

Copyright © Agrément South Africa, August 2012

The master copy of this document appears on the website:

[www.agrement.co.za](http://www.agrement.co.za)

### Validity

Users of any Agrément certificate should check its status: All currently valid certificates are listed on the website. In addition, check whether the certificate is [Active](#) or [Inactive](#).

The certificate holder is in possession of a confirmation certificate attesting to his/her status.

Republic of South Africa.  
**National Building Regulations**,  
Government Notice No. R. 711,  
Government Gazette No 34586,  
Pretoria, South Africa, 9  
September 2011

### Quick guide

Contents	<a href="#">page 2</a>
Preamble	<a href="#">page 3</a>
Conditions of certification	<a href="#">page 4</a>
Assessment	<a href="#">page 6</a>
Technical description	<a href="#">page 9</a>

PO Box 395 Pretoria 0001  
Tel +27 12 841 3708  
Fax +27 12 841 2539  
Email [agrement@csir.co.za](mailto:agrement@csir.co.za)  
[www.agrement.co.za/](http://www.agrement.co.za/)

### Certificate holder:

## Greenbuild Consultants

PO Box 12 102, DIE BOORD, 7613, Stellenbosch,  
South Africa

Tel: +27 (0) 21 880 2925

Email: [francois@greenplan.co.za](mailto:francois@greenplan.co.za)

Website: [www.greenplan.co.za](http://www.greenplan.co.za)

### Subject:

## DESIGNBUILDER (VERSION 3.1) BUILDING ENERGY ANALYSIS SOFTWARE

### Use

The certificate covers *DesignBuilder* (Version 3.1) Building Energy Analysis Software when used for the assessment of the energy requirement of buildings as required in Regulation XA3 of Part XA: *Energy usage in buildings* of the **National Building Regulations**.

This certificate and Agrément South Africa's assessment apply only to the *DesignBuilder* (Version 3.1) Building Energy Analysis Software as described in this certificate, and where the terms and conditions of certification are complied with.

### General description

*DesignBuilder* Energy Analysis Software is a user-friendly interface for the US Department of Energy software, *EnergyPlus*. *EnergyPlus* has been developed from both of the *BLAST* (Building Loads Analysis and System Thermodynamics) and the *DOE-2* programmes of the 1970's and 1980's.

*DesignBuilder* Energy Analysis Software may be used for the rational design air-conditioned buildings or naturally ventilated buildings of all occupancies in terms of the requirements of Regulation XA3 b) and c) of Part XA: *Energy usage in buildings* of the National Building Regulations.

# CONTENTS

## PREAMBLE

## PART 1: CONDITIONS OF CERTIFICATION

## PART 2: ASSESSMENT

### **Scope of Assessment**

- Accuracy of the predictions made using *DesignBuilder* (Version 3.1) software
- Features of the software explicitly required to enable modelling in terms of Agrément South Africa's assessment protocol
- Ability to be able to edit and add to existing material property database
- Ability to be able to add pre-determined or directly modelled energy loads resulting from vertical transport, where provided, and for the supply of hot water
- Ability to be able to determine energy consumption of buildings in terms of SANS 10400 Part XA for South African climate zones
- Training and technical support
- Quality management

## PART 3: TECHNICAL DESCRIPTION

- General description
- Air –conditioned and naturally ventilated buildings
- Methods of assessment used in the software
- Thermal properties of materials utilised in the software
- Climatic file format and compatibility of reference files covering the six climate zones in South Africa
- Technical support and training

## PREAMBLE

This certificate is issued by Agrément South Africa in terms of the powers granted to it by the Minister of Public Works.

This certificate:

- has been granted after a technical assessment of the performance of *DesignBuilder* (Version 3.1) Building Energy Analysis Software in terms of **Agrément South Africa's assessment protocol** for the uses covered by the certificate.
- is independent of any patent rights that may or may not subsist in the subject of the certificate.
- does not relieve the user from complying with any of the requirements imposed by the building authority concerned pertaining to the National Building Regulations.

