Communities
and Local Government

Display Energy Certificate
Software Specification

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Scope

This document describes the processes involved in generating an Operational Rating from details of a building and its energy consumption, generating a Display Energy Certificate (DEC) and producing, as required, an Advisory Report.

The processes include both administrative processes and operational steps in the software that carries out the process of receiving input information from the Display Energy Certificate Assessor, and processes and calculates outputs from that information to produce the DEC and the Advisory Report.

Core processes and calculations identified in this document represent the minimum requirements that all embedded Operational Rating calculation and DEC generation software should be based on.

The procedures in this document are arranged as a number of interactions with the Assessor, and with resources including the Communities and Local Government Central Information Point (CIP), the Assessor's Accreditation Body (AB), and the Communities and Local Government Central Register (CR) that stores the DEC and associated information, and the Advisory Report.

Abbreviations

OR   Operational Rating
DEC   Display Energy Certificate
AR   Advisory Report
EPC   Energy Performance Certificate
CR   Central Register
CIP   Central Information Point
AB   Accreditation Body
ABI   Approved Benchmark Information
TUFA   Total Usable Floor Area
GIA   Gross Internal Area
TADA   Total Area for DEC Assessment
DD   Degree Days
OSR   On Site Renewables (as defined for inclusion in the DEC CO_2 histogram, including measured output from additional Low and Zero Carbon (LZC) technologies)

Working units (unless otherwise noted)
Area $[m^2]$
Energy   [kWh]
Energy density $[kWh/m^2]$
Carbon dioxide emissions $[kgCO_2]$
Carbon dioxide intensity $[kgCO_2/kWh]$
Carbon dioxide density $[kgCO_2/m^2]$
Energy measuring period   [days]
Standard Year   [365 days]

Variables *(to be updated and completed)*

Variable	Units	Qualifier	Description
Total Useful Floor Area (TUFA)	m^2	*of the building for which the AR and DEC are being prepared*	Floor area measurement term used in "Statutory Instrument 2007 No. 991" (as defined in Building Regulations Approved Document L2A (2006), referencing GIA)
Gross Internal Area (GIA)	m^2	*of the building for which the AR and DEC are being prepared*	Measure of floor area (as RICS definition –"Code of Measuring Practice")
Net Lettable Area (NLA) and Sales Floor Area (SFA)	m^2	*of the building for which the AR and DEC are being prepared*	Alternative "Secondary Metrics" allowed for particular sectors. Standard "default" factors to convert to TUFA (GIA) are given in the Approved Benchmark information
Total Area for DEC Assessment (TADA)	m^2	*of the building for which the AR and DEC are being prepared*	Area on which the OR is based, equal to the TUFA (GIA) minus the internal area associated with a metered Separable Use of energy that has been deducted from the building energy consumption
Measured Consumption	kWh	*of a fuel or 'district' heat/coolth*	The measured or estimated consumption known and entered by the Assessor (nett of exports)
Measurement Period	Days	*of a fuel or 'district' heat/coolth*	The number of days (nominally 365 but with allowable tolerances) duration over which the consumption was measured
Assessment Period	Days	*of the information included in the DEC*	The 365 day year to which the DEC assessment apples
365 Day Energy Consumption	kWh	*of a fuel or 'district' heat/coolth*	The measured consumption corrected to a standard 365 day year
Measured Separable Energy	kWh	*of a fuel or 'district' heat/coolth*	The metered energy consumed by an allowed Separable Use
Separable Energy Measurement Period	Days	*of a fuel or 'district' heat/coolth*	The number of days (nominally 365 but with allowable tolerances) duration over which the Separable Energy was measured
365 Day Separable Energy	kWh	*of a fuel or 'district' heat/coolth*	The Measured Separable Energy corrected to a standard 365 day year
Relevant 365 Day Consumption	kWh	*of a fuel or 'district' heat/coolth*	The 365 Day Energy Consumption less the 365 Day Separable Energy
Measured OSR Energy	kWh	*of electricity or thermal supply*	The metered contribution from an On Site Renewable energy source

Variables *(to be updated and completed)* (continued)

Variable	Units	Qualifier	Description
OSR Measurement Period	*Days*	*of electricity or thermal supply*	The number of days (nominally 365 but with allowable tolerances) duration over which the OSR contribution was measured
365 Day OSR Energy	*kWh*	*On-site electricity or thermal supply*	The Measured OSR Energy corrected to a standard 365 day year
365 Day Non-electric Energy	*kWh*		The total of the Relevant 365 Day Consumptions of all energies except electricity
365 Day Electric Energy	*kWh*		The total of the Relevant 365 Day Consumptions of all electricity
Total Number of DD in Assessment Period	*Degree Days*	*For the region the building is located in*	The number of heating degree days, to the base 15.5°C, in the Assessment Period
Electricity Density Benchmark	*kWh/m^2*	*For the building category*	The basic electrical energy intensity benchmark from the Approved Benchmark Information
Non-Electricity Density Benchmark	*kWh/m^2*	*For the building category*	The basic non-electrical energy intensity benchmark from the Approved Benchmark Information
Electricity CO_2 Density Benchmark	*kgCO$_2$/m^2*	*For the building category*	The carbon dioxide density obtained from the electrical energy density benchmark and the approved carbon dioxide conversion factor for electricity
Non-Electricity CO_2 Density Benchmark	*kgCO$_2$/m^2*	*For the building category*	The carbon dioxide density obtained from the non-electrical energy density benchmark and the approved carbon dioxide conversion factor for gas
DD Corrected Electricity/Non-electricity CO_2 Density Benchmark	*kgCO$_2$/m^2*	*For the building category*	The electricity/non-electricity components of the above, corrected for the local number of heating degree days in the relevant 12-month period
DD & Occ Corrected Electricity/Non-electricity CO_2 Density Benchmark	*kgCO$_2$/m^2*	*For the building category*	As above, corrected for longer occupancy hours (currently optional, and for categories as defined in the Approved Benchmark Information)

GENERAL PROCEDURES

The following sections outline the preparation that the Assessor will need to make in order to carry out the calculation of the Operational Rating, and outline the stages of the calculation procedure. The preparatory stages, and the calculation procedure, are then explained in detail.

PREPARATION

1. Administrative requirements before using the software

The Assessor must carry out a number of quality checks to ensure that the software and other information resources to be used to calculate the OR, generate the DEC and the Advisory Report are the most recent available versions.

The Assessor also obtains information from DECs issued over the 2 previous years and valid Advisory Report, and any valid EPC and Recommendation Report.

The Assessor should have obtained the Unique Property Reference Number(s) for the DEC and/or Advisory Report for entry to the Software. UPRN are available from the CR.

2. Information requirements before using the software

The Assessor must have determined the boundaries of the building being assessed, and the areas, energy consumptions, energy measurement periods and dates, the building type, and other information required to carry out the necessary calculations to produce the OR, DEC and Advisory Report.

Specific procedures may apply where only partial energy information is available, but the OR and DEC cannot be produced without knowledge of the energy consumptions of the fuels and energies used over a consistent period matched reasonably closely to the period for which the assessment is being made.

If preparing a 'Composite Rating', the Assessor must have determined the building types and hence benchmark categories for each of the areas for which the Composite is required.

If discounting Separable energy uses or extended occupancy hours, the Assessor should have obtained, reviewed and be satisfied that the evidence submitted, supporting the claim for energy discounting, is in line with the applicable quality assurance requirements as defined by CIBSE.

DATA ENTRY

3. Enter administrative details

The software includes an automatic check that the versions of (a) the software being used and (b) the resources downloaded from the CIP are the most recent available.

