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The Green Building Handbook South Africa

The Essential Guide

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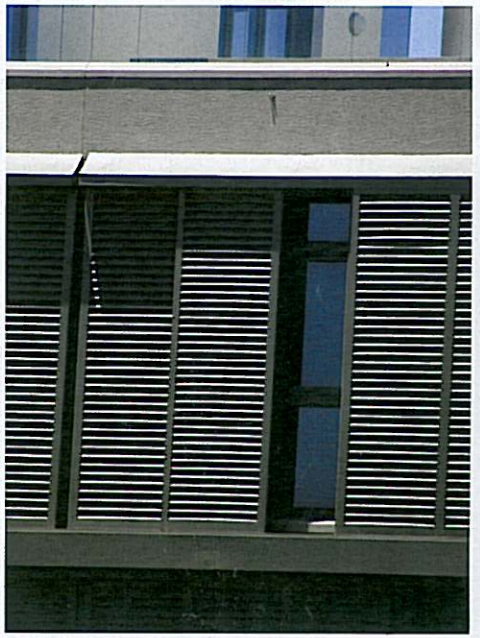

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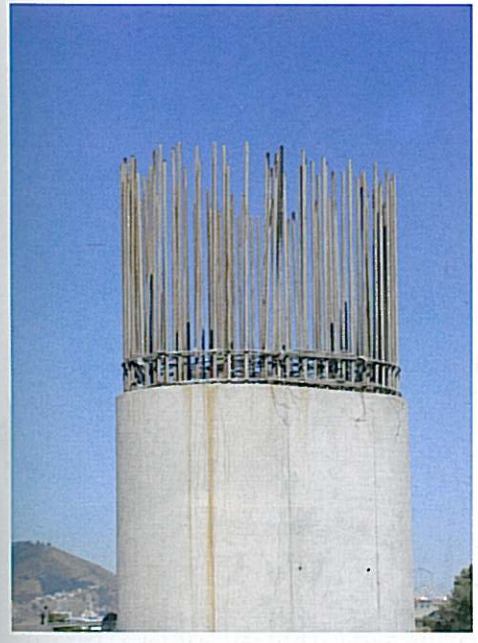

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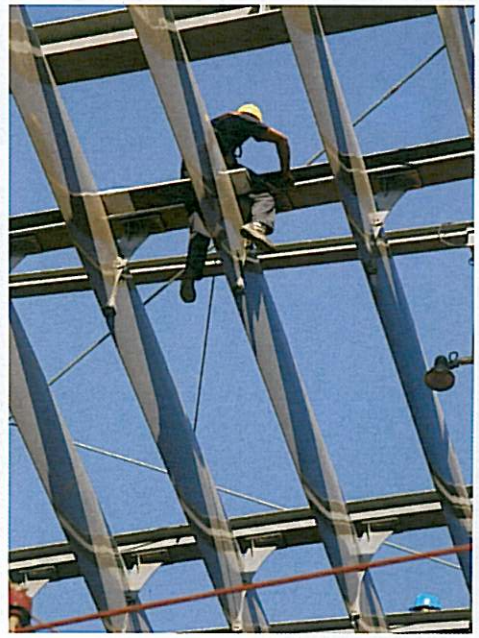

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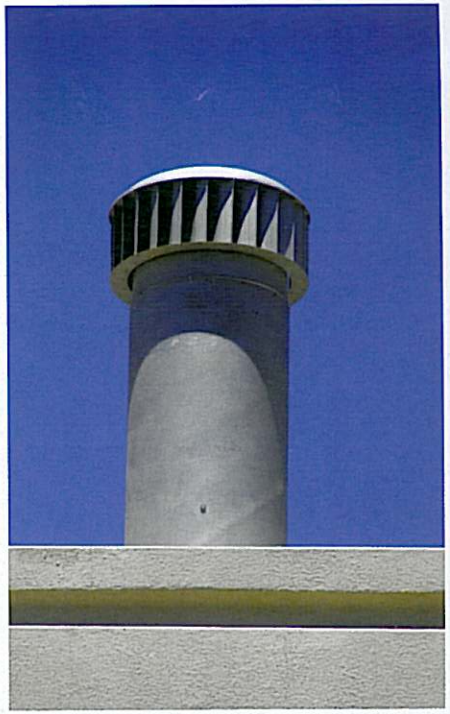

