

Building Energy Analysis for Commercial Buildings

This updates Practice Note 2012-09 issued April 2012.

Reference to the BCA in this Practice Note means Volume One of the National Construction Code Series.

1. SUMMARY

This Practice Note advises on the qualifications and experience required to use building energy analysis software for Class 3 and Class 5 to 9₁ buildings and the required information to be provided as part of a building permit application

2. BACKGROUND

The Building Code of Australia (BCA) 2006 introduced energy efficiency measures for Class 5 to 9 buildings. One of the means of demonstrating compliance with Performance Requirement JP1 involves the use of Verification Method JV3 and building energy analysis software.

BCA Verification Method JV3 is applicable to a:

- Class 3 building
- Class 5 building
- Class 6 shop, shopping centre, restaurant or café
- Class 8 laboratory
- Class 9a clinic, day surgery, procedure unit or ward area of a health care building
- Class 9b theatre, cinema, or school
- Class 9c aged care building.

Verification Method JV3 requires the annual energy consumption of the proposed building to

be determined and compared with a reference building. 'Annual energy consumption' is the theoretical amount of energy used by a building's services in a year, excluding kitchen exhaust and the like.

The BCA requires the annual energy consumption to be calculated using a method that complies with the Australian Building Codes Board (ABCB) Protocol for Building Energy Analysis Software Version 2006.1, published January 2006. The Protocol is available on the ABCB website, www.abcb.gov.au.

To meet the Protocol, evidence must be provided by the software supplier that demonstrates that the building energy analysis software complies with the Protocol. The Protocol also requires that a training program for users is available for the current version of the software and any subsequent new version, and that trainers be "technically qualified and well versed in the functionality of the program and the calculation methods employed".

To comply with the ABCB protocol the software must:

- be commercially available;
- be based on a simulation program with an hourly climate data file;
- be capable of computing the annual energy consumption of a building in accordance with the Verification Methods of the BCA; be capable of geometrically describing the building in three dimensions including taking into account the surface azimuth³, tilt angle and adjacent structures and features; and

- provide results comparable to other similar software in accordance with ASHRAE Standard 140-2001.
1. For guidance on requirements for Class 1, 2 and 4 buildings, see Practice Note 55.
 2. Australian Building Codes Board, "Protocol for Building Energy Analysis Software", Version 2006.1, January 2006 ABCB
 3. Azimuth is a mathematical concept defined as the angle, usually measured in degrees (°), between a reference plane (usually True North) and a point. It is not expected that a Relevant Building Surveyor (RBS) will need to technically check a software package against the testing procedures of ASHRAE 140-2001.

However, the software provider must provide evidence that this testing has occurred and the software meets these provisions.

3. USING BUILDING ENERGY ANALYSIS SOFTWARE

The Buildings Regulations 2006 (the Regulations) do not prescribe a class of building practitioner for persons using building energy analysis software. Where a BCA Alternative Solution is being undertaken, consideration needs to be given to A0.9 of the BCA. A0.9 outlines various methods to determine whether an Alternative Solution meets the relevant Performance Requirements. Where JV3 is used to demonstrate compliance with JP1, the Assessment Method used would be a combination of the Verification Method and expert judgement. The BCA defines expert judgement as:

"the judgement of an expert who has the qualifications and experience to determine whether a Building Solution complies with the Performance Requirements."

To use building energy analysis software under JV3, the software user needs a comprehensive

knowledge of building services, so that the energy used by these services can be determined. The software assesses the energy contribution of various components such as the building fabric, air infiltration and natural ventilation, internal heat sources, air-conditioning systems and vertical transport systems.

The category of registered building practitioner most likely to have relevant qualifications and experience for this task is a mechanical engineer. Mechanical engineers design hydraulics, smoke exhaust systems, fire services, sprinkler systems, heating, ventilation and air-conditioning systems, lift services, air conditioning services and vertical transport systems. However, there may be situations where an architect, services draftsman or other consultant is deemed by the RBS to have appropriate qualifications and experience

4. RELEVANT BUILDING SURVEYOR'S ROLE

To perform a building energy analysis, a person needs to demonstrate to the RBS that they have the relevant qualifications and experience, such as training in the use of the specific software package.