The Assessor enters the descriptions of the building (or site) and its occupant to which the DEC will apply, details of the Assessor and the Assessor's affiliation, the DEC software and version used, the building address and other unique identifiers.

The Assessor's Professional Indemnity Insurance details may also be entered.

The Assessor will need to define the Start and End Dates of the Assessment Period over which the OR is to be calculated, which must be one calendar year apart and aligned with either the Start Date or End Date of the energy measurement period of the main heating fuel.

The Assessor will need to define the Assessment Date and period of validity of the DEC and/ or Advisory Report to be produced.

The information will include, where available, any existing references including earlier DEC information and any valid EPC/Asset Rating, obtained (subject to the building Occupant's permission) from the Central Register using the earlier Report Reference Numbers.

CALCULATION

4. Obtain Basic CO_2 Density Benchmark (or Benchmarks)

The Assessor has the opportunity to base the OR calculation on either a single-use or Composite Benchmark.

The software uses the Approved Benchmark information (ABI) to obtain the Basic Energy Density Benchmarks for the Building Category (or Categories where a Composite Benchmark is to be calculated), and other information to enable corrections to be made to the Benchmark. The Energy Density Benchmarks are converted to CO_2 Density Benchmarks using the up to date CO_2 conversion factors (for electricity and gas) from the CIP. The conversion factors used should be those for the year that includes the start date of the assessment period.

(Where a Composite Benchmark is to be calculated, the Assessor must provide individual floor areas to associate with each Building Category.)

5. Degree Days correction on CO_2 Density Benchmark (or Benchmarks)

The software uses the building Postcode to obtain the appropriate Local Degree Days for the region in which the building is located, and uses the proportional split between heating and non-heating energy indicated in the Approved Benchmark information, to correct the weather-dependent element of the main CO_2 Density Benchmark (or each of the Benchmarks where a Composite Benchmark is to be calculated) for the local influence of weather over the Assessment Period.

6. Occupancy correction on DD Corrected CO_2 Density Benchmark

(Optional)

The software allows a further correction, if allowed in the Approved Benchmark Information, and where satisfactory evidence has been provided to the Assessor, to be made to the DD Corrected CO_2 Density Benchmark (or Benchmarks) to account for longer hours of occupancy per week than the 'standard' for the Benchmark (or Benchmarks).

(Loops back to Step 4 as necessary where the Assessor has opted to use a Composite Benchmark.)

Where the Assessor has opted to use a Composite Benchmark, the software combines the individual Corrected Benchmarks in proportion to the Composite Floor Areas to obtain the Composite Corrected Electrical, Non-Electrical and Total CO_2 Density Benchmarks.

7. Check whether metered, estimated or apportioned energy information is available

The Assessor is initially asked whether there is sufficient energy consumption information available (consumption that is metered or able to be obtained as a utility company estimate, or apportioned from these sources) to carry out the assessment. The Assessor should confirm that at least 95 per cent of the energy consumed can be accounted for. If less than 95 per cent of the consumption can be accounted for, the OR is set to be double the typical value for the building type. This is, by definition, OR = 200 giving a Grade "G". The electrical and non-electrical energy densities are set to be double the degree day and occupancy corrected benchmark values. All other procedures are by-passed.

8. Obtain 365 Day Separable Energy and Area deductions (Optional)

The Assessor enters the floor area (TUFA) and annual energy consumption associated with each allowed Separable Use for which satisfactory evidence has been provided. Energies for Separable Uses must always be separately metered or they are not admissible. Where Separable Uses are allowable for the Building Category, the Separable Use energy and area may be subtracted from the overall building information within the calculation procedure. The Assessor may enter 'annual' consumptions of each fuel (electric, fossil and bio) and 'district' sources for separately metered Separable Use energies and details of the energy measurement period and the software corrects the input to 365 day consumption. Tolerance on Separable Energy Measurement Period is 365 +/- 7 days, or the Separable Use will not be discounted. The Separable Energy Measurement Period must be aligned within +/- 31 days with the Assessment period, or the Separable Use will not be discounted.

9. Obtain 365 Day Energy for heating and other fuel consumptions

The Assessor enters the measured 'annual' consumptions, or estimates of consumption obtained from the energy supply company, of each fuel (electric, fossil, bio, district heating and district cooling) and details of the energy Measurement Period. These consumptions are nett of exported energy, which should be subtracted before data is entered.

The Assessment Period is aligned with either the start or end dates (or both) of the Measurement Period of the main heating fuel. The start or end dates of the Measurement Periods for other energies must be synchronised with the start or end dates of the Assessment Period within +/- 31 days. Outside these limits the assessor will need to obtain utility estimates for a more appropriate period, or the software will set the OR to be double the typical value for the building type. This is, by definition, OR = 200 giving a Grade "G". The electrical and non-electrical energy densities will be set to be double the degree day and occupancy corrected benchmark values. All other procedures will be by-passed.

Except for electricity consumption, if the Measurement Period of any fuel or energy carrier, including the main heating fuel, is between 365+/- 7 and 365 +/- 31 days, the software generates a data quality warning. For electricity the tolerance for generating a warning is reduced from 31 to 15 days. Warnings are only displayed where the total CO_2 emissions affected exceed 5 per cent of the total CO_2 emissions. Outside these limits the assessor will need to obtain utility estimates for a more appropriate period, or the software will set the OR to be double the typical value for the building type. This is, by definition, OR = 200 giving a Grade "G". The electrical and non-electrical energy densities will be set to be double the degree day and occupancy corrected benchmark values. All other procedures will be by-passed.

Where a fuel or energy use is from estimated data, that fuel or energy is flagged with the letter "E". Where the fuel or energy use has been measured, it is flagged with the letter "A".

Where the measurement periods are within tolerance, the software corrects the main heating fuel consumption to 365 day consumption on a degree day basis. Where a Separable Energy use of the main heating fuel has been entered, the Separable energy use is subtracted before the degree day correction is carried out. The consumptions of other fuels are corrected on a pro rata time basis.. Where the corrected period is between 7 days and the maximum (31 or 15 days according to energy type), the software informs the assessor how many additional or less days were involved in the correction.

10. Obtain Relevant 365 Day Energy Consumptions

For each fuel use, the software subtracts the 365 day corrected energies for Separable Uses from the 365 day corrected Building energy consumptions, to obtain the energy consumptions used to calculate the OR.

11. Obtain Relevant 365 Day Non-electric Energy Consumption

The software forms a separate total of the relevant annual energy consumptions of the fossil and bio fuels and district heating and cooling. (**Relevant 365 Day Electric Energy consumption** is already available from the previous step)

12. Obtain 365 Day Contribution from On-site Renewable Energy Sources and output from other LZC

The Assessor is asked whether to enter On Site Renewables and other LZC outputs, to provide a name for any that are to be entered, and to specify whether the named OSR/LZC provides electricity, heating or cooling.

On Site Renewables and other LZC outputs must be separately metered or they are not included in the calculation or displayed. For each, the Assessor enters 'annual' energy contributions of electrical energy or thermal energy from on site renewable sources (such as wind, solar, geothermal) or from other LZC sources (such as heat pump, bio-fuel boiler) and details of the energy measurement period. The software corrects the input to 365 day consumption, warning the Assessor where the measurement periods are between 7 and 31 days out of alignment with the Assessment Period, rejecting the OSR if the measurement period is greater than 31 days out of alignment, warning the assessor if the metering period length is between 365 +/- 7 days and 365 +/- 15 days, and rejecting the OSR where the metering period length is outside the range 365 +/- 15 days.

For measured electricity, heating and cooling energy outputs by OSR/LZC, the software also calculates the CO_2 avoided by the use of the OSR/LZC.

