

User Guide

iSBEM

An Interface for SBEM (Simplified
Building Energy Model)

*Part of the National Calculation Methodology: SBEM for assessing
the Energy Performance of Buildings*

A User Guide to iSBEM: (3) EPC Generation - UK

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Key changes and additions from previous versions of the User Guide

Changes and additions in version 6.1.c compared to the previous version:

NEW

Modified

**Further
guidance**

Changes related to **new** or **modified functionality** in the new version as well as further explanation or clarification of **existing** parameters and functionality in iSBEM are listed below and denoted in this guide using the “NEW”, “Modified” and “Further guidance” icons in the left margin.

This manual, together with the software tools described in it, were developed by the BRE for the Department for Levelling Up, Housing, and Communities (DLUHC).

Disclaimer

The iSBEM User Guide cannot provide legal advice or a definitive interpretation of the law. The guidance provided in this document is limited to the technical operation of the software tool. It is offered in good faith but is not binding on any person(s) or organization. The same applies to the default values in the interface, which should be viewed as conservative suggestions intended to be replaced by actual values.

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Acronyms used in iSBEM and this guide

AHU	Air Handling Unit
BER	Building Emission Rate
BPER	Building Primary Energy Rate
BRUKL	Building Regulations United Kingdom Part L (The Building Regulations compliance checking module)
CCHP	Combined Cooling, Heat, and Power
CEN	Comité Européen de Normalisation (The European Committee for Standardisation)
CHP	Combined Heat and Power
CO ₂	Carbon dioxide
ECA	Enhanced Capital Allowance
EER	Energy Efficiency Ratio
EPCgen	Energy Performance Certificate Generator (The EPC generator module)
ETL	Energy Technology List
HEPA	High Efficiency Particulate Air
HTHW	High Temperature Hot Water (boiler)
HVAC	Heating Ventilation and Air Conditioning
HWS	Hot Water System
IF	Improvement Factor
iSBEM	Interface for SBEM
LTHW	Low Temperature Hot Water (boiler)
LZC	Low or Zero Carbon
MTHW	Medium Temperature Hot Water (boiler)
NCM	National Calculation Methodology
PVS	Photovoltaic System
SBEM	Simplified Building Energy Model
SSEER	Seasonal System Energy Efficiency Ratio
SSEff	Seasonal System Efficiency
SES	Solar Energy System
SFP	Specific Fan Power
TER	Target Emission Rate
TPER	Target Primary Energy Rate
VAV	Variable Air Volume
VRF	Variable Refrigerant Flow
WWHRS	Waste Water Heat Recovery System

1. WHAT IS IN THIS GUIDE

1.1. Scope of the guide

The objective of this document is to give step-by-step guidance on the use of iSBEM for the purpose of generating energy performance certificates for non-domestic buildings in the UK.

This guide includes:

- How to work through the steps of the input procedure that are specific to EPC calculations or different to those for compliance assessments, which are described in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.
- How to obtain the Energy Performance Certificate and Recommendations Report.

This guide **does not** include:

- A detailed description of the structure of the NCM.
- A full definition of the Reference building which is used to generate the asset rating, or that of the Notional building.

The above can be found in England’s NCM Modelling Guide which is available from the NCM website at www.uk-ncm.org.uk.

- A description of the contents of the NCM Construction, Glazing, or Activity databases.
- A detailed description of SBEM, the calculation engine to which iSBEM is an interface. This is described in the SBEM Technical Manual, available for download from the NCM website at www.uk-ncm.org.uk.
- How to set up iSBEM to operate on your computer, how to assemble the required information for your own building, how to zone your building, or how to convert files created with previous versions of iSBEM to be compatible with the current version. This can be found in the User Guide volume “**How to use iSBEM: Basics - UK**”.
- A tutorial. This can be found in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.
- Guidance related to energy calculations for the States of Jersey.

This manual is one volume in a set of documentations for the iSBEM User Guide. The other volumes in this set are as follows:

- **How to use iSBEM: (1) Basics – UK** – Contains an introduction to the use of iSBEM, an interface for SBEM (Simplified Building Energy Model) - an approach for the National Calculation Methodology (NCM) for assessing the energy performance of buildings.
- **How to use iSBEM: (2) Compliance Assessment – UK** - Contains step-by-step guidance on the use of iSBEM for the purpose of assessing compliance with the building regulations in the UK for non-domestic buildings.

2. CALCULATION BASICS

2.1. UK Energy Performance Certificate purposes

The calculation procedure required by the NCM is explained more fully in the National Calculation Methodology Modelling Guide. SBEM complies with the NCM. It is suitable for use with the majority of buildings, but some designs will contain features that mean that more accurate energy calculations may be obtained by more sophisticated calculation methods.

This section briefly defines the “Reference” building, which is the basis of setting the energy rating scale for Energy Performance Certificates (EPCs) for England, Wales, and Northern Ireland. The “Asset Rating” rates the CO₂ emissions from the Actual building in comparison to a Standard Emission Rate (SER), where both emission values are in kgCO₂/m².annum. The Standard Emission Rate is determined by applying a fixed improvement factor to the emissions from a Reference building, which is defined below.

EPCs are intended to send market signals about the relative performance of comparable buildings, and so it is necessary that the Reference building should be the same for all buildings of a given type. In order to provide this consistency, the Reference building must be the same irrespective of: (a) whether the Actual building is naturally ventilated or air conditioned and (b) the fuel choice in the Actual building.

The insulation levels and HVAC efficiencies in the Reference building are identical to the 2006 Part L Notional building except that certain parameters in the Reference building are fixed (subject to conditions below) irrespective of features in the Actual building (please refer to the 2021 NCM Modelling Guide, available from www.uk-ncm.org.uk, for the detailed description of the Reference building). These aspects are:

- a. The heating and hot water service is always met by a gas-fired system irrespective of whether a fuel other than gas is used in the Actual building or is even available in the locality of the Actual building.
- b. Each space which is unconditioned, i.e., unheated and uncooled, in the Actual building will also be unconditioned in the Reference building. In all other cases, the spaces in the Reference building have a fixed servicing strategy regardless of the strategy adopted in the Actual building. Therefore:
 - Each space is heated to the heating setpoints defined in the activity database.
 - Each space is cooled, to a fixed cooling setpoint (mixed-mode cooling), irrespective of whether the particular space in the Actual building has cooling provision or not.
 - Each space is naturally ventilated, irrespective of whether the corresponding space in the Actual building has natural or mechanical ventilation.

The CO₂ emissions arising from the use of the fixed building services in the Reference building (in kgCO₂/m².annum) are calculated (the Reference Emission Rate or RER), and then adjusted by an improvement factor of 23.5%. This adjusted CO₂ emission rate (in kgCO₂/m².annum) is termed the Standard Emission Rate (SER), i.e., $SER = RER \times 0.765$.

It is not intended that the definition of the Reference building should change as Part L standards change, since this would mean that the energy rating of a given building would also change, even if its energy efficiency had not been varied. Therefore, the Reference building is always as defined above (please refer to the 2021 NCM Modelling Guide, available from www.uk-ncm.org.uk, for the detailed description of the Reference building).

The Asset Rating (AR) in England, Wales, and Northern Ireland is simply the ratio of the CO₂ emissions from the Actual building (i.e., the BER) to the Standard Emission Rate (i.e., the SER) multiplied by 50. The AR should be rounded to the nearest whole number.

$$\frac{BER}{SER} \times 50 = AR$$

The Asset Rating is also converted into an energy band/grade on a linear “A-G” scale (with A+ being the most efficient followed by A, and G being the least efficient), Table 1, where the border between grade B and grade C is set at the SER and given an AR of 50. This means that a gas-heated building with mixed-mode cooling that is just compliant with Part L 2006 would have an Asset Rating of 50.

$AR < 0.0 \Rightarrow A +$
$0.0 \leq AR \leq 25.0 \Rightarrow A$
$25.0 < AR \leq 50.0 \Rightarrow B$
$50.0 < AR \leq 75.0 \Rightarrow C$
$75.0 < AR \leq 100.0 \Rightarrow D$
$100.0 < AR \leq 125.0 \Rightarrow E$
$125.0 < AR \leq 150.0 \Rightarrow F$
$150.0 < AR \Rightarrow G$

Table 1: Asset rating and energy bands in England, Wales, and Northern Ireland

More details on the calculation procedure required by the NCM and the definition of the rating scale are explained in more detail in the NCM Modelling Guide (available from www.uk-ncm.org.uk).

Further information on EPCs (including the treatment of communal areas that accompany units with independent heating systems) can be found in DLUHC’s publication: “*Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale and let of non-dwellings*” which can be accessed from <https://www.gov.uk/government/publications/energy-performance-certificates-for-the-construction-sale-and-let-of-non-dwellings--2>. This document provides an introduction to energy performance certificates for non-dwellings, describes the scope and requirements of the regulations that apply on construction, sale, or let, and provides guidance on how these are applied in practice.

NB: While no EPCs are required for permanently unconditioned buildings (i.e., buildings which do not use energy to condition the indoor climate and are expected to remain this way), it is possible to voluntarily lodge EPCs for unconditioned buildings and, as such, the definition of the Reference building was revised (see above) in order to allow for the calculated energy rating for these types of buildings to be representative. Permanently unconditioned buildings are different to those which are expected to be conditioned later on, and which should be modelled as per the guidance in DLUHC’s publication: “*Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale, and let of non-dwellings*”, which can be accessed as indicated above.

Buildings with no building services currently installed, but which are expected to be installed in the future (e.g., shell areas in shell and core buildings), should be modelled in iSBEM for the purposes of producing an EPC with assumed building services of the types that are most likely to be installed in those areas/class of buildings and which have the minimum acceptable specification standards that meet the requirements in Part L of the Building Regulations in force when the building was constructed (the minimum standards for building services are specified in the Approved Documents).

NB: The domestic type activities available under the building type “Residential spaces” in iSBEM are to allow the energy calculations for the generation of one EPC for a building which contains residential accommodation above a non-domestic space (e.g., a shop or a pub) provided that the residential space can only be accessed from within the non-domestic space, i.e., the residential part is not designed or altered for use as a separate independent dwelling. In addition to common circulation areas of apartment buildings containing self-contained flats, these are the **only** cases where iSBEM can be used to model domestic areas. For more information on the appropriate software tools to use for modelling your building, please refer to DLUHC’s publication: “*Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale, and let of non-dwellings*”, which can be accessed as above.

In Scotland, the EPC displays the approximate CO₂ emissions and energy usage of the building based on a standardised use of the building. The Rating is expressed as the CO₂ emissions in kg per m² of floor area per year (i.e., the same as BER, rounded to the nearest whole number), and it determines where the building sits on a seven-band scale. The EPC also includes a list of recommendations for the cost-effective improvements (lower cost measures) of the energy performance. Further information is available from the Scotland 2015 NCM Modelling Guide, which can be accessed from <http://www.gov.scot/Topics/Built-Environment/Building/Building-standards/techbooks/techhandbooks/ncmq2015>), and the Scotland Building Regulations Section 6 for 2015, which can be accessed from <http://www.gov.scot/Topics/Built-Environment/Building/Building-standards/techbooks/techhandbooks/th2015nondom6>.

For Northern Ireland, the EPC is very similar to that in England and Wales. Please refer to www.finance-ni.gov.uk/topics/building-regulations-and-energy-efficiency-buildings for further information on building regulations.

3. ENTERING A BUILDING INTO iSBEM

This chapter takes you through each of the iSBEM data entry forms consecutively (the *General*, *Project Database*, *Geometry*, and *Building Services* forms), giving guidance on what information is required at each stage, wherever it is different to, or in addition to, that required for compliance assessments as described in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.1. Important note on the default values in iSBEM

In iSBEM, there are default values included for various parameters. For example, there are default seasonal efficiencies for HVAC systems and default constructions for envelope elements so that you can select them when defining the envelopes of a zone when learning how to use the tool. These default values are not generous (i.e., usually pessimistic), should be checked by the user, and, if appropriate, changed or added to.

NB: If none of the default values in iSBEM are changed when modelling a new building, it is likely that the building will achieve a poor asset rating.

3.2. General form

The *General* form contains two tabs:

- **File Options** tab
- **General Information** tab

3.2.1. File Options tab

The *File Options* tab has five sub-tabs:

- **File Operations** sub-tab.
- **System Configuration** sub-tab.
- **System Configuration (cont.)** sub-tab.

File Operations sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

System Configuration sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

System Configuration (cont.) sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.2.2. General Information tab

The *General Information* tab contains a few sub-tabs, as described below, where you can enter as much or as little background information about the project. However, there are also essential parameters to be selected, such as the weather location for the project and the purpose of the analysis. These details can be entered and edited in their respective tabs (see Figure 1). Some of this information may have already been entered when the project was first created (see the User Guide volume “**How to use iSBEM: Basics - UK**”).

The *General Information* tab contains the following sub-tabs:

- **Project Details** sub-tab.
- **Additional Project Details** sub-tab.
- **Special Considerations** sub-tab.
- **Regulation 25A** sub-tab.
- **Building Details** sub-tab.
- **Energy Assessor Details OR Qualified/Accredited Person** sub-tab.

The screenshot shows the 'General' tab selected in the top navigation bar. Below it, the 'General Information' sub-tab is active. The main content area is titled 'Basic information about Project and Energy Assessor' and contains a sub-tab bar with 'Project details', 'Additional project details', 'Special considerations', 'Regulation 25A', 'Building details', and 'Energy Assessor details'. The 'Project details' sub-tab is selected, showing a form with the following fields:

- Building Regulations Bye-Laws parameters**
 - Purpose of the analysis: EPC England (dropdown menu)
 - ☐ Tick to produce EPC in Welsh language
 - ☐ Tick to additionally check Building Regulations
- Weather (location): London (dropdown menu)
- Stage of analysis: As built (dropdown menu)
- ☐ Tick if the building is a Shell and Core building
- Project complexity: Level 3 (dropdown menu)

Figure 1: The General Information tab in the General form

Project Details sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

In this sub-tab, the following information can be entered (Figure 1):

Building Regulations & Bye-Laws Parameters

1. Purpose of the analysis – purpose for carrying out a calculation using iSBEM, whether it is to generate an Energy Performance Certificate in England or any other country in the UK, e.g., EPC England.
2. Type of EPC – whether the model created is for the Actual building (building as currently is) or the Potential building (building with potential improvements). This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC Scotland’ in order to enable the assessor to create a scenario (similar to the process applied in the Green Deal Tool) which features the selected improvements so that the tool can calculate the potential asset rating which appears on the Scotland EPC.

NB: In order for the potential asset rating to be populated on the Scotland EPC and the XML file generated, a scenario for the potential building with the assessor-recommended improvements needs to be created and run successfully as described in Section 3.2.3: Obtaining Potential Asset Rating for EPC Scotland.

NB: iSBEM now automatically calculates the comparative England asset rating and reports it on the XML file for Scotland EPC, i.e., the user no longer needs to calculate it separately and input it manually into iSBEM.

3. Tick box to indicate whether you wish to produce the EPC in Welsh as well as in English – This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC Wales’.
4. Tick box to indicate whether, in addition to producing an EPC, you wish to check compliance with Building Regulations and produce a compliance document (relevant for new buildings only). This option is not available if the selected purpose of analysis is EPC Scotland.
5. Stage of analysis – Only the option “as built” is available when the purpose of analysis is generating an EPC.
6. Project complexity – complexity of the building for the purposes of energy assessments for EPCs. The options available are:
 - ‘Level 3’ – simple, existing buildings that can be modelled using iSBEM, e.g., small buildings such as converted houses or doctors’ surgeries.
 - ‘Level 4’ – new and existing buildings that can be modelled using iSBEM, e.g., small purpose-built office buildings.
 - ‘Level 5’ – new and existing complex buildings that need to be modelled using Dynamic Simulation Models (DSMs), e.g., large office buildings or factories.

NB: If in doubt about whether iSBEM would be appropriate for modelling your building, please contact your Accreditation Scheme Provider.

7. Main renewable source – Select to either let SBEM determine the main renewable source (the one associated with the largest amount of energy) to appear on the Scotland EPC based on the input parameters and the calculated results (select “From calculation”), or to display ‘Other non-calculated’ on the EPC to denote that the main renewable source is of a type that cannot currently be modelled in iSBEM. This parameter is active only if the Scotland EPC is selected in the “Purpose of the Analysis” parameter above.

The screenshot shows the iSBEM software interface. At the top, there is a navigation bar with tabs: General, Project Database, Geometry, Building Services, Ratings, Building Navigation, and About iSBEM. Below this, there is a sub-navigation bar with 'File Options' and 'General Information'. The 'General Information' tab is active, and within it, the 'Additional project details' sub-tab is selected. The sub-tab contains a form with two dropdown menus: 'Related party disclosure' (set to 'Not related to the owner') and 'Transaction type' (set to 'Mandatory issue (Marketed sale)'). A help icon (?) is visible in the top right corner of the sub-tab area.

Figure 2: The Additional project details sub-tab of the General Information tab in the General form

Additional Project Details sub-tab:

In this sub-tab, the following information can be entered (Figure 2):

1. Related party disclosure – any related party disclosure by the Energy Assessor for the purposes of energy calculations for EPCs. This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC England’, ‘EPC Wales’, or ‘EPC Northern Ireland’. **NB:** A valid option for this parameter **must** be selected for the EPC calculation to run successfully.
2. Transaction type – the transaction type which has prompted the generation of the EPC. A valid option for this parameter **must** be selected from the drop-down menu for the EPC calculation to run successfully. **NB:** The option ‘Mandatory issue (Display in public building)’ is available for EPC Scotland only.

The screenshot shows the iSBEM software interface. At the top, there are tabs: General, Project Database, Geometry, Building Services, Ratings, Building Navigation, and About iSBEM. Below these, there are sub-tabs: File Options and General Information. The 'General Information' sub-tab is active, and within it, the 'Building Details' sub-tab is selected. The form is titled 'Basic information about Project and Energy Assessor'. It contains the following fields and options:

- Building type:** A dropdown menu with 'Offices and Workshop businesses' selected.
- Name of the project:** A text field with 'Example building' entered.
- Building address:** A text field with '56 London Road' entered.
- City:** A text field with 'LONDON' entered.
- Postal Code:** A text field with 'SW1 2WS' entered.
- Location Description:** A text field.
- Inspection date:** A text field with '29/01/2021' entered.
- Tick if the building is of special conservation status:** A checkbox.
- What unique reference do you know about this address?:** A section with three radio buttons:
 - UPRN:** Selected. The text field next to it contains '000000000000 UPRN'.
 - Previous EPC RRN:** A text field.
 - Neither:** A radio button.

Figure 3: The Building Details sub-tab of the General Information tab in the General form

Building Details sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

In this sub-tab (Figure 3), the following information can be entered:

Building Details

1. UPRN - the Unique Property Reference Number (UPRN) of the building. In England, Wales, and Northern Ireland, this parameter is optional and consists of 1 to 12 digits (the software will add a “UPRN-” prefix), and it can be left blank if it is not available. In Scotland, on the other hand, it consists of 10 digits (with no prefix), and it should not be left blank.

NB: The RRN for each of the Energy Performance Certificate and the Recommendations Report for an EPC in England, Wales, and Northern Ireland is now randomly generated in EPCgen every time the calculation runs successfully, and it is no longer linked to the UPRN and the inspection date. As such, if an EPC calculation is re-run, new RRNs will always be generated by EPCgen for buildings in England, Wales, and Northern Ireland, even if there have been no changes in the input data. The last generated EPC RRN will be displayed in the Ratings form.

If the "Purpose of Analysis" parameter has been set for generation of EPC in England, Wales, or Northern Ireland, radio buttons allow the selection of either of the following as an alternative to inputting the UPRN, if it is not available for the building:

- a. Previous EPC RRN - the Report Reference Number (RRN) of an EPC which was previously done for the building in England, Wales, or Northern Ireland. This parameter is active only if the "Purpose of Analysis" parameter is set for generation of EPC in England, Wales, or Northern Ireland, and the UPRN cannot be provided. It consists of 20 digits in the form of five sets of numbers separated

by hyphens, where each set is comprised of 4 digits (the software will add an “RRN-” prefix).

- b. Neither – if neither a UPRN nor RRN of a previous EPC is available for the building in England, Wales, or Northern Ireland that is being assessed for an EPC.
2. Access restriction - Specifies if any restrictions are to be imposed on the retrieval of the EPC’s XML file from the National Register in Scotland. This parameter is active only if the Scotland EPC is selected in the “Purpose of the Analysis” parameter.
3. Inspection Date – the date on which the energy assessor inspected the building for the purposes of energy calculations for EPCs.
4. Tick box to indicate whether the building has a special conservation status (i.e., the building has been identified as being: one of special architectural or historical interest, in a conservation area, in a designated area of special character or appearance, or of traditional construction) - This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC England’, ‘EPC Wales’, or ‘EPC Northern Ireland’.

Energy Assessor Details / Qualified/Accredited Person Details sub-tab:

The name of this sub-tab changes depending on the option selected in the parameter “Purpose of Analysis” in the *Projects Details* sub-tab, as follows:

- **Energy Assessor Details** sub-tab – if the option selected is ‘EPC England’, ‘EPC Wales’, or ‘EPC Northern Ireland’.
- **Qualified/Accredited Person Details** sub-tab – if the option selected is ‘EPC Scotland’.