The RBS must apply their own judgement using their qualifications and experience to the specific matters being assessed when using JV3. In some instances the RBS will need to seek the advice of other suitably qualified practitioners or industry experts in determining the acceptability or otherwise of a specific building, element of construction or use.

5. FURTHER CONSIDERATIONS FOR REGISTERED BUILDING PRACTITIONERS

Registered building practitioners using building energy analysis software for the purpose of JV3

or an RBS need to be aware that regulation 1502 requires that “a registered building practitioner must perform his or her work as a building practitioner in a competent manner and to a professional standard.”

6. CERTIFICATES OF COMPLIANCE

Regulation 1505 outlines the type of practitioners that can issue a Certificate of Compliance – Design and it should be noted that this regulation does not specifically make mention of energy efficiency matters. If the use of the software has been undertaken by a mechanical engineer, it is up to the RBS having regard to the circumstances of a particular project, whether to accept a certificate of compliance if one is offered.

The RBS must ensure that the practitioner providing the certificate has the appropriate qualifications and experience. If the provider of a certificate was acting outside his or her field of expertise, the RBS may not be able to rely on good faith as a defence. It would be inappropriate for the RBS to accept a certificate from a building practitioner who did not have suitable qualifications or experience.

The RBS cannot require the submission of a certificate of compliance. The RBS is responsible for checking the design, as part of the building permit process. It is open to building surveyors to accept a report from experienced persons. The RBS can choose to seek an independent check from a registered building practitioner.

7. INFORMATION TO BE PROVIDED WHEN APPLYING FOR A BUILDING PERMIT

The Regulations require a certain amount of information to be provided to the RBS when applying for a building permit. Regulation 302 requires a copy of any computations or report to be provided if necessary to show compliance

with the Act or Regulations. The RBS should ensure that they receive the following information in regard to energy analysis for compliance with JV3:

- evidence that the software complies with the ABCB protocol;
- a copy of the input data used. This data is required to ensure that the inputs comply with the requirements of Specification JV;
- a copy of the report provided by the software;
- evidence that the software has been tested in accordance with ASHRAE Standard 140-2001;
- the qualifications and experience of the person undertaking the analysis.

In addition, Minister’s Guideline MG/05 states “Municipal building surveyors and private building surveyors must only accept appointment as relevant building surveyors in the area of their own competence.”

8. ENERGY ANALYSIS REPORTS

The energy analysis report must include all relevant inputs for the building fabric, the air-conditioning and ventilation systems, the lighting and power systems, the vertical transport systems and the supply hot water systems.

Inputs and outputs must be detailed on the energy analysis report produced in order to demonstrate compliance with the chosen verification method so that in conjunction with the relevant plans and specifications and any supplementary regulatory information, the RBS can check compliance with the Verification Method including Specification JV.

The outputs must be presented in terms of annual energy consumption of the building in MJ/m² of floor area per annum for the appropriate climate region. A distinction must

be made as to whether the energy source for the building heating is electric, such as heat pump plant, or gas.

9. TESTING AND QUALITY ASSURANCE

Any analysis software used must be tested in accordance with ASHRAE Standard 140-2001 using the International Energy Agency BESTEST. The results should be within the range of results from acceptable comparable programs indicated in the Standard.

While there will be times that results will fall out of this range, these are not necessarily incorrect. The sources of the differences must be investigated, documented and made known to the RBS. Software suppliers must have a quality assurance program in place and be able to demonstrate its effectiveness. The RBS may, if encountering a particular analysis software for the first time, ask for evidence of the quality assurance and testing evidence to ensure that the software meets the ABCB protocol.

10. EVIDENCE OF SUITABILITY

Evidence must be to be provided to the RBS as part of the building permit application to demonstrate that the software is suitable. This may be provided as part of the energy report or as a separate document. The evidence must demonstrate that:

- the software has the features outlined in clause (2) and the specific capabilities outlined below in clause (11);
- the software has undergone appropriate testing and results analysis and the process has undergone quality assurance;
- a training program is available for users.