13. Obtain Relevant 365 Day CO_2 Emissions

The software obtains the individual CO_2 emissions for each fuel and 'district' source from the 365 day consumptions using the Standard CO_2 Intensities (Conversion Factors) obtained from the CIP. The conversion factors used should be those for the year that includes the start date of the assessment period. The Assessor enters the intensities (conversion factors) supplied by the energy provider for any district heating and cooling used, or for unusual fuels (supported by suitable evidence of appropriateness). These intensities (conversion factors) should also be relevant to the year that includes the start date of the assessment period. Software then sums the individual emissions to produce the total relevant CO_2 emissions.

Where energy uses that have been entered as utility estimates account for more than 5 per cent of the total building carbon emissions, the DEC will note the OR has been calculated from "Estimated" energies, otherwise it would note that the calculation has been based on "Actual" energies.

Where On-Site Renewable and other LZC energy sources have contributed, the software calculates the amount by which thermal and electrical CO_2 emissions have been reduced by use of the OSR/LZC, compared with more conventional servicing.

(Note: result in Tonnes CO_2 per year)

14. Determine building Total Usable Floor Area (TUFA)

The Assessor enters floor area data normally as Total Usable Floor Area (TUFA) (same as GIA). In particular cases indicated by the Approved Benchmark Information an Approved Secondary Metric may be used, and the software converts from Approved Secondary Metric to TUFA where necessary using conversion factors provided in the Approved Benchmark Information. *(TUFA is defined in Part L Approved Documents L2, referencing GIA as defined in the RICS Code of Measuring Practice. [RICS Books])*

15. Determine the Total Area for DEC Assessment (TADA)

Software calculates the TADA as the TUFA (GIA) less the area for Separable Uses.

16. Calculate the Operational Rating (OR) and Grade

The software calculates the OR from the relevant annual CO_2 density, the TADA and the local Corrected CO_2 Density Benchmark or Composite Corrected CO_2 Density Benchmark, and allocates the OR Grade to an "A to G" scale.

(Note: OR is calculated as a percentage, but expressed as a dimensionless number, rounded to the nearest whole number)

(Note: The DEC displays the TUFA as the Total Usable Floor Area. The TUFA with the Separable Use area subtracted, TADA, is stored for use in the Technical Table. The Separable Use area deducted, and the unconditioned area, are also stored in the input data file and used in the Technical Table)

17. Calculate the Non-electrical Energy and Electrical Energy Ratios

The software individually compares the Relevant 365 Day Non-electrical and Electrical Energies with Non-Electrical and Electrical Energy Density components derived from the Composite Benchmark calculations and the standard CO_2 conversion factors from the CIP. (These Composites are already Degree Day corrected and Occupancy corrected as necessary).

DEC AND ADVISORY REPORT FILE PACKAGE PRODUCTION

18. Generate and display the full Technical Table

A more comprehensive Technical Table including information that is not included on the DEC is displayed for the Assessor (on screen, and available for printing separately). The content and the relevant variable 'names' used in this calculation procedure are listed later in the detailed specification.

19. Generate the draft DEC

The software generates the draft of the DEC, the OR/DEC calculation input and output files, and header data file.

For buildings with a Welsh Postcode, the software offers the option of generating a Welsh language DEC.

20. Generate the draft Advisory Report

The Assessor will have chosen earlier whether to generate either a DEC and Advisory Report together, or (where there is a valid Advisory Report that is to remain unchanged), a DEC alone. If an Advisory Report is not needed (the Assessor has responded that the session is to generate the DEC alone), then the procedure to filter the standard improvement options list is by-passed.

SUBMIT AND ISSUE THE DEC AND ADVISORY REPORT

21. Submission to the Accreditation Body

The Assessor submits the data package [DEC (.pdf); DEC header file, input and output data files (XML); Advisory Report (.pdf); Advisory Report header, input and output data files (XML)] to the AB for Validation and Registration.

(If these are not approved by the AB, the Assessor makes the required alterations, repeats the assessment, and re-submits to the AB.)

SPECIFIC PROCEDURES

The following Sections 1 and 2 detail the preparation that the Assessor will need to make in order to carry out the calculation of the Operational Rating. Sections 3 onward provide the specification for the calculation procedure.

Within Section 3 and onward, text highlighted in green represents factors that are input by the Assessor, and text highlighted in blue represent calculated outputs and intermediate results that need to be stored and that are necessary to produce the DEC.

PREPARATION

1. Administrative requirements before using the software

Before beginning the process of generating any OR, DEC and Advisory Report, the Assessor must have:

– Where available, obtained:

  o Any existing DECs relating to the building for the two years prior to the validity period of the DEC to be generated.

  o Any Advisory Report produced up to 7 years prior to the validity period of the DEC to be generated

    o   Any valid Energy Performance Certificate (EPC), including the Asset Rating, relating to the building

    o   Any valid Recommendation Report

– If not available from the Occupant, then using the relevant Certificate Reference Numbers, and with the Occupant's permission, obtained copies of the expiring and previous DEC, DEC information and Advisory Report from the Central Register.

– If not available from the Occupant, then using the relevant Certificate Reference Numbers, and with the Occupant's permission, obtained copies of the Energy Performance Certificate and Recommendation Report from the CR.

Information required from the DEC information from the two previous years:
(Note: this refers to the previous two DECs, ie, the previous DEC and the DEC before that)

    – Year (current minus one) CO_2 emissions for each of the fuels used (TCO_2/year)
    – Year (current minus two) CO_2 emissions for each of the fuels used (TCO_2/year)
    – Year (current minus one) CO_2 emissions saved by use of OSR/LZC
    – Year (current minus two) CO_2 emissions saved by use of OSR/LZC
    – Year (current minus one) Operational Rating
    – Year (current minus two) Operational Rating
    – Year (current minus one) Nominated Date
    – Year (current minus two) Nominated Date

– Checked that the version of the software being used is the latest available (the CIP keeps a log of all current software versions). This check is automated within the software.

– Downloaded the most recent Degree Day information from the CIP.

– Downloaded the most recent table of conversions from Postcode to Degree Day Region from the CIP

– Downloaded the most recent Approved Benchmark Information from the CIP.

– Downloaded the most recent Fuel Carbon Dioxide Intensity ($kgCO_2$/kWh) information from the CIP (*Note that the CIP holds this information for the previous 3 years*).

– Downloaded all other CIP files necessary to undertake successful generation of the DEC and advisory report

2.   Information requirements before using the software

Before entering data to the software the Assessor must have determined:

– The provisions of Regulation 18 and checked their implications on the assessment about to be undertaken

– Whether a DEC is necessary for the particular site, building or part of a building (*from this point onward termed 'the building'*)

– Whether a new Advisory Report is also to be produced for the building

(The Advisory Report containing the list of recommended measures is valid for a period of 7 years commencing with the date of issue)

‒ The Report Reference Number for the latest Advisory Report

(Note: where a new Advisory Report is being generated as part of the current building assessment, then the new Advisory Report Number should be obtained before carrying out the OR calculation and DEC generation, as the Advisory Report Number is required for display on the DEC)

‒ Whether the current Asset Rating is available for the building
(*Note: as Numeric*)

‒ The Unique Property Reference Number

‒ The boundaries defining the building to be assessed

‒ The area of the building, either as TUFA (or GIA), or as the acceptable other form of area measurement (Approved Secondary Metric) indicated in the Approved Benchmark Information for the benchmark category

‒ The unconditioned floor area within the building

‒ The expiry date for the DEC to be generated

‒ The main heating fuel used in the building

‒ The Start and End Dates for the energy measurement periods of each fuel (or, if using energy supply company estimates during an initial period, the Start and End Dates of the periods over which the estimates have been made)

‒ The actual or apportioned consumption of energy for the building in each energy type in the period

‒ Annual energy consumptions of any Approved Separable Use energy (which must have been separately metered) within the period

‒ Allowable floor area to be deducted associated with the Approved and metered Separable Use energy

‒ The measurement period for each fuel used for the Separable Use

‒ Where applicable, the metered energy contributions from On Site Renewable sources (eg solar; wind; geothermal) and other LZC sources (such as CHP; biofuel heating; ground, water and air source heat pumps)

‒ Where applicable, the Carbon Dioxide Intensity ($kgCO_2/kWh$) of energy supplied by an external (district) supplier of heating and/or cooling energy, supported by a statement from the supplier. This intensity (conversion factor) should be relevant to the year that includes the start date of the assessment period.

