

Minutes of the 5th meeting of the SAP Scientific Integrity Group 10th May 2016.

Attendees

SAPSIG members:

Neil Cutland (NC)
Malcolm Bell (MB)
Ashley Bateson (AB)
Simon Lannon (SL)
Kevin Lomas (KL)

Apologies for absence – Richard Fitton, Martin Searle, Paul Decort, Bob Lowe

DECC:

Neil Witney (NW)

BRE:

Paul Davidson (PD)
John Henderson (JH)
Will Griffiths (WG)

WWHR advocates (just attending for WWHR item):

Chris Gaze (CG)
Tony Gordon (TG)

Agenda

1. Review of which assumptions in SAP are key to assessing energy performance of existing homes
2. Overview of process to update SAP – discussion of likely impact
3. Waste Water Heat Recovery – treatment prior to update of SAP
4. Product performance – impact of Eco-design of Energy Related Products Directive

Note that comments from group members have been anonymised.

PD welcomed attendees. Everyone introduced themselves (not all group members had met before).

PD noted that there was currently no SAPSIG chairperson, but the group was content to continue without one for the time being, so PD agreed to be time-keeper for the meeting and moved attention onto the first agenda item.

1. Review of which assumptions in SAP are key to assessing energy performance of existing homes

NW explained that this item related to DECC's desire to ensure the numerous SAP/BREDEM-based models used by DECC are suitably robust and transparent. Ideally he

would like this to take the form of a RAG (Red/Amber/Green) rating for the sensitivity of each SAP input/assumption, but since there are so many, it may be necessary to focus attention on the key items. Several members made the point that the most significant inputs/assumptions depend on the context in which the model is being used. NW agreed, but since this analysis has to be generally applicable to all DECC models doing different things, is seeking to focus on the most generally important items.

A SAPSIG member said that there are a number of existing documents that help with this already.

- There is a 1993 BREDEM document written by Jake Chapman which gives the justification and evidence for many of the fundamental features of the calculation still used today.
- The basis of the RdSAP inference procedure is given in a FAERO document written when RdSAP was first created.
- The technical papers published as part of the 2009 and 2012 SAP consultations give the basis of the newer parts of SAP.

Action (BRE and NW): BRE to locate the first 2 papers above. NW to send to group and other interested parties in DECC.

A SAPSIG member pointed out that the RdSAP table assumptions have become very important because they are so widely used. Another said that, although outside of SAP, IUFs have also taken on a great importance where SAP is used to predict savings from measures.

NW explained that DECC outsources most of its models, so in theory each supplier might use different assumptions, despite the fact they are all nominally using SAP as the calculation basis. A suggestion was made that when contracts are let for individual models they could include a requirement to risk assess inputs. Another suggestion was that, alternatively, there could be a requirement to use a harmonised set of assumptions. NW agreed these options deserved further consideration, although he was concerned that if defined too tightly this might be seen as limiting innovation through the procurement process.

Several members of the group mentioned papers that had already been published including SAP (or BREDEM) sensitivity analyses. It was agreed that it would therefore be worthwhile summarising all of these in a new paper. Alongside the SAP evidence documents described earlier, this would go a long way to fulfilling DECC's needs to show their SAP/BREDEM based models are robust and suitably transparent.

Action (all): Provide any papers you know of looking at SAP or BREDEM's sensitivity to inputs/assumptions.

Action (BRE): Produce a summary paper on SAP sensitivity and publish this alongside the earlier evidence documents that are not already in the public domain.

2. Overview of process to update SAP – discussion of likely impact

NW told the group that the original SAP timetable had been driven by the expectation of a Part L update in 2016, but this has been postponed and its timing is now very uncertain. The intention is for DECC to consult on its energy related proposals in the summer, so things may become clearer then. NW reminded that group that the need to minimise regulatory

impact is always a consideration when changes are proposed. NW saw the most impactful changes proposed to SAP as the use of updated CO₂ factors and the changes to solid wall U-values (an RdSAP change). A SAPSIG member added that the MVHR and community heating proposals would also have a major impact for new build. It was confirmed that the timetable was to have SAP ready for consultation in the summer. NW added that an update to RdSAP 2012 would also need to be ready at this time.