This sub-tab (Figure 4) contains two sub-forms: *Energy Assessor Details* sub-form and *Insurance Details* sub-form.

Figure 4: The Energy Assessor Details in the General form

Energy Assessor Details sub-form: in this sub-form, the following information can be entered:

1. Name – of the energy assessor or qualified/accredited person. **NB:** The input should be as you want it to appear in the XML file and lodged EPC.
2. Address – of the energy assessor or qualified/accredited person. **NB:** The input should be as you want it to appear in the XML file and lodged EPC.
3. City – of the energy assessor or qualified/accredited person. **NB:** The input should be as you want it to appear in the XML file and lodged EPC.
4. Post Code – of the energy assessor or qualified/accredited person. **NB:** The input should be as you want it to appear in the XML file and lodged EPC.
5. Telephone number – of the energy assessor or qualified/accredited person.
6. Email address – of the energy assessor or qualified/accredited person.
7. Accreditation Scheme – the name of the Accreditation Scheme to which the energy assessor belongs. For energy assessors accredited with more than one scheme, the scheme name you input here should correspond to the Assessor Number you input below.
8. Assessor number – the registration number of the energy assessor within his Accreditation Scheme. This parameter must consist of 4 letters followed by 6 digits, and it should not be left blank. For energy assessors accredited with more than one scheme, the assessor number you input here should correspond to the name of the Accreditation Scheme you input above. **NB:** The input should be exactly as on the National Register of non-domestic Energy Assessors (www.ndepcregister.com for England & Wales and www.epbniregisternd.com for Northern Ireland). If in doubt, please contact your Accreditation Scheme Provider.

9. Qualifications – the qualifications of the energy assessor as they will need to be qualified for the type of building being assessed (check with your Accreditation Scheme Provider). This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC England’, ‘EPC Wales’, or ‘EPC Northern Ireland’. See the “Project complexity” parameter in the *General Information* tab.
 10. Emp/Trading Name – the employer or the trading name of the energy assessor. This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC England’, ‘EPC Wales’, or ‘EPC Northern Ireland’. **NB:** The input should be exactly as you want it to appear in the XML file and lodged EPC.
 11. Emp/Trading Address – the employer or the trading address of the energy assessor. This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC England’, ‘EPC Wales’, or ‘EPC Northern Ireland’. **NB:** The input should be exactly as you want it to appear in the XML file and lodged EPC.
- NB:** Please note that an internet connection is no longer required to generate EPC XML files for buildings in England, Wales, and Northern Ireland as EPCgen no longer needs to connect to the National Register’s servers to verify the assessor’s accreditation status and the software version. If ‘EPC Scotland’ has been selected as the “Purpose of Analysis”, the XML file will be generated only if the calculation runs successfully for both the actual and potential ratings.
- NB:** Please note that the EPC and Recommendations Report produced on your computer will always contain the watermark.
- NB:** Energy Assessors should input their full details (name, address, qualifications, trading name, etc.) in the interface exactly as they want them to be recorded in the XML file, as well as their assessor number.
12. Membership Number – the membership number of the qualified/accredited person. This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC Scotland’.
 13. Protocol Organisation – the accreditation scheme of the qualified/accredited person. This parameter is active only if the “Purpose of Analysis” parameter is set to ‘EPC Scotland’.

Clear all – All the information in the *Energy Assessor Details / Qualified/Accredited Person Details* sub-tab will remain visible in any new project created but can be cleared by pressing the “Clear all” button.

The screenshot shows the iSBEM software interface. At the top, there is a navigation bar with tabs: General, Project Database, Geometry, Building Services, Ratings, Building Navigation, and About iSBEM. Below this, the 'General Information' tab is active, showing 'Basic information about Project and Energy Assessor'. Under this, there are sub-tabs: Project details, Additional project details, Special considerations, Regulation 25A, Building details, and Energy Assessor details. The 'Energy Assessor details' sub-tab is selected, displaying the 'Insurance details' form. The form contains the following fields: 'Insurer company' with the value 'Insurance', 'Policy number' with the value '0001', 'Effective date' with the value '01/08/2010' and a 'Calendar' button, 'Expiry date' with the value '31/07/2022' and a 'Calendar' button, and 'PI Limit' with the value '500000'. A 'Clear all' button is located at the bottom right of the form area.

Figure 5: Insurance Details in the General form

Insurance Details sub-form: This is where the following information can be entered:

1. Insurer Company – Name of the energy assessor’s insurance company. **NB:** The text input in this field should not include any double quotes.
2. Policy Number – The energy assessor’s insurance policy number.
3. Effective Date – The energy assessor’s insurance policy effective start date.
4. Expiry Date – The energy assessor’s insurance policy expiry date.
5. PI Limit – The energy assessor’s insurance policy cover limit.

3.2.3. Obtaining Potential Asset Rating for EPC Scotland

In order to obtain the potential asset rating for a Scotland EPC, the assessor will need to have first run the EPC calculation to obtain the asset rating for the building as it currently is, i.e., with the “Type of EPC” parameter in the *General form* > *General Information* tab > *Project details* sub-tab set to ‘Actual’ (see Figure 6). Any editing of NCM recommendations or addition of user-defined recommendations in the *Ratings form* > *Asset Rating* tab > *Recommendations* sub-tab must be completed whilst Type of EPC is set to ‘Actual’ before commencing the Potential rating.

General **Project Database** **Geometry** **Building Services** **Ratings** **Building Navigation** **About iSBEM**

ACTUAL SCOTLAND EPC

File Options General Information

Basic information about Project, Owner and Agent ?

Project details Additional project details Special considerations EPBD Recast Building details Qualified / Accredited Person details

Building Regulation, Bye-Laws & EPBD parameters

Purpose of the analysis: EPC Scotland

Type of EPC: Actual
☐ Tick to additionally check Building Regulations

Weather (location): Scotland

Stage of analysis: As built

SE type of building: Other buildings
☐ Occupied period temperature always below 28°C

Main renewable source: From calculation
☒ Tick if mains gas supply is available to development site

Actual = EPC for building as currently is

Potential = EPC for building with selected recommended improvements

Figure 6: Type of EPC for Scotland for actual and potential buildings

In order to generate the potential asset rating with the recommended improvements, this will necessitate creating a scenario in iSBEM and then implementing the selected improvements to the building model. The format of the software tool in this mode is very similar to that used for Green Deal assessments in the GDTTool (www.ncm-sbem.org.uk) so should be familiar to assessors who have undergone Green Deal training.





To create a scenario of recommended improvements in iSBEM:

1. Set the "Type of EPC" parameter to "Potential" in the *General* form > *General Information* tab > *Project details* sub-tab (see Figure 6). This action causes a new tab entitled *Potential Measures* to appear in the *General* form (see Figure 7).
2. From the "Record selector" drop-down menu in the *Potential Measures* tab, select the option "Create new Scenario based on BASELINE". This will create a copy of the baseline building model, i.e., the building as-is, on which the assessor can make alterations to add improvement measures while leaving the original baseline model unaffected.
3. The 'Scenario copy' is assigned the name "New Scenario" by default, but the name can be changed by editing the text within the "Name" field (see Figure 8). A short description may also be entered in the "Description" field explaining what changes will be introduced and assessed, but this is not obligatory. Notice that the name of the scenario the user is working on is shown at the top left-hand side of the *General* form in green text for reference.
4. To create an improvement measure, in the *General* form > *Potential Measures* tab > *Improvements* sub-tab, input a name for the improvement measure within the "New Measure" field, and click on the **Create** button. Notice that the name of the measure will appear at the top of the form in green text for reference. A short description of the measure may also be entered in the "Description" field, such as what change it entails (see Figure 9).

General Project Database Geometry Building Services Ratings Building Navigation About iSBEM

ACTUAL SCOTLAND EPC

File Options General Information Potential Measures

Record selector    

General Improvements **Select action or SCENARIO from the list**
Create new Scenario based on BASELINE

Name

Based on scenario Created on

Description








Record: 1 of 1    No Filter Search

Figure 7: General form > Potential Measures tab

General Project Database Geometry Building Services Ratings Building Navigation About iSBEM

New Scenario

File Options General Information Potential Measures

Record selector **New Scenario**    

General Improvements

Name

Based on scenario Created on

Description




Record: 1 of 1    No Filter Search

Figure 8: New scenario

The screenshot displays the iSBEM software interface. At the top, there are tabs for General, Project Database, Geometry, Building Services, Ratings, Building Navigation, and About iSBEM. Below these, the 'New Scenario' window is open, showing the 'MEASURE: Measure 1' form. The form has a 'General' tab selected. It includes a 'Record selector' set to 'New Scenario'. The form fields are: NAME (Measure 1), DESCRIPTION (Replace T8 lamps with T5), and a table for energy performance improvements. The table has columns for kWh/m2, Heating, Cooling, Auxiliary Lighting, and Hot Water. The 'Improved' row shows values for each category. The 'Created ON' date is 15/01/2014 14:18:41. The interface also shows tabs for File Options, General Information, and Potential Measures. At the bottom, there are record navigation controls showing 'Record: 1 of 1' and a search bar.

Figure 9: New improvement measure

5. At this point, the assessor should go to the relevant section in iSBEM in order to make the change to the building model that is relevant to the improvement measure just created. For example, if the measure is for changing T8 lamps to T5 lamps, the assessor should go to the *Building Services* form > *Zones* tab > *Lighting* sub-tab and change the lamp types of all the zones which have T8 to T5. If the recommended improvement is to upgrade single-glazed windows to double-glazing, the assessor should go to the *Project Database* form > *Glazing* tab > *General* sub-tab and modify the definition of the glazing type which is assigned to those windows. If the recommended improvement is for adding a PV system, then the assessor should go to the *Building Services* form > *PVS* tab > *General* sub-tab and enter the definition of the PV system in order to add it to the building model, and so on.
6. Once the building model has been modified with the recommended improvement measures, the impact on the energy performance of the building and its CO₂ emissions can be assessed. In the *Ratings* form, click on the **Calculate EPC rating** button (see section 4.1.1: Asset Rating tab) to initiate the calculation of the building's performance with the improvement scenario (containing all the recommended improvement measures in a single package).
7. After the calculation has completed successfully, the potential asset rating for the building with the recommended improvements will appear in the relevant section on the Actual building's EPC which is generated on the user's computer, and it will also be recorded on the generated XML file so that it can appear on the official EPC generated at the Scotland National Register after lodgement.

3.3. Project Database form

Guidance on input in this form is the same as that provided in the User Guide volume "**How to use iSBEM: Compliance Assessment - UK**".

3.4. Geometry form

Guidance on input parameters in this form not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.4.1. Project tab

This tab consists of the following two sub-tabs:

- **General & Geometry** sub-tab
- **Thermal Bridges** sub-tab

General & Geometry sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

This sub-tab requires the input of the following information, as shown in Figure 10:

Building Infiltration (Global)

1. Air permeability at 50 pa ($\text{m}^3/\text{h.m}^2$) - If the purpose of analysis option that has been selected in the *General* form > *General Information* tab > *Project Details* sub-tab is EPC generation only, i.e., without a simultaneous Building Regulations compliance check, then iSBEM's default value for air permeability will be $25 \text{ m}^3/\text{h.m}^2$. If the relevant box is ticked to also carry out a compliance assessment, then the default value in the interface is $10 \text{ m}^3/\text{h.m}^2$. Either way, however, the user can over-write the default value by manually entering an alternative value.

Figure 10: General & Geometry sub-tab of Project tab in the Geometry form

Thermal bridges sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.4.2. Defining zones – Zones tab

Guidance on input parameters in this tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

NB: For building regulations calculations purposes, we recommend that users generally avoid creating more than 100-150 zones in iSBEM. However, the processing time will depend on the total number of objects (not just zones), i.e., zones, envelopes, windows, etc. Note that for the asset rating to be calculated for an EPC, 3 buildings need to be generated: Actual, Notional, and Reference (Typical is based on the Notional building’s performance), i.e., all the objects in the input are multiplied by 3 to give the total number of objects being processed by SBEM. Hence, creating a project with a very large number of objects will slow down the calculation and may cause it to crash.

The *Zones* tab contains four sub-tabs:

- **General** sub-tab.
- **Quick Envelopes** sub-tab.
- **Thermal bridges** sub-tab.

- **Envelope Summary** sub-tab.

General sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

To create a zone, you will need to click into the *General* sub-tab of the *Zones* tab, add a new record, and enter the following information:

1. **HVAC System** – If you have defined your HVAC systems before defining your zones (i.e., if you have started with the *Building Services* form instead of the *Geometry* form), you can select the HVAC system that serves this zone from the drop-down list. If no HVAC system serves the space (i.e., an unconditioned zone that is intended to remain that way), select ‘Zones without HVAC system’ (spaces which have no heating or cooling, e.g., plant rooms, storage spaces, exposed circulation spaces). If you have not yet defined your HVAC system, this can be left as ‘Unassigned’ at this stage. You will be able to assign the zones to an HVAC system later within the *Building Services* form so there is no need to define the HVAC system before continuing. If you leave the zone as unassigned, a red warning will appear in the top right-hand corner to let you know how many zones remain unassigned so that you would not proceed with running the calculation before assigning them.

If you do not know the type of the HVAC system in your existing building or its detailed parameters when modelling a building for an EPC calculation, you should select one of the following default options from the drop-down menu (see Section 3.5: Building Services form):

- ‘Heating only - Electric resistance’ - Heat generated by passing an electric current through resistance wire. Assumed to be electric central heating system with warm air distribution. Fan storage heaters and electric fan converters should be input by defining an HVAC system in the *Building Services* form > *HVAC Systems* tab > *General* sub-tab and selecting the system type “Other local room heater - fanned”. If you do not know the heating method (i.e., whether a heated-only building uses electricity or a fuel-based heating system), you should select electric resistance heating as your default.
- ‘Heating only - Other systems’ - Assumed to be a wet radiator system with heat generated by fuel combustion. Pumps assumed to be powered by grid-supplied electricity. If you know the fuel type used by the heating system, you can define it in the *Building Services* form > *Global and Defaults* tab > *HVAC System Defaults* sub-tab (see Section 3.5.1: Global and Defaults tab).
- ‘Heating and mechanical cooling’ - Assumed to be a constant volume air system with terminal reheat and fixed fresh air. Refrigeration (chillers), fans, and pumps assumed to be powered by grid-supplied electricity. If you know the fuel type used by the heating system, you can define it in the *Building Services* form > *Global and Defaults* tab > *HVAC System Defaults* sub-tab (see Section 3.5.1: Global and Defaults tab).

NB: The default HVAC systems in iSBEM are representative of existing, rather than new, buildings and should only be used if you are running an EPC calculation for an existing building (not a new building) and do not know the type of the HVAC system in your building or its detailed parameters as the default efficiencies assumed by iSBEM for them are quite pessimistic and cannot be edited by the user.

NB: If a zone is defined as having no heating or cooling, i.e., assigned to 'Zones without HVAC system', but the activity type selected for the zone is one which typically requires conditioning (according to the Activity Database), a **red exclamation mark "!"** will appear next to this parameter as a warning to the user, in case this was done in error.

Ultimately, however, the calculation will be carried out using the data input by the user. On the other hand, if the user assigns an HVAC system (i.e., which provides heating or heating and cooling) to a zone whose activity type is typically unconditioned in the NCM Activity Database, a similar **red exclamation mark "!"** will appear next to this parameter in the interface, and if the calculation is initiated, it will be terminated by the SBEM engine. Because there are no values for heating-set-point or cooling-set-point temperatures specified in the NCM Activity Database for these unconditioned activities, no heating or cooling energy demand can be calculated by the SBEM engine for these activities.

NB: The domestic type activities available under the building type "Residential spaces" in iSBEM are to allow the energy calculations for the generation of one EPC for a building which contains residential accommodation above a non-domestic space (e.g., a shop or a pub) provided that the residential space can only be accessed from within the non-domestic space, i.e., the residential part is not designed or altered for use as a separate independent dwelling. In addition to common circulation areas of apartment buildings containing self-contained flats, these are the **only** cases where iSBEM can be used to model domestic areas. For more information on the appropriate software tools to use for modelling your building, please refer to DLUHC's publication: "*Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale, and let of non-dwellings*" which can be accessed from DLUHC's website at <https://www.gov.uk/government/publications/energy-performance-certificates-for-the-construction-sale-and-let-of-non-dwellings--2>.

Infiltration

2. Air permeability at 50pa, in $\text{m}^3/\text{h}.\text{m}^2$ - If the purpose of analysis option that has been selected in the *General* form > *General Information* tab > *Project Details* sub-tab is EPC generation, then iSBEM's default value for air permeability will be $25 \text{ m}^3/\text{h}.\text{m}^2$. However, the user can over-write the default value by manually entering an alternative value.

Figure 11 shows a zone being defined.

General Project Database Geometry Building Services Ratings Building Navigation About iSBEM

Project Zones Envelope Doors Windows & Rooflights

Zone selector z0/01east

General Quick Envelopes Envelope Summary

Name z0/01east Multiplier 1

HVAC system HVAC for the example building

Building Type A3/A4/A5 Restaurant and Cafes/Drinking Establishment

Activity Eating/drinking area

Area 162 m2 Flr-to-flr height 3 m

☐ Tick if this is a shell area

Infiltration

☐ No, use default value 25 m3/h/m2

☒ Yes, Air permeability at 50pa is 3 m3/h/m2

Thermal Bridges

☒ Tick here to use Global Psi values

User's notes

The coffee shop on the ground floor - core and east perimeter area

Description of Activity from NCM database

Areas where food or drink are consumed. This could include open corridors or stairs providing access to the main eating/drinking spaces.

Record: 1 of 19 Unfiltered Search

Figure 11: A zone being defined in the General sub-tab of the Zones tab in the Geometry form

Thermal Bridge sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “How to use iSBEM: Compliance Assessment - UK”.

Envelope Summary sub-tab:

Guidance on this sub-tab is the same as that provided in the User Guide volume “How to use iSBEM: Compliance Assessment - UK”.

3.4.3. Defining envelopes – Envelope tab

Guidance on input parameters in this tab not described below is the same as that provided in the User Guide volume “How to use iSBEM: Compliance Assessment - UK”.

The main *Envelope* tab contains two sub-tabs:

- General sub-tab.
- Window & Door Summary sub-tab.

General sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume “How to use iSBEM: Compliance Assessment - UK”.

For each envelope element, you will need to click into the *General* sub-tab of the *Envelope* tab, create a new record, and add the following information:

1. Connects space to (sometimes referred to as “adjacent condition”) – Here you need to select what conditions apply on the other side of the wall/floor or ceiling/roof.

NB: If surfaces of the room are not rectilinear, for example, if a pitched roof is exposed to the inside of the conditioned zone (i.e., there is no flat ceiling underneath it), then the roof area will be that of the inner surface area of the roof as "seen" by the heat flux.

Convention: For EPCs - Dimension conventions

See APPENDIX C: for the treatment of other rooms with non-rectilinear surfaces.

Windows & Doors Summary sub-tab:

Guidance on this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.4.4. Defining windows and rooflights – Windows & Rooflights tab

Guidance on input in this tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.4.5. Defining doors – Doors tab

Guidance on input in this tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.4.6. Quick Envelopes tab: Short cut to creating envelopes and windows

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.5. Building Services form

Guidance on input parameters in this form not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

This form holds all the information relating to the building services. This information is entered into the following main tabs (these are circled in Figure 12):

- **Global and Defaults** tab – This tab contains some default information on HVAC systems if no or little information is known about the systems in the Actual building. It also requires information on the electric power factor and lighting controls for the whole building.
- **HVAC systems** tab.
- **HWS** tab.
- **SES** tab.
- **PVS** tab.

- **Wind generators** tab.
- **CHP generator** tab (this tab only appears when one of the HVAC systems described in the *HVAC Systems* tab is specified as using CHP).
- **Solar collectors** tab.
- **Showers** tab.
- **Zones** tab.

The screenshot shows the 'Building Services' form in the iSBEM software. The top navigation bar includes tabs: General, Project Database, Geometry, Building Services (selected), Ratings, Building Navigation, and About iSBEM. Below this is a row of sub-tabs: Global and Defaults (circled), HVAC systems, HWS, SES, PVS, Wind generators, CHP generator, Solar collectors, Showers, and Zones. The main content area has three sub-tabs: HVAC System Defaults (selected), Project building services, and Air Conditioning Inspection. The HVAC System Defaults sub-tab contains instructions and four sections: 'Zones without HVAC system', 'Heating only - Electric resistance', 'Heating only - other systems', and 'Heating and mechanical cooling'. Each section provides detailed descriptions and options for system configuration, such as fuel type (Natural Gas) and power source (Grid Supplied Electricity).

Figure 12: The tabs in the Building Services form

3.5.1. Global and Defaults tab

In this tab, there are three sub-tabs:

- **HVAC System Defaults** sub-tab
- **Project Building Services** sub-tab
- **Air Conditioning Inspection** sub-tab - This sub-tab is visible only if EPC generation in England, Wales, or Northern Ireland is selected as the "Purpose of Analysis" in the *General* form > *General Information* tab > *Project Details* sub-tab.

