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Loughborough Centre
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in energy demand

ANNUAL COLLOQUIUM 2010

Predictive Variability In Energy Performance Compliance Verification Tools

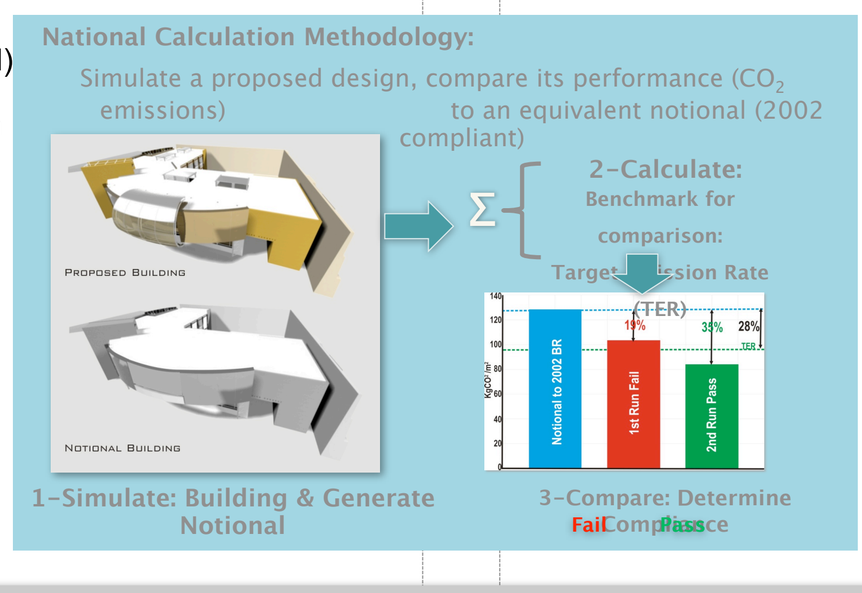
Rokia Raslan

Background

In transposing the requirements of the Directive on Energy Performance of Buildings (EPBD), the UK adopted a unified calculation-based approach for the demonstration of building energy performance compliance, the National Calculation Methodology (NCM)

For the non-domestic sector, this is applied through the use of any of the following options:

- The default quasi-steady state calculation tool SBEM
- SBEM Front-end Interfaces (FI-SBEM) that implement the same quasi-steady state method as SBEM
- Dynamic Simulation Modelling (DSM) software that implement complex dynamic methods.



A fundamental issue that has been highlighted in various studies is the predictive variability found between calculation /simulation tools.

The issue of inconsistency in results in this case is particularly important due to the associated regulatory implications and consequent impact regarding industry confidence in the applicability of the approach.

To investigate the possibility of similar inconsistencies between the range of accredited tools in the UK, a comprehensive inter-model comparative study was undertaken to assess the extent of variability between generated compliance benchmarks and a range of outputs included in the compliance output document (BRUKL).

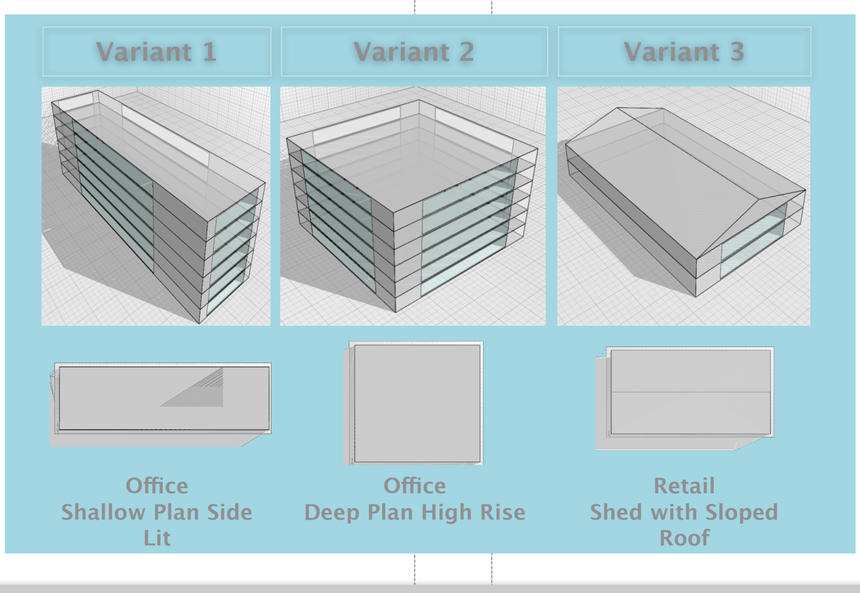
Study Methodology

The inter-model comparative format involves the use of a single test model and results generated by various tools are then compared.

Three single zone (UKGBC) simplified physical building variants were used for the analysis. These are considered to be representative of the main typologies that cover much of the UK non-domestic stock .

The use of a single modeller with relevant qualifications and experience.

The minimisation of external tools except when necessary due to accredited tool requirements/ limitations.



The standardisation of input parameters through the modification of source variant data to suit capabilities of all analysed tools.

The analysis of the entire range of accredited tools available at the time. Including:

- SBEM (iSBEM)
- Carbon Checker
- Cymap 2008
- Design Builder
- Design Database
- Graphical iSBEM
- Pro EP Cert
- Quick EP Cert
- SBEM Lifespan
- Space Manager
- VE Virtual Environment
- TAS Building Designer

Results

A-Compliance Outcome: Inconsistent Pass/fail outcome

Tool	Pass/Fail Outcome		
	Variant 1	Variant 2	Variant 3
A	Pass	Pass	Pass
B	Pass	Pass	Fail
C	Pass	Pass	Pass
D	Pass	Pass	Pass
E	Pass	Pass	Pass
F	Pass	Pass	Fail
G	Pass	Pass	Fail
H	Pass	Pass	Pass
I	Pass	Pass	Pass
J	Pass	Pass	Fail
K	Pass	Pass	Pass
L	Fail	Pass	Pass
M	Pass	Pass	Pass
	92 % Pass Rate	100 % Pass Rate	69 % Pass Rate

B- Additional Parameters: Inconsistency between tools

Parameter	Expected results	Actual results
U-Values	Consistent calculated area weighted and individual U-Values for all tools	Inconsistencies between calculated area weighted and individual U-Values
Geometry	Consistent calculated geometry for all tools	Floor area variability : up to 83 % External area variability : up to 200%

C-HVAC Parameters: Large variability in predicted HVAC system consumption

Findings

1. Limitations in the scope of applicability of accredited tools
2. A lack of input data standardisation
3. Variability between tool results

Implications

Regulatory fairness: Is this a credible and fair approach?

Carbon reduction targets: Will they be achieved?

Real vs. estimated performance: Is predicted performance a credible indicator?

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