Agrément South Africa considers that the accuracy of energy assessments carried out by competent persons using *DesignBuilder* (Version 3.1) Building Energy Analysis Software will be satisfactory. However, Agrément South Africa does not on behalf of itself, or the government, or any of its employees or agents guarantee such accuracy.

No action for damages, or any other claim whatsoever, lies against Agrément South Africa, its members, the government or any of its employees should the said software fail to comply with the standards set out in this certificate.

Building authorities or users of the software, who are in any doubt about the continued validity of this certificate should contact [Agrément South Africa](#).

The validity of this certificate is reviewed every three years. The certificate shall remain valid as long as Agrément South Africa is satisfied that:

- the certificate holder complies with the general and specific conditions of certification
- no serious anomalies have become apparent in the results obtained using the software
- any changes in legislation, regulations, relevant standards or Agrément assessment protocol have not invalidated the technical assessment that formed the basis of certification.

Agrément South Africa reserves the right to withdraw the certificate at any time, should reasonable cause exist.

Notices affecting the validity of this certificate will be published in the *Government Gazette*.

## PART 1: CONDITIONS OF CERTIFICATION

Licensee - any person or company appointed by the certificate holder and registered with Agrément South Africa to make the software available, offer technical support and training.

This certificate covers only *DesignBuilder* (Version 3.1) Building Energy Analysis Software:

- as long as technical support and training are available from the certificate holder or licensees appointed by the certificate holder and registered as such with Agrément South Africa
- provided that the conditions of certification are complied with.

Any change to an aspect of the software could result in other aspects of the software no longer complying with Agrément South Africa's performance criteria. For these reasons, no changes, other than changes and/or additions to the user interface, or additions of features not affecting the main methods of computations, may be made to the *DesignBuilder* (version 3.1) Building Energy Analysis Software as described in this certificate unless such changes are approved in writing by Agrément South Africa before they are implemented.

### **DesignBuilder 3.1 Building Energy Analysis Software**

Tested and approved fit for  
modelling or calculation purposes

**CERTIFICATE 2012/413**



### **General conditions**

#### **Marking**

Where possible and appropriate software packaging, marketing brochures, user manuals and other material must be marked with Agrément South Africa's identification logo and certificate number, as illustrated opposite.

#### **Validity**

The validity of this certificate is subject to a satisfactory review by Agrément South Africa every three years.

#### **Quality monitoring**

The certificate holder is required to participate in Agrément South Africa's post-certification quality management scheme, which requires:

- that the certificate holder shall continue to implement and manage the quality system approved by Agrément South Africa in the assessment of the *DesignBuilder* (Version 3.1) Building Energy Analysis Software
- the cooperation of the certificate holder in facilitating post-certification quality monitoring by Agrément South Africa or its authorised agents

#### **Reappraisal:**

- must be requested by the certificate holder prior to introducing new versions of the software into the market
- will be required by Agrément South Africa if there are changes to regulations or Agrément South Africa's criteria.

This certificate may be withdrawn if the certificate holder or a registered licensee fails to comply with the above-mentioned requirements.

On behalf of the Board of Agrément South Africa:

A handwritten signature in black ink, appearing to be 'M. N. ...', written in a cursive style.

Chairperson  
15 August 2012

## PART 2: ASSESSMENT

### Scope of assessment

This assessment is based on:

- an assessment of the software in accordance with Agrément South Africa's assessment protocol
- an assessment of *DesignBuilder* Software Limited's quality management system.

### Assessment

In the opinion of Agrément South Africa, the *DesignBuilder* (Version 3.1) Building Energy Analysis Software is suitable for the uses as specified on page 1 of this certificate.

Agrément South Africa's comments on the various aspects of the assessment are set out in Table 1.

**SANS 9001:** *Quality management systems*

### Quality Management System

The certificate holder's quality management system complies with Agrément South Africa's requirements. The certificate holder's quality system is based on **SANS 9001**.

