minimum performance required.

85. To make the solid fuel efficiency values consistent with other fuels, it is proposed that SAP changes so that the heat gain from the case loss is disregarded (as in the HETAS minimum efficiencies).

86. It is proposed that for independent boiler systems (manual and auto feed), the efficiency values for an unheated space be deleted. The values for a heated space would be retained:

Manual feed boiler:	65% (60% if not HETAS approved)
Auto (gravity) feed boiler:	70% (65% if not HETAS approved)

87. The deleted values for independent boilers in an unheated space are 60% (55% if not HETAS approved) for a manual feed boiler and 65% (60% if not HETAS approved) for an auto feed boiler.

Impact

88. This will improve the default assumptions for some solid fuel systems. So where the model is unknown, the overall assumed efficiency of the boiler is improved.

Consultation Question	
13.	Do you agree with the amendments proposed to solid fuel heating efficiencies?

Proposed Amendment 14 – Solar PV systems and overshading

Current methodology

89. This is set out in SAP Appendix M.

Proposals

90. We are proposing changes to the calculation of solar photovoltaic system (PV) annual energy yield within the next revision of SAP. The challenge is to improve calculation accuracy and repeatability without unduly adding to the workload of the SAP assessor and without assuming an in-depth technical knowledge. Full details of the changes are in Technical Working Paper CONSP-12.

91. The proposals allow for Microgeneration Certification Scheme (MCS) data to be used when assessing overshading.

92. Where the correct MCS documentation exists, the value of **the shade factor, SF, should be used directly for the Zpv (overshading) factor in SAP appendix M**.

93. If MCS documentation is not available, it is proposed that assessors:

- Assess the general level of overshading from distant objects (>10m), Zpv_{far}, using the existing Table H2 in SAP 2012 overshading categories (factors have been amended in this proposal); and
- Apply a second (new) correction factor to correct for any near shading (<10m), Zpv_{near}.

94. For new dwellings a SAP calculation is carried out twice: once at the design stage, and once when the dwelling is built, with the latter reflecting any changes compared to the design. At the design stage it is likely that details of the site and possibly of near-field obstructions will not be fully known. **It is therefore proposed that the maximum overshading factor is limited to 0.85 for design stage SAP calculations**. As appropriate, a lower factor should still be determined and used to account for obstructions that can be anticipated.

95. Enabling the use of shading factors provided in MCS certificates will improve the accuracy and consistency of SAP assessments and make them marginally easier for the assessor to undertake.

96. In cases where the householder has not been supplied with documentation, which is mandatory under MCS, the proposed amended method for estimating the shading factor (Zpv) should still lead to more realistic assessments with little or no extra burden for the assessor. In particular it acknowledges the importance of any obstructions near to the array.

97. For sites where there is no significant shading (e.g. no ‘roof clutter’, such as satellite dishes, vents or chimneys, and no horizon shading from other buildings or hills), there

is no effect on the existing SAP method and the shading factor remains set at 1, whether or not MCS data is available.

98. For situations where there is some shading of a PV array, the proposed shading factors are lower than those used in SAP 2012 because they recognise the non-linear impact of shading on PV output. Therefore, the predicted output of PV systems is generally lower than currently determined by SAP.

99. In many cases an MCS shading factor will be available and the revised Zpv tabulated values should not be used. The MCS figure could of be lower or higher than the tabulated figure depending on the circumstances.

Impact

100. This will make it possible to re-use MCS data to calculate overshading, leading to a more accurate assessment with less effort for the SAP assessor.

Consultation Question	
14.	Do you agree with the proposal to amend the procedure for determining overshading of solar PV installations?

Proposed Amendment 15 – Treatment of Solar PV and solar thermal systems – diverters

Current methodology

101. SAP 2012 assumes that electricity generated by photovoltaics (PV) which is not used within the dwelling at the time of generation will be exported to the electricity grid. The exported energy is assumed to be useful to someone else on the electricity network, thereby reducing CO_2 emissions to the same extent as if it had been used in the original dwelling. A Feed In Tariff (FIT) payment is made to the householder on the assumption that 50% of electricity generated according to SAP will be exported.

Discussion

102. However, a new type of device is now being sold and appears to be gaining popularity. This product avoids exporting any power to the grid by diverting any surplus electricity generated to an electric immersion heater in the dwelling's hot water cylinder. Heating the cylinder, assuming the water temperature it is thermostatically controlled, will reduce the need for heat from the usual water heating device (e.g. a boiler), reducing fuel use.

103. This makes sense from the perspective of the householder because they are paid a flat rate for the amount of electricity deemed to be exported, regardless of whether they do in fact export any. Thus electricity diverted in this way provides them with a benefit. However, since the dominant water heating fuel in the UK is gas, offsetting a unit of water heating fuel in the dwelling, rather than offsetting a unit of electricity in someone else's dwelling, changes the carbon dioxide emissions associated with the dwelling.