The group then moved on from discussing the timetable to the individual updates proposed. The majority of these had been discussed at a previous meeting, so most previously discussed proposed changes were not revisited in detail. One member questioned whether the use of all day heating at weekends was appropriate given it was not the most common weekend heating pattern found in the EFUS. NW replied that DECC had internally also been considering whether this should be changed to reflect the most common EFUS pattern of 7 days of morning/evening heating (like the existing SAP weekday pattern). However, a different SAPSIG member pointed out that deviating from the current pattern would throw out the calibration made using the existing IUFs (for GD and ECO), which were based on the existing heating pattern, so there were consequences to consider. Another noted that there are some heating controls for which benefits depend on heating period lengths (e.g. TPI) which might be impacted by this assumption. Since there was no clear view NW suggested an open question on this should be put in the consultation document (i.e. not stating DECC's opinion on which was favoured). BRE said they would provide an example illustrating the consequences of this change on energy consumption.

Action (NW): Include open question on heating hours in SAP consultation

Action (BRE): Provide example to group using BREDEM calculation showing effect of reduced weekend heating hours.

Proposed changes to heat networks were discussed next. One SAPSIG member asked the impact. BRE explained that the impact was usually negative, due to higher distribution loss assumptions, but for systems meeting 'code of practice' requirements a more favourable figure could be used. A SAPSIG member said (to murmurs of agreement) the combination of the lower CO₂ figure proposed for electricity and the worsened distribution loss factor for heat networks meant that in future community CHP would no longer be viable. However, he did not disagree with the approach – it reflected the current reality of communal heating systems. Given their importance, the basis and rigour of the proposed CO₂ factors was then discussed. NW explained that using 3 year predictions gives some forward look, but still within a time period where the predictions are likely to be reasonably good. The uncertainty that the emissions factor for electricity will fall as fast as predicted in the next few years is reduced by the fact that EU legislation requires the UK to undertake some of the key policies required to achieve this. Following this discussion there was general agreement that the approach to CO₂ emissions was reasonable and the proposals relating to heat networks were sensible, given the evidence of current performance.

A SAPSIG member questioned whether requiring corrections to Psi-values adjacent to unheated sheltered spaces was a level of detail too far for SAP. NW said that in some situations, e.g. involving junctions with internal corridors in flats, this could be quite significant in new homes. This example was also a potential problem because it could generate an incentive for such corridors to be heated, so this would need consideration.

On the changes proposed for the treatment of MVHR, BRE described the proposals to the group, explaining that the consequences were that there would be far greater differentiation between those systems that perform well and those which perform poorly. A SAPSIG member stated that he was happy with the proposal, but he questioned whether one of the options mentioned – installing uninsulated ducting outside the heated space – was allowed and therefore why it had been included. BRE replied that while it should not be found in new installations, it might still be found in existing ones and in any case the IUF applied was suitably severe, so it would not be a viable solution for meeting the TER. A SAPSIG member also questioned the option of 25mm of insulation on ducts as being too little, although noted that this was an issue for the Building Services Compliance Guide, not SAP. Another SAPSIG member suggested that the length of ductwork was also an important factor in some cases and not fully taken into account, which perhaps could be in a further refinement. He had some evidence that may be useful to support this. Overall, the group were supportive of the changes proposed.

On the subject of solid fuel heating system efficiency updates, NW explained that these were just updates to a small number of the defaults in the SAP tables to bring them into line with HETAS figures. The group were content with this and had no questions.

BRE then explained the proposed changes to the overshadowing factor used in the PV calculation. These are intended to allow the use of a more accurately calculated figure from an MCS certificate, where available (which is the case for nearly all PV installations at present due to it being a FIT requirement) and, secondly, to update the current table used to determine the overshadowing factor when an MCS value is not available. The current single table is to be replaced with two tables, one describing any near-field overshadowing (<10m) and one for distant sources of overshadowing. A SAPSIG member asked whether the new tables were derived using the same procedure as MCS. It was confirmed that they were, so there is consistency. The group approved of the changes. A SAPSIG member suggested that at least one of the sun-path diagrams from the technical paper relating to this change should be included in the SAP specification because they would be helpful to assessors.

