LEED V4.0 and V4.1 Minimum Energy Performance Calculator User Guide

DesignBuilder v7.3

April 2024

1. Introduction

This document provides guidance on the DesignBuilder LEED V4.0 and V4.1 Minimum Energy Performance Calculator (MEPC) reporting feature, also known as the LEED Data Reporting tool. It explains how to use the tool, the outputs it generates and its limitations.

The guide assumes that you have already run ASHRAE 90.1 Appendix G 2010 simulations (for LEED V4.0) or 2016 simulations (for LEED V4.1) for both proposed and baseline buildings before attempting to use the MEPC tool.

Note: Users should study this guide carefully before using the tool and understand that the auto-filled LEED V4.0 and V4.1 MEPC spreadsheet requires further manual editing, validity checking and verification before it is submitted to the rating authority.

1.1. Precautions

In order to reduce possible problems with the use of the DesignBuilder LEED v4.0 or V4.1 reporting tool, you should consider the following points:

- The ASHRAE 90.1-2010 (for LEED V4.0) or ASHRAE 90.1-2016 (for LEED V4.1) energy code must be selected.
- The Microsoft Excel program must be installed on the PC that runs the DesignBuilder software.
- It is important to include and/or set up utility tariffs before running the ASHRAE 90.1 simulations so the cost comparisons can be displayed in the graph and the cost savings data will be filled out in the MEPC.
- Where the reported data does not specifically refer to the baseline building, the tool will report the data from the proposed building. As defined in the ASHRAE 90.1 Standard, unless there is an exception, the baseline building takes its floor areas, schedule data, etc., input from the proposed building.
- The LEED Data Reporting tool works most reliably when the English language interface and English locale on the user PC's region are set, and we therefore recommend that these settings be made before generating the MEPC report.

1.2. Model Preparation

The DesignBuilder proposed model should represent the design (or as built) documents as accurately as possible, including:

- Zone settings, such as zone types, activities, and loads input, should be correctly set. It is not mandatory, but all conditioned zones defined by zone type definition on the Activity tab should

match the HVAC zones defined in the Detailed HVAC zone groups definition. Appendix A of this document provides further details on this.

- Where applicable, constructions should be consistent with ASHRAE 90.1 Appendix A.
- For HVAC systems, the equipment capacity and efficiency should meet the mandatory provisions of ASHRAE 90.1 Standard.

2. Instructions on Using the Tool

The procedures below show how to run the LEED V4.0 or V4.1 Data Reporting tool.

- To invoke the tool, click on the "LEED Data Reporting" toolbar icon, which is visible when the ASHRAE 90.1 tab on the Simulation screen is selected (Figure 2). The tool will automatically choose the corresponding reporting version depending on the selected energy code, i.e., ASHRAE 90.1-2010 or 2016.

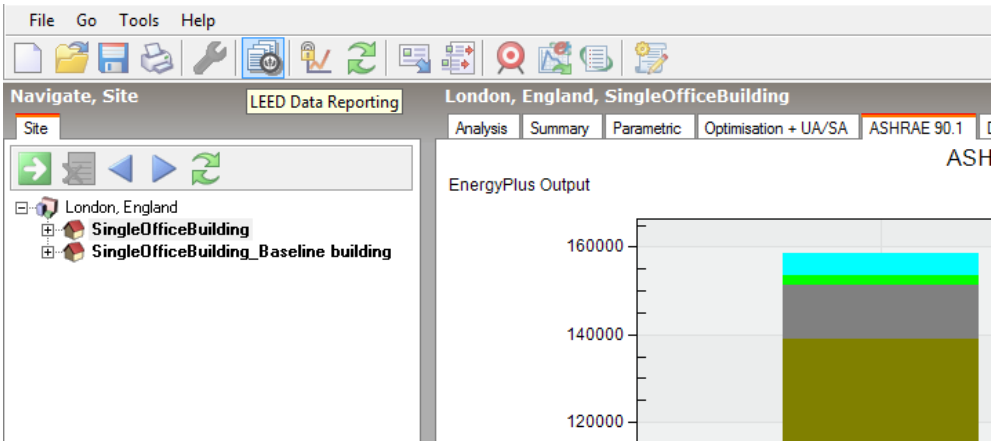

Figure 2. The icon that accesses to LEED Data Reporting tool

- The tool starts extracting data from the model. Once the data extraction process in DesignBuilder has been completed, you can specify the report's location and file name.
- Once the Save button is clicked, the LEED MEPC reporting starts. Depending on the computer configurations and the complexity of the model, the process can take a while to finish.
- After successfully generating the data in spreadsheets, DesignBuilder offers to open the MEPC that has just been generated (Figure 3). You can revisit it anytime from the directory you specified in the last steps.
- The generated worksheet must be validated, verified and manually revised where necessary, taking into account the limitations listed in the following section.