104. We are also aware of the diversion of solar PV electricity into batteries for storage and would be interested in how in future the methodology might consider this. In future it may become more common to combine renewable electricity generation technologies with battery storage so that a greater proportion of the energy generated can be used within the dwelling. Ideally therefore, in future, SAP will need to have a method to predict the proportion of renewably generated electricity which is likely to be used in the home, based on the parameters such as the electrical load of the dwelling, the output of the generation system and the storage capacity provided. We would like to verify any such methodology against data from field trials. Are you aware of any existing data which could be used for this? Or do you know of any studies being planned?

Proposals

105. We have outlined a proposal to apply a utilisation factor of 0.9 (i.e. a 10% reduction) to the diverted electricity, which is then subtracted from the energy required for water heating. Field trials could be used to validate and refine this figure in future. So, where a PV diverter is present the calculation in SAP would be:

Contribution of PV diverter to water heating = (1-β) * 0.9 * PV generation, where β is the fraction used within the dwelling for normal electricity using activities, currently defined as 50%.

106. An extra line will have to be added to the SAP procedure for calculating the water heating requirement, subtracting the contribution made by the PV diverter.

107. Appendix M, section M1, item 3, will also need to be reworded such that, if a PV diverter is used:

Net PV generation [for box (233)] = (β x gross PV generation)

108. By correctly accounting for the delivered energy consumption, as described above, the reduction in fuel costs and the increase in CO_2 emissions will be calculated correctly without any need for changes to the existing procedures. More details are in Technical Working paper CONSP-17. However, we are aware that we would need additional evidence to support this approach. So we would be interested in any evidence that would support this or an alternate approach.

Export tariff rate

109. There is also a broader question of whether the value of exported solar energy should be equal to the retail price of electricity consumed. This makes logical sense, but in practice the availability of subsidies has eroded this value. So we would be interested in views on how to amend SAP to provide a steady value for the price for electricity sold to the grid in Appendix M.

"The cost saving associated with the generated electricity depends on whether it is used directly within the dwelling or whether it is exported. Electricity used directly within the dwelling is valued at the unit cost for purchased electricity (standard tariff, or the high/low rate proportions given in Table 12a in the case of an off peak tariff). Electricity exported is valued at the price for electricity sold to the grid. The effective price depends on a factor b, which is in the range 0.0 to 1.0 and is defined as the proportion of the generated electricity that is used directly within the dwelling. The value of b depends on the coincidence of electricity generation and electricity demand within the dwelling. At present the value of b = 0.50 should be used for SAP calculations: this will be reviewed in future if relevant data become available.
The fuel price used for calculation of the cost benefit is:

b ´ normal electricity price + (1 - b) ´ exported electricity price,

Where the normal electricity price is standard tariff, or weighted high and low rates (Table 12a) if an off-peak tariff."

Solar thermal space heating

110. At the moment, it is the assumed that the benefit from solar thermal is the provision of water heating. However we would also be interested in views on how to produce a standardised way to capture the benefit from solar thermal used to top-up space heating.

Impact

111. The reduced water heating energy consumption due to a PV diverter being used will result in a reduction in the use of fuel by the main water heating system, giving lower predicted heating running costs. However, the reduction in the amount of electricity generated for export will lead to a comparative increase in CO_2 emissions. Thus a PV diverter will have a positive effect on the SAP rating, but a negative effect on Dwelling Emission Rating and Environmental Impact rating.

112. This proposed change should allow us to model the effect of solar PV diverters and reflect the impact on carbon emissions more accurately.

Consultation Question	
15.	Do you agree with the approach to adjust the carbon savings where solar PV electricity is used in the home to heat water or where it is put into battery or other storage? Do you have a view on the correct export tariff for PV electricity exported to the grid? Do you have ideas on how solar thermal space heating, or storage of solar PV or hot water through a battery or other medium can be modelled?

Proposed Amendment 16 – Boilers and seasonal efficiency in the Product Characteristics Database (PCDB) – including RdSAP

Current methodology

113. The presentation of the efficiency of boilers can be seen on the database at http://www.ncm-pcdb.org.uk/sap/pcdbsearch.jsp?pid=26

Proposals

114. Technical Working Paper CONSP-02 sets out a proposal to revise the SAP calculation method for Mains gas, LPG and Oil boiler efficiency (known as SEDBUK), which results in submitted boiler test data being processed and added to the Product Characteristics Database. This includes a proposal to align boiler efficiency credits for compensating controls with the control class definitions defined by the Ecodesign of Energy Related Products Directive (though not using the same efficiency credits).

115. The paper also defines other efficiency adjustments based on the design flow temperature (80ºC, 70ºC, 55ºC, 45ºC, 35ºC), the fuel (Mains gas, LPG and Oil) and boiler firing control (modulating or on/off).

116. No changes are proposed for the treatment of non-condensing boilers in SAP 2016.

117. The Energy Balance Validation (EBV) method was introduced to improve the reliability of the measured efficiency in the Product Characteristics Database. Boilers are entered in the Product Characteristics Database (PCDB) if the direct measure is not more than 4 and 2 percentage points (net efficiency) higher, for the part and full load test respectively, than a value derived from the measured combustion product temperature and the carbon dioxide concentration. It is proposed that the EBV part load efficiency allowance is reduced to 2 percentage points to ensure proper weight is given to the part load measure efficiency.