- Where applicable, the Carbon Dioxide Intensity ($kgCO_2$/kWh) of any fuel used other than those for which standard conversion factors are available from the CIP or the district sources above. This should be supported by a report, signed by a suitably qualified person, detailing how the emission factor has been derived. The intensity (conversion factor) used should be relevant to the year that includes the start date of the assessment period.

- The "Building Type" of the building, from the list included in the Approved Benchmark Information, for which the DEC is required. For a building with multiple uses, different "Building Types" may be used to derive the OR (this is the composite benchmark approach).

- Where a "Composite Benchmark" assessment is required:

  o The number of different Benchmark Categories to be included in the Composite Benchmark assessment

  o The Benchmark Category (Category[##]) and the associated Gross Internal Area of Category[##] for each of the Benchmark Categories (or the area expressed in terms of the Approved Secondary Metric if this is allowed and defined for the Category[##] in the Approved Benchmark Information)

  (Note: A list of the Building Types and their corresponding Benchmark Categories is included in the Approved Benchmark Information. These appear as 'dropdowns' for the Assessor to choose from. Further descriptions or explanations will also be available in separate technical guidance to aid selection)

  (Note: the Communities and Local Government software accommodates up to 5 different building types. This may result in up to five different Categories being accommodated in the 'combined benchmark' in the Communities and Local Government software)

  - The Assessor may choose to take account of extended occupancy hours per week if these are greater than the standard hours indicated in the Approved Benchmark information for the benchmark category, and if this option is available within the Approved Benchmark Information. Any adjustment made for occupancy period must be supported by the specified documentary evidence from the building Occupant and must be applicable to the relevant Assessment Period. Appropriate forms of evidence are included in the Approved Benchmark Information.

(Note: Procedures for obtaining individual building energy data from whole-site metering, energy supply 'statements' from district heating /cooling, alternative energy sources, are included in published guidance for Assessors.)

DATA ENTRY AND CALCULATION PROCEDURE SPECIFICATION

3. Enter administrative details

3.1 *At the software start-up point, the software accesses the (internally held) monthly Degree Day Information, Carbon Conversion Factors, Postcode to Degree Day Region conversions, (previously downloaded by the Assessor from the CIP) to check that these are the latest monthly version. Software checks that the validity period of the download includes the current date (date when the calculation is being made)*

IF the "current date" is later than the "date of the end of the validity period" of the most recent monthly CIP Information, the software:

– Displays a message to the Assessor that the CIP Information is out of date

– Displays a message to the Assessor that a valid DEC cannot be produced unless the latest information set has been downloaded from the CIP

– CLOSES THE SESSION

IF the version of the software in use is not the most recent version available for download from the CIP, the software:

– Displays a message to the Assessor that the calculation software is out of date

– Displays a message to the Assessor that a valid DEC cannot be produced unless the latest software is used

– CLOSES THE SESSION

ELSE

3.2 Software prompts Assessor to input:
(Note: Inputs need to be checked against the agreed DEC design and information storage options, when these are finalised)

– Name of the Assessor

– Name of the Assessor's employer (OR if self-employed, the Assessor's trading name

– Address of the Assessor's employer (OR if self-employed, the Assessor's trading address)

– Name of the Assessor's Accrediting Body

– Assessor's Registration Number

– Name of the building occupier organisation

– Address of the building

- Postcode of the building

- The UPRN available from the CR (to allow generation of the RRN)

- The Assessment Software used (this should be a drop down from a maintained list of current approved software available from the CIP)

- Issue Date of the assessment

- The Nominated Date (*defining the start of the 12 month validity period*) (no later than 3 months from end date of assessment period)

- (The "Valid Until" "Date" is derived automatically and is 12 months after the "Nominated Date")

- The Assessment Period Start Date

- The Assessment Period End Date

(Note: The Assessment Period between the Start and End Date must be one year (365 days), with either Start or End Date being the same as the Start or End Date of the measurement period of the main heating fuel for the main part of the building)

- The "Related Party Disclosure" (a free text box)

Software may provide the option, for the following Assessor's Professional Indemnity Insurance details to be entered:

- Insurer Name

- Insurance Policy Number

- Policy Effective Date

- Policy Expiry Date

- P I Limit (£)

3.3 *(Note: Assessor selects main heating fuel and Internal Environment information for DEC and to 'pass over' to the Advisory Report generator)*

Software prompts Assessor for the Main Heating Fuel that applies to the majority of the building,
(Selected from options in "Table of fuels and CO_2 conversion factors", plus "District heating" and "On Site Renewables")

Software prompts Assessor for the "Internal Environment" that applies to the majority of the building, and to be displayed on the DEC, and the secondary description of the system or means by which the environment is delivered that is not displayed but is also stored in the input file:

Assessor enters "Internal Environment" and "Secondary descriptor", selected from:

O   Air conditioning

- radiators
- under-floor heating
- convectors
- local system
- partially centralised
- centralised
- other (free text)

O   Heating and natural ventilation

- radiators
- under-floor heating
- convectors
- local system
- partially centralised
- centralised
- other (free text)

O   Heating and mechanical ventilation

- radiators
- under-floor heating
- convectors
- local system
- partially centralised
- centralised
- other (free text)

O   Mixed mode with natural ventilation

- radiators
- under-floor heating
- convectors
- local system
- partially centralised
- centralised
- other (free text)

O   Mixed mode with mechanical ventilation

- radiators
- under-floor heating
- convectors
- local system
- partially centralised
- centralised
- other (free text)

3.4   Software asks whether session is to provide "DEC only", "Advisory Report only", or "DEC and Advisory Report"

IF session is "Advisory Report only" Software goes to "ADVISORY REPORT GENERATOR"

ELSE

DEC GENERATOR

3.5   Software prompts Assessor to input:

–   The "Number of Building Benchmark Categories" (*Integer value*) included in the Building to be assessed
(Note: The Communities and Local software accommodates integer values 1 to 5. Other software may accommodate higher numbers)

–   *(Note: "Categories" refer to the top level descriptions in the Approved Benchmark information)*

–   FOR the "Number of Building Benchmark Categories"

    o   The Benchmark Category name: "Benchmark Category [##]"

    o   Access the Approved Benchmark Information to determine whether "Benchmark Category [##]" includes an "Approved Secondary Metric" and a "Default Multiplier" (*comment – to get TUFA area from secondary*) for the Category

    IF an Approved Secondary Metric is available prompt the Assessor to enter either the "Gross Internal Area" or the "Approved Secondary Metric" area to associate with the Benchmark Category.