**Table 1: Assessment**

Aspect of assessment	Opinion of Agrément South Africa	Explanatory notes
<p><b>Accuracy of the predictions made using DesignBuilder 3.1</b></p> <div style="border: 1px solid green; padding: 5px;"> <p><b>ANSI/ASHRAE standard 140-2007:</b>  <i>“Standard method of test for the evaluation of building energy analysis computer programs”</i></p> </div>	<p>Satisfactory</p>	<p>Tested in accordance with the <b>ANSI/ASHRAE standard 140-2007</b></p> <p>It was deemed necessary to perform only test cases 600, 630, 910, 920, and 600FF to confirm the integrity of the <i>DesignBuilder</i> interface and <i>EnergyPlus</i>. <i>EnergyPlus</i> has already been assessed in the USA and conforms to ASHRAE 140-2007</p>
<p><b>Features of the software explicitly required to enable modelling in terms of Agrément South Africa’s assessment protocol</b></p> <div style="border: 1px solid green; padding: 5px;"> <p><i>Protocol for the Certification of Energy Simulation Software</i></p> </div>	<p>All features required in terms of the protocol are present</p>	<p>Refer to protocol</p>
<p><b>Ability to be able to edit and add to existing material property database</b></p>	<p>Satisfactory</p>	<p>Refer to protocol</p>
<p><b>Ability to be able to add energy loads resulting from vertical transport, where provided, and for the supply of hot water</b></p>	<p>Vertical transport loads cannot be modelled nor can pre-determined data be added, however, water heating loads, determined in accordance with the requirements of <b>SANS 10252-1</b>, can be modelled</p>	<p>Vertical transport loads must be allowed for as a separate item to the output of the software.</p> <div style="border: 1px solid green; padding: 5px;"> <p><b>SANS 10252-1:</b> <i>Water supply and drainage for buildings</i></p> </div>
<p><b>Ability to be able to determine energy consumption of buildings in terms of SANS 10400 Part XA for South African climate zones</b></p> <div style="border: 1px solid green; padding: 5px;"> <p><b>SANS 10400:</b> <i>The application of the National Building Regulations</i></p> </div>	<p>Satisfactory</p>	<p>Climate files for the six zones in South Africa can be used to assess building performance in terms of SANS 10400</p>

**Table 1 (Continued): Assessment**

<b>Aspect of assessment</b>	<b>Opinion of Agrément South Africa</b>	<b>Explanatory notes</b>
<b><i>Training and technical support</i></b>	Satisfactory	Training and technical support are readily available from the certificate holder
<b><i>Quality management</i></b>	Satisfactory  When properly implemented, the quality system will ensure that acceptable standards are maintained	The quality system complies with Agrément South Africa's requirements. The quality system assessed is based on <b>SANS 9001</b>



## PART 3: TECHNICAL DESCRIPTION

### General description

*DesignBuilder* was developed as a user-friendly interface for the United States Department of Energy (DOE) building energy analysis software, *EnergyPlus*. *EnergyPlus* is the simulation engine on which *DesignBuilder* is based.

*EnergyPlus* has its roots in both the *BLAST* and *DOE-2* programs. *BLAST* (Building Loads Analysis and System Thermodynamics) and *DOE-2* were both developed and released in the late 1970's and early 1980's as energy and load simulation tools. Like its parent programs, *EnergyPlus* is an energy analysis and thermal load simulation program. Based on a user's description of a building from the perspective of the building's physical make-up, associated mechanical systems, etc., *EnergyPlus* will calculate the heating and cooling loads necessary to maintain thermal control setpoints and specified conditions throughout the building. It will calculate and report the energy use associated with the HVAC system and all plant equipment as well as many other simulation details that are necessary to ensure that the simulation is representative of the actual building.