The RBS may ask for evidence of training of any person who prepared the report. Any evidence of training must include the name and version of the software and state whether the software

has been approved for use by any appropriate authority.

11. SPECIFIC SOFTWARE CAPABILITIES

The RBS will need to understand the specific capabilities of the software. The software must be capable of addressing all of the specific aspects of the BCA Verification Method JV3 and Specification JV either by direct modelling or by adding in pre-determined data. It is important that the RBS understand the requirements of Verification Method JV3 and Specification JV.

Software must use the thermal properties of building products that are available in Australia.

Aspects of thermal modelling that the software must be capable of addressing directly are:

- The energy flow through the building envelope, including adiabatic surfaces and also including thermal storage effects;
- Accurately modelling the performance of the air conditioning and ventilation including any plant and equipment using energy input ratios, coefficients of performance, or efficiency at full and part load;
- The control strategies, sequencing of plant and equipment, controlled settings and type of controls;
- The design relative humidity range;
- The different energy types, e.g. gas or electricity.

Aspects of thermal modelling that may be addressed by adding in pre-determined data rather than direct modelling are:

- Lighting systems and equipment, provided the calculation includes consideration of the loads, operating profiles, and the distribution of the lighting load between the space load and return air load;
- Vertical transport loads;
- Supply hot water loads in accordance with BCA Specification JV.

12. CLIMATE DATA

It is not expected that the RBS will need to ask for evidence of the data used to develop climate information in any particular analysis software. It is important for an RBS to understand the background to climate development within the software. However, the RBS will need to ensure that the climate zone used for the analysis is appropriate for the location of the proposed building.

Climate data must be based on hourly data derived from the Australian meteorological records taken at no more than 3 hourly intervals and adjusted to provide a representative year for the proposed locations.

5. A sample report is provided in Appendix A of “Protocol for Building Energy Analysis Software”, Version 2006.1 issued January 2006.

Where sufficient records are not available, the data may be estimated from other recorded data provided a reliable method is used to make these estimates, e.g. cloud cover records or satellite measurements can be used to estimate solar radiation data in the absence of recorded solar data.

Appropriate climate data based on the Australian Bureau of Metrology records is available in the “Australian Climatic Data Bank for Use in the Estimation of Building Energy Use” which is maintained by ACADS-BSG by agreement with the Australian Government.

13. OTHER TECHNICAL DATA INPUTS. SPECIFICATION JV – ANNUAL ENERGY CONSUMPTION CALCULATIONS

Other technical inputs for calculating the annual energy consumption of services in a building must be in accordance with Specification JV in BCA Volume One. Verification Method JV3 sets

out the inputs for calculating the annual energy consumption for a reference building.

The Specification sets out the standard procedure for calculating annual energy consumption of services in a building. It specifies the parameters that must be used for particular building operation and occupant profiles in the assessment of services including:

- Air-conditioning systems
- Artificial Lighting
- Lifts; and
- Hot water supply.

Although the values used within Specification JV may not be those actually achieved in the building, as the building may change occupancies over time, they are considered to be typical, and therefore must be used in a JV3 assessment.

It is not the responsibility of the RBS to provide design advice about the technical input data details of Specification JV. It is the responsibility of the designers, engineers and energy raters to ensure that the appropriate inputs have been used prior to providing the information to the RBS. Therefore designers, engineers and energy raters should fully understand Specification JV. The RBS should simply be familiar with Specification JV so they can ensure that any report provided as part of an application for a building permit includes the relevant inputs required by the tables in Specification JV.

If a special purpose building is likely to have the same building characteristics for the complete life of the building and they are different to those listed in Specification JV, those characteristics could be used in another Verification Method developed specifically for that building. It is not the responsibility of the RBS to develop the Verification Method for special use buildings. It is important that designers engage with the RBS early to ensure

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that the Verification Method being developed is suitable. The RBS can then be informed about the proposal, preventing unnecessary delays in assessing the application for the building permit.

If you have a technical enquiry please email:
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