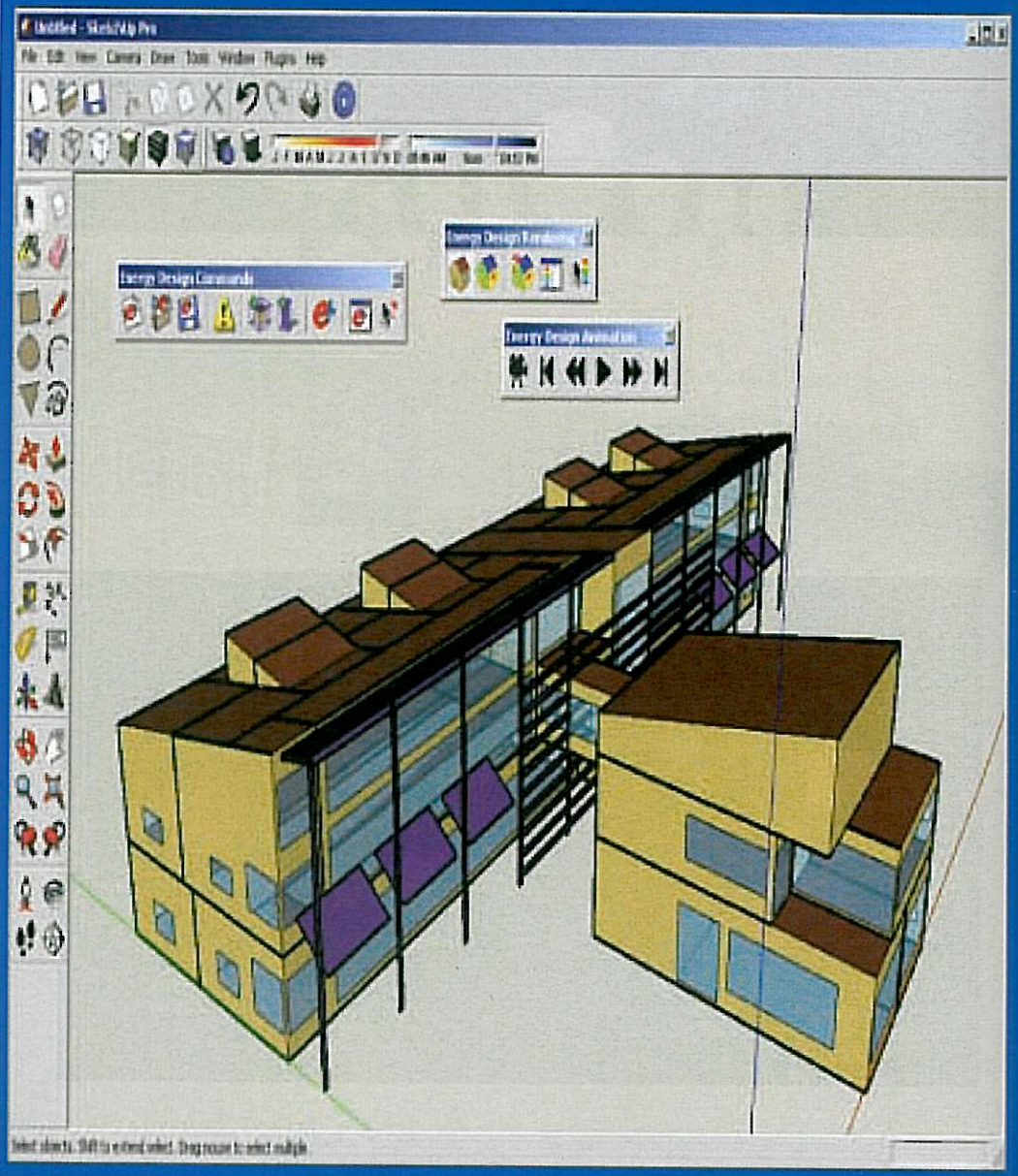

ENERGY MODELLING SOFTWARE

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INTRODUCTION

The construction industry has turned to energy modelling of buildings in order to assist them in reducing the amount of energy consumed by buildings. However, while the energy loads of buildings can be accurately modelled, energy models often under-predict the energy consumed.

ENERGY MODELLING AS A DESIGN TOOL

Energy modelling can be effectively used as a design tool to aid decision-making within the project and is best brought into the project during the conceptual design phase. Often decisions made early on during the design phase of a project can significantly impact the energy load of a building including such facets as shape, orientation and the facade. Additionally some energy saving initiatives require good integration with the building design and the overall aesthetic appeal of the building. While a suitable competent person can render advice in this regard, energy modelling allows the benefits to be quantified within certain assumptions and can be used to guide the overall design process.

Additionally not all energy saving measures are equal and they differ in potential gains and upfront capital costs. Energy modelling can serve to identify the potential gain of such interventions and can be used to identify the most cost-effective interventions. Also, buildings are often unique constructs and an in-depth energy analysis is usually required for each building.

