

Are our energy models outdated? A response to AECB.

Introduction

Recently the AECB has issued a report ¹ and has made public statements ² about the energy model BREDEM (and the Standard Assessment Procedure, SAP, which is a version of BREDEM intended for labelling purposes) claiming that it is based on outdated data and is therefore not useful. This is a serious misrepresentation of the situation, and the following states the true position.

Background

BREDEM was first developed in the early 1980s. Thus, much of the data on which certain elements of it are based came from the 1970s (this is presumably the basis for the erroneous claims noted above). Fundamentally, the model is based on the physics of heat losses from buildings which, of course, does not change. Furthermore, the model has been tested against considerably more recent data.

In the 1980s and 1990s the model was extensively tested against measurements from the monitoring of real dwellings, mostly during the latter part of the 1980s. The majority of these dwellings formed a part of Government demonstration schemes and consequently many were built to standards that far-exceeded the Building Regulations of the day. In effect, therefore, the testing work included many relatively modern dwellings, albeit probably not up to the standards of the 2006 Building Regulations. In these tests, BREDEM was found to predict the space heating energy use of the dwellings well, provided it was fed with appropriate inputs on indoor temperatures and heating patterns (which had generally been measured during the monitoring).

In the mid-1990s the model was also subjected to the same tests as detailed simulation models. BREDEM produced results that were essentially indistinguishable from those of the simulation models in most cases. Annual energy use predictions were always very similar, with the simulation models differing from each other by as much as any one of them differed from BREDEM.

These facts indicate that BREDEM is reliable and can be used with confidence for relatively modern dwellings, provided it is given appropriate inputs. This is not to say, however, that the model should not continue to be updated via further testing and development. Such activities have been on-going ever since the model was first developed (see the list of references at the end of this note for examples of such work), and they will continue in future.

Recent development work

Examples of recent work include:

- The lights and appliances procedures were updated a few years ago using data from the DECADE model (these are therefore not based on old monitored data as suggested by the AECB). The lights and appliances procedures have since been reviewed extensively, referring to data from the Market Transformation Programme, monitored data from the Electricity Association and data from the English House Condition Survey. This work is considering the ages of appliances as well as appliance labelling, and it is anticipated that the next update to the BREDEM specification, due in 2006/07, will incorporate these new procedures. The effort required to undertake such work is considerable, and the

¹ Minimising CO₂ emissions from new homes. A review of Building Regulations methodology: How much energy will *actually* be saved. AECB Report February 2006.

² Liz Reason, a spokeswoman for the sustainable homes pressure group AECB, told Radio Four's 'Today' that Government's computer models predicting the future use of energy date from the 1970s and are no longer useful:

"The Government tells us over and over again that they are saving 40% of energy in new homes. They are talking about figures based on models that are 25 to 30 years old," she said. "People expect to live in warmer homes these days and they expect to use entertainment and have daily showers. The models simply don't reflect this type of reality. Revising the models and getting accurate predictions of energy use couldn't be simpler. It could be done in a couple of days."

AECB suggestion in the Today programme that “it could be done in a couple of days” is patently absurd.

- During the preparation of SAP 2005, which is now published, numerous issues were looked at, covering many aspects that AECB claim are not dealt with. These developments are also reflected in BREDEM modelling wherever appropriate. Examples of issues that have either been newly allowed for or else improved include:
 - Thermal bridging
 - Daylighting
 - Solar panels
 - Heat pumps
 - Photovoltaics
 - Biomass heating
 - Combined heat and power

There is also now a provision for incorporating additional items in SAP 2005 without having to wait for a full revision – via a procedure that will rely on measurements made on specific products.

Future development work

Examples of issues that are in line for further work include:

- It is planned to review and revise assumptions about hot water usage in due course. This can only be done once the results of current EST monitoring become available in mid-2007. This is probably the aspect of the model that is most in need of attention at present, although some interim work has indicated that it has not changed as much as might be anticipated.
- The AECB suggest that BREDEM assumes inappropriate heating patterns. This will happen if the default pattern is accepted rather than entering an appropriate pattern in BREDEM - which is an available option. We are intending to look at available information relating to heating patterns and internal temperatures with the aim of reviewing the whole area - and possibly providing guidance on appropriate assumptions within future BREDEM specifications (note that the current default heating pattern and temperature assumption is known to be reasonably typical of average households and, of course, its use as a fixed assumption in SAP is essential to ensure that rating results for different dwellings can be meaningfully compared).
- Improvements to the model’s handling of certain aspects of heating controls are planned. This will be based on results that have been obtained from a detailed simulation model.
- Work to test BREDEM against measurements on low energy dwellings is required and will be undertaken once suitable data is available. Funding permitting, a dedicated monitoring programme should be set up to provide such data. The results, and any modifications arising from such work in the next few years, will ensure that BREDEM is as reliable for these types of dwellings as it is for the vast majority of the existing stock of dwellings.

Conclusions

The above demonstrates that, far from being outdated, BREDEM and SAP are under continuous review and are being developed using available reliable data, and are as up to date as possible at present.

The AECB statements, although seriously misguided, do highlight the very real need to continue collecting data and developing the models so that they remain as reliable and up to date as possible.

References

Note that not all of the work on developing and testing BREDEM has been published so the below only represents a part of the work that has been undertaken aimed at keeping the model up to date. Note also that no superseded specification documents have been listed below, so this is only a selected part of all the published material.

BREDEM-8, a Monthly Calculation Method for Energy Use in Dwellings: Testing and Development. L D Shorrock, S Macmillan, J Clark and G Moore.
Proceedings of Building Environmental Performance '91, BEPAC 1991.

Testing BREDEM-8 Against Measured Consumption Data and Against Simulation Models, L D Shorrock, J E Dunster, C F Seale, H Eppel and K J Lomas.
Proceedings of Building Environmental Performance '94, BEPAC 1994.

A Guide to the Development of BREDEM. L D Shorrock and B R Anderson.
Building Research Establishment Information Paper. IP 4/95. 1995.

BREDEM: Testing monthly and seasonal versions against measurements and against detailed simulation models. C M Dickson, J E Dunster, S Z Lafferty and L D Shorrock.
Building Services Engineering Research and Technology. Vol 17 No. 3. 1996.

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

BREDEM-8 Model description. 2001 update. BR Anderson, P F Chapman, N G Cutland, C M Dickson, S Doran, G Henderson, J H Henderson, P J Iles, L Kosmina and L D Shorrock.
BRE Report BR 439. January 2002.

A method to evaluate the savings from domestic solar water heating systems. J H Henderson.
Proceedings of the third European Conference on Energy Performance and Indoor Climate in Buildings. October 2002.

The Government's Standard Assessment Procedure for Energy Rating of Dwellings. 2005 Edition. Published on behalf of Defra by BRE.