On the proposed changes to Appendix P, BRE explained the proposals to the group. These do not involve any fundamental change to the calculation, only the way in which the assessor selects the summer air change rate. Instead of the assessor having a free choice of window opening options, they are to answer a series of yes/no questions from which the air change rate will be determined by SAP software. This should reduce the chances of an inappropriate category being chosen inadvertently, or otherwise. The change is generally likely to mean more homes do not 'pass' appendix P without more careful consideration of the proposed design, particularly in urban areas, where noise or security is more likely to be an issue. A SAPSIG member pointed out that it was important when discussing this topic and for supporting documentation (the SAP specification, the technical paper relating to this change, etc.) to be careful to avoid describing this as a method to avoid 'overheating'. It should be made clear that this is simply a method to assess the risk of high levels of internal gains in summer (as worded in Part L). It would be worth making this even clearer in the SAP specification and any other supporting documents that SAP Appendix P is not a sufficient check to ensure a home will not overheat.

Action (BRE): Review wording in technical paper and draft SAP specification to make sure it is clear that 'passing' appendix P is not sufficient to ensure a home won't overheat.

A SAPSIG member expressed concern that the proposed updates to solid wall U-values (for use in the RdSAP tables) were based on data which had a large standard deviation in results (~0.4 W/m²K). Therefore the use of the average figure of 1.7 W/m²K might not be sufficiently 'conservative' as a default. Another member replied that what is conservative for the rating of dwellings may be the opposite for policy uses where savings from improvement measures are calculated (e.g. ECO), so using the true mean/median rather than attempting to be 'conservative' may now make more sense than it did when SAP's uses were more limited. This was accepted, but it was suggested that there might be some sense in attempting to differentiate further, perhaps based on wall thickness to reduce the range covered by a single number. However, overall there was agreement that the new evidence showed the current figure of 2.1 was too high and the figure should be reduced.

BRE informed the group that there is also a proposal to update the default heat pump efficiency figures used in the absence of a PCDB entry, based on the recent analysis of RHPP data. The study suggests a small increase in the default efficiencies is needed. DECC have yet to publish the paper in question, so the group were not really able to comment further at this stage, other than to express their approval for the use of real field data to inform this type of figure in SAP.

3. Waste Water Heat Recovery – treatment prior to update of SAP

CG and TG entered the meeting for discussion of this item only. CG gave a presentation describing the basis of what the WWHR industry perceive as errors in the current treatment of WWHR in SAP 2012. The background to this perception was the AIMC4 project which showed significantly higher energy savings from WWHR than predicted by SAP, albeit for only 2 homes. This encouraged members of the industry to investigate possible reasons for the difference. The 6 errors CG described were as follows:

- i) The hot water demand figure used in SAP was based on a typical sample of UK homes, many of which will have electric showers. Since WWHR is not used with electric showers, these homes (with lower hot water use) should be ignored for the WWHR calculation, giving a higher hot water requirement.
- ii) Electric showers are included when calculating the fraction of bathing water used for showers (as opposed to baths). If they were excluded for the reasons described in error i), they should also be excluded here, leading to a larger fraction of water available for recovery of heat.
- iii) The number of showers is wrongly multiplied by the shower/bath ratio, effectively double discounting the amount of hot water available for heat recovery. BRE informed the group that this was accepted by BRE as a genuine error and had already been corrected by updating the UFs stored in the PCDB¹.

¹ See Data Amendments Table - Index no: 080001 to 080102 - <http://www.boilers.org.uk/data1/pcdf2012.dat>

It was also noted at this point that the hot water calculation method proposed for SAP 2016 would bypass any issues associated with electric showers, since shower type was taken into account directly to give a dwelling specific hot water figure (individually) for showers, baths and other uses. Hence i) to iii) would no longer be relevant once the change was made. NW said that the purpose of today was therefore to consider what short term action might be needed, under the current SAP 2012 framework.

iv) The utilisation factor (UF) assumed the WWHR unit and feed pipe work begins at cold water temperature rather than room temperature, even though the unit is installed within the insulated envelope of the dwelling.

v) The UF assumes all heat lost from the WWHR unit and pipework is lost from the dwelling. In practice some would be useful as internal gains to the dwelling.

vi) The UF ignores the benefits of thermal capacity of the WWHR system during start-up.

Applying the corrections related to errors iv) to vi) increases the UF for nearly all the units listed to 0.976 or 0.977. The more thermally massive products in the database currently have UF of around 0.9, so in total these made a significant difference.

Additionally, correcting errors i) to iii) would make a difference equivalent to increasing the UF to 1.468, increasing energy savings by around 50%. CG noted that this was still far lower than the savings found in the 2 AIMC4 examples, so this was still suitably conservative.