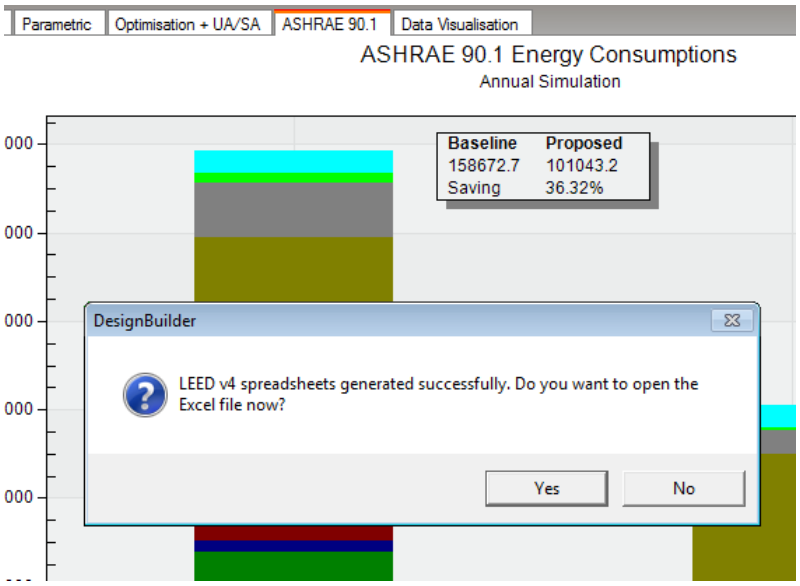

Figure 3. LEED MEPC spreadsheets generated successfully (example of 4.0 version)

2.3. Further Considerations and Limitations of the Tool

The reported conditioned/unconditioned areas of the building may, in some cases, differ from your initial inputs in the model. This discrepancy is typically caused by a mismatch between the zone type settings and the Detailed HVAC zone group settings. Further explanation on this topic can be found in Appendix A.

Note: The following statements apply to both V4.0 and V4.1 unless otherwise stated.

2.3.1. Input with the most common case

Some checkboxes and input cells in MEPC that cannot be (easily) read from the model are populated with the typical settings that fit most cases. These settings must be checked, and changes should be made as required. For example, the following data should be carefully checked:

- "Opaque Building Envelope Requirements" section on the "Opaque Assemblies" tab.
- "Interior Lighting Requirements" section on the "Lighting" tab for V4.0, on the "General Lighting" tab for V4.1.
- "Process Load Requirements" and "Garage Fan Power Calculation" sections on the "Process Loads" tab.
- "Service Hot Water Flow" (for low-flow fixtures modelled in the proposed building) section on the "Service Water Heating" tab.
- General HVAC requirements, "Spaces Modeled" and "HVAC Modeling Requirements" sections on the "General HVAC" tab.

In addition, you should consider the following points:

- On the “General Information” tab, MEPC’s “Project has residential dwelling units” is defaulted to “No”.
- For V4.1 only, on “Lighting Counts” tab, lighting fixtures need to be filled out individually. However, DesignBuilder currently does not allow this input; instead, the entire zone is treated as a single fixture and reported as such in the table.

2.3.3 Limitations (manual handling needed)

Consider the following limitations while using the tool:

- DesignBuilder does not allow models with multiple buildings to be processed. The site must include exactly one proposed building and one baseline building for the reporting tool to work.
- On the “Schedules” tab (V4.0), the number of “Hours per year fans running continuously” is defaulted to the whole year (8760 hours), which normally needs to be revised. Note that the “Schedules-Equivalent Full Load Hours” summary output table provides details on the number of equivalent hours for each schedule, and this can be used to override the default 8760 written by DesignBuilder to the Schedules table.
- On the “Air-Side HVAC” tab, Pressure drop adjustments are not provided.
- On the “Service Water Heating” tab, SHW low-pressure fixtures need to be input manually if they are modeled elsewhere.
- On the “Air-Side HVAC” tab (V4.0) or the “Baseline Air-Side HVAC” tab (V4.1), similar baseline air loops are grouped together, but only air loops that match the primary baseline HVAC system.
- On the “General HVAC” tab, the reporting tool only writes out the primary HVAC system and the first air loop. Data for any other HVAC systems and air loops must be added manually.
- Lighting gains are currently reported for conditioned spaces only. If unconditioned spaces are modeled in the project the lighting consumption should be manually added from unconditioned spaces on the Lighting tab.
- Detailed exterior lighting input, such as exterior lighting zone selection and exterior lighting definitions on tradable/nontradable surfaces are not treated in the software. If this data is needed, it should be manually entered on the Lighting tab Exterior lighting section.
- For V4.1 only, on the “Performance_Outputs_1” tab in Table 12.1: Energy Sources, the GHG Emissions Factor is not automatically reported. Users should manually edit this factor for the corresponding tariffs reported.