    IF the entry was Approved Secondary Metric, convert to "TUFA Category[##]" using the Default Multiplier as:
    TUFA Category [##] = Approved Secondary Metric Area Category [##] x Default Multiplier Category [##]

    ELSE Prompt the Assessor to enter TUFA directly "TUFA Category [##]"

–   The "Building Type(s)"
(Note: up to 5 Building Types may be entered)
(Note: "Types" refer to the second level descriptions in the Approved Benchmark information for the Building Category (or Categories))

–   Main Heating Fuel
(Selected from options in "Table of fuels and CO_2 conversion factors", plus "District heating" and "On Site Renewables")

–   Main Benchmark Category name : Main Benchmark Category [##}

- *(Note: Where the Composite Benchmark approach is to be used, Assessor selects the Main Benchmark Category as the largest area where the Main Heating Fuel is used. If there is only a single Benchmark Category, the Main Benchmark Category[##] is entered as the same as Benchmark Category [##]*

- Unconditioned Floor Area *(m²)*

    Information required from the DEC information from the two previous years:
    (Note: this refers the previous two DECs, ie, the previous DEC and the DEC before that)

    - Year (current minus one) CO_2 emissions for each of the fuels used (TCO_2/year)
    - Year (current minus one) CO_2 emissions saved by use of OSR/LZC
    - Year (current minus two) CO_2 emissions for each of the fuels used (TCO_2/year)
    - Year (current minus two) CO_2 emissions saved by use of OSR/LZC
    - Year (current minus one) Operational Rating
    - Year (current minus two) Operational Rating
    - Year (current minus one) Nominated Date
    - Year (current minus two) Nominated Date

- Information required from the valid EPC:

    o   Asset Rating

    o   Asset Rating Grade

- Information required from the latest Advisory Report

    o   Advisory Report Reference Number:

4.   Obtain Basic CO_2 Density Benchmark(s)

4.1   FOR each of the identified Building Benchmark Categories

COMPOSITE BENCHMARK LOOP RESTART POINT

Software accesses the Approved Benchmark Information for "Benchmark Category [##]" to obtain:

Category[##] Typical Electricity Energy Density   *(kWh/m²)*
Category[##] Typical Non-Electricity Energy Density   *(kWh/m²)*

Calculate "Category[##] Typical Electricity CO_2 Density"   *(kgCO_2/m²)*
as
Category[##] Typical Electricity Energy Density x CO_2 Conversion Factor [Electricity]

Calculate "Category[##] Typical Non-Electricity CO_2 Density"   *(kgCO_2/m²)*
as
Category[##] Typical Non-Electricity Energy Density x CO_2 Conversion Factor [Gas]

Calculate "Category[##] Typical Total CO_2 Density"   *(kgCO_2/m²)*
as

Category[##] Typical Electricity CO_2 Density + Category[##] Typical Non-Electricity CO_2 Density

(Note: Approved Benchmark Information and CO_2 Conversion Factor [Fuel} are held in the Assessor's computer having been downloaded from the CIP)

(Note: Throughout the calculation processes, on all occasions the "CO_2 Conversion Factor [Fuel]" used should be those for the year that includes the Start Date of the Assessment Period.)

5. **Degree Days correction on Basic CO_2 Density Benchmark (or on each Benchmark where a Composite Benchmark is to be calculated)**

    (Note: DD information is held in the Assessor's computer having been downloaded from the CIP)

    (Note: software accommodates that the Assessment Period End Date may be either the same as the Measurement End Date, or 365 days after the Measurement Start Date, of the main heating fuel)

5.1 Software accesses the Postcode Conversion Information to determine the Degree Day Region of the building from the Postcode of the building

5.2 Software accesses the Approved Degree Day Information for the Degree Day Region to determine the monthly Degree Days for each of the months included in and between the Assessment Period End Date and the Assessment Period End Date, and calculates the total number of degree days in the Assessment Period:

    Access the DD Information for the "Assessment Start Month" to obtain the "DD in the Assessment Start Month"
    (number of degree days in the month that contains the Assessment Period Start Date)

    Calculate "Assessment Days in Start Month" as:
    (Number of Days in Assessment Start Month) minus (Day *(number)* of Assessment Period Start Date)

    Calculate "Proportion of Assessment Days in Start Month" as:
    [Assessment Days in Start Month]/[Number of Days in Assessment Start Month]

    Calculate "Number of Assessment DD in Assessment Start Month" as:
    (DD in Assessment Start Month) x (Proportion of Assessment Days in Start Month)

    Access the DD Information for the Assessment End Month to obtain the "DD in Assessment End Month"
    (number of degree days in the month that contains the Assessment Period End Date)

    Set "Assessment Days in End Month" to:
    (Day *(number)* of the Assessment End Date)

    Calculate "Proportion of Assessment Days in End Month" as:
    (Assessment Days in End Month)/(Number of Days in Assessment End Month)

    Calculate "Number of Assessment DD in Assessment End Month" as:

(DD in Assessment End Month) x (Proportion of Assessment Days in End Month)

Calculate "Total Number of DD in Assessment Period" as:
The total of (DD in the month) added for each month between *(but not including)* the Measurement Start Month and the Assessment End Month
+ (Number of Assessment DD in Assessment Start Month)
+ (Number of Assessment DD in Assessment End Month)

5.3   Software accesses, for Category[##], the
        "Percent of electricity benchmark pro-rated to degree days", (DPE[##]) and
        "Percent of fossil-thermal benchmark pro-rated to degree days" (DPFT[##])

5.4   Software calculates the Category[##] DD Corrected Electricity CO_2 Density *($kgCO_2/m^2$)* from:
        Category[##] Typical Electricity CO_2 Density (TECD[##])   *($kgCO_2/m^2$)*
        Category[##] Standard Degree Days, (SDD[##])
        Total Number of DD in Assessment Period, (TNDD)
        Category[##] Percent of electricity benchmark pro-rated to degree days (DPE[##]) as:

        Category[##] DD Corrected Electricity CO_2 Density =
        (TECD[##] (1 – (DPE[##]/100)) + ((DPE[##]/100) x TECD[##] x TNDD/SDD[##])
        ($kgCO_2/m^2$)

        (Note: Category[##] Standard Degree Days, (SDD[##]), is obtained from the Approved Benchmark Information. At present (March 2008) all benchmark categories use the same number, 2021 degree days)

        (Note: DD correction to the Electricity CO_2 Density benchmark leaves TECD[##] unchanged where the Percent of electricity benchmark pro-rated to dd is zero)

5.5   Software calculates the Category[##] DD Corrected Non-Electricity CO_2 Density *($kgCO_2/m^2$)* from:
        Category[##] Typical Non-Electricity CO_2 Density (TNECD[##])   *($kgCO_2/m^2$)*
        Category[##] Standard Degree Days, (SDD[##])
        Total Number of DD in Assessment Period, (TNDD)
        Category[##] Percent of non-electricity benchmark pro-rated to degree days (DPFT[##]) as:

        Category[##] DD Corrected Non-Electricity CO_2 Density =
        (TNECD[##] (1 – (DPFT[##]/100)) + ((DPFT[##]/100) x TNECD[##] x TNDD/SDD[##])
          ($kgCO_2/m^2$)

5.6   Software calculates the Category[##] DD Corrected Total CO_2 Density *($kgCO_2/m^2$)* as:

        Category[##] DD Corrected Total CO_2 Density =
        Category[##] DD Corrected Electricity CO_2 Density +
        Category[##] DD Corrected Non-Electricity CO_2 Density   *($kgCO_2/m^2$)*

6.   Occupancy correction on DD Corrected CO_2 Density Benchmark (*Optional*) (optional on each Benchmark where a Composite Benchmark is to be calculated)

6.1   IF the "Category[##]" Approved Benchmark Information includes values for "Benchmark hours per year", and
"Maximum allowed hours per year"
Software asks the Assessor whether to use "Standard Occupancy" hours or "Extended Occupancy".