118. It is also proposed that the Energy Balance Validation (EBV) method is introduced for LPG and oil-fired boilers.

Impact

119. Normalising Ecodesign control classifications will ensure straightforward implementation of both SAP assessments and Ecodesign regulations. The Ecodesign control class is recorded in the PCDB for applicant manufacturers. This will ensure greater consistency, whilst reflecting the more robust evidence supporting SAP compensating control efficiency credits, particularly in view of the UK's differing heating pattern (to Ecodesign's continuous heating assumption).

120. Toughening the Energy Balance Validation method requirements and introducing for LPG and Oil fired boilers will enhance accuracy of data held in the PCDB.

Consultation Question	
16.	Do you agree with the proposal to provide a series of seasonal efficiencies for boilers on the Product Characteristics Database dependent on the controls they use and the design flow temperature of the system? Do you agree with the proposed change to the Energy Balance Validation method?

Proposed Amendment 17 – Heat pump default values

Current methodology

121. This is set out in section 9.2.7 and Table 4 of SAP.

Proposals

122. We have analysed the results of the field trials from the metering of heat pumps installed under the Renewable Heat Premium Payment (RHPP) scheme.

123. As a result, we propose amending the default values for some heat pumps installed under the MIS 3005 standard (for example, Microgeneration Certification Scheme or equivalent). The proposals to update the values are as below.

Current SAP default SPFs versus RHPP derived values

System type	Flow temperature	MIS 3005 issue 3.0 compliant?	Space heating		Water heating	
			Current default	Updated	Current default	Updated
ASHP	<35°C	No	1.7	[b]	1.7	[b]
	>35°C	No	1.7	[b]	1.7	[b]
	<35°C	Yes	2.5	[b]	1.8	[b]
	>35°C	Yes	1.8	2.2 [a]	1.8	1.9 [a]
GSHP	<35°C	No	2.3	[b]	1.7	[b]
	>35°C	No	1.7	[b]	1.7	[b]
	<35°C	Yes	3.2	[b]	2.2	[b]
	>35°C	Yes	2.2	2.6 [a]	2.2	2.3 [a]

[a] 25th percentile SPF derived from RHPP data, based on 234 ASHPs and 87 GSHPs with estimated design flow temperatures > 35°C

[b] Insufficient systems in RHPP analysis dataset

Impact

124. This improves the assumed default performance of some heat pumps installed under the Microgeneration Certification Scheme or equivalent schemes.

Consultation Question	
17.	Do you agree with the proposal to amend the default values for some heat pumps based on evidence from RHPP field trials?

Proposed Amendment 18 – Technology costs in RdSAP

125. Technical Working Paper CONSP-13 provides the indicative cost data for energy efficiency improvement measures used for Energy Performance Certificates and Green Deal assessments which is contained in the Product Characteristics Database (PCDB). We are not proposing to update this as part of the SAP review as it was amended for Green Deal relatively recently in 2014. It is provided simply for information, having not been made available previously in an easily accessible way.

126. However, it would be useful to have evidence to reflect any changes to technology costs.

Consultation Question	
18.	Do you have any evidence on the technology costs used in RdSAP?

Proposed Amendment 19 – Heating controls

127. Most heating controls are recognised and modelled in SAP (see section 9.4 and Table 4). However, we are aware that there are new types of heating controls on the market, and better information about the benefit from some types of current heating controls. It is helpful both for SAP and heat policy in general to understand better the effect of heating controls on the performance of the building as modelled, as well as in practice, the subject of a separate consultation.

Consultation Question	
19.	Do you have any evidence to update the assumptions that SAP makes about heating controls?

Cost to business

Consultation Question	
20.	Can you provide any evidence on the cost and benefits to business of revisions to SAP independent of changes to any particular set of Buildings Regulations?

Glossary

Energy Performance Certificate (EPC) – is the certificate commissioned when selling or renting a dwelling which describes the home's energy performance.

Psi (Ψ) values (the unit of measurement is W/mK) are used to calculate the y-value (W/m2K) for the effect of non- repeating thermal bridges.

Reduced data SAP (RdSAP) is the methodology used to produce Energy Performance Certificates

Standard Assessment Procedure (SAP) – the UK Government's methodology for assessing energy performance in homes

U-value, or thermal transmittance - Thermal transmittance, also known as U-value, is the rate of transfer of heat through a structure (which can be a single material or a composite), divided by the difference in temperature across that structure. The units of measurement are W/m^2K.

Y-value or thermal admittance. The unit of measurement is W·m-2·K-1. It is a measure of the ease by which energy will pass through the internal surface of the element to, or from, the room per degree of temperature difference between the surface at a particular time and the 'room' average temperature (environmental temperature is used to represent the room's temperature).

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