NW added that since SAP 2016 may not be in use for quite a long time this is why a short term solution, operating within the SAP 2012 architecture, was being considered. There was a brief discussion on whether an "Appendix Q" approach was appropriate, but it was noted that this is only intended to enable recognition of new technologies in SAP. Using it to correct something that is already in SAP was not seen by the group as a good precedent. Therefore, an adjustment to the UF (stored in the PCDB) would be the only option. A SPSIG member asked what data was collected during the AIMC4 field trial. CG confirmed there was no detail of inlet temperatures, only the total heat output from the unit, so nothing that could directly shed light on the UF achieved in practice.

Before CG and TG left to allow SPSIG to discuss the presentation amongst themselves, CG gave some feedback on the proposed SAP 2016 treatment of hot water use. He made the following suggestions:

- Shower duration should be longer, at around 8 minutes, not 6.
- Efficiency of WWHR units varies with flow rate, so using a fixed efficiency where the actual flow rate is to be entered could lead to inconsistencies – the lower the flow rate the better the heat recovery efficiency.
- Very low flow rates (<7 l/min) lead to longer shower duration.
- Flow rates should be measured, if possible, not estimated from the shower type.
- Provision should be made for thermostatically controlled electric showers.
- The AN+B form of equation for calculating hot water demand is not the best choice – BRE should consider basing hot water on number of bedrooms. Look at shower usage data from the EST publication 'At home with water'.

CG, TG then left the meeting.

SAPSIG members discussed the basis of the errors they had been presented with. There was general agreement that error iii) needed no further consideration as it had been fixed for SAP 2012.

One SAPSIG member stated that there would certainly be a portion of heat stranded at the end of the shower and therefore it was clear utilisation could not be 100%. He was also inclined to believe that any inertia in the system (i.e. thermal mass) would tend to reduce efficiency overall, so the behaviour of the current UF seemed logical (lower UFs with greater thermal mass products). Regarding error v) he wondered if gains from a unit under the bath would really contribute usefully to gains in the heated space. On error iv) BRE stated that a WWHR unit would be purged of room temperature water during the start-up phase by cold water flow prior to the shower reaching temperature, hence the original assumption of it starting at cold water temperature, despite being in the heated envelope of the dwelling.

A SAPSIG member pointed out that there was almost no field data, meaning the energy saving corrections proposed were purely based on theory. Experience of other products had shown real life performance was usually worse than theory, so until such data was available, he was inclined to stick to a more conservative estimate. Another member suggested it might be fairly easy to do a controlled experiment in a test dwelling where the SAP hot water use profile was used over the course of a one week with no WWHR unit and another week with WWHR present. This would allow the actual UF to be calculated and the various component temperatures at each stage of the shower to be confirmed. He added that he thought making a significant change to SAP without consultation, by changing a figure in the PCDB, was a bad precedent. Other products had to wait until SAP was updated. A different member added that, from a scientific point of view, using the utilisation factor as a correction factor (referring to the larger corrections related to hot water use) was a messy solution. The conclusion of the group was that error iii) was already fixed, errors i) and ii) were being fixed at the next update and that test or field trial data would be needed to convince them that errors iv) to vi) needed the proposed corrections.

4. Product performance – impact of Eco-design of Energy Related Products Directive

BRE informed the group about proposals to adjust the SAP procedures for dealing with heat pump efficiencies based on test data. The situation is changing due to a new more detailed HP test which is now required for labelling purposes. To make best use of this new data a new method (based on a draft EN15316-4-2 standard) is proposed to estimate Seasonal Performance Factors (SPFs) from the test results for entry in the PCDB and use in SAP. BRE agreed to send the document describing the new method to the group.

Action (BRE): Send document describing heat pump SPF calculation method to group (This was provided following the meeting on 12/05/2016)

BRE informed the group that a new proposed method for calculating boiler efficiency (new SEDBUK) had been rejected during initial consultation with the trade association HHIC, but a new one is being drawn up for release shortly.

Any other business

NW asked the group's opinion on whether for stock modelling purposes (i.e. tracking improvements in the efficiency of the housing stock over time) it would be sensible to move away from using the (cost based) SAP rating as a metric and move instead for using primary energy. The arguments for doing this were that heating cost is not necessarily the best basis for determining 'energy efficiency' and fuel prices are more volatile than primary energy factors, complicating the picture when looking at long term trends. The group were very much in agreement that this was a sensible move.