6.2   AND IF response is "Extended Occupancy"
AND IF Assessor ticks a box generated by the software to confirm that suitable written evidence has been obtained and retained by the Assessor that proves the extended occupancy for the relevant Assessment Period
Software sets "Occupancy Period" to "Extended"
Software prompts Assessor to enter "Total Equivalent Hours per year"

Software ensures the Assessor can only enter "Total Equivalent Hours per year" within the limits defined by "Benchmark hours per year" and "Maximum allowed hours per year" for "Category[##]"

(Note: These terms are taken from the 'consultation' Approved Benchmark information Sept 07:
"Benchmark Hours per year"
"Maximum allowed hours per year"
"Percentage increase in electricity benchmark at maximum allowed hours per year"
"Percentage increase in fossil-thermal benchmark at maximum allowed hours per year")

6.3   Software calculates Category[##] DD & Occ Corrected Electricity CO_2 Density *($kgCO_2/m^2$)* as:

Category[##] DD & Occ Corrected Electricity CO_2 Density =
Category[##] DD Corrected Electricity CO_2 Density x
$(1 + ((TEH[\#\#] - BH[\#\#])/(MAH[\#\#] - BH[\#\#])) x (PEB[\#\#]/100))$ *($kgCO_2/m^2$)*

Where:
TEH[##]   is Total Equivalent Hours per year for Category[##]
BH[##]   is Benchmark Hours per year for Category[##]
MAH[##] is Maximum allowed hours per year for Category[##]
PEB[##]   is Percentage increase in electricity benchmark at maximum allowed hours per year for Category[##]

6.4   Software calculates Category[##] DD & Occ Corrected Non-Electricity CO_2 Density *($kgCO_2/m^2$)* as:

Category[##] DD & Occ Corrected Non-Electricity CO_2 Density =
Category[##] DD Corrected Non-Electricity CO_2 Density x
$(1 + ((TEH[\#\#] - BH[\#\#])/(MAH[\#\#] - BH[\#\#])) x (PFTB[\#\#]/100))$ *($kgCO_2/m^2$)*

Where:
PFTB[##] is Percentage increase in fossil-thermal benchmark at maximum allowed hours per year for Category[##]

6.5   Software calculates Category[##] DD & Occ Corrected Total CO_2 Density *(kgCO$_2$/m^2)* as:

Category[##] DD & Occ Corrected Total CO_2 Density =
Category[##] DD & Occ Corrected Electricity CO_2 Density +
Category[##] DD & Occ Corrected Non-Electricity CO_2 Density   *(kgCO$_2$/m^2)*

6.6   ELSE:
Software sets:
Category[##] DD & Occ Corrected Electricity CO_2 Density = Category[##] DD Corrected
Electricity CO_2 Density

Software sets:
Category[##] DD & Occ Corrected Non-Electricity CO_2 Density = Category[##] DD Corrected
Non-Electricity CO_2 Density

Software calculates the Category[##] DD & Occ Corrected Total CO_2 Density as:

Category[##] DD & Occ Corrected Total CO_2 Density =
Category[##] DD & Occ Corrected Electricity CO_2 Density +
Category[##] DD & Occ Corrected Non-Electricity CO_2 Density

(Note: This recombines the corrected electricity and non-electricity components back into the 'overall' benchmark to be used to calculate the OR)

COMPOSITE BENCHMARK LOOP END POINT

6.7   IF "Number of Building Benchmark Categories" > 1

Software calculates Composite Benchmarks as:

CBE = ((BE[a] x A[a])+(BE[b] x A[b])+ …. +(BE[n] x A[n]))/(A[a] + A[b] +…..+ A[n])
CBNE = ((BNE[a] x A[a])+(BNE[b] x A[b])+….+(BNE[n] x A[n]))/(A[a] + A[b] +…+ A[n])
CB = ((B[a] x A[a])+(B[b] x A[b])+…..+(B[n] x A[n]))/(A[a] + A[b] +…..+ A[n])
(Where: CBE   = Composite Benchmark Electrical
            CBNE   = Composite Benchmark Non-Electrical
            CB   = Composite Benchmark
            BE[a]   = DD & Occ Corrected Electricity CO_2 Density for Area [a]
            BNE[a]   = DD & Occ Corrected Non-Electricity CO_2 Density for Area [a]
            B[a]   = DD & Occ Corrected Total CO_2 Density for Area [a]
            A[a]   = Floor area associated with Area [a]
            Etc…for [a], [b], ….. [n]

Note: Where there is only one Benchmark Category

Software holds:

DD & Occ Corrected Electricity CO$_2$ Density
DD & Occ Corrected Non-Electricity CO$_2$ Density
DD & Occ Corrected Total CO$_2$ Density

7. Check whether metered , estimated or apportioned energy information is available to account for at least 95 per cent of all of the energy used by the building, and set 'default' OR and other indicators where it is not

7.1 Software asks "Do you have metered , estimated or apportioned measurements of energy consumption available that can account for at least 95 per cent of all of the energy used by the building?" (Y/N)

IF response is "N":
SET "Operational Rating" = 200
SET "OR Grade" = "G"
BYPASS all the energy input and calculation routines that follow
BYPASS the procedure to calculate the Operational Rating that follows
BYPASS the procedure for Separable Use area and energies that follow
BYPASS the procedures for OSR/LZC energies that follow
SET "Measured/Estimated" flag to "Estimated"
BYPASS the routine that allocates A to G Grade to the Operational Rating

If a composite benchmark approach was used, calculate:
Category[##] Typical Electricity Energy density = CBE/CO_2 Conversion Factor [Electricity]

If a single benchmark category was used, calculate:
Category[##] Typical Electricity Energy density = Category[##] DD & Occ Corrected Electricity CO_2 Density/CO_2 Conversion Factor [Electricity]

If a composite benchmark approach was used, calculate:
Category[##] Typical Non-Electricity Energy density = CBNE/CO_2 Conversion Factor [Gas]

If a single benchmark category was used, calculate:
Category[##] Typical Non-Electricity Energy density = Category[##] DD & Occ Corrected Non-Electricity CO_2 Density/CO_2 Conversion Factor [Gas]

Calculate:
"Electrical Energy Density" = 2 x Category[##] Typical Electricity Energy Density
"Non-Electrical Energy Density" = 2 x Category[##] Typical Non-Electricity Energy density

SET all "energy saved" and "percentage energy saved" to zero

Calculate:
TUFA = TUFA Category[##1] + TUFA Category[##2] + ……. + TUFA Category[##5]

GO TO END OF CALCULATION PROCEDURES (preparatory to DEC information transfer)

ELSE

8.   Obtain 365 Day Separable Energy and Area deductions
(Note: this correction is optional – Assessor is asked Y/N whether to take account of any Separable Energy uses/areas.)

