SBD Lab
Building Energy Modelling Quality Assurance Guild

Shady Attia

v.01

Sustainable Building Design Lab

Quality Assurance Modelling Guild

Sustainable Building Design Lab Report, Version 01
ISBN: 978-2-930909-26-4
Author: Shady Attia
Publication Date: 15 August 2025

SBD Lab Quality Assurance Modelling Guild

Executive Summary

This report presents the official SBD Lab Quality Assurance (QA) protocol for building energy performance simulation. It defines structured steps to ensure input accuracy, functional validation, calibration, sensitivity analysis, uncertainty analysis, and transparent reporting. The methodology integrates international best practices from CIBSE TM63, CSA Group, ASHRAE Guideline 14, IPMVP, and peer-reviewed literature. It aims to close the “performance gap” between predicted and actual building energy performance by embedding QA into every modelling stage.

Purpose & Scope

This Guild sets the official SBD Lab standards for producing robust, transparent, and reproducible building energy performance simulations. It combines international best practices (CIBSE TM63, CSA Group, ASHRAE Guideline 14, IPMVP) with lab-specific workflows and resources to minimise the *performance gap* between predicted and actual building behaviour.

---

1. Input Data Workflow

1. **Building Model Input Data Template**
    - Collect all input parameters using the official SBD Lab Template.
    - Sources: building audits, as-built drawings, field measurements, manufacturer data, validated literature.
    - Ensure completeness before proceeding.
    - Submit for **review and approval** by a senior modeller.
    - Template Link: SBD Lab Template
2. **Data Verification**
    - Cross-check against benchmarks (ASHRAE, CIBSE, or previous SBD Lab calibrated models).
    - Identify high-impact parameters early (Donn, 1999).

2. Model Creation & Functional Testing

Once the template is approved, build the initial model in DesignBuilder/EnergyPlus (or equivalent).

Functional Testing Before Calibration:

- Change **setpoint temperatures** and observe load changes.
- Turn **mechanical ventilation** on/off to see IAQ and energy use variations.
- Switch **HVAC** on/off and check comfort and load response.
- Adjust **airtightness** and **U-values**; confirm proportional load impact.

Goal: Ensure the model behaves logically and reacts predictably (CSA Group, 2020).

3. Model Calibration

1. **Standards**: ASHRAE Guideline 14 & CIBSE TM63.
2. **Data**: 36 months of electricity and fuel bills.
3. **Targets**:
    - Monthly NMBE ≤ 5%
    - Monthly CV(RMSE) ≤ 15%
4. **Process**:

    - Adjust schedules, efficiencies, infiltration, setpoints, and thermal properties iteratively.
    - Verify changes are physically realistic.
    - Keep a change log for traceability.

4. Sensitivity & Uncertainty Analysis (SA/UA)

Purpose: Identify parameters that most influence outputs; quantify uncertainty.

- **Option 1 – Basic SA/UA in DesignBuilder**
  Video: DesignBuilder SA/UA Guide
- **Option 2 – Advanced SA/UA**
    - **jEPlus**: Define variables/outputs (Guide)
    - **jEPlus+EA**: Run Morris/Sobol methods (Guide)

Run SA/UA only after calibration and functional testing confirm model robustness.

5. Verification & Peer Review

- Compare outputs against benchmarks or simplified hand calculations.
- Use visual inspection (thermal maps, schedules, load profiles) for anomalies.
- Peer review: geometry, schedules, HVAC settings checked by another modeller.

6. Documentation & Reporting

- Maintain a modelling log with:
    - All input sources and assumptions.
    - Change history during calibration.
    - SA/UA results.
- Archive all final files (Template, IDF, DDB, DDF, results) in the **SBD Lab Repository**.
- Follow CIBSE TM63 guidance on transparent reporting.

7. Resources

- **Master Resource Folder** (all documents + process video): Google Drive Link
- **Benchmark dataset**: Attia et al., 2021 – includes sample template, DDB, DDF, IDF.
    - Paper: Download
    - Dataset: Download
- **Workstation Access**: SBD Lab workstation (64 cores) available for large parametric runs.

8. References

- CIBSE TM63 (2021). *Operational performance: Modelling and calibration for reliable outcomes.*
- CSA Group (2020). *Building energy modelling: Guide for quality assurance.*
- Donn, M. (1999). *Quality Assurance – Simulation and the Real World.* BS1999.
- Foroutan, H., Parand, F., Scott, P. W. (2008). *Quality assurance in the use of energy and environmental performance prediction software.*
- ASHRAE (2014). *Guideline 14 – Measurement of Energy, Demand, and Water Savings.*

ISBN: 978-2-930909-26-4

Sustainable Building Design Lab