HVAC System Defaults sub-tab:

If no HVAC system serves the space (i.e., an unconditioned zone), you should select the option 'Zones without HVAC system' as the HVAC system for that zone in the *Geometry*

form > *Zones* tab > *General* sub-tab or the *Building Services* form > *Zones* tab > *HVAC & HW System* sub-tab (spaces which have no heating or cooling, e.g., plant rooms, storage spaces, exposed circulation spaces.). If you do not know the type of the HVAC system in your existing building or its detailed parameters, you should instead select one of the following default options from the drop-down menu (see Section 3.4.2: Defining zones – Zones tab):

- ‘Heating only - Electric resistance’ - Heat generated by passing an electric current through resistance wire. Assumed to be an electric central heating system with warm air distribution. Fan storage heaters and electric fan converters should be input by defining an HVAC system in the *Building Services* form > *HVAC Systems* tab > *General* sub-tab and selecting the system type "Other local room heater - fanned". If you do not know the heating method (i.e., whether a heated-only building uses electricity or a fuel-based heating system), you should select electric resistance heating as your system.
- ‘Heating only - Other systems’ - Assumed to be a wet radiator system where heat is generated by fuel combustion. Pumps assumed to be powered by grid-supplied electricity. If you know the fuel type used by the heating system, you can define it in this sub-tab (Figure 12).
- ‘Heating and mechanical cooling’ - Assumed to be a constant volume air system with terminal reheat and fixed fresh air. Refrigeration (chillers), fans, and pumps assumed to be powered by grid-supplied electricity. If you know the fuel type used by the heating system, you can define it in this sub-tab (Figure 12).


NB: The default HVAC systems in iSBEM are representative of existing, rather than new, buildings and should only be used if you are running an EPC calculation for an existing building (not a new building) and do not know the type of the HVAC system in your building or its detailed parameters as the default efficiencies assumed by iSBEM for them are quite pessimistic and cannot be edited by the user.


Project Building Services sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

Air Conditioning Inspection sub-tab:

This sub-tab is visible only if EPC generation in England, Wales, or Northern Ireland is selected as the “Purpose of Analysis” in the *General* form > *General Information* tab > *Project Details* sub-tab. In this sub-tab, you need to enter details about the air conditioning system in the building, if applicable, as shown in Figure 13. This data is used by iSBEM purely for reporting purposes (in the XML file for lodgement) and is not used during the calculation.

1. Tick box to indicate if the building has an air conditioning system. If the box is ticked, the following parameters become active:
 - a) Tick box to indicate if the total effective rated output of the air conditioning system is known.
 - If the actual output is known, the box should be unticked, and the value should be entered, in kW, into the box, which becomes active. Further guidance can be accessed by clicking on the adjacent  button.
 - If the actual output is unknown, the box should be ticked, and a value for an estimated range should be selected from the options in the drop-down menu,

which becomes active. Further guidance can be accessed by clicking on the adjacent  button.

- b) Has an air conditioning inspection been commissioned for compliance with Energy Performance of Buildings Regulations – Select an option from the drop-down menu.

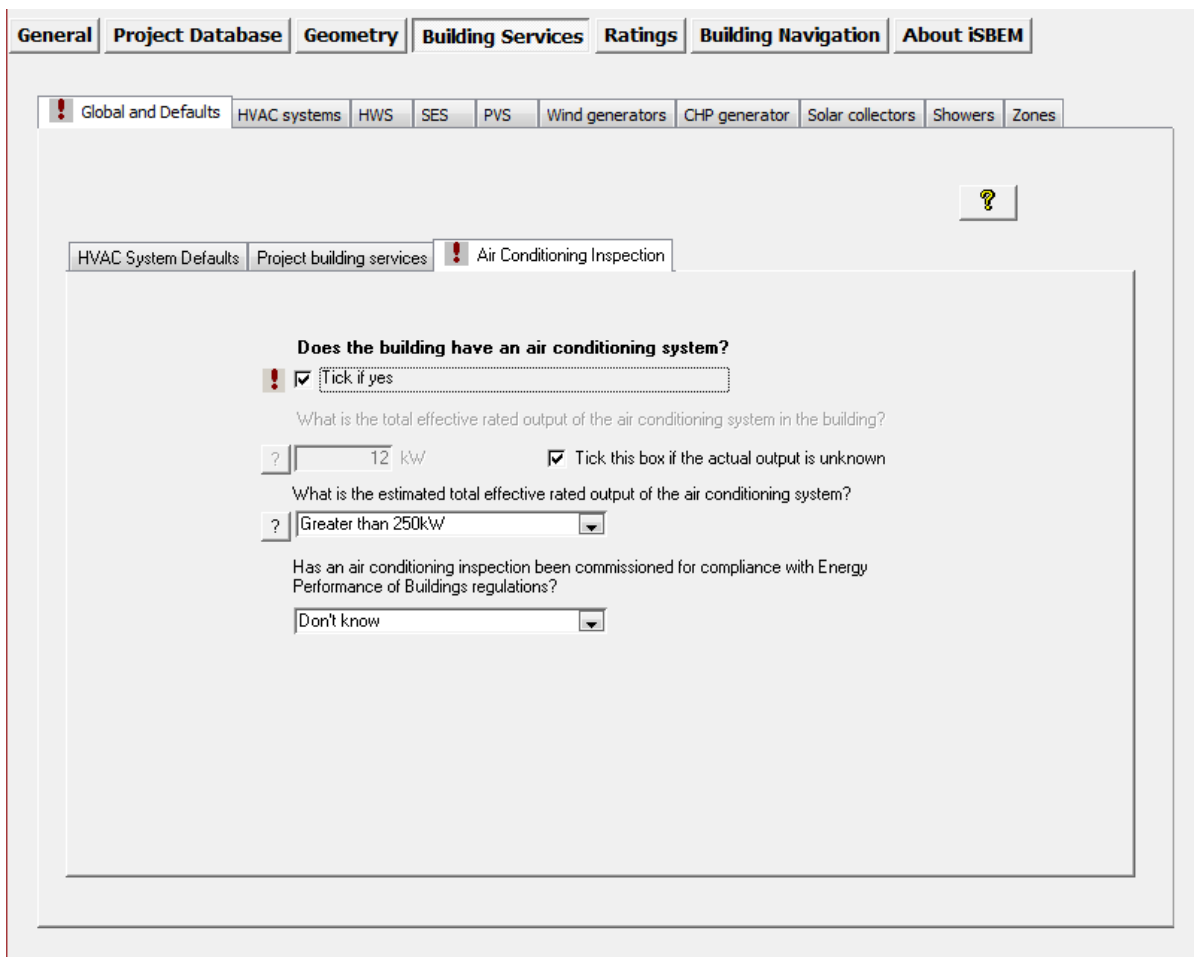


Figure 13: Air Conditioning Inspection sub-tab of the Global and Defaults tab in the Building Services form

3.5.2. Defining HVAC Systems – HVAC Systems tab

Guidance on input parameters in this tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

The building’s HVAC system(s) is defined within the first seven sub-tabs of the *HVAC systems* tab.

- **General** sub-tab.
- **Heating** sub-tab.
- **Cooling** sub-tab.
- **Systems Adjustments** sub-tab.
- **Metering Provision** sub-tab.

- **System Controls** sub-tab: This is where heating system controls for each HVAC system can be defined.
- **Bi-valent Systems** sub-tab.
- **Zone Summary** sub-tab.

If no HVAC system serves the space (i.e., an unconditioned zone), you should select the option 'Zones without HVAC system' as the HVAC system for that zone in the *Geometry* form > *Zones* tab > *General* sub-tab or the *Building Services* form > *Zones* tab > *HVAC & HW System* sub-tab (spaces which have no heating or cooling, e.g., plant rooms, storage spaces, exposed circulation spaces). If you do not know the type of the HVAC system in your existing building or its detailed parameters, you should instead select one of the following default options from the drop-down menu (see Section 3.4.2: Defining zones – Zones tab):

- 'Heating only - Electric resistance' - Heat generated by passing an electric current through resistance wire. Assumed to be electric central heating system with warm air distribution. Fan storage heaters and electric fan converters should be input by defining an HVAC system in the *Building Services* form > *HVAC systems* tab > *General* sub-tab and selecting the system type "Other local room heater - fanned" (see below). If you do not know the heating method (i.e., whether a heated-only building uses electricity or a fuel-based heating system), you should select electric resistance heating as your default.
- 'Heating only - Other systems' - Assumed to be a wet radiator system with heat generated by fuel combustion. Pumps assumed to be powered by grid-supplied electricity. If you know the fuel type used by the heating system, you can define it in this sub-tab (Figure 12).
- 'Heating and mechanical cooling' - Assumed to be a constant volume air system with terminal reheat and fixed fresh air. Refrigeration (chillers), fans, and pumps assumed to be powered by grid-supplied electricity. If you know the fuel type used by the heating system, you can define it in this sub-tab (Figure 12).

NB: The default HVAC systems in iSBEM are representative of existing, rather than new, buildings and should only be used if you are running an EPC calculation for an existing building (not a new building) and do not know the type of the HVAC system in your building or its detailed parameters as the default efficiencies assumed by iSBEM for them are quite pessimistic and cannot be edited by the user.

General sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **"How to use iSBEM: Compliance Assessment - UK"**.

Heating sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume **"How to use iSBEM: Compliance Assessment - UK"**.

1. Heat generator seasonal efficiency - If you know the seasonal efficiency for the heat generator, it can be introduced manually into the interface. Otherwise, the (conservative) default value visible in the interface will be used for the calculation. The default seasonal efficiency value (if no efficiency is input by the user) is based on whether the generator is on the Energy Technology List (ETL) of the 'Enhanced

Capital Allowance' (ECA) schemeⁱ. If not, you then need to select whether the generator was installed in or after 1998.

NB: For boiler systems installed from 1998 onwards, a default seasonal efficiency of 0.81 is suggested by the tool (based on Statutory Instrument 1994 No. 3083), and for boiler systems installed before this period, a conservative default seasonal efficiency of 0.65 is suggested. Please note that from around 1989, the boiler industry began producing boilers with efficiencies that would have complied with the above statutory instrument.

NB: Minimum efficiency standards for the different HVAC systems in new buildings are described in the Approved Documents. Note that the necessary documentation to support the input efficiency values may be requested by your Accreditation Scheme Provider for auditing purposes.

Figure 14 shows a heating system being defined.

The screenshot displays the iSBEM software interface with the 'Building Services' tab selected. Within this tab, the 'HVAC systems' sub-tab is active. The 'Record selector' is set to 'HVAC for the example building'. The 'Heating' sub-tab is selected, showing the 'Heating system' configuration. The 'Heat source' is set to 'LTHW boiler' and the 'Fuel type' is 'Natural Gas'. A checkbox 'Tick if this system also uses CHP' is checked. The 'Does it qualify for UK ECAs?' section has a dropdown set to 'ECA list (after 2001)'. The 'Was it installed in or after 1998?' section has 'Yes' selected. The 'Do you know the generator's seasonal heating efficiency?' section has 'Yes, seasonal efficiency is' selected with a value of 4. The 'Do you know the generator radiant efficiency?' section has 'No, use default value' selected with a value of 0.4. The 'Do you know the ratio of fan power to heating output?' section has 'No, use default value' selected with a value of 20 W/kWh. The bottom of the interface shows a record list with '1 of 1' records and a search bar.

Figure 14: HVAC systems definition, Heating sub-tab

Cooling sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume "How to use iSBEM: Compliance Assessment - UK".

ⁱ www.eca.gov.uk/et/

System Adjustments sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “How to use iSBEM: Compliance Assessment - UK”.

Metering Provision sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “How to use iSBEM: Compliance Assessment - UK”.

System Controls sub-tab:

The software also needs to know if you have certain controls in your heating system, which would be considered during the production of the energy efficiency recommendations to accompany the EPC. There are 5 tick boxes in this sub-tab (see Figure 15):

Heating System Controls

1. Tick box to indicate whether the heating system has central time control.
2. Tick box to indicate whether the heating system has optimum start/stop control.
3. Tick box to indicate whether the heating system has local time control (i.e., room by room).
4. Tick box to indicate whether the heating system has local temperature control (i.e., room by room).
5. Tick box to indicate whether the heating system has weather compensation control.

NB: The HVAC system controls indicated in the *System Controls* sub-tab are used by iSBEM only for generating the recommendations for the Recommendations Report which accompanies the EPC. They have no impact on the energy calculations.

NB: If you have more than one HVAC system defined in your project, the *System Controls* sub-tab will be available for each one of them, i.e., each HVAC system can have control definitions different from the others.

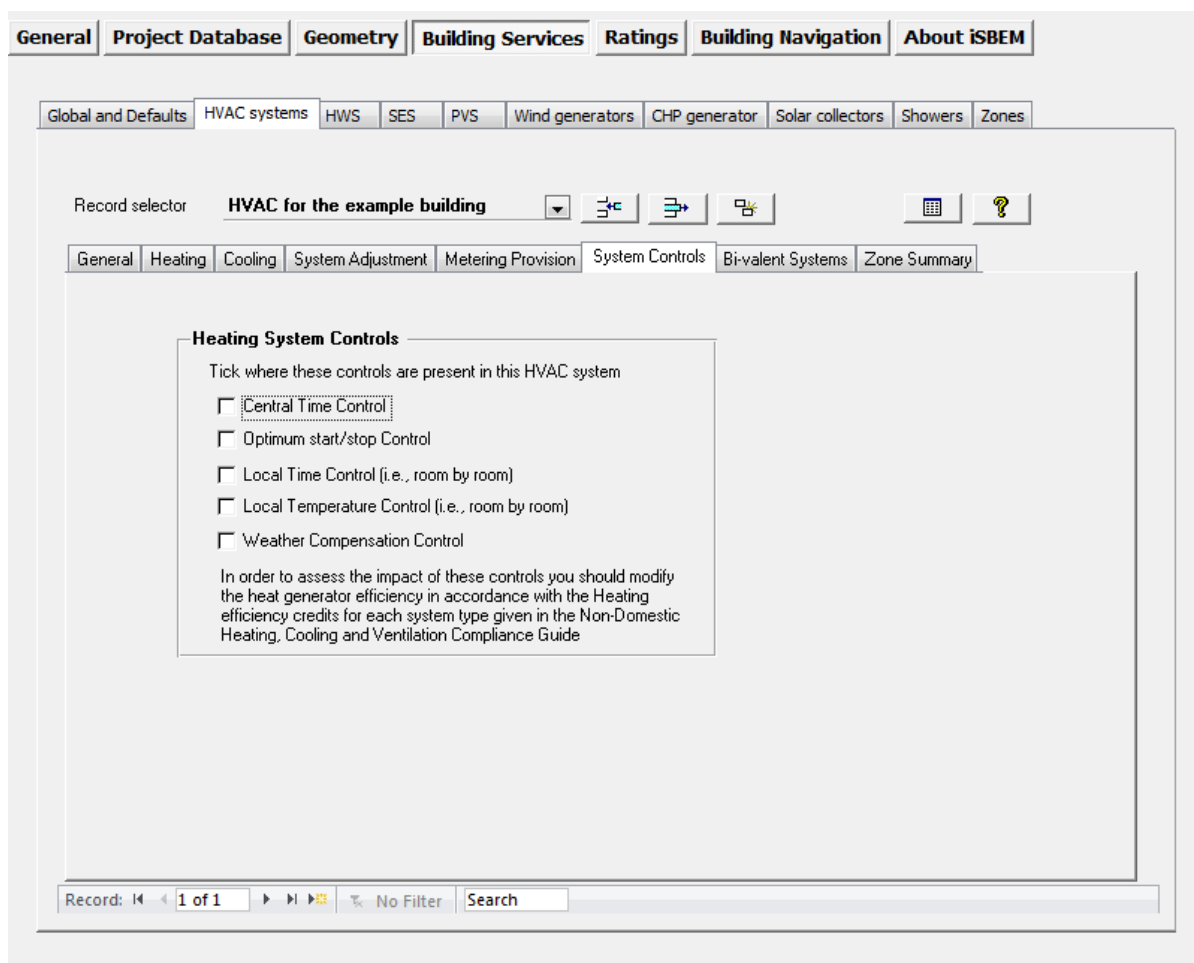


Figure 15: HVAC systems definition: System Controls sub-tab

Bi-valent Systems sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

Zone Summary sub-tab:

Guidance on this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.5.3. Defining HWS – HWS tab

Guidance on input parameters in this tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

The *HWS* tab has four sub-tabs:

- **General** sub-tab.
- **Storage & Secondary Circulation** sub-tab.
- **Assigned** sub-tab.
- **Bi-valent Systems** sub-tab.
- **Showers** sub-tab.

General sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

A HWS is defined by the following information:

1. Is it later than 1998? - Tick if the system was installed later than 1998. The generator type selected above determines whether this tick box is enabled. Whether this box is ticked determines the default seasonal efficiency used by the tool if no value is input by the user.

NB: For boiler systems installed from 1998 onwards, a default seasonal efficiency of 0.81 is suggested by the tool (based on Statutory Instrument 1994 No. 3083), and for boiler systems installed before this period, a conservative default seasonal efficiency of 0.65 is suggested. Please note that from around 1989, the boiler industry began producing boilers with efficiencies that would have complied with the above statutory instrument.

2. Heat generator seasonal efficiency - If you know the seasonal efficiency for the heat generator, it can be introduced manually into the interface. Otherwise, the (conservative) default value visible in the interface will be used for the calculation. This field is inactive if the HWS Generator type selected is ‘Same as HVAC’. The default value is based on the above tick box on whether the generator was installed in or later than 1998.

NB: Minimum efficiency standards for the different HW systems in new buildings are described in the Approved Documents. Note that the necessary documentation to support the input efficiency values may be requested by your Accreditation Scheme provider for auditing purposes.

Figure 16 shows a HWS generator being defined.

The screenshot displays the iSBEM software interface for defining a Hot Water System (HWS). The top navigation bar includes tabs for 'General', 'Project Database', 'Geometry', 'Building Services', 'Ratings', 'Building Navigation', and 'About iSBEM'. Below this, a sub-navigation bar shows tabs for 'Global and Defaults', 'HVAC systems', 'HWS', 'SES', 'PVS', 'Wind generators', 'CHP generator', 'Solar collectors', 'Showers', and 'Zones'. The 'HWS' tab is selected, and the 'HWS selector' is set to 'HWS for the example building'. The 'General' sub-tab is active, showing the following fields:

- Name:** HWS for the example building
- Generator type:** Dedicated hot water boiler
- Fuel type:** Natural Gas
- Do you know the effective heat generating seasonal efficiency?**
 - ☐ No, use default value 0.65
 - ☒ Yes, seasonal efficiency is 0.94

At the bottom of the interface, there is a record navigation bar showing 'Record: 1 of 1' and a search bar.

Figure 16: Defining a HWS in the General sub-tab

Storage & Secondary Circulation sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

Bi-valent Systems sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

Showers sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

Assigned sub-tab:

Guidance on this sub-tab is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

3.5.4. Defining Solar Energy Systems (SES) – SES tab

Guidance on input in this tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.5.5. Defining a Photovoltaic system (PVS) – PVS tab

Guidance on input in this tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.5.6. Defining a wind generator – Wind Generators tab

Guidance on input in this tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.5.7. Defining a CHP generator – CHP Generator tab

Guidance on input in this tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.5.8. Defining a Solar Collector – Solar Collectors tab

Guidance on input in this tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.5.9. Defining a Shower – Showers tab

Guidance on input in this tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

3.5.10. Defining the zone-specific building services- Zones tab

Guidance on input parameters in this tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

There are eight sub-tabs in the *Zones* tab:

- **HVAC and HWS Systems** sub-tab.
- **Ventilation** sub-tab.
- **Ventilation (cont)** sub-tab.
- **Exhaust** sub-tab.
- **Lighting** sub-tab.
- **Lighting Controls** sub-tab.

- **Display Lighting** sub-tab.
- **Solar Collector** sub-tab.

HVAC and HWS Systems sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

The sub-tab is used to specify the HVAC system and HWS for each zone. The following information is required:

HVAC System Parameters

1. HVAC Systems – Here you need to select from the drop-down list (of systems you have already defined in the *HVAC Systems* tab or the default systems) the HVAC system which serves the zone. If no HVAC system serves the space (i.e., an unconditioned zone), select ‘Zones without HVAC system’ (spaces which have no heating or cooling and will remain unconditioned, e.g., plant rooms, storage spaces, exposed circulation spaces).

If you do not know the type of the HVAC system in your existing building or its detailed parameters, you should select one of the following default options from the drop-down menu:

- ‘Heating only - Electric resistance’ - Heat generated by passing an electric current through resistance wire. Assumed to be an electric central heating system with warm air distribution. Fan storage heaters and electric fan converters should be input by defining an HVAC system in the *Building Services* form > *HVAC Systems* tab > *General* sub-tab and selecting the system type “Other local room heater - fanned”. If you do not know the heating method (i.e., whether a heated-only building uses electricity or a fuel-based heating system), you should select electric resistance heating as your default.
- ‘Heating only - Other systems’ - Assumed to be a wet radiator system with heat generated by fuel combustion. Pumps assumed to be powered by grid-supplied electricity. If you know the fuel type used by the heating system, you can define it in the *Building Services* form > *Global and Defaults* tab > *HVAC System Defaults* sub-tab (see Section 3.5.1: Global and Defaults tab).
- ‘Heating and mechanical cooling’ - Assumed to be a constant volume air system with terminal reheat and fixed fresh air. Refrigeration (chillers), fans, and pumps assumed to be powered by grid-supplied electricity. If you know the fuel type used by the heating system, you can define it in the *Building Services* form > *Global and Defaults* tab > *HVAC System Defaults* sub-tab (see Section 3.5.1: Global and Defaults tab).