3. Error Reporting and Feedback

If any problems occur during the LEED data reporting process, please contact the DesignBuilder support team by submitting a support ticket at **support.designbuilder.co.uk**

It will usually help us to provide a quicker response if you supply the dsb model file together with the LEEDReporting log file located in **C:\Users\<User Name>\AppData\Local\DesignBuilder** folder.

Appendix A – Building Conditioned/Unconditioned Areas Reported

Building areas are reported in different locations. The table below summarizes where to access the reported areas and how to make these reports consistent.

Where reported	Description	Notes
Activity tab on building level	The building area reported here is the sum of zone floors areas whose "Zone type" is set to **1-Conditioned**.	DB recommends that you set the Zone type on the Activity tab to be **1-Conditioned** for all zones that are included in an HVAC zone group. Otherwise, a warning message will be displayed before the simulations are run. Although DesignBuilder provides the flexibility to ignore the warning and continue to run the simulations, please be aware that this could cause inaccurate totals. conditioned and/or unconditioned areas to be written to the MEPC.
Baseline Building Wizard	As above.	
EnergyPlus Input Verification and Results Summary	All zones that are included in a DesignBuilder HVAC zone group are categorized in the EnergyPlus Summary reports as "conditioned".	
EnergyPlus LEED Summary	As above.	

Note: It is important to check the total areas reported in the LEED table in the EnergyPlus Summary output report against the project design documents (or the actual building) and, if necessary, modify the data on the "General Information" tab of the MEPC to the correct value.

Conditioned building area (sq m)	911
Unconditioned building area (sq m)	0
Total building area (sq m)	911

In addition, zones with ASHRAE 90.1 **2-Unconditioned**, **2-Ventilated** zone type are not included in the total floor area, because DesignBuilder flags these zones as "Not Part of Total" to EnergyPlus. In ASHRAE 90.1, this zone is considered to be effectively "outside", and surfaces between this zone and adjacent zones will be assigned with external elements.

Appendix B - Glazing Overall U-factor, SHGC, VLT Calculations

The EnergyPlus summary report splits the heat transfer through glazed construction into three portions: glass, frame and dividers. The area, U-factor (thermal conductance), SHGC and VLT of each of these are reported separately. The overall performance of the glazed construction reported in the MEPC is calculated based on an area-weighted average of the individual portions reported by EnergyPlus as follows.

$$P_{overall} = \frac{\sum_{i=1}^{3} A_i \cdot P_i}{\sum_{i=1}^{3} A_i}$$

Where, P denotes performance, which can be either U-factor, SHGC or VLT; A stands for area; i represents the order of the elements, i.e. glass, frame and divider.

For example, the calculation to overall U-factor is calculated as:

$$U_{overall} = \frac{A_{glass} \cdot U_{glass} + A_{frame} \cdot U_{frame} + U_{divider} \cdot A_{divider}}{A_{glass} + A_{frame} + U_{divider}}$$

Similar calculations are used to calculate the overall SHGC and VLT values reported in the MEPC. Note that the frame and divider are assumed to be 100% opaque, i.e.:

$$SHGC_{frame} = 0$$
$$VLT_{frame} = 0$$
$$SHGC_{divider} = 0$$
$$VLT_{divider} = 0$$

EnergyPlus does not report the U-factor for the frame and divider directly. Instead it reports the conductance of these elements. Surface resistances (inside and outside) need to be added to the element in order to convert conductance to U-factor (if conductance is not zero)

$$U = \frac{1}{1/C + R_i + R_o}$$

Where, U is U-factor; C is conductance; R_i is inside surface resistance and R_o is outside surface resistance.

ASHRAE 90.1 standard 2010 Appendix A section A9.4.1 gives the air films R-values (surface resistances) as:

R-Value (m2-K/W)	Condition
0.03	All exterior surfaces
0.11	Interior horizontal surfaces, heat flow up
0.12	Interior vertical surfaces

Appendix C - Reported DX Cooling Coil EER

The DX Cooling Coil EER [Btuh/W] can be calculated from the COP using the formula below.

$$EER = 3.4121416 \times COP$$

The COP can be found in the “Nominal Efficiency [W/W]” column of the Cooling Coils table in the Summary report.