ENERGY MODELLING AS A VERIFICATION TOOL

A much simpler application of energy modelling is to use it to predict the energy consumption of a building and this is becoming increasingly important for property developers as verification is required for certification with the South African Green Star rating tool. Internationally it is becoming increasingly required by building regulations that buildings demonstrate energy efficient design and this can often be demonstrated through appropriate energy modelling.

While energy modelling can be used to demonstrate compliance with such tools or legislation its true benefit is accrued from guiding the building design process to a practical energy efficient design rather than just predicting energy consumption.

AVAILABILITY OF ENERGY MODELLING TOOLS

There is a plethora of available tools that have been developed in order to perform building energy modelling. Currently there are 377 tools listed within the United States Department of Energy's Building Energy Software Tools Directory.

The different tools can be very different to each other as well as their scope or focus, being able to model certain building characteristics very well, while using simpler algorithms for other heat transfer modes or energy uses. Considering the complexity of these tools, it is unlikely for any simulationist to have a strong working knowledge for more than a handful of these tools. It is also important for the simulationist to understand the strengths and weaknesses of the tool which he is using so that it is not used inappropriately.

COMPLEX OR SIMPLE

Energy software tools also vary greatly in the level of complexity that they provide, with some being appropriate to model large buildings with complex HVAC systems while others are more suited for small residential dwellings. Complex tools offer the technical rigidity to provide accurate results for complex buildings, and while they could be used to model simpler building constructs, by their nature they require detailed inputs and are more time consuming to use.

Simpler tools are generally easier to use, make a higher number of assumptions and require fewer inputs. Simpler tools are also generally focussed on specific building classes due to the assumptions that they make within their algorithms. However, for the class of buildings they focus on, they can provide acceptable results. Within these applications the application of simpler tools should be considered as a cost saving mechanism while providing the required level of accuracy.

The utilisation of complex tools also generally require a greater level of fundamental knowledge of energy use within buildings, fundamental heat transfer mechanisms, as well as how these are modelled within the tool.

ENERGY SOFTWARE CERTIFICATION

Initially when large numbers of energy software tools became available it became clear that there was little if any objective quality control over the accuracy of such tools. Consequently, the International Energy Agency, with the assistance of the National Renewable Energy Laboratory, developed the series of Building Energy Simulation Tests (BESTEST) in order to evaluate the accuracy of such tools.

While such tests are largely comparative in nature, that is, the results from different tools are compared to the results of others for the same well defined building constructs, they are very capable in identifying flaws and bugs within the algorithms of the tools. Additionally, if results do vary, this is not to necessarily due to any of the results being "wrong" but rather that they are just different from the results from other tools. However, when results do vary significantly they should be investigated. Usually under such circumstances a flaw in the programming is identified.

More recently, the American Society for Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) has released a standard, ASHRAE 140, Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs. This standard was based on much of the previous work that was used in order to produce the BESTEST standards.

Interestingly ASHRAE 140 does not carry any pass or fail criteria. The test cases are composed of both comparative test cases as well as analytical ones, with the analytical test cases actually having a "correct" answer. However, due to the strength of such tests to identify errors within the algorithms of such programmes, it is generally required by most legislative requirements that any software to be used within any building regulations be tested against such a protocol or against a national specific protocol.

For property developers and clients who are interested in producing an energy efficient building, and who want to use energy modelling to aid in this goal, it is important that they understand the limitations of the energy software being used and to which standards it complies.

TRAINING

Energy modelling software is a tool, and like all tools it requires a competent user in order to be used effectively. Depending on the complexity of the building, the user should have a strong working knowledge of the components of which he or she is modelling as well as the heat transfer mechanisms involved. The software vendors usually provide training for the software; however, this is usually a short course in how to use the software and not training in how to perform accurate energy modelling.

QUALIFICATIONS

The International Building Performance Simulation Association (IBPSA) is a non-profit international society of building performance simulation researchers, developers and practitioners, dedicated to improving the built environment. While IBPSA does not provide any certification for energy modellers, they do provide the appropriate environment for such professionals for knowledge sharing and networking.

The Association for Energy Engineers (AEE) provides a certification course titled Certified Energy Manager (CEM), which is a general energy management course. It does not directly deal with energy modelling but provides a large amount of relevant knowledge that an energy modeller should have. In order to qualify as a CEM, significant appropriate experience and prior education is required in addition to passing an exam.

ASHRAE is launching a qualification titled Building Energy Modeling Professional certification, however, it is only to be launched on January 27, 2010, and this will be the first exam date for the qualification. It will unfortunately be some time before there is a significant quantity of such professionals within South Africa.

The purpose of this certification is to certify individuals' ability to evaluate, choose, use, calibrate,

and interpret the results of energy modelling software when applied to buildings, systems energy performance, economics and to certify individuals' competence to model new and existing buildings and their systems with their full range of physics.

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