NB: The default HVAC systems in iSBEM are representative of existing, rather than new, buildings and should only be used if you are running an EPC calculation for an existing building (not a new building) and do not know the type of the HVAC system in your building or its detailed parameters as the default efficiencies assumed by iSBEM for them are quite pessimistic and cannot be edited by the user.

NB: If a zone is defined as having no heating or cooling, i.e., assigned to ‘Zones without HVAC system’, but the activity type selected for the zone is one which typically requires conditioning (according to the Activity Database), a red exclamation mark “!” will appear next to this parameter as a warning to the user, in case this was done in error.

Ultimately, however, the calculation will be carried out using the data input by the user. On the other hand, if the user assigns an HVAC system (i.e., which provides heating or

heating and cooling) to a zone whose activity type is typically unconditioned in the NCM Activity Database, a similar **red exclamation mark “!”** will appear next to this parameter in the interface, and if the calculation is initiated, it will be terminated by the SBEM engine. Because there are no values for heating-set-point or cooling-set-point temperatures specified in the NCM Activity Database for these unconditioned activities, no heating or cooling energy demand can be calculated by the SBEM engine for these activities.

Figure 17 shows a zone’s HVAC and HWS being defined.

The screenshot displays the iSBEM software interface with the 'Building Services' tab selected. Within this tab, the 'Zones' sub-tab is active. The 'Record selector' shows 'z0/01'. Below this, a row of sub-tabs includes 'HVAC & HW systems', 'Ventilation', 'Ventilation (cont)', 'Exhaust', 'Lighting', 'Lighting Controls', 'Display Lighting', and 'Solar Collector'. The 'HVAC & HW systems' sub-tab is selected, showing three main sections: 'HVAC system parameters', 'Lighting system', and 'Hot Water System'. In the 'HVAC system parameters' section, 'System selection' is set to 'HVAC for the example building' and there is a checkbox for 'Are there De-stratification fans in the zone?'. The 'Lighting system' section has 'System selection' set to 'Lighting configured at zone level'. The 'Hot Water System' section shows 'HWS selection' as 'HWS for the example building' and 'Deadleg length in this zone' as '2 m'. At the bottom, a record list shows 'Record: 1 of 19' and a search bar.

Figure 17: Selecting a zone’s HVAC and HWS

Ventilation sub-tab:

Guidance on input parameters in this sub-tab not described below is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

This sub-tab is used to specify the type of ventilation system specific for each zone. The following information is required:

Zonal Ventilation Type

1. Zonal ventilation type – A mechanical ventilation system separate from the heating or cooling system (i.e., zonal ventilation) can be added here. If the selected HVAC system does not already include ventilation, the zonal ventilation radio buttons become active. This would be possible, for example, with radiators or under-floor heating. You need to select either: Natural or Mechanical supply & extract, according

to whether there is a mechanical ventilation system present in the zone to provide fresh air.

Figure 18 shows a zone's ventilation characteristics being defined.

The screenshot displays the iSBEM software interface with the 'Building Services' tab selected. Within this tab, the 'Ventilation' sub-tab is active. The 'Record selector' is set to 'z0/01'. The interface includes a navigation bar with tabs: 'Global and Defaults', 'HVAC systems', 'HWS', 'SES', 'PVS', 'Wind generators', 'CHP generator', 'Solar collectors', 'Showers', and 'Zones'. Below the navigation bar, there is a sub-tab bar with options: 'HVAC & HW systems', 'Ventilation', 'Ventilation (cont)', 'Exhaust', 'Lighting', 'Lighting Controls', 'Display Lighting', and 'Solar Collector'. The main content area is divided into several sections:

- Zonal Ventilation Type:** Two radio buttons are present: 'Natural' (unselected) and 'Mechanical supply/extract' (selected).
- Does activity require high pressure drop air treatment?:** Two radio buttons: 'Use default from Activity database' (selected) and 'Use user value' (unselected). A checkbox labeled '(Tick if yes)' is also present.
- Do you know the Supply/Extract SFP?:** Two radio buttons: 'No, use the default' (selected) and 'Yes, SFP for the system is:' (unselected). The 'Yes' option has a text input field containing '0.5 W/l/s'.
- Demand controlled ventilation:** A dropdown menu is set to 'No demand-controlled ventilation'. Below it, there are two more dropdown menus: 'Flow regulation type' and 'Damper control'.

At the bottom of the interface, there is a record navigation bar showing 'Record: 1 of 19', a 'No Filter' button, and a 'Search' input field.

Figure 18: Defining the zone ventilation in the Ventilation sub-tab

Ventilation (cont) sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **"How to use iSBEM: Compliance Assessment - UK"**.

Exhaust sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **"How to use iSBEM: Compliance Assessment - UK"**.

Lighting sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **"How to use iSBEM: Compliance Assessment - UK"**.

Lighting Controls sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

Display Lighting sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

Solar Collector sub-tab:

Guidance on input in this sub-tab is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

3.6. Building Navigation form

Guidance on this form is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

3.7. About iSBEM form

Guidance on this form is the same as that provided in the User Guide volume **“How to use iSBEM: Compliance Assessment - UK”**.

4. CALCULATING AND VIEWING THE ENERGY PERFORMANCE OF THE BUILDING - THE RATINGS FORM AND OUTPUT REPORTS

The energy performance of the building is calculated, and the Energy Performance Certificate is generated via the *Ratings* form. The key results are then displayed in this form while further details on the asset rating and a more detailed analysis of the energy used and CO₂ emitted from the building are given in the iSBEM output reports. This chapter describes how to calculate the results and access the various outputs.

4.1. The Ratings form

The *Ratings* form allows the user to run the entered building model through SBEM and the Energy Performance Certificate Generator Module (EPCgen) to calculate the energy consumption of the building, CO₂ emissions (and those of the Notional, Reference, and Typical buildings), and its Asset Rating. You can do this by pressing the “Calculate EPC rating” button in the *Asset Rating* tab > *Building Rating* sub-tab.

NB: You will be able to monitor on the screen the progress of the calculation process as it is carried out for the different building objects.

In this form, the user can also:

1. View the key results within the interface.
2. Access the following output reports: the *Energy Performance Certificate*, the *Recommendations Report*, the *SBEM Main Output* report, *iSBEM Secondary Recommendations Report* and the *Data Reflection Report* for the Actual building.

The *Ratings* form is composed of one tab, which is:

- **Asset Rating** tab: displays the CO₂ emissions, in kg per m² of building area, for the Actual and Typical buildings, Part L TER, and SER, along with their corresponding EPC bands. It also displays a break-down of the annual energy consumption by end-use for the Actual, Notional, and Reference buildings in kWh/m².

4.1.1. Asset Rating tab

The *Asset Rating* tab has the following sub-tabs:

- **Building Rating** sub-tab
- **Graphic Rating** sub-tab
- **Recommendations** sub-tab
- **EPC Audit** sub-tab
- **Calculation Logs** sub-tab
- **Calculation Errors** sub-tab
- **Supporting Documents** sub-tab

Building Rating sub-tab:

The *Asset Rating* is calculated by clicking on the “Calculate EPC Rating” button. This runs the data through the SBEM calculation engine and the Energy Performance Certificate Generator (EPCgen).

NB: An internet connection is no longer required to generate EPC XML files for buildings in England, Wales, and Northern Ireland as EPCgen no longer needs to connect to the National Register’s servers to verify the assessor’s accreditation status and the software version. If ‘EPC Scotland’ has been selected as the “Purpose of Analysis”, the XML file will be generated only if the calculation runs successfully for both the actual and potential ratings.

NB: The RRN for each of the Energy Performance Certificate and the Recommendations Report for an EPC in England, Wales, and Northern Ireland is now randomly generated in EPCgen every time the calculation runs successfully, and it is no longer linked to the UPRN and the inspection date. As such, if an EPC calculation is re-run, new RRNs will always be generated by EPCgen for buildings in England, Wales, and Northern Ireland, even if there have been no changes in the input data. The last generated EPC RRN will be displayed in the *Ratings* form.

The *Building Rating* sub-tab then displays the following calculated results:

1. The energy used per unit floor area (kWh/m²) annually by the Actual, Notional, and Reference buildings for heating, cooling, auxiliary energy, lighting, and hot water.
2. The total energy used per unit floor area (kWh/m²) annually by the Actual, Notional, and Reference buildings in terms of electricity and fuel use. **NB:** If applicable, this total value includes any energy consumed by a CCHP generator to provide space heating, space cooling, and/or water heating, and it is net of any electrical energy displaced by the CCHP generator.
3. The resulting annual CO₂ emissions (kgCO₂/m²) from the Actual building (BER), the target (Part L TER), the Typical building (Stock average TYP), and the standard emission rate (SER). For details on the definition of the Reference and Typical buildings, SER, and Part L target, see Section 2.1: UK Energy Performance Certificate purposes and the 2021 NCM Modelling Guide.
4. The EPC bands corresponding to the annual CO₂ emissions from the Actual building, the SER, the target (Part L TER), and the Typical building (Stock average TYP).
5. The *EPC Rating (Asset Rating)* of the Actual building.

Also accessible from this sub-tab is the *Energy Performance Certificate*, the *Recommendations Report*, the *SBEM Main Output* report, the *Data Reflection* Report for the Actual building and supporting recommendations in the form of a secondary not-for-official-submission report (only available for the generation of EPCs for England, Wales and Northern Ireland). See Sections: 4.2.1: SBEM Main Output Document, 4.2.2: Data Reflection Report – Actual Building, 4.2.2: Energy Performance Certificate, 4.2.3: Recommendations Report, and 4.2.4: iSBEM Secondary Recommendations Report.

NB: The Data Reflection Reports in html format are generated, and the related access buttons become visible in the *Ratings* form, only if the relevant box has been ticked in the *General* form > *File Options* tab > *System Configuration* sub-tab.

NB: If any changes are made to a project (i.e., input parameters), the “Calculate EPC Rating” button needs to be clicked on again upon returning to this tab in order to update the results as the results figures cannot be refreshed unless the calculation is re-run.

NB: You must close all output files before re-running the calculation (so the software can over-write them). Otherwise, an error message will be produced.

Figure 19 shows the *Building Rating* sub-tab in the *Asset Rating* tab of the *Ratings* form for EPC England (Wales and Northern Ireland are similar). Figure 20 shows the same for Scotland with the “Type of EPC” parameter set to ‘Actual’ while Figure 21 shows the tab after the calculation has run with the “Type of EPC” parameter set to ‘Potential’. The message at the bottom of the screen indicates that there are no critical un-assignments detected in the project. If there were, the user would need to click on the “Objects Report” button, identify the un-assignment, make the correction in the appropriate part of iSBEM, return to this page, and then click the “Calculate EPC Rating” button.

EPC England

Building Rating Graphic rating Recommendations EPC Audit Calculation Logs Calculation Errors Supporting Documents

	Heating	Cooling	Auxiliary	Lighting	Hot Water	Total	
Actual	5.33	10.49	27.37	21.78	20.78	85.74	kWh/m2/yr
Notional	5.01	7.82	10.81	13.1	24.77	61.51	kWh/m2/yr
Reference	50.81	32.81	2.52	62.11	45.91	194.16	kWh/m2/yr

	Part L TER	Typical	SER	BER	EPC Rating
kgCO2/m2/yr	8.3	33.2	25.7	13.5	26
Band	A	C	B-C	B	

Calculate EPC Rating

Energy Performance Certificate

EPC Recommendations Report

Supporting Recommendations

Click on text below for...

SBEM Outputs

HTM data reflection reports are only produced if the relevant box is ticked in the General form

Calculation progress: Asset rating completed

Click to check object assignments, there are NO CRITICAL un-assignments in the project

New RRN created for XML: 7809-8961-4302-6048-1120

Figure 19: Using the interface to calculate the Asset Rating for the building in the Asset Rating tab of the Ratings form for England

General | Project Database | Geometry | Building Services | Ratings | Building Navigation | About iSBEM

ACTUAL SCOTLAND EPC

Asset Rating

EPC Scotland

Building Rating | Recommendations | EPC Audit | Calculation Logs | Calculation Errors | Supporting Documents

	Heating	Cooling	Auxiliary	Lighting	Hot Water	Total	
Actual	1.6	18.19	19.97	31.31	23.86	94.93	kWh/m2/yr
Notional	57.97	48.68	34.13	81.33	45.95	268.06	kWh/m2/yr

	S6 TER	Actual	Comparable in EW
kgCO2/m2/yr	53.1	40.5	
EPC Rating	53	41	32
Band	D	C	B

Calculate EPC Rating Click on text below for...

Energy Performance Certificate SBEM Outputs

EPC recommendations report Data Reflection - Actual Building

Calculation progress: Asset rating completed

Click to check object assignments, there are NO CRITICAL un-assignments in the project

Figure 20: Using the interface to calculate the Asset Rating for the building, with the “Type of EPC” set to ‘Actual’, in the Asset Rating tab of the Ratings form for Scotland

General | Project Database | Geometry | Building Services | Ratings | Building Navigation | About iSBEM

New Scenario.1 **MEASURE: Adding wind turbine**

Asset Rating

EPC Scotland

Building Rating | Recommendations | EPC Audit | Calculation Logs | Calculation Errors | Supporting Documents

	Heating	Cooling	Auxiliary	Lighting	Hot Water	Total	
Actual	1.95	13.22	30.04	33.05	6.04	84.31	kWh/m2/yr
Notional	3.58	13.7	17.84	35.91	12.43	83.46	kWh/m2/yr
Potential	1.95	13.22	30.04	33.05	6.04	84.31	kWh/m2/yr

	S6 TER	Actual	Comparable in E&W	Potential
kgCO2/m2/yr	39.4	38.7		
EPC Rating	39	39	30	38
Band	C	C	B	C

Calculate EPC Rating Click on text below for...

Energy Performance Certificate SBEM Outputs

EPC recommendations report HTM data reflection reports are only produced if the relevant box is ticked in the General form

Calculation progress: Asset rating completed

Click to check object assignments, there are NO CRITICAL un-assignments in the project

Figure 21: Using the interface to calculate the Asset Rating for the building, with the “Type of EPC” set to ‘Potential’, in the Asset Rating tab of the Ratings form for Scotland

Graphic Rating sub-tab:

The *Graphic Rating* sub-tab (Figure 22) is only visible for the generation of EPCs for England, Wales, and Northern Ireland. It displays the following:

1. A graph of the EPC rating band scale showing the energy bands and asset ratings corresponding to the annual CO₂ emissions from the Actual building, the target (Part L TER), the Typical building (Stock average TYP), and the Reference and zero CO₂ emissions benchmarks. The same graph is also displayed on the Energy Performance Certificate.

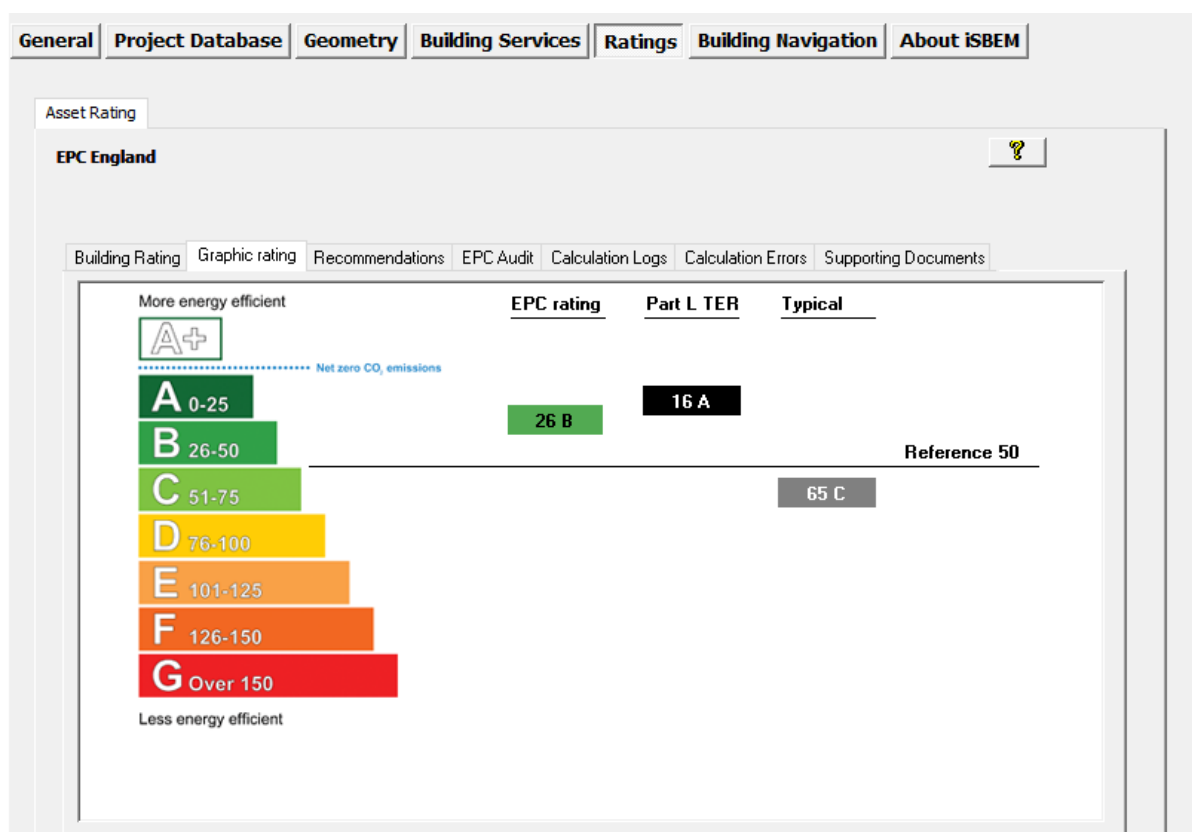


Figure 22: The Graphic Rating sub-tab in the Asset Rating tab of the Ratings form

Recommendations sub-tab:

Once the *Asset Rating* has been calculated successfully, the EPCgen module produces the *EPC* and the *Recommendations* Report. The latter contains the NCM and user-defined recommendations for energy efficiency improvements to the Actual building. This sub-tab (Figure 23) contains the following parameters:

1. There are 4 radio buttons in a box entitled "Show recommendations":
 - a. All NCM – Click this button to view only the NCM recommendations generated by EPCgen.
 - b. All USER – click this button to view only the recommendations added by the user. If there are no user-defined recommendations, then iSBEM will prompt you to add one (see below).
 - c. All – Click this button to view both the NCM recommendations and the ones added by the user.

- d. Only from Report – Click this button to view only the recommendations that have been included in the *Recommendations* report.


In addition to creating new recommendations in this sub-tab, the energy assessor can also edit the NCM recommendations generated by EPCgen by adding comments and/or modifying the calculated impacts, using the following parameters:

2. Click to edit this recommendation – By ticking this tick-box, you indicate that you wish to edit this particular NCM recommendation (whose text can be viewed in the grey box entitled “Recommendation”) generated by EPCgen. If the box is ticked, the following fields become active:
 - a. Assessor Comments - You can enter any comments related to the recommendation, for e.g., the reason why you have chosen to edit this NCM recommendation. These comments will appear in iSBEM's *Secondary Recommendations* report, not the official *Recommendations* report.
 - b. Energy Impact - You can select from the options available in the drop-down menu in order to specify the potential impact of implementing the recommendation on the energy performance of the Actual building. (HIGH = change in total building energy is >4%, MEDIUM = change in total building energy is ≤4% and >0.5%, LOW = change in total building energy is <0.5%).
 - c. CO₂ Impact - You can select from the options available in the drop-down menu in order to specify the potential impact of implementing the recommendation on the CO₂ emissions of the Actual building. (HIGH = change in total building CO₂ emissions is >4%, MEDIUM = change in total building CO₂ emissions is ≤4% and >0.5%, LOW = change in total building CO₂ emissions is <0.5%). This impact will appear in the *Recommendations* report.
 - d. CO₂ Saved per £ Spent - You can select from the options available in the drop-down menu (GOOD, FAIR, POOR, and UNKNOWN) in order to specify the potential CO₂ emissions saved from the Actual building per pound spent on implementing the recommendation in the Actual building.
 - e. Payback (drop-down menu) - You can select from the options available in the drop-down menu (LONG, MEDIUM, and SHORT) in order to specify the typical payback time for implementing the recommendation in the Actual building. (LONG = payback is >7 years, MEDIUM = payback is ≥3 years and ≤7 years, SHORT = payback is <3 years). If you know the exact figure for payback time in years, use the next parameter instead.
 - f. Payback (number) – Here you can input, in years, the typical payback time for implementing the recommendation in the Actual building. If you do not know the exact figure for payback time in years, use the previous parameter instead.