8.1   Software accesses the Approved Benchmark Information for all of the "Building Categories" entered if the "Number of Building Categories" is >1 *(for the composite benchmark approach)*, or accesses the Approved Benchmark Information for the "Building Category" associated with the "Building Type"

IF The Approved Benchmark Information <u>does not</u> indicate any allowable Separable Use Areas for any of the "Building Categories"

Skip this section *(ie. go directly to Section 9)*

ELSE

8.2   Software prompts assessor for "Do you want to deduct any individually Metered Separable Energy areas" (Y/N)

IF Y/N response is "N" then skip this section *(ie, go to the beginning of Section 9)*

IF Y/N response is "Y" then continue

SEPARABLE ENERGY AREA LOOP START POINT

8.3   IF Number of Separable Energy Area Loops > 0

Software prompts assessor for "Any other individually Metered Separable Energy areas" (Y/N)

IF Y/N response is "Y"

Software prompts Assessor to enter:
"Separable Energy "Description" "
Note: "Description" should be selected from the "Building Types" included in the Approved Benchmark Information

Software prompts Assessor to enter:
[Description]Separable Energy "Area" to be deducted (m²)

SEPARABLE FUEL ENTRY LOOP START POINT

8.4   Software prompts assessor to enter details of each "[Description]Separable Energy [fuel]" metered

FOR each [fuel] entered
(NOTE – Fuel uses may include: Electricity; Natural Gas; LPG; Biogas; Oil; Coal; Anthracite; Smokeless fuel (inc coke); Biomass; District Heating; District Cooling; Separable Energy Free Field)

Assessor enters:
Start Date of [Description] Separable Energy Measurement Period [fuel], and
End Date of [Description] Separable Energy Measurement Period [fuel]

8.5 Software converts

"Start Date of [Description] Separable Energy Measurement Period [fuel]" and
"End Date of [Description] Separable Energy Measurement Period [fuel]"
to produce
"[Description] Separable Energy Measurement Period [fuel]" *(days)*

8.6 IF [Description]Separable Energy Measurement Period [fuel] – 365 is > 7 or < -7

Display message to the Assessor:
"This is an Invalid Measuring period – Separable Energy use [Description] cannot be deducted"
Software returns to SEPARABLE ENERGY AREA LOOP START POINT

ELSE

8.7 Calculate "m" = number of days between "Start date of the Separable Energy [Fuel] measuring period" and "Start date of the Assessment Period"

Calculate "mm" = number of days between "End date of the Separable Energy [Fuel] measuring period" and "End date of the Assessment Period

IF either "m" or "mm" is > 31 or < -31

Generate a message "Invalid alignment with Assessment Period. This Separable Use [Description] cannot be deducted"
Software returns to SEPARABLE ENERGY AREA LOOP START POINT

ELSE

8.8 Enter "[Description] Metered Separable Energy [fuel]"

Calculate [Description]365 Day Separable Energy [fuel] as:
[Description]Metered Separable Energy [fuel] x 365/[Description]Separable Energy Measurement Period [fuel]

RETURN POINT FOR ENTERING SEPARABLE FUEL USES

8.9 FOR each [fuel] type entered:

Software calculates:

365 Day Separable CO_2 Emissions [fuel] =
365 Day Separable Energy [fuel] x CO_2 Conversion Factor [fuel] *(Note: result here is in $kgCO_2$)*

[Description]365 Day Separable CO_2 Emissions =
Sum of all the "365 Day Separable CO_2 Emissions [fuel]" *(Note: result here is in $kgCO_2$)*

[Description]365 Day Separable Energy [Non-Electrical] =
Sum, for all "fuels" other than electricity, of "[Description]365 Day Separable Energy [fuel]"

(Note: "[Description]365 Day Separable Energy [Electricity]" is required separately later, for the Technical Table)

Add 1 to Number of Separable Energy Area Loops

RETURN TO SEPARABLE ENERGY AREA LOOP START POINT

ELSE *(If there are no more Separable Energy Areas)*

8.10   Calculate "Separable Energy Deductions Electrical" =
Sum, for all "Descriptions", of "[Description]365 Day Separable Energy [Electricity]"

Calculate "Separable Energy Deductions Non-Electrical" =
Sum, for all "Descriptions" and all "fuels" other than electricity, of "[Description]365 Day Separable Energy [fuel]"

Calculate "Separable Energy Area" =
Sum, for all "Descriptions", of all "[Description]Separable Energy Area"

Calculate "Separable Use of Main Heating Fuel" =
Sum, for all "Descriptions", of "[Description]365 Day Separable Energy [Main Heating Fuel]"

9.   Obtain 365 Day (nett*) Energy for heating and other fuel consumptions
(*Note: Assessor should observe published guidance on dealing with energy exports and form energy consumptions nett of exports before data entry)

9.1   IF Main Heating Fuel is Electricity

Software asks (Y/N) is Heating Electricity metered separately from other uses of electricity?

IF response is "Y"

Software prompts Assessor for "Measured Consumption [Heating Electricity]" *(kWh)* and the associated:

"Start date of energy measuring period [Heating Electricity]"
and
"End date of energy measuring period [Heating Electricity]"

Software asks Assessor 'Is this consumption directly from meter readings or is it an estimate from a utility company?'

IF entry was based on an estimate, associate Flag "E" to the fuel [Electricity]
ELSE associate Flag "A" to the fuel [Electricity]

IF response is "N"

Software prompts Assessor for "Measured Consumption [Electricity]" *(kWh)* and the associated:

"Start date of energy measuring period [Electricity]"
and
"End date of energy measuring period [Electricity]"

Software sets:

Start date of energy measuring period [Heating Electricity] = Start date of energy measuring period [Electricity]"
and
End date of energy measuring period [Heating Electricity] = End date of energy measuring period [Electricity]

Software asks Assessor 'Is this consumption directly from meter readings or is it an estimate from a utility company?'

IF entry was based on an estimate, associate Flag "E" to the fuel [Electricity]
ELSE associate Flag "A" to the fuel [Electricity]

For the Main Benchmark Category, software calculates a "Category[##] Default DD Dependency (%)" for the "Benchmark Category" as:
"Category[##] Default DD Dependency (%)" =
"Category[##] Percent of non-electricity benchmark pro-rated to degree days (DPFT[##])" x "Category[##] Typical Non-Electricity CO_2 Density"/"Category[##] Typical Total CO_2 Density"

Software sets:
"Measured Consumption [Heating Electricity]" =
"Measured Consumption [Electricity]" x "Category[##] Default DD Dependency (%)"/100
and
"Measured Consumption [Electricity]" =
"Measured Consumption [Electricity]" – "Measured Consumption [Heating Electricity]"

ELSE For electricity
and

9.2   FOR each of the fuels:

Natural Gas
LPG
Biogas
Oil
Coal
Anthracite
Smokeless fuel (inc coke)
Biomass
District Heating
District Cooling
Free field *(Assessor input for fuel not specified above)*

Software prompts Assessor for "Measured Consumption [fuel]"   *(kWh)*

and the associated
"Start date of energy measuring period [fuel]"
"End date of energy measuring period [fuel]"

Software asks Assessor 'Is this consumption directly from meter readings or is it an estimate from a utility company?'

IF entry was based on an estimate, associate Flag "E" to the fuel [fuel]
ELSE associate Flag "A" to the fuel [fuel]

9.3   FOR each fuel:

Software converts

"Start date of energy measuring period [fuel]" and
"End date of energy measuring period [fuel]"
to produce
"Measurement Period [fuel]" *(days)*

9.4   Software prompts the Assessor to select Either "All energy consumptions are measured" Or "One or more energy consumption has been estimated"

IF Assessor's response is "All energy consumptions are measured" Software sets "Measured / Estimated" Flag for inclusion on DEC to "Measured"

ELSE Software sets "Measured /Estimated" Flag to "Estimated"

9.5   *(Software applies Degree-Day based measurement period correction to main heating fuel consumption – for the main Benchmark Category only)*

For Fuel Type = Main Heating Fuel (MHF)

Access the DD Information for the "Measurement Start Month" to obtain the "DD in the Measurement Start Month"
(number of degree days in the month that contains the Energy Measurement Start Date)

Calculate "Measurement Days in Start Month" as:
(Number of Days in Measurement Start Month) minus (Day *(number)* of Energy Measurement Start Date)

Calculate "Proportion of Measurement Days in Start Month" as:
[Measurement Days in Start Month]/[Number of Days in Measurement Start Month]