*DesignBuilder* features an OpenGL (Open Graphics Library), which allows building models to be assembled by positioning, stretching and cutting "blocks" in 3-D space. Realistic 3-D elements provide visual feedback of actual element thickness and room areas and volumes. There are no limitations on geometric form or surface shape. Users can draw their own 3-D building models or import 3-D models from any BIM (Building Information Modelling) software supporting the gbXML (Green Building XML schema) standard.

Data templates allow users to load common building constructions, activities, HVAC & lighting systems into their design by selecting from drop-down lists. They can also add their own templates when working on similar types of buildings. This combined with data inheritance, allows global changes to be made at building, block or zone level. The level of detail in each building model can be controlled, allowing the tool to be used effectively at any stage of the design or evaluation process.

## Air-conditioned and naturally ventilated buildings

*DesignBuilder* may be used to model large commercial, industrial as well as small domestic buildings. Buildings may be air-conditioned or naturally ventilated.

## Methods of assessment used in the software

Below is list of most of the features of the *DesignBuilder*:

- Integrated, simultaneous solution where the building response and the primary and secondary systems are tightly coupled
- Sub-hourly, user-definable time steps for the interaction between the thermal zones and the environment and, where applicable, HVAC systems
- ASCII text based weather, input, and output files that include hourly or sub-hourly environmental conditions, and standard and user definable reports, respectively
- Heat balance based solution technique for building thermal loads that allows for simultaneous calculation of radiant and convective effects at both in the interior and exterior surface during each time step
- Transient heat conduction through building elements such as walls, roofs, floors, etc. using conduction transfer functions
- Improved ground heat transfer modelling through links to three-dimensional finite difference ground models and simplified analytical techniques
- Combined heat and mass transfer model that accounts for moisture adsorption/desorption either as a layer-by-layer integration into the conduction transfer functions or as an effective moisture penetration depth model (EMPD)
- Thermal comfort models based on activity, inside dry bulb, humidity, etc.
- Anisotropic sky model for improved calculation of diffuse solar on tilted surfaces, electrochromic glazings, layer-by-layer heat balances that allow proper assignment of solar energy absorbed by window panes, and a performance library for numerous commercially available windows
- Daylighting controls including interior illuminance calculations, glare simulation and control, luminaire controls, and the effect of reduced artificial lighting on heating and cooling
- loop based configurable HVAC systems (conventional and radiant) that allow users to model typical systems and slightly modified systems without recompiling the program source code

- Atmospheric pollution calculations that predict CO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub>, CO, particulate matter, and hydrocarbon production for both on site and remote energy conversion
- links to other popular simulation environments/components such as WINDOWS, DElight and SPARK to allow more detailed analysis of building components

The *EnergyPlus* program is a collection of many program modules that work together to calculate the energy required for heating and cooling a building using a variety of systems and energy sources. It does this by simulating the building and associated energy systems when they are exposed to different environmental and operating conditions.

The core of the simulation is a model of the building that is based on fundamental heat balance principles. The model is described in great detail in the US Department of Energy: *EnergyPlus Engineering Reference – The reference to EnergyPlus Calculations*, October 2, 2009.

### **Thermal properties of materials utilised in the software**

The software includes a data base of generic material properties sourced from:

- Energy Plus & *DesignBuilder* Library (sourced from CIBSE, ASHRAE, the International Glazing database)
- Reputable supplier data sheets
- Agrément South Africa (sourced originally from CSIR publications)

These material properties may be selected by the user or, if necessary, edited. Additional materials and properties may also be added to this data base.

### **Climate file format and compatibility of the reference climate files covering the six climate zones in South Africa**

Climate files are ASCII text based weather, input and output files that include hourly or sub-hourly environmental conditions, and standard and user defined reports, respectively. As such the reference climate files for the six climatic zones as defined in SANS 10400 Part XA may be used as input.

### **Technical support and training**

Technical support and training is available from the certificate holder. *DesignBuilder* also maintain a register of consultants

worldwide who can offer assistance with all aspects of the software and related issues.