The following fields, however, remain greyed-out or un-editable as the user is not allowed to modify these parameters of NCM recommendations:

- a. Category – This describes the category under which the recommendation is classified, such as heating, cooling, etc.
- b. Code – This describes a unique code for each NCM recommendation. The code of any recommendation created by the energy assessor will be USER.
- c. Recommendation – This describes the text of the NCM recommendation. This text will appear in the *Recommendations* report.
- d. Applicable to – This describes the object to which the recommendation applies, for e.g., the whole building or a particular HVAC system or HWS.

3. Click to take out – By ticking this tick-box, you indicate that you wish to remove this particular NCM recommendation, which was generated by EPCgen, from the *Recommendations* Report.

If the “All USER” radio button is selected in the “Show recommendations” box or the “Add new record” button  at the bottom of the screen is clicked, then iSBEM will prompt you to create a new recommendation.

4. Once you have confirmed that you do wish to add a recommendation to the ones already generated by EPCgen, then the following fields become active (Figure 24):
 - a. Category - You can select from the options available in the drop-down menu in order to specify the category under which the recommendation will be classified.
 - b. Code – This parameter remains set to ‘USER’ for any user-defined recommendation.
 - c. Recommendation – You can enter text to describe the newly-added recommendation. This text will appear in the *Recommendations* report.
 - d. Assessor Comments - You can enter any comments related to the recommendation, for e.g., the reason why you have chosen to add this NCM recommendation. These comments will appear in iSBEM's *Secondary Recommendations* report, not the official *Recommendations* report.
 - e. Energy Impact - You can select from the options available in the drop-down menu in order to specify the potential impact of implementing the recommendation on the energy performance of the Actual building. (HIGH = change in total building energy is >4%, MEDIUM = change in total building energy is ≤4% and >0.5%, LOW = change in total building energy is <0.5%). **NB:** If you enter the value as UNKNOWN, SBEM will set it to LOW.
 - f. CO₂ Impact - You can select from the options available in the drop-down menu in order to specify the potential impact of implementing the recommendation on the CO₂ emissions of the Actual building. (HIGH = change in total building CO₂ emissions is >4%, MEDIUM = change in total building CO₂ emissions is ≤4% and >0.5%, LOW = change in total building CO₂ emissions is <0.5%). This impact will appear in the *Recommendations* report. **NB:** If you enter the value as UNKNOWN, SBEM will set it to LOW.
 - g. CO₂ Saved per £ Spent - You can select from the options available in the drop-down menu (GOOD, FAIR, POOR, and UNKNOWN) in order to specify the potential CO₂ emissions saved from the Actual building per pound spent on implementing the recommendation in the Actual building. **NB:** If you enter the value as UNKNOWN, SBEM will set it to POOR.
 - h. Payback (drop-down menu) - You can select from the options available in the drop-down menu (LONG, MEDIUM, and SHORT) in order to specify the typical payback time for implementing the recommendation in the Actual building. (LONG = payback is >7 years, MEDIUM = payback is ≥3 years and ≤7 years, SHORT = payback is <3 years). **NB:** If you enter the value as UNKNOWN, SBEM will set it to LONG. If you know the exact figure for payback time in years, use the next parameter instead.
 - i. Payback (number) – Here you can input, in years, the typical payback time for implementing the recommendation in the Actual building. If you do not know the exact figure for payback time in years, use the previous parameter instead.
 - j. Applicable to – Here you can specify the object to which the recommendation applies, for e.g., the whole building or a particular HVAC system or HWS. If the

option selected is either 'HVAC-SYSTEM' or 'HWS', then the following parameter becomes active:

- i. Name – You need to specify the name of the particular HVAC system or HWS (already defined in iSBEM) to which the user-defined recommendation refers.

NB: Only recommendations that are defined as applicable to the whole building, i.e., the parameter “Applicable to” has been set to ‘BUILDING’, appear in the official Recommendations report. All the defined recommendations, however, will appear in iSBEM’s Secondary Recommendations report.

5. Delete Recommendation – This button allows you to delete a user-defined recommendation.

Figure 23: The Recommendations sub-tab in the Asset Rating tab of the Ratings form showing an NCM recommendation

NB: After editing, deleting, or adding any recommendations, you need to re-run the calculation in order to re-generate the Recommendations Report with all your editing applied.

NB: The NCM recommendations are generated for the building and its energy systems when operated according to standard schedules appropriate to the general activities in the building. The Energy Assessor is expected to use his or her knowledge to remove inappropriate ones and possibly to add further ones. It is strongly recommended that more detailed assessments are carried out to quantify the benefits before making final decisions on implementation. If the Energy Performance Rating calculation has made extensive use of default values, some of the recommendations may be based on uncertain assumptions. These recommendations do not cover the quality of operation or maintenance of the building and its systems. There are frequently significant opportunities for energy and carbon savings in these areas and a full "energy audit" to identify them is strongly recommended.

NB: Once a recommendation has been edited by the user, it can no longer be displayed in the *Recommendations* report as being automatically generated by the calculation, and so cannot appear in any of the first 3 tables. It must appear in the fourth table containing the users' added or edited recommendations. This is the case if the 'tick to edit' box is ticked for any particular recommendation (even if no changes are actually made or comments are added by the user after ticking the box).

NB: For EPC Scotland, all editing of NCM recommendations and addition of user-defined recommendations must be completed whilst 'Type of EPC' is set to 'Actual', prior to commencing work to calculate the potential rating. Any editing or addition of recommendations whilst 'Type of EPC' is set to 'Potential' is not recorded and will have no effect on the output documents.

Figure 24: The Recommendations sub-tab in the Asset Rating tab of the Ratings form showing the active fields for creating a user-defined recommendation

NB: Guidance on editing recommendations: When editing recommendations for a particular project, you are advised to first run the calculation before editing or removing any recommendations in the *Recommendations* sub-tab. Once the calculation has run successfully, you can view the official Recommendations Report and identify if there are any recommendations which you feel are not valid for your specific project and you want removed, or new ones you want added based on your knowledge of the project. Then, you can go to the *Recommendations* sub-tab and click on the radio button "Only from report" in order to display only the recommendations that have been triggered by the calculation for this project, rather than all the possible recommendations. Out of these recommendations, you can then tick to remove any ones that are applicable to the whole building, so that they no longer appear on the report. You can also add any new ones making sure you set them as "applicable to the whole building" if you want them to appear on the official report. Once you are done editing, you can re-run the calculation, and save your updated nct file.

EPC Audit sub-tab:

The *EPC Audit* sub-tab (Figure 25) contains four sub-forms as follows:

- **Construction** sub-form – contains the audit trail information relating to the construction input parameters, i.e., construction specification of walls, floors, roofs, windows, rooflights, and doors.
- **Geometry** sub-form - contains the audit trail information relating to the geometry input parameters, i.e., definitions of thermal bridges; air permeability; and shading systems on glazing.
- **HVAC & HWS** sub-form - contains the audit trail information relating to the HVAC and HWS input parameters, i.e., heating and cooling system type; heating and cooling efficiencies, duct and AHU leakage, specific fan power, HWS generator efficiency, metering and controls provision, and high pressure drop air filtration.
- **Lighting** sub-form - contains the audit trail information relating to the lighting input parameters, i.e., lamp type, lighting controls, and parasitic power.

This sub-tab is where the energy assessor provides supporting evidence for over-riding any of the default values in iSBEM. This information is necessary for the audit trail regarding all the parameters that are used to carry out the energy calculations for the generation of the EPC, should any of the default values or settings be changed by the energy assessor. Each of the above four sub-sub-tabs contains the following:

1. Accept defaults – this is the list of defaults set in iSBEM for each of: Construction, Geometry, HVAC & HWS, and Lighting, which the energy assessor can over-ride.
2. Assessor walk-through inspection – supporting evidence based on a walk-through inspection by the energy assessor.
3. Inspection by other: Sales particulars - supporting evidence based on sales particulars.
4. Inspection by other: Technical inspection - supporting evidence based on a technical inspection by someone other than the energy assessor.
5. On-site measurements of input parameters for assessment - supporting evidence based on on-site measurements of the input parameters.
6. Other sources - supporting evidence based on other sources.
7. Comments – additional information that the energy assessor would like to include for the audit trail.

General | Project Database | Geometry | Building Services | Ratings | Building Navigation | About iSBEM

Asset Rating

EPC England ?

Building Rating | Graphic rating | Recommendations | EPC Audit | Calculation Logs | Calculation Errors | Supporting Documents

Construction | Geometry | HVAC & HWS | Lighting

Please introduce concise supporting evidence for over-writing default values

Accept default	Internal wall, roof, floor parameters based on age, generic type; thermal bridging based on use of accredited details
Assessor walk-through inspection	Type of internal wall, roof, floor
Inspection by others	
Sales particulars	Construction/regulations date from building control approval documentation
Technical inspection	
On-site measurements of input parameters for assessment	
Design or as-built documentation	External wall, door, glazing parameters derived from first principles from drawings and manufacturers info; accredited details confirmed
Other sources	
Comments	

Figure 25: The EPC Audit sub-tab in the Asset Rating tab of the Ratings form

Calculation Logs sub-tab:

Log files for the SBEM calculation (SBEM.log) and the EPC generator, EPCgen, (EPCgen.log) can be viewed in this sub-tab (Figure 26).

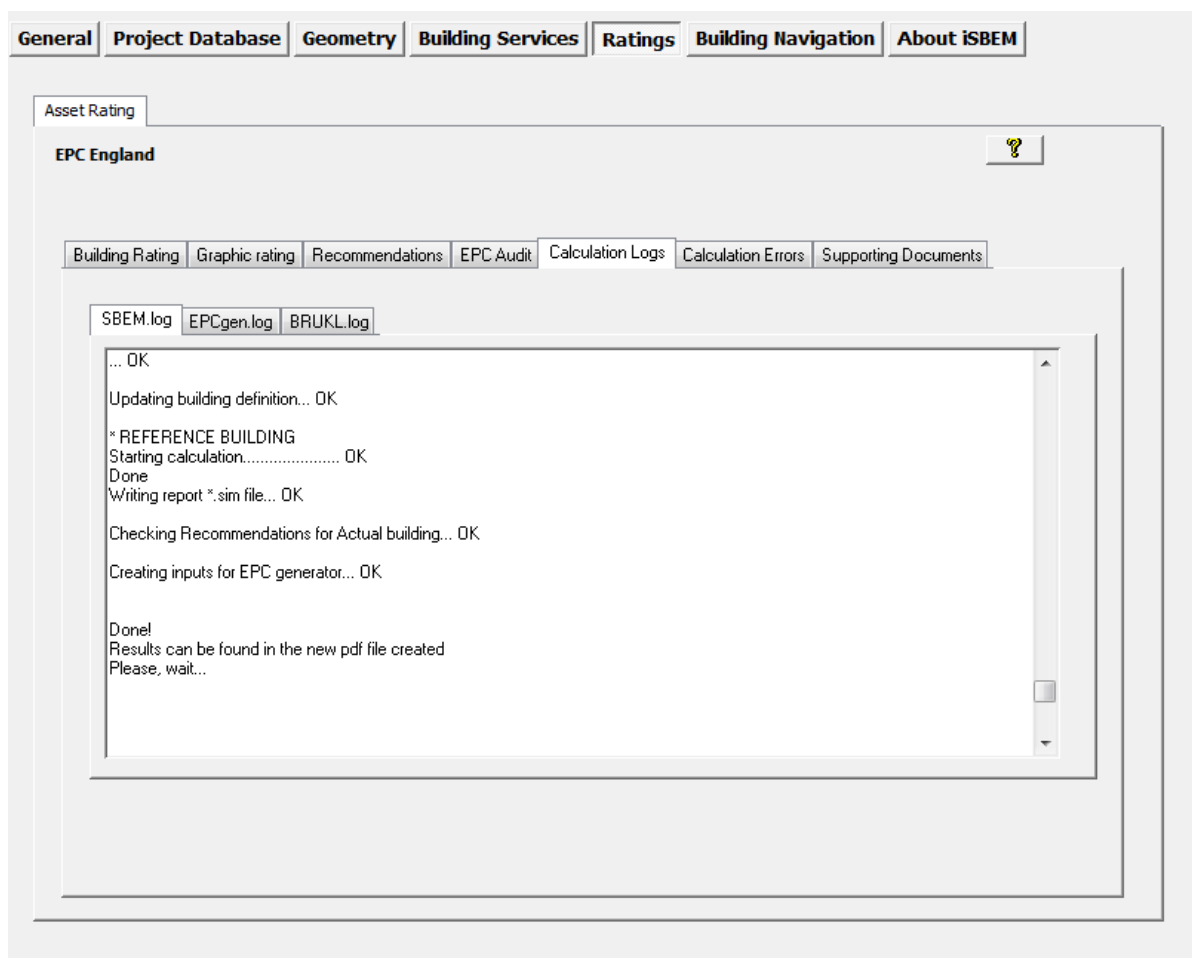


Figure 26: The Calculation Logs sub-tab in the Asset Rating tab of the Ratings form

Calculation Errors sub-tab:

Error files for the SBEM calculation (SBEM.err) and the EPC generator, EPCgen, (EPCgen.err) can be viewed in this sub-tab (Figure 27). If the calculation crashes, you can refer to these files for any error messages produced during the calculation.

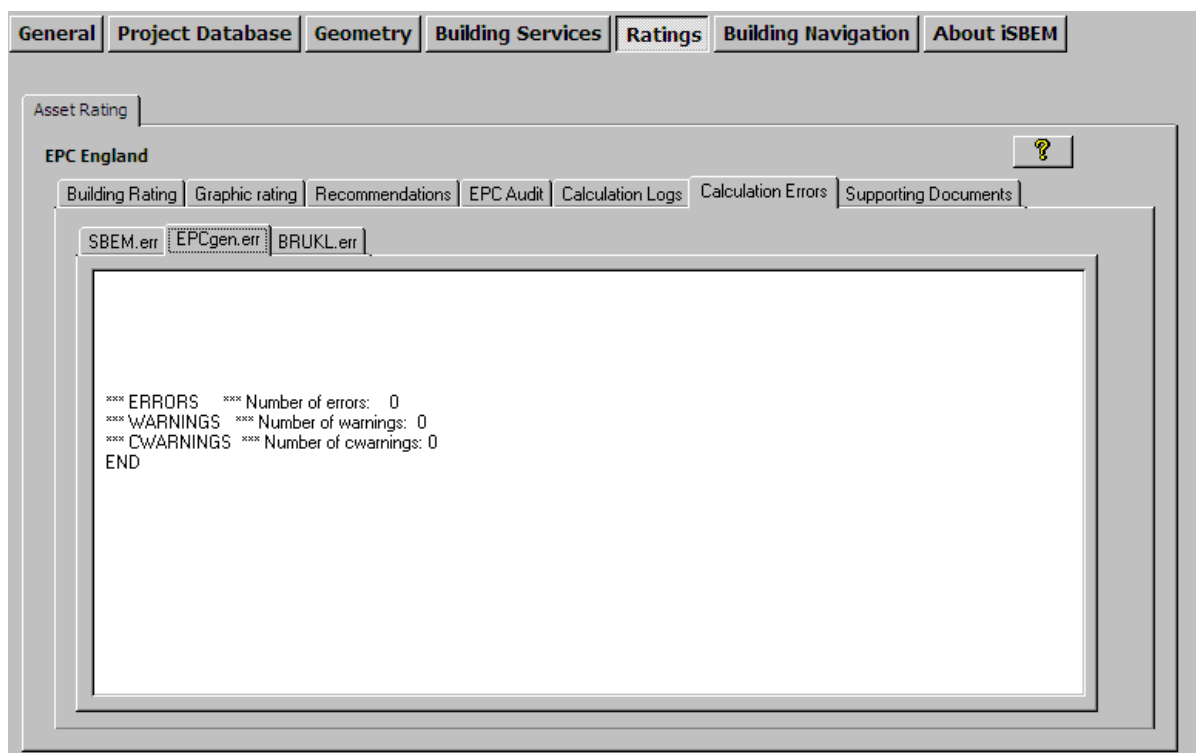


Figure 27: The Calculation Errors sub-tab in the Asset Rating tab of the Ratings form

Supporting Documents sub-tab:

Guidance on this sub-tab is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

4.2. iSBEM Output reports

Output reports when running iSBEM for Energy Performance Certificates:

If the calculation were run to generate the Energy Performance Certificate, then iSBEM produces the following reports:

1. SBEM Main Output Document
2. Energy Performance Certificate
3. Recommendations Report
4. Data Reflection Report – for the Actual Building
5. Technical Output Report – for the Actual Building
6. Technical Output Report – for the Notional Building
7. Technical Output Report – for the Reference Building

The following additional report is also produced but only during the generation of the Energy Performance Certificate for England, Wales, and Northern Ireland.

8. iSBEM Secondary Recommendations Report

As described previously, the first four reports are accessible from within iSBEM, using the appropriate buttons or hyperlinks in the *Ratings* form > *Asset Rating* tab > *Building Rating* sub-tab. These reports are all stored in the same location as the project files, along with the

Technical Output Reports, which can only be accessed from the “Projects” folder. The default location for the project files is within the specific project folder (created when the project was first created, see in the User Guide volume “**How to use iSBEM: Basics - UK**”) within the iSBEM_v6.1.c folder, e.g., C:\NCM\iSBEM_v6.1.c\ Projects\Example building-complete.

9. XML file for lodgement on the National EPC Register

One more file is produced when running the asset rating calculation and generating an EPC. This file is the XML message required for the official submission/lodgement of the EPC with the National Register. It contains all the data used in the generation of the Energy Performance Certificate and the EPC Recommendations report.

NB: An internet connection is no longer required to generate EPC XML files for buildings in England, Wales, and Northern Ireland as EPCgen no longer needs to connect to the National Register’s servers to verify the assessor’s accreditation status and the software version. If ‘EPC Scotland’ has been selected as the “Purpose of Analysis”, the XML file will be generated only if the calculation runs successfully for both the actual and potential ratings.

NB: The RRN for each of the Energy Performance Certificate and the Recommendations Report for an EPC in England, Wales, and Northern Ireland is now randomly generated in EPCgen every time the calculation runs successfully, and it is no longer linked to the UPRN and the inspection date. As such, if an EPC calculation is re-run, new RRNs will always be generated by EPCgen for buildings in England, Wales, and Northern Ireland, even if there have been no changes in the input data. The last generated EPC RRN will be displayed in the Ratings form.

4.2.1. SBEM Main Output Document

Guidance on this document is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

4.2.2. Data Reflection Report – Actual Building

Guidance on this document is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

4.2.3. Data Reflection Report – Notional Building

Guidance on this document is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

4.2.4. Technical Output Report – Actual Building

Guidance on this document is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

4.2.5. Technical Output Report – Notional Building

Guidance on this document is the same as that provided in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

4.2.1. Technical Output Report – Reference Building

This is a comma-separated-values ‘.csv’ file (which can be opened using Microsoft Excel) for the Reference building similar in format to the technical output report for the Actual building described in the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

4.2.2. Energy Performance Certificate

This report can be accessed from the *Ratings* form > *Asset Rating* tab > *Building Rating* sub-tab by clicking on the “Energy Performance Certificate” button and is stored in the same location as the project files as described in Section 4.2.5: Accessing the reports from the project folder. The file is in “pdf” format.

This report gives a summary of the energy performance of the building and its Asset Rating. It contains the following sections:

- Energy Performance Certificate: contains the title of the certificate, address of the building, and the Certificate Reference Number.
- Energy Performance Asset Rating: contains information about the building’s calculated Asset Rating based on its predicted CO₂ emission rate (BER). It also shows where the building’s Asset Rating fits on a scale of the building energy efficiency bands.
- Benchmarks: contains information about the Asset Ratings corresponding to the target CO₂ emission rate (Part L TER) and the Typical (stock average) CO₂ emission rate.
- Technical Information: contains information on the servicing strategy of the building (i.e., building environment – the service strategy that delivers the greatest total CO₂ emissions), the main heating fuel (the fuel which delivers the greatest total thermal output for space or water heating), and the complexity of the building.

NB: If none of the zones in the building have been defined as conditioned, the “building environment” will be set by the calculation to be “Unconditioned”.

NB: If none of the zones in the building, as defined, have space or water heating energy consumption, or the building environment is “Unconditioned”, the “main heating fuel” will be set by the calculation to be “Other”.

NB: Permanently unconditioned buildings are different to those which are expected to be conditioned later on, and which should be modelled as per the guidance in DLUHC’s publication: “*Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale and let of non-dwellings*” which can be accessed from <https://www.gov.uk/government/publications/energy-performance-certificates-for-the-construction-sale-and-let-of-non-dwellings--2>.

NB: For Scotland, the EPC (which has a different format from that in England, Wales, and Northern Ireland, and implements a different methodology for the calculation of the Asset Rating), also displays the top 4 of the short payback NCM recommendations. If there are user-defined or user-edited recommendations, then the EPC will display up to 3 user recommendations with the shortest payback and the rest will be made up of the top 1, 2, or 3 of the short payback NCM recommendations. If there are no short payback recommendations, or there are less than 4, then the top recommendations with medium payback are displayed instead.

NB: In order for the potential asset rating to be populated on the Scotland EPC and the XML file generated, a scenario for the potential building with the assessor-recommended improvements needs to be created and run successfully as described in Section 3.2.3: Obtaining Potential Asset Rating for EPC Scotland.

- Administrative Information: contains the energy assessor's details, Property Reference Number, assessment software, the certificate's validity dates, and the Recommendations Report Reference Number (the second output file from EPCgen).

See APPENDIX A: A.1 for a sample *Energy Performance Certificate* for the Example building.

NB: You must close all output files before re-running the calculation (so the software can over-write them). Otherwise, an error message will be produced.

4.2.3. Recommendations Report

This report can be accessed from the *Ratings* form > *Asset Rating* tab > *Building Rating* sub-tab by clicking on the "EPC Recommendation Report" button and is stored in the same location as the project files, as described in Section 4.2.5: Accessing the reports from the project folder. The file is in "pdf" format.

This report contains some administrative information about the building and the energy assessor and a list of recommendations (generated by the calculation and input by the energy assessor) for energy-efficiency improvements in the building. It contains the following sections:

- Administrative Information: contains information on the Property Reference Number, the software used to produce the report, and the validity dates of the report.
- Energy Assessors Details: contains details about the energy assessor.
- Background: contains information on the legislation and the servicing strategy of the property.
- Introduction: contains information on the calculation tool used.
- Recommendations: contains a list of recommendations, edited by the energy assessor, for the improvement of the energy performance of the building and their respective potential impact on the CO₂ emission rate of the building. The recommendations are grouped into the following sub-sections: short payback (up to 15 recommendations), medium payback (up to 10 recommendations), long payback (up to 5 recommendations), and other recommendations created by the energy assessor (up to 10 recommendations).

NB: Only recommendations that are defined as applicable to the whole building, i.e., the parameter "Applicable to" has been set to 'BUILDING', appear in the official Recommendations report. All the defined recommendations, however, will appear in iSBEM's Secondary Recommendations report.

- Next Steps: contains information on the steps that need to be taken following the production of the reports.
- Glossary: contains definitions of some of the terms used in the report.

See APPENDIX A: A.2 for a sample *Recommendations Report* for the Example building.

NB: You must close all output files before re-running the calculation (so the software can over-write them). Otherwise, an error message will be produced.

NB: The NCM recommendations are generated for the building and its energy systems when operated according to standard schedules appropriate to the general activities in the building. The Energy Assessor is expected to use his or her knowledge to remove inappropriate ones and possibly to add further ones. If the Energy Performance Rating calculation has made extensive use of default values, some of the recommendations may be based on uncertain assumptions. These recommendations do not cover the quality of operation or maintenance of the building and its systems. There are frequently significant opportunities for energy and carbon savings in these areas and a full "energy audit" to identify them is strongly recommended.

4.2.4. iSBEM Secondary Recommendations Report

This report is generated if either 'EPC England', 'EPC Wales', or 'EPC Northern Ireland' were selected as the "Purpose of Analysis" in the *General* form > *General Information* tab > *Project Details* sub-tab, and the calculation was run to generate the Energy Performance Certificate. It can be accessed from the *Ratings* form > *Asset Rating* tab > *Building Rating* sub-tab by clicking on the "Supporting Recommendations" button and is stored in the same location as the project files as described in Section 4.2.5: Accessing the reports from the project folder. The file is in "pdf" format.

This report gives a summary of building's energy and CO₂ emissions performance for the different end-use categories and a full list of recommendations (generated by the calculation and/or input by the user) for energy-efficiency improvements in the building (i.e., not just the recommendations that appear in the official *Recommendations* report described in section 4.2.3: Recommendations Report. It provides:

- The name and type of the building.
- A key to the colour codes used in displaying the recommendations.
- The current performance of the building for each of the following categories, such as the attributed percentage of the total building's CO₂ emissions and overall energy performance:
 - Heating
 - Cooling
 - Hot water
 - Lighting
 - Renewables
 - Overheating
 - Envelope
 - Fuel-Switching
 - Auxiliary
 - Other
- Recommendations related to each of the above categories, and for each recommendation, a set of information is displayed, such as the potential impact of implementing the recommendation on the energy performance and CO₂ emissions of the building, the potential saving in CO₂ emissions per pound spent, and any additional comments input by the energy assessor. It also includes any comments added by the Energy Assessor to any of the NCM recommendations.

NB: Any NCM recommendations removed by the Energy Assessor from the official *Recommendations Report* will still appear in the *iSBEM Secondary Recommendations* report.

See APPENDIX A: A.3 for a sample *iSBEM Secondary Recommendations Report* for the Example building.

4.2.5. Accessing the reports from the project folder

All of the above reports are accessible from the specific project folder (created when the project was first created, in the User Guide volume “**How to use iSBEM: Basics - UK**”). The default location for this folder is within the main **Projects** folder within the **iSBEM_v6.1.c** folder, e.g., “C:\NCM\iSBEM_v6.1.c\ Projects\Example building-complete”. The reports have the following file names and extensions:

Output reports when running iSBEM for Energy Performance Certificates:

1. SBEM Main Output Document – “project name”_sbem. pdf
2. Energy Performance Certificate – “project name”_epc[epc].pdf
3. EPC Recommendations Report – “project name”_epc[rec].pdf
4. Data Reflection Report - Actual Building – “project name”_dr.htm
5. Data Reflection Report - Actual Building – “project name”_dr.pdf
6. Technical Output Report - Actual Building – “project name”_sim.csv
7. Technical Output Report - Notional Building – “project name”_not_sim.csv
8. Technical Output Report - Reference Building – “project name”_ref_sim.csv
9. iSBEM Secondary Recommendations Report.– “project name”_epc[srec].pdf

XML file when running iSBEM for official submission of Energy Performance Certificates will be named as follows:

10. XML file for the Energy Performance Certificate and the Recommendations Report – “EPC reference number”. xml

NB: The RRN for each of the Energy Performance Certificate and the Recommendations Report for an EPC in England, Wales, and Northern Ireland is now randomly generated in EPCgen every time the calculation runs successfully, and it is no longer linked to the UPRN and the inspection date. As such, if an EPC calculation is re-run, new RRNs will always be generated by EPCgen for buildings in England, Wales, and Northern Ireland, even if there have been no changes in the input data. The last generated EPC RRN will be displayed in the Ratings form.

If the EPC is generated in Welsh as well as in English (by ticking the relevant tick box in the *General* form > *General Information* tab > *Project Details* sub-tab), the file containing the EPC in Welsh will be named as follows:

11. Energy Performance Certificate in Welsh – “project name”_epc[epcw].pdf

The project folder for the “Example building – Complete” file is shown in Figure 28 with the output reports highlighted when running iSBEM for Energy Performance Certificates.

Also highlighted is **the NCT file which is the file that is read by iSBEM and where all the input data has been stored**. If you need to share a project with your colleagues, this is the only file you need to send them. They will be able to open it through iSBEM and generate all the other files.

Other files highlighted in Figure 28, 4 error files (with the extension **.err**) are highlighted which contain warnings or error messages generated by SBEM or EPCgen during the calculation. These are text files which can be opened by any text editor on your computer, for e.g., MS Notepad. The contents of these files can also be viewed in the *Calculation Errors* sub-tab in the *Ratings* form (see section 4.1.1: Asset Rating tab).

NB: You must close all output files before re-running the calculation (so the software can over-write them). Otherwise, an error message will be produced.

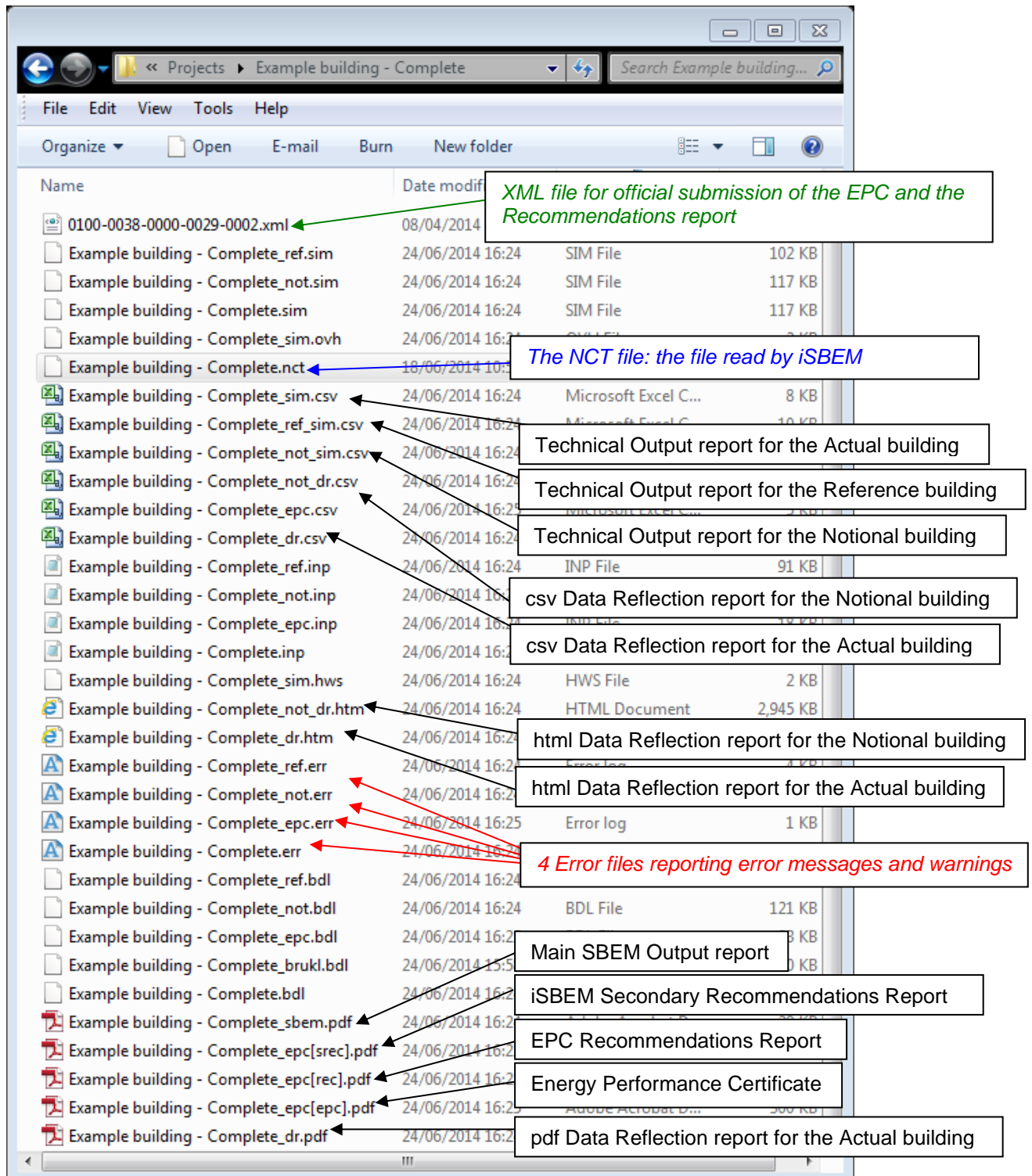



Figure 28: Contents of the Projects folder showing the iSBEM output reports when running iSBEM for Energy Performance Certificates

APPENDIX A: Sample Output Reports

A.1. Sample Energy Performance Certificate for England

Energy Performance Certificate
Non-Domestic Building

 HM Government

56 London Road
LONDON
SW1 2WS

Certificate Reference Number:
3656-8434-0164-0173-7015

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO₂ emissions

A0-25

24

This is how energy efficient the building is.

B26-50

C51-75

D76-100

E101-125

F126-150

GOver 150

Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Air Conditioning
Total useful floor area (m ²):	2900
Building complexity:	Level 3
Building emission rate (kgCO ₂ /m ² per year):	12.57
Primary energy use (kWh/m ² per year):	113.04

Benchmarks

Buildings similar to this one could have ratings as follows:

17

If newly built

67

If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software: iSBEM v6.1.c using calculation engine SBEM v6.1.c.0

Property Reference: UPRN-000000000000

Assessor Name: Joe Bloggs

Assessor Number: ABCD000000

Accreditation Scheme: Information not available

Assessor Qualifications: NOS3

Employer/Trading Name: <insert Employer/Trading Name>

Employer/Trading Address: <insert Employer/Trading Address>

Issue Date: 11 Jul 2022

Valid Until: 10 Jul 2032 (unless superseded by a later certificate)

Related Party Disclosure: Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 4836-0048-5063-8126-5988

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by Information not available. You can obtain contact details of the Accreditation Scheme at Information not available.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at: www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

A.2. Sample Recommendations Report for England

4836-0948-5963-8126-5988

Recommendation Report



This report is associated with an Energy Performance Certificate.

Report Reference Number: 4836-0948-5963-8126-5988

56 London Road

LONDON

SW1 2WS

Building Type(s): Offices and Workshop Businesses

ADMINISTRATIVE INFORMATION

Issue Date:	11 Jul 2022
Valid Until:	10 Jul 2032 (*)
Total Useful Floor Area (m ²):	2900
Building Environment:	Air Conditioning
Calculation Tool Used:	iSBEM v6.1.c using calculation engine SBEM v6.1.c.0
Property Reference:	UPRN-000000000000
Energy Performance Certificate for the property is contained in Report Reference Number: 1592-2537-9332-9424-1839	

ENERGY ASSESSOR DETAILS

Assessor Name:	Joe Bloggs
Employer/Trading Name:	<insert Employer/Trading Name>
Employer/Trading Address:	<insert Employer/Trading Address>
Assessor Number:	ABCD000000
Accreditation scheme:	Information not available
Related Party Disclosure:	Not related to the owner

(*) Unless superseded by a later recommendation report

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4. Glossary..... 7

5. Green Deal Information..... 8

ONLY FOR ILLUSTRATION

1. Introduction

This is a Recommendation Report as defined in the Energy Performance of Buildings (England and Wales) Regulations 2012 as amended which transposes the requirements of the Energy Performance of Building Directive 2010/31/EU. This Recommendation Report accompanies the relevant Non-Domestic Energy Performance Certificate.

This Recommendation Report was developed based on an inspection of the building. This Recommendation Report was produced in line with the Government's approved methodology.

In accordance with Government's current guidance, the Energy Assessor is required to use plans or undertake a building inspection in order to gather information to produce this Recommendation Report.

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2. Recommendations

The following sections list recommendations selected by the energy assessor for the improvement of the energy performance of the building. The recommendations are listed under four headings: short payback, medium payback, long payback, and other measures.

a) Recommendations with a short payback

This section lists recommendations with a payback of less than 3 years:

Recommendation	Potential impact
Replace 38mm diameter (T12) fluorescent tubes on failure with 26mm (T8) tubes.	HIGH

b) Recommendations with a medium payback

This section lists recommendations with a payback of between 3 and 7 years:

No recommendations of medium term payback have been identified

c) Recommendations with a long payback

This section lists recommendations with a payback of more than 7 years:

Recommendation	Potential impact
Consider installing building mounted wind turbine(s).	LOW
Add time control to heating system.	LOW
Consider installing PV.	LOW
Add optimum start/stop to the heating system.	LOW
Some walls have uninsulated cavities - introduce cavity wall insulation.	LOW

d) Other recommendations

This section lists other recommendations selected by the energy assessor, based on an energy performance assessment of the building. It may take into account other reliable relevant evidence that has been provided by the building owner or occupier.

No recommendations defined by the energy assessor have been identified

3. Next steps

a) Your Recommendation Report

As the building occupier, it is a regulatory requirement that an Energy Performance Certificate must include a Recommendation Report unless there is no reasonable potential for energy performance improvements compared to the energy performance requirements in force.

You must be able to produce a copy of this Recommendation Report within seven days if required by an Enforcement Authority.

This Recommendation Report has also been lodged on the Government's central register. Access to the report, to the data used to compile the report, and to previous similar documents relating to the same building can be obtained through the Non-Domestic Register (www.ndepcregister.com) using the report reference number of this document.

b) Implementing recommendations

The recommendations are provided as an indication of opportunities that appear to exist to improve the building's energy efficiency.

The calculation tool has automatically generated a set of recommendations. The Energy Assessor, in the light of the energy assessment of the building, the building fabric and services, the operation of plant and equipment within the curtilage of the building, the general management of the building and its use, and other relevant reliable evidence, may remove some of the recommendations. He / She may insert additional recommendations in section 3d (Other Recommendations).

These recommendations do not include matters relating to operation and maintenance which cannot be identified from the calculation procedure.

c) Legal disclaimer

The advice provided in this Recommendation Report is intended to be for information only. Recipients of this Recommendation Report are advised to seek further detailed professional advice before reaching any decision on how to improve the energy performance of the building.

d) About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by Information not available. You can obtain contact details of the Accreditation Scheme at Information not available.

A copy of this report has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The report (including the building address) and other data about the building collected during the energy assessment but not shown on the report, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This report and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a report and how to make a complaint.

4. Glossary

a) Payback

The payback periods are based on data collated through Carbon Trust energy survey reports. They provide a range of typical payback periods for different types of measures. They are likely payback periods, and may differ from the actual payback period for the building being assessed. Therefore, it is recommended that each suggested measure be further investigated before reaching any decision on how to improve the energy efficiency of the building.

b) Carbon impact

The High / Medium / Low carbon impact indicators against each recommendation are provided to distinguish between the suggested recommendations, those that would most effectively reduce carbon emissions from the building. For automatically generated recommendations, the carbon impact indicators are determined by software, but may have been adjusted by the Energy Assessor based on the energy assessment of the building.

c) Valid report

A valid report is a report that has been:

- Produced within the past 10 years
- Produced by an Energy Assessor who is accredited to produce Recommendation Reports through a Government Approved Accreditation Scheme
- Lodged on the Register operated by or on behalf of the Secretary of State.

5. Green Deal Information

The Green Deal may enable you to improve the property to make it more energy efficient and cheaper to run.

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A.3. Sample Secondary Recommendations Report

Secondary Recommendations Report

Not for Official Submission

Building name

Date: Mon Jul 11 12:35:43 2022

Example building

Building type:Offices and Workshop Businesses

This report lists recommendations for energy-efficiency improvements to the building.

Key to colour codes used in this report

Included by the calculation
Included by the user
Excluded by the user

Recommendations for HEATING

HEATING accounts for 1.4% of the CO2 emissions
The overall energy performance of HEATING provision is GOOD
The overall CO2 performance of HEATING provision is GOOD
The average energy efficiency of HEATING provision is GOOD
The average CO2 efficiency of HEATING provision is GOOD

Add time control to heating system.

Code:

EPC-H2

Energy Impact:

LOW

CO2 Impact:

LOW

CO2 Saved per £ Spent:

POOR

Applicable to:

Whole building

Comments:

Add local time control to heating system.

Code:

EPC-H5

Energy Impact:

LOW

CO2 Impact:

LOW

CO2 Saved per £ Spent:

POOR

Applicable to:

Whole building

Comments:

Add local temperature control to the heating system.

Code:

EPC-H6

Energy Impact:

LOW

CO2 Impact:

LOW

CO2 Saved per £ Spent:

POOR

Applicable to:

Whole building

Comments:

Add optimum start/stop to the heating system.

Code:

EPC-H7

Energy Impact:

LOW

CO2 Impact:

LOW

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CO2 Saved per ? Spent: POOR
Applicable to: Whole building

Comments:

Add weather compensation controls to heating system.

Code: EPC-H8
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: Whole building

Comments:

Add time control to heating system.

Code: EPC-H2
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: HVAC for the example building

Comments:

Add local time control to heating system.

Code: EPC-H5
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: HVAC for the example building

Comments:

Add local temperature control to the heating system.

Code: EPC-H6
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: HVAC for the example building

Comments:

Add optimum start/stop to the heating system.

Code: EPC-H7
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: HVAC for the example building

Comments:

Add weather compensation controls to heating system.

Code: EPC-H8
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: HVAC for the example building

Comments:

Recommendations for COOLING

COOLING accounts for 15.1% of the CO2 emissions

The overall energy performance of COOLING provision is GOOD
The overall CO2 performance of COOLING provision is GOOD
The average energy efficiency of COOLING provision is GOOD
The average CO2 efficiency of COOLING provision is GOOD

There are no recommendations for COOLING

Recommendations for HOT-WATER

HOT-WATER accounts for 12.7% of the CO2 emissions

The overall energy performance of HOT-WATER provision is GOOD
The overall CO2 performance of HOT-WATER provision is GOOD
The average energy efficiency of HOT-WATER provision is GOOD
The average CO2 efficiency of HOT-WATER provision is GOOD

There are no recommendations for HOT-WATER

Recommendations for LIGHTING

LIGHTING accounts for 31.3% of the CO2 emissions

The overall energy performance of LIGHTING provision is GOOD
The overall CO2 performance of LIGHTING provision is GOOD

Consider replacing T8 lamps with retrofit T5 conversion kit.

Code: EPC-L5
Energy Impact: MEDIUM
CO2 Impact: HIGH
CO2 Saved per ? Spent: GOOD
Applicable to: Whole building

Comments:

Introduce HF (high frequency) ballasts for fluorescent tubes: Reduced number of fittings required.

Code: EPC-L7
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: GOOD
Applicable to: Whole building

Comments:

Recommendations for RENEWABLES

Consider installing building mounted wind turbine(s).

Code: EPC-R2
Energy Impact: LOW

CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: Whole building

Comments:

Consider installing PV.

Code: EPC-R4
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: Whole building

Comments:

Recommendations for OVERHEATING

There are no recommendations for OVERHEATING

Recommendations for ENVELOPE

Some solid walls are poorly insulated - introduce or improve internal wall insulation.

Code: EPC-E3
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: Whole building

Comments:

Some walls have uninsulated cavities - introduce cavity wall insulation.

Code: EPC-E4
Energy Impact: LOW
CO2 Impact: LOW
CO2 Saved per ? Spent: POOR
Applicable to: Whole building

Comments:

Recommendations for FUEL-SWITCHING

There are no recommendations for FUEL-SWITCHING

Recommendations for AUXILIARY

AUXILIARY accounts for 39.4% of the CO2 emissions

The overall energy performance of AUXILIARY provision is FAIR

The overall CO2 performance of AUXILIARY provision is FAIR

There are no recommendations for AUXILIARY

Recommendations for OTHER

There are no recommendations for OTHER

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A.4. Sample Energy Performance Certificate for Scotland

Energy Performance Certificate

Non-Domestic buildings and buildings other than dwellings

Scotland

123 Any Avenue, Any City, AB1 2CD

Date of assessment:	30 Apr 2020	Reference number:	0000-0030-0002-0074-0002
Date of certificate:	11 May 2020	Building type:	Office/Workshop
Total conditioned area:	402.6 m ²	Assessment software:	EPCgen, v5.6.b.0
Primary energy indicator:	425 kWh/m ² .yr	Approved organisation:	Bre

Building Energy Performance Rating

Excellent

Very Poor

Carbon Neutral

A (0 to 15)

B (16 to 30)

C (31 to 45)

D (46 to 60)

E (61 to 80)

F (81 to 100)

G (100+)

Current

Potential

67 E+

67 E+

Approximate Energy Use: 178 kWh per m² per year

Approximate Carbon Dioxide Emissions: 66.55 kgCO₂ per m² per year

The building energy performance rating is a measure of the effect of a building on the environment in terms of carbon dioxide (CO₂) emissions. The better the rating, the less impact on the environment. The current rating is based upon an assessor's survey of the building. The potential rating shows the effect of undertaking all of the recommended measures listed below. The Recommendations Report which accompanies this certificate explains how this rating is calculated and gives further information on the performance of this building and how to improve it.

Benchmark

A building of this type built to current building regulations at the date of issue of this certificate would have a building energy performance rating of:

22 B+

Recommendations for the cost-effective improvement of energy performance

1. Consider replacing T8 lamps with retrofit T5 conversion kit.
2. Add time control to heating system.
3. Introduce HF (high frequency) ballasts for fluorescent tubes: Reduced number of fittings required.
4. Add optimum start/stop to the heating system.

There are additional improvement measures applicable to this building. Refer to the Recommendations Report.

THIS PAGE IS THE ENERGY PERFORMANCE CERTIFICATE WHICH MUST BE AFFIXED TO THE BUILDING AND NOT BE REMOVED UNLESS REPLACED WITH AN UPDATED CERTIFICATE.

A.5. Sample Recommendations Report for Scotland

123 Any Avenue, Any City, AB1 2CD

11 May 2020

0000-0030-0002-0074-0002

Recommendations Report

Background

This section provides additional information regarding the building and your energy assessment.

Building type: Offices and Workshop businesses

Total useful floor area: 402.6 m²

Main heating fuel: Natural Gas

Building environment: Air Conditioning

Renewable energy source: Wind generators

Electricity: Grid supplied

The Recommendations Report provides additional information in support of your Energy Performance Certificate. It was produced in line with the Government's approved calculation methodology and is based upon output from CLG, iSBEM, v5.6.a, SBEM, v5.6.b.0.

This calculates energy used in the heating, hot water provision, lighting, and ventilation of your building. Different fuels produce different amounts of carbon dioxide for every kilowatt hour (kWh) of energy used. The calculation methodology, therefore, applies fuel emission factors to energy use for each fuel used to give an overall rating for your building. This assessment covers all fixed building services but excludes energy used in portable appliances, office equipment, and for industrial processes.

As buildings can be used in different ways, energy use is calculated using standard occupancy assumptions which may be different from the way you use the building. The rating also uses national weather information to allow comparison between the performance of similar buildings in different parts of Scotland.

Further information on the assessment process and approved software tools can be found online at: www.scotland.gov.uk/epc.

Recommendations for improvement

This section lists the improvement measures recommended on your Energy Performance Certificate and further action you can take to improve the performance of your building. These measures have been checked by your assessor as being appropriate for your building and are listed under four headings: short payback period, medium payback period, long payback period and other improvement measures.

The calculation tool has automatically produced a set of recommendations which are reviewed by your assessor to ensure that they are relevant to the building and its use. The assessor may add or remove recommendations and may also have commented on the recommendations based upon their professional knowledge and expertise. This may include inserting additional recommendations or measures under 'other recommendations' (see below).

Note that these recommendations do not include advice on matters relating to the operation and maintenance of your building as such cannot be identified or represented within the calculation process.

Implementing improvements - legal disclaimer:

The advice provided in this Recommendations Report is intended to be for information only. Recipients of this report are advised to seek further professional advice before making any decision on how to improve the energy performance of the building.

Recommended measures with a short payback period (less than 3 years)

Recommendations (short payback)	Potential Impact
Consider replacing T8 lamps with retrofit T5 conversion kit.	HIGH
Add time control to heating system.	LOW
Introduce HF (high frequency) ballasts for fluorescent tubes: Reduced number of fittings required.	LOW
Add optimum start/stop to the heating system.	LOW

Recommended measures with a medium payback period (3 to 7 years)

Recommendations (medium payback)	Potential Impact
The default heat generator efficiency is chosen. It is recommended that the heat generator system be investigated to gain an understanding of its efficiency and possible improvements.	LOW
Add local temperature control to the heating system.	LOW
Add weather compensation controls to heating system.	LOW
Add local time control to heating system.	LOW

Recommended measures with a long payback period (more than 7 years)

Recommendations (long payback)	Potential Impact
The default chiller efficiency is chosen. It is recommended that the chiller system be investigated to gain an understanding of its efficiency and possible improvements.	LOW
Install more efficient water heater.	LOW
Ductwork leakage is high. Inspect and seal ductwork.	LOW

Other measures

This section lists other measures selected by your assessor based upon an understanding of the building and/or a valid existing Recommendations Report.

Your assessor has not identified other measures for this building.

Payback period:

Payback periods are based upon data provided by Good Practice Guides and Carbon Trust energy survey reports and are average figures calculated using a simple payback method. It is assumed that the source data is correct and accurate, using up to date information.

They should be considered indicative. The figures have been calculated as an average across a range of buildings and may therefore differ from the actual payback period for the building being assessed. It is recommended that the cost effectiveness and payback of each suggested measure be further investigated before making any decision on how to improve the energy efficiency of your building.

Carbon impact:

Each measure is assigned a low, medium, or high potential impact on the energy efficiency of your building. This relates to their potential to reduce carbon dioxide emissions arising from energy used in your building. For automatically generated recommendations, the carbon impact is determined by the approved software but may be adjusted by your assessor based upon their knowledge of the building. The impact of 'other recommendations' is determined by the assessor.

Comparative assessment - Feed-in Tariff

Eligibility for standard tariff for solar PV under the DECC Feed-in Tariff initiative is contingent on a minimum energy efficiency requirement being met. This requires a building to have an EPC band of D or better. Further information can be found at: www.decc.gov.uk/fits. This requirement is based upon the means of determining EPC band which is used in England & Wales. recommendations' is determined by the assessor.

If calculated using this process, but using Scottish climate data, your building would currently have an EPC band of C (and a rating of 74).

Requirements under section 63 of the Climate Change (Scotland) Act

From 1 June 2016, regulations require the assessment and improvement of existing non-domestic buildings with an area of more than 1,000 m². See www.gov.scot/section63 for information.

As this building does not exceed 1,000 m² in area, it is not currently subject to these regulations.

123 Any Avenue, Any City, AB1 2CD

11 May 2020

0000-0030-0002-0074-0002

Recommendations Report

About this document

This report and the accompanying Energy Performance Certificate are valid for a maximum of ten years. These documents cease to be valid where superseded by a more recent assessment of the same building carried out by a member of an Approved Organisation.

Your Energy Performance Certificate and this Recommendations Report for this building were produced following an energy assessment undertaken by an assessor accredited by Bre (<http://www.po.org.uk>), an Approved Organisation appointed by Scottish Ministers. The certificate has been produced under the Energy Performance of Buildings (Scotland) Regulations 2008 from data lodged to the Scottish EPC register. You can verify the validity of this document by visiting www.scottishepcregister.org.uk and entering the report reference number (RRN) printed at the top of this page.

Assessor's name: Joe Bloggs
Assessor membership number: ABCD000000
Company name/trading name: Joe Bloggs Ltd
Address: 123 My Street, My City, AB3 4CD
Phone number: 9999999999
E-mail address: joe@bloggs.com

If you have any concerns regarding the content of this report or the service provided by your assessor, you should, in the first instance, raise these matters with your assessor and with the Approved Organisation to which they belong. All Approved Organisations are required to publish their complaints and disciplinary procedures, and details can be found online at the web address given above.

Use of this energy performance information

Once lodged by your EPC assessor, this Energy Performance Certificate and Recommendations Report are available to view online at www.scottishepcregister.org.uk with the facility to search for any single record by property address. This gives everyone access to any current, valid EPC except where a property has a Green Deal Plan, in which case the report reference number (RRN) for the EPC must first be provided. The energy performance data in these documents, together with other building information gathered during assessment, is held on the Scottish EPC register and is available to authorised recipients, including organisations delivering energy efficiency and carbon reduction initiatives on behalf of the Scottish and UK Governments. A range of data from all assessments undertaken in Scotland is also published periodically by the Scottish Government. Further information on these matters and on Energy Performance Certificates in general can be found at www.scotland.gov.uk/epc.

Opportunity to improve resource efficiency

Resource Efficient Scotland, a Scottish Government programme managed by Zero Waste Scotland, provides free, specialist advice, and on-site support to help businesses and other organisations cut their energy, water, and raw material costs.

To find out how you could benefit from improved resource efficiency, visit www.resourceefficientscotland.com or contact 0808 808 2268.

APPENDIX B: List of parameters required by iSBEM for EPC calculations

Form: General

Tab: General Information

Sub-tab: Project details

- Purpose of analysis
- Type of EPC (*field enabled only for EPC Scotland*)
- EPC in Welsh? (*field enabled only for EPC Wales*)
- Additionally check Building regulations?
- Weather (location)
- Stage of analysis
- Project complexity (*field enabled only for England, Wales, and Northern Ireland EPCs*)
- S6 type of Building (*field enabled only for Scotland EPC*)
- Main renewable source (*field enabled only for Scotland EPC*)

Sub-tab: Additional Project details

- Related party disclosure (*field enabled only for England, Wales, and Northern Ireland EPC*)
- Transaction type

Sub-tab: Building details

- Building type
- Name of project
- Building address
- City
- Postcode
- Location description
- UPRN
- Previous EPC RRN (*field enabled only if the UPRN has not been provided for England, Wales, and Northern Ireland EPCs*)
- Are any restrictions to be imposed on the retrieval of the EPC's XML file from the National Register in Scotland (*field enabled only for Scotland EPC*)
- Inspection date
- Is building of special conservation status? (*field enabled only for England, Wales, and Northern Ireland EPCs*)

Sub-tab: Energy Assessor's / Qualified/Accredited Person's details

Sub-form: Energy Assessor's / Qualified/Accredited Person's details

- Name
- Telephone number
- Email address
- Address
- City
- Postcode
- Assessor number/Membership number
- Accreditation Scheme / Protocol Organisation
- Qualifications (*field enabled only for England, Wales, and Northern Ireland EPCs*)
- Employer/Trading name
- Employer/Trading address

Sub-form: Insurance details

- Insurance Company
- Policy Number
- Policy start/effective date
- Policy end/expiry date
- Policy cover limit

Form: Project Database

Tab: Construction for walls

Sub-tab: General

- Name of construction
- Does it involve metal cladding?
- Globally used in walls that connect zone to
- Definition of construction of walls using one of the following 3 options:
 - 1) Library
 - Category
 - Library
 - or
 - 2) Inference procedures
 - Building sector
 - Building Regulations compliance
 - General description
 - or
 - 3) Enter parameters manually
 - U-value [$\text{W/m}^2\text{K}$]
 - K_m [$\text{kJ/m}^2\text{K}$]

Tab: Construction for roofs

Sub-tab: General

- Name of construction
- Does it involve metal cladding?
- Globally used in roofs that connect zone to
- Definition of construction of roofs using one of the following 3 options:
 - 1) Library
 - Category
 - Library
 - or
 - 2) Inference procedures
 - Building sector
 - Building Regulations compliance
 - General description
 - or
 - 3) Enter parameters manually
 - U-value [$\text{W/m}^2\text{K}$]
 - K_m [$\text{kJ/m}^2\text{K}$]

Tab: Construction for floors

Sub-tab: General

- Name of construction
- Globally used in floors that connect zone to
- Definition of construction of floors using one of the following 3 options:
 - 1) Library
 - Category
 - Library
 - or
 - 2) Inference procedures
 - Building sector
 - Building Regulations compliance
 - General description
 - or
 - 3) Enter parameters manually
 - U-value [$\text{W/m}^2\text{K}$] or $1/R_f$ [$\text{W/m}^2\text{K}$] if uncorrected for insulation

- K_m [kJ/m²K]
- Has the U-value been corrected to account for insulation to counter heat loss through floors in contact with the ground?

Tab: Construction for doors

Sub-tab: General

- Name of construction
- Definition of construction of doors using one of the following 3 options:
 - 1) Library
 - Category
 - Library
 - or
 - 2) Inference procedures
 - Building sector
 - Building Regulations compliance
 - General description
 - or
 - 3) Enter parameters manually
 - U-value [W/m²K]
 - K_m [kJ/m²K]

Tab: Glazing

Sub-tab: General

- Name of construction
- Definition of construction of glazing using one of the following 3 options:
 - 1) Library
 - Category
 - Library
 - or
 - 2) Inference procedures
 - Building Regulations compliance
 - Number of panes
 - Coating
 - Frame material
 - or
 - 3) Enter parameters manually
 - U-value - for glazing in vertical inclination [W/m²K]
 - T-solar – for normal incidence
 - L-solar – for normal incidence
 - Has the U-value been adjusted for the horizontal orientation?

Form: Geometry

Tab: Project

Sub-tab: General & Geometry

- Global air permeability at 50pa [m³/h.m²]
- Building (clockwise) rotation [degrees]
- Global zone floor-to-floor height [m]
- Maximum number of storeys
- Building area [m²]
- Foundation area [m²] (*field enabled only for England EPC*)

Sub-tab: Thermal Bridges

- Global Psi value [W/mK] for junctions involving metal cladding for each of:
 - Roof-Wall
 - Wall-Ground floor
 - Wall-Wall (corner)

- Wall-Floor (not ground floor)
- Lintel above window or door
- Sill below window
- Jamb at window or door
- Global Psi value [W/mK] for junctions not involving metal cladding for each of:
 - Roof-Wall
 - Wall-Ground floor
 - Wall-Wall (corner)
 - Wall-Floor (not ground floor)
 - Lintel above window or door
 - Sill below window
 - Jamb at window or door

Tab: Zones

Sub-tab: General

- Zone name
- HVAC system which serves the zone
- Building type
- Activity type in the zone
- Zone area [m²]
- Zone floor-to-floor height [m], or select global value
- Air permeability at 50pa [m³/h.m²] in the zone, or select global value
- Zone multiplier
- Description of zone
- Define the following Psi values for thermal bridges in the zone or use global values?
 - Zone Psi value [W/mK] for junctions involving metal cladding for each of:
 - Roof-Wall
 - Wall-Ground floor
 - Wall-Wall (corner)
 - Wall-Floor (not ground floor)
 - Lintel above window or door
 - Sill below window
 - Jamb at window or door
 - Zone Psi value [W/mK] for junctions not involving metal cladding for each of:
 - Roof-Wall
 - Wall-Ground floor
 - Wall-Wall (corner)
 - Wall-Floor (not ground floor)
 - Lintel above window or door
 - Sill below window
 - Jamb at window or door

Tab: Envelopes

Sub-tab: General

- Envelope name
- Zone which envelope belongs to
- Type of envelope
 - Pitch angle [degrees] (*field enabled if envelope type is roof or floor/ceiling*)
 - Perimeter length [m] (*field enabled if envelope type is wall*)
- Envelope connects space to, or select global value
- Envelope construction
- Envelope area [m²]
- Envelope orientation

- Is there a solar collector (SC) on this wall? (*field enabled if envelope type is wall*)
 - SC name
 - SC area [m²]
- Definition of any thermal bridges in the envelope additional to global values
 - Thermal bridge multiplier
 - Thermal bridge length [m]
 - Thermal bridge Psi [W/mK]
 - Thermal bridge description

Tab: Doors

Sub-tab: General

- Door name
- Envelope which door is in
- Door type
- Door construction
- Door area [m²]
- Definition of any thermal bridges in the door additional to global values
 - Thermal bridge multiplier
 - Thermal bridge length [m]
 - Thermal bridge Psi [W/mK]
 - Thermal bridge description

Tab: Windows & Rooflights

Sub-tab: General

- Window/Rooflight name
- Envelope which window/rooflight is in
- Glazing type
- Window/Rooflight projected area [m²]
- Ratio of developed area to projected area of window/rooflight/roof window
- Roof opening type (*field enabled if selected envelope is a roof*)
- Is it a display window?
- Frame factor
- Aspect ratio
- Shading position on window/rooflight
 - Shading colour
 - Shading translucency
- Transmission factor due to fins and overhangs
- Is overhang a brise-soleil?
- Definition of any thermal bridges in the window/rooflight additional to global values
 - Thermal bridge multiplier
 - Thermal bridge length [m]
 - Thermal bridge Psi [W/mK]
 - Thermal bridge description

Form: Building Services

Tab: Global and Defaults

Sub-tab: HVAC System Defaults

- Fuel type for default Heating only – Other systems
- Fuel type for default Heating and mechanical cooling systems

Sub-tab: Project building services

- Do the lighting systems have provision for metering?
 - Is there monitoring and targeting with alarms for out-of-range values? (*field enabled if lighting systems have provision for metering*)

- Electric power factor
- Is this a new district heating network? *(field enabled only for England EPC)*
- The CO₂ emission factor for the district heating network. *(field enabled only if the heat source and fuel type of any of the HVAC systems is set to be district heating)*
- The primary energy factor for the district heating network. *(field enabled only if the heat source and fuel type of any of the HVAC systems is set to be district heating)*

Sub-tab: Air Conditioning Inspection *(sub-tab not enabled for EPC Scotland)*

- Does the building have an air conditioning system?
 - Is the actual output unknown?
 - Total effective rated output of the air conditioning system [kW]
 - or
 - Estimated total effective rated output of the air conditioning system
 - Has an air conditioning inspection been commissioned for compliance with Energy Performance of Buildings regulations?

Tab: HVAC Systems

Sub-tab: General

- HVAC system name
- HVAC system type
 - Heat recovery in ventilation system *(field enabled if there is mechanical ventilation at HVAC level)*
 - Heat recovery seasonal efficiency
 - Variable heat recovery efficiency?

Sub-tab: Heating System

- Heat source
- Fuel type for heat generator
- Does this heating system also use CHP?
- Heat generator seasonal efficiency
- Heat generator radiant efficiency *(field enabled if HVAC is a radiant system)*
- Does the heating system qualify for ECA *(relevant only if default efficiency value is used)?*
 - Was the heating system installed in or after 1998 *(relevant only if default efficiency value is used)?*
- Do the convectors have fans? *(field enabled if applicable for system)*
- Ratio of fan power to heating output [W/kW] *(field enabled if applicable for system)*

Sub-tab: Cooling System *(enabled only if HVAC system provides cooling)*

- Generator type
- Generator kW
- Fuel type for cooling generator
- Seasonal energy efficiency ratio for cooling generator
- Nominal energy efficiency ratio for cooling generator
- Does the cooling system qualify for ECA *(relevant only if default efficiency value is used)?*
- Does the system have mixed-mode operation strategy?

Sub-tab: System adjustment *(enabled only if there is mechanical ventilation at HVAC level)*

- Has the ductwork been leakage tested?
 - CEN classification it meets
- Does the AHU meet CEN leakage standards?
 - CEN classification it meets
- Specific fan power [W/(l/s)]

- Variable speed pumping?
 - Type

Sub-tab: Metering Provision

- Does the HVAC system have provision for metering?
 - Is there monitoring and targeting with alarms for out-of-range values? *(field enabled if HVAC system has provision for metering)*

Sub-tab: Bi-valent Systems

- Heat source
- Fuel type for heat generator
- Heat generator seasonal efficiency
- Proportion of heating load provided by heat generator

Sub-tab: System Controls

- Does the HVAC system have central time control?
- Does the HVAC system have optimum stop/start control?
- Does the HVAC system have local time control?
- Does the HVAC system have local temperature control?
- Does the HVAC system have weather compensation control?

Tab: HWS

Sub-tab: General

- HWS name
- HWS generator type
 - Fuel type for HWS generator *(field enabled if hot water is not generated by HVAC system)*
 - Heat generator seasonal efficiency for HWS *(field enabled if hot water is not generated by HVAC system)*
 - Was the HWS installed later than 1998 *(relevant only if default efficiency value is used)?* *(field enabled if hot water is not generated by HVAC system)*

Sub-tab: Storage & Secondary Circulation

- Is the system a storage system?
 - Storage volume [litres]
 - Insulation type on storage vessel
 - Insulation thickness [mm]
- or
- Storage losses [MJ/month]
- Does the system have secondary circulation?
 - Circulation losses [W/m]
 - Pump power [kW]
 - Loop length [m]
 - Is there time control on the secondary circulation?

Sub-tab: Bi-valent Systems

- Heat generator type
- Fuel type for heat generator
- Heat generator seasonal efficiency
- Proportion of water heating load provided by heat generator

Sub-tab: Showers

- Name of shower type served by this HWS
- Number of abovementioned shower type served by this HWS

Tab: SE Systems

Sub-tab: Collector Parameters

- SES name
- HWS which SES is in
- SES area [m²]
- SES multiplier
- SES orientation

- SES inclination [degrees]
- Do you know the collector performance parameters according to EN 12975-2?
 - Zero-loss collector efficiency factor
 - Collector heat loss coefficient [$\text{W/m}^2\text{K}$]
 - Temperature dependence of heat loss coefficient [$\text{W/m}^2\text{K}$]
 - Incidence angle modifier of collector

Sub-tab: Solar Storage & Collector Loop

- Solar storage volume [litres]
- Solar pre-heating type
 - Insulation type on storage vessel
 - Insulation thickness [mm]
- Do you know the heat transfer rate of the heat exchanger(s) in the collector loop?
 - Heat transfer rate [W/K]
- Do you know the overall heat loss coefficient of all pipes in the collector loop?
 - Heat loss coefficient [W/K]

Sub-tab: Auxiliary Energy & Distribution Losses

- Are the distribution pipes between the solar energy system and the back-up system insulated? (*field enabled only if the solar pre-heating type is a separate solar cylinder*)
- Circulation system
 - Do you know the nominal power of the pumps?
 - Nominal power of the pumps [W]

Tab: PV Systems

Sub-tab: General

- PVS name
either
 - PVS type
 - PVS area [m^2]
- or
 - PVS peak power
- PVS multiplier
- PVS orientation
- PVS inclination [degrees]
- PVS overshadowing
- PVS ventilation strategy

Tab: Wind Generators

Sub-tab: General

- Wind generator name
- Terrain type
- Horizontal axis?
 - Diameter of blades [m]
- Other axis?
 - Area swept by blades [m^2]
- Hub height [m]
- Wind generator power [kW]

Tab: CHP Generator

Sub-tab: General

- Fuel type
- Heat efficiency
- Electrical efficiency
- CHPQA Quality Index
- % of building space heat supplied by CHP

- % of building hot water supplied by CHP
- Is it a tri-generation system?
 - % of building space cooling supplied by CHP
 - Chiller efficiency

Tab: Solar Collectors

Sub-tab: General

- SC name
- SC type
- SC control type
- SC shading factor
- TSC type
- TSC operation
- TSC absorptivity
- NTSC collector height [m]
- NTSC air temperature coefficient [$K/(W/m^2)$]
- Air flow rate coefficient

Sub-tab: Air flows

- Is SC provided with independent fan?
 - SC supply specific fan power [$W/(l/s)$]
- SC design air flow rate [m^3/s]

Tab: Showers

Sub-tab: General

- Shower name
- Type of shower
- Shower above a bath?
- Shower fitted with a WWHRs?
 - Heat recovery seasonal system efficiency of WWHRs
 - WWHRs uses a pump?
 - Nominal power of pump [W]

Tab: Zones

Sub-tab: HVAC, HWS, and Lighting systems

- HVAC system which services the zone
- Are there de-stratification fans in the zone?
- HWS which serves the zone
- Dead leg length for HWS in the zone [m]

Sub-tab: Ventilation

- Zonal ventilation system – natural or mechanical (*field enabled if there is no mechanical ventilation at HVAC level*)
 - Specific fan power for supply & extract [$W/(l/s)$] (*field enabled if there is mechanical ventilation at zone level*)
 - Demand-controlled ventilation?
 - Flow regulation type
- Does activity require high pressure drop air treatment?

Sub-tab: Ventilation (cont.)

- Heat recovery in the zone ventilation (*field enabled if there is mechanical ventilation at zone level*)
 - Heat recovery seasonal efficiency
 - Variable heat recovery efficiency?
- Specific fan power for system terminal units [$W/(l/s)$] (*field enabled if HVAC serving the zone is 'Fan coil systems' or 'Indoor packaged cabinet (VAV)'*)

Sub-tab: Exhaust

- Is there mechanical exhaust in the zone?
 - Flow rate of mechanical exhaust [$l/s.m^2$]
 - Specific fan power for exhaust [$W/(l/s)$]

- Fan within zone, remote from zone, or remote from zone with grease filter?

Sub-tab: Lighting

- Design illuminance [lux]
- Provide information on lighting using one of the following 3 options:
 - 1) Full lighting design
 - Total wattage [W]
 - or
 - 2) Lighting chosen but calculation not carried out
 - Light source lumens per circuit wattage
 - Light output ratio
 - or
 - 3) Lighting parameters not available
 - Lamp type
- Are air-extracting luminaires fitted?

Sub-tab: Lighting Controls

- Type of lighting controls in the zone
 - Local manual switching?
 - Photoelectric?
 - Dimming or switching?
 - Type of sensors?
 - Different sensor for back of zone?
 - Constant illuminance control?
 - Parasitic power for photoelectric control and/or constant illuminance control
 - Do you want SBEM to perform automatic daylight zoning for lighting controls?
 - Percentage area of zone where lighting is controlled by daylight.
- Type of occupancy sensing in the zone
 - Parasitic power for occupancy sensing

Sub-tab: Display Lighting

- Does display lighting use efficient light sources? (*field enabled for activities with display lighting*)
 - Light source lumens per circuit wattage for display lighting
- Is there time-switching for display lighting? (*field enabled for activities with display lighting*)

Sub-tab: SC

- Name of SC system providing pre-heated air to this zone
- Percentage of the total air pre-heated by the SC system that is provided to this zone

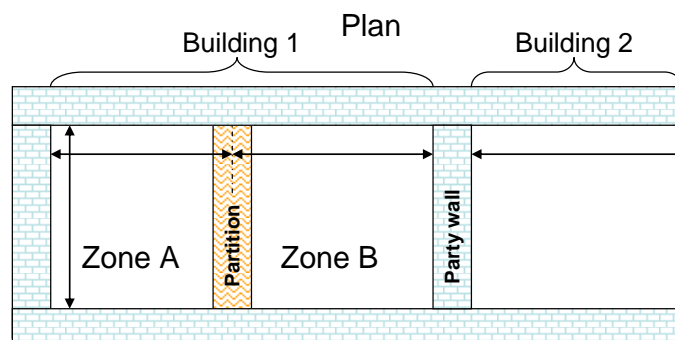
APPENDIX C: Agreed convention for determining dimensions

NB: The data below is developed and maintained by Accreditation Scheme Providers so it is constantly evolving, and assessors are advised to contact their scheme providers for the most up-to-date version. This document may also be accessed from the UK-NCM website at <https://www.uk-ncm.org.uk/page.jsp?id=36>

Horizontal dimensions

Consider

- Plan view of two buildings in a terrace
 - Separated by a party wall
 - Building 1 has two zones
- Wall types
 - “Perimeter” surrounds each building (external and party walls)
 - “Internal” refers to walls within each building (partitions)



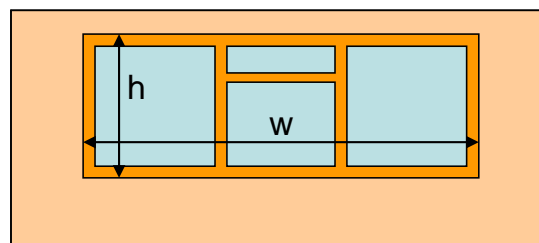
Generally follow RICS definition of Gross Internal Area

Need to measure

- Inside perimeter walls
- Mid point of internal walls
- Party walls are perimeter, so measure to surface, not mid point

Openings

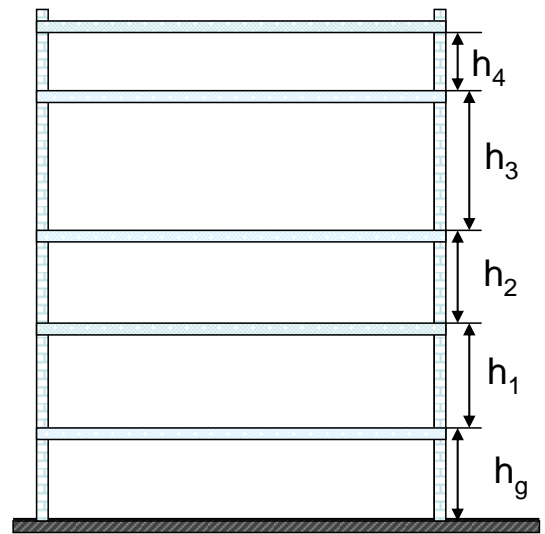
- Inside structural opening ($w \times h$)
- *Not just glass area*
- Percentage glazing is as viewed from inside
 - ie percentage of wall area to full zone height (defined below)
- 100% Glazing
 - Enter a wall of total area
 - Enter glazing with same area (or as 100%)



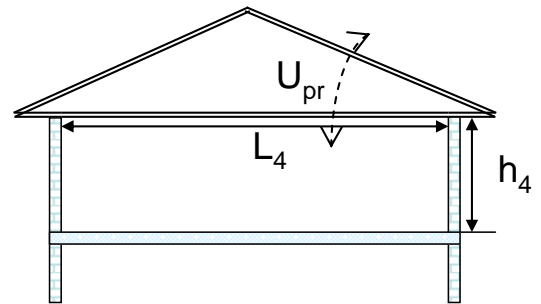
Zone height and element areas

Generally zone height is top of slab to top of slab for ground and intermediate floors, or soffit/eaves level at roof level

- For ground and intermediate floors
 - Zone height is top of floor to top of floor
- For top floors with flat roof
 - Zone height is top of floor to soffit/underside of roof slab

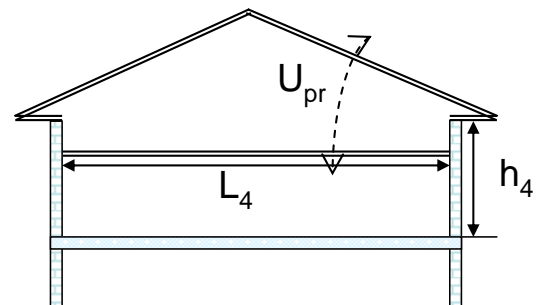


- For top floors with pitched roof but flat ceiling
 - Zone height is top of floor to underside of soffit/eaves level
 - U value is from under ceiling to outside roof including insulation wherever it is
 - that is, consistent with the area being entered
 - Area of gable wall is that below soffit/eaves level ie length L_4 x h_4



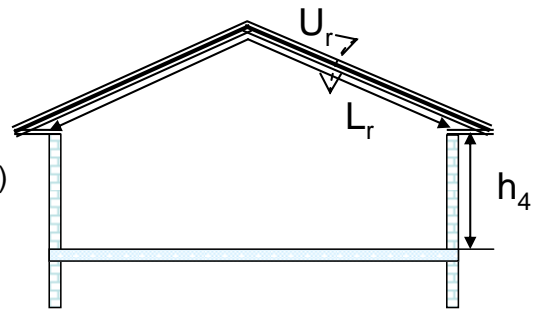
- For top floors with pitched roof and dropped ceiling with or without insulation at ceiling level

- Zone height (h_4) is top of floor to underside of soffit/eaves level (not ceiling)
- U value is from under ceiling to outside roof
- Side and end wall areas are calculated to soffit/eaves level i.e. dropped ceiling is treated as though it is at soffit/eaves level
- This convention has been adopted to avoid having to determine the relative levels of ceiling and soffit, and confusion over where the insulation is placed



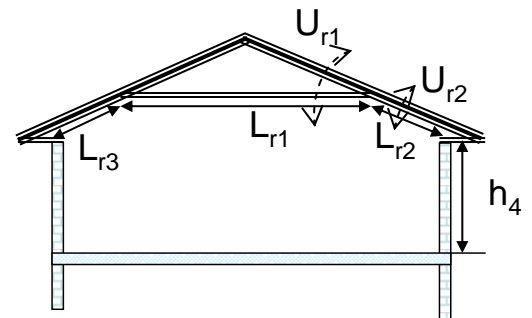
- For rooms with pitched ceiling (e.g. where ceiling is fixed in line of pitched roof)

- Zone height (h_4) is top of floor to underside of soffit/eaves level (*not average room height*)
- Roof heat loss area is as seen from underside of ceiling, i.e. $L_r \times d$ (zone depth)
- U value is from under ceiling to outside roof (U_r)
- End wall area is whole gable up to roof apex (as this is all exposed to inside temperature)



- If there is a horizontal ceiling half way up the pitched roof, split the area into

- The part with a void (L_{r1}), using the U-value including the void (U_{r1})
- The part where there is no void (L_{r2} , L_{r3}), using the U-value without a void (U_{r2})
- Zone height is still to underside of soffit/eaves level



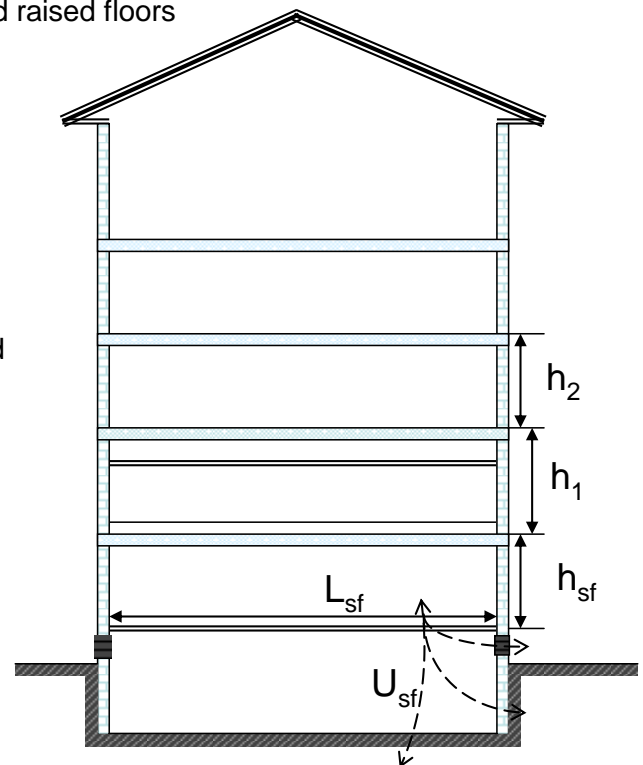
So the general rule is to **input the area exposed to the inside temperature, and the U-value between this surface and outside**, except for the dropped ceiling case.

- Intermediate floors with suspended ceilings and raised floors

- Zone height is top of floor slab to top of next floor slab e.g. h_1
- So, ignore the suspended ceilings and raised floors for the purposes of
 - zone height
 - surrounding wall areas
- But include their impact on Kappa values of the slabs above and below so that thermal mass effects are calculated correctly

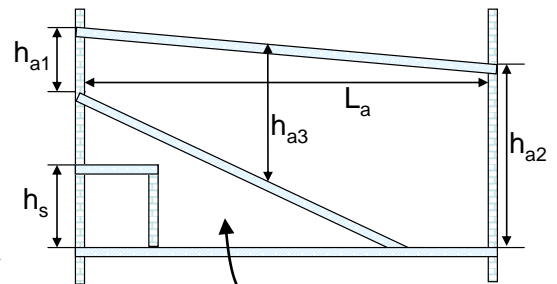
- With suspended timber ground floor and ventilated void below

- Zone height is top of suspended floor surface to top of first floor surface (h_{sf})
- Where the floor U value is calculated it should take account of the ventilated void (U_{sf})



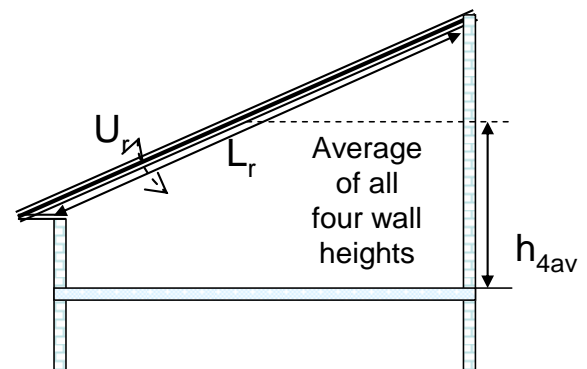
When there are walls of different heights to consider:

- For sloping floors and ceilings (eg auditoria)
 - If the activity above and under the floor is the same, or the void is inaccessible, choose normal zone height, otherwise zone height = weighted average wall height h_{a1} , h_{a2} , h_{a3} , etc (from where floor adjoins each wall to top of floor above)
 - Zone area A_a is projected area/plan area as per RICS GIA standard
 - Make sure in addition that all external (and internal) wall and slab areas are input so that all heat loss/gain and thermal mass is calculated
 - **Note that zoning for daylit areas must be carried out manually in these circumstances (do not use automatic daylight zoning)**
- For cubical rooms under the sloping floor
 - Zone height = top of slab to top of slab (h_s)
- Area weighted average wall height is defined as total wall area divided by horizontal perimeter length (eg $2L_a + 2 \times \text{depth (d)}$ in the diagram)



Don't forget this void is another zone if it has a different activity! Its zone height = area weighted average vertical wall height. If it has the same activity or is inaccessible, then merge with auditorium and enter zone area as though the floor is flat ($L_a \times d$). However, the sloping floor area must be input so that thermal mass is calculated.)

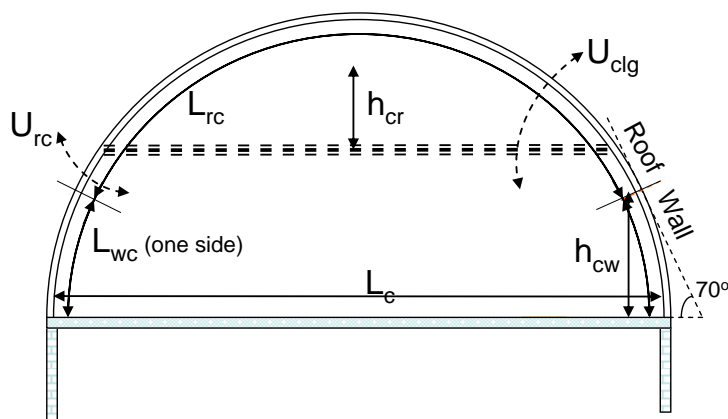
- For rooms with mono-pitched ceiling
 - Zone height is top of floor to weighted average height of all walls - h_4
 - Area of roof (A_r) is as seen from underside i.e. $L_r \times \text{zone depth}$
 - U value from under ceiling to outside roof is U_r
 - Use total area of gable wall
 - **Note that zoning for daylit areas must be carried out manually in these circumstances**
- If there is a horizontal ceiling under the mono-pitched roof
 - Level with or below eaves: zone height at eaves
 - Above eaves: zone height = average exposed wall height
 - Roof area would have to be divided into areas with different U-values with and without void



- Curved roof – for EPCs all buildings with curved roof sections shall be approximated as in the diagram:

- Circular (not elliptical or other shapes)
- Semi-circular so that width = 2 x height

- Walls are 70-90° from horizontal, roofs are <70°
- So zone height h_{cw} = dividing point between wall and roof, where slope = 70° at “eaves”
- If a floor (eg as shown dotted) meets roof at <70°, there is no wall, so zone height h_{cr} = average height of space
- If the dotted line represents the ceiling with an unoccupied void above, remember to input
 - the area of roof where the slope < 70° between this ceiling and the “eaves”, with its U value (U_{rc}), and
 - the flat ceiling with U value (U_{clg}) including the void above the ceiling
- Treat dormer windows the same as for a room in a pitched roof (see below)



For consistency, the convention is to assume all such roofs are semi-circular. If floor width = L_c and building depth is d

- Zone height $h_{cw} = 0.171 \times L_c$
- Wall height $L_{wc} = 0.175 \times L_c$
- Area curved walls = $L_{wc} \times d \times 2$ (both sides)
- Curved roof width $L_{rc} = 1.222 \times L_c$
- Area curved roof = $L_{rc} \times d$

- For room in roof (or mansard roof):
 - Areas and U values should correspond
 - U values for walls should include any voids – U_{w1} , U_{w2}
 - Zone height (h_{w1}) = height of vertical part of wall
 - If this varies, calculate area weighted average height
- Where there are dormer windows (ie window bays that project through the roof)
 - Do not adjust zone height for the dormer windows
 - Zone manually for daylit areas (if the glazing > 20% of vertical wall area)
 - Enter the glazing details and areas as normal
 - ***Note that zoning for daylit areas must be carried out manually in these circumstances***