Calculate "Number of Measurement DD in the Start Month" as:
(DD in Measurement Start Month) x (Proportion of Measurement Days in Start Month)

Access the DD Information for the "Measurement End Month" to obtain the "DD in Measurement End Month"
(number of degree days in the month that contains the Energy Measurement End Date)

Set "Measurement Days in End Month" to:

Day *(number)* of Energy Measurement End Date

Calculate "Proportion of Measurement Days in End Month" as:
(Measurement Days in End Month)/(Number of Days in Measurement End Month)

Calculate "Number of Measurement DD in End Month" as:
(DD in Measurement End Month) x (Proportion of Measurement Days in End Month)

Calculate "Total Number of DD in Measurement Period" as:
The total of (DD in the month) added for each month between *(but not including)* the Measurement Start Month and the Measurement End Month
+ (Number of Measurement DD in Start Month)
+ (Number of Measurement DD in End Month)

9.6   Software corrects the 365 day Separable Energy use of the Main Heating Fuel to the MHF measurement period length, removes this from the total prior to DD correction, then recombines the Separable and DD corrected components to form the 365 day corrected total

Calculate "MHF Period Separable Energy Consumption[MHF]" as:
"Separable Use of Main Heating Fuel" x (Measurement Period [MHF]/365)

Calculate "Non-Separable Energy Consumption[MHF]" as:
Measured Energy Consumption[MHF] – "MHF Period Separable Energy Consumption[MHF]"

For all "MHF"s other than "Heating electricity" if this heating electricity consumption was earlier calculated as a proportion of a total electrical consumption:
Calculate "365 Day Non-Separable Energy Consumption[MHF]" as:
Non-Separable Energy Consumption[MHF] x (1 – DPFT/100) x 365/Measurement Period[MHF] + DPFT/100 x Non-Separable Energy Consumption [MHF] x (Total Number of DD in Assessment Period/Total Number of DD in Measurement Period)

where: DPFT is the "Percent of fossil-thermal benchmark pro-rated to degree days" *(used earlier)*

For the case where the "MHF" is "Heating electricity" and this heating electricity consumption was earlier calculated as a proportion of a total electrical consumption, then calculate:

"365 Day Non-Separable Energy Consumption[MHF]" as:

Non-Separable Energy Consumption[MHF] x (Total Number of DD in Assessment Period/Total Number of DD in Measurement Period)

(Note: all of this 'calculated' heating electricity is corrected on a degree day basis, as it was determined by the earlier calculation as the proportion of total electricity that would be pro-rated to degree days)

Calculate "365 Day Energy Consumption[MHF]" as:
"365 Day Non-Separable Energy Consumption[MHF]" + "Separable Use of Main Heating Fuel"

9.7   FOR each fuel other than "Main Heating Fuel"

Software calculates 365 Day Energy Consumption [fuel] from Measured Energy Consumption [fuel]; Measurement Period [fuel] and 365 as:

365 Day Energy Consumption[fuel] =
Measured Energy Consumption[fuel] x 365/Measurement Period[fuel]

To produce (as appropriate):

365 Day Energy Consumption[fuel]   *(kWh)*

(Note: [fuel] may be: Electricity; LPG; Biogas; Oil; Coal; Anthracite; Smokeless fuel (inc coke); Biomass; District Heating; District Cooling; (Free Field))

Calculate Total 365 day energy consumption of all fuels other than electricity (including the main heating fuel, and including [heating electricity] where this is the main heating fuel) as:
"365 Day Energy Consumption[non-electrical]" =
Sum of all "365 Day Energy Consumption[fuel]" for all [fuel]s entered except [Electricity]

9.8   Calculate Total CO_2 emissions for electricity and non-electrical (for the DEC histogram), and Reference Total CO_2 emissions (for comparison with fuel and other energy uses to check significance of alignment of measurement periods)

Calculate "Total CO_2 emissions [electricity]" as:
Total CO_2 emissions [electricity] = "365 Day Energy Consumption[electricity]" x "CO_2 Conversion Factor[electricity]"
and
Histogram Total CO_2 emissions [electricity] = Total CO_2 emissions [electricity]/1000
(Note: Histogram displays tonnes CO_2)

Calculate "Reference Total CO_2 emissions" as:
Sum, for all [fuels] entered (including MHF and district sources), of
"365 Day Energy Consumption[fuel]" x "CO_2 Conversion Factor[fuel]"

Calculate "Total CO_2 emissions [non-electrical]" as:
Total CO_2 emissions [non-electrical] =
Reference Total CO_2 emissions – Total CO_2 emissions [electricity]
and
Histogram Total CO_2 emissions [non-electrical] = Total CO_2 emissions [non-electrical]/1000
(Note: Histogram displays tonnes CO_2)

9.9   *(Software sets Data Quality warnings as necessary based on Fuel Measurement Periods)*

IF "Main Heating Fuel" is electricity
    Calculate "n" = Measurement Period[Heating Electricity] – 365
    IF "n" is between +/- 7 and +/- 15
        Generate a Data Quality warning for the Assessor as:
        "The software will extrapolate/interpolate the electricity data provided by "n" days to derive energy consumption for a 365 day period"

IF "n" >15 or < -15

    Generate a message "Invalid Measurement Period. Obtain an estimate from the electricity supply company to cover a valid period."
    Software:
    Applies the 'default' procedure setting OR to 200 and other variables to their default values, as defined at 7.1, and
    GO TO END OF CALCULATION PROCEDURES (preparatory to DEC information transfer)

9.10   Else FOR all fuels (i.e IF Main Heating Fuel" is not heating electricity)
    Calculate "n" = Measurement Period[Fuel] – 365
    IF "n" is between +/- 7 and +/- 31

        Generate **but do not display** a Data Quality warning for the Assessor as:
        "The software will extrapolate/interpolate the [Fuel] data provided by "n" days to derive energy consumption for a 365 day period"

    IF "n" >31 or < -31

        Generate a message "Invalid Measurement Period. Obtain an estimate from the [Fuel] supply company to cover a valid period."
        Software:
        Applies the 'default' procedure setting OR to 200 and other variables to their default values, as defined at 7.1, and
        GO TO END OF CALCULATION PROCEDURES (preparatory to DEC information transfer)

9.11   *Software sets Synchronisation warnings as necessary based on difference between start and end dates of both measurement period and assessment period*

    FOR each Fuel other than the Main Heating Fuel
    Calculate "m" = number of days difference between "Start date of the [Fuel] measuring period" and "Start date of the Assessment Period"
    Calculate "mm" = number of days difference between "End date of the [Fuel] measuring period" and "End date of the Assessment Period
    IF either "m" or "mm" is between +/-7 and +/- 31

        Generate **but do not display** a Data Synchronisation warning for the Assessor as:
        "The Measurement Period for [Fuel] is ["m" or "mm"] days out of line with the 365 day Assessment Period"

    IF either "m" or "mm" is > 31 or < -31

        Generate a message "Invalid alignment with Assessment Period. Obtain an estimate from the [Fuel] supply company to cover a valid period"
        Software:
        Applies the 'default' procedure setting OR to 200 and other variables to their default values, as defined at 7.1, and
        GO TO END OF CALCULATION PROCEDURES (preparatory to DEC information transfer)

FOR those [fuels] for which a Data Quality warning, or Data Synchronisation warning, was generated:

    Software calculates "Misaligned 365 Day CO_2 Emissions [fuel]" as:
    365 Day Energy Consumption[fuel]" x "CO_2 Conversion Factor[fuel]

    Software adds all "Misaligned 365 Day CO_2 Emissions [fuel]" to obtain:
    "Total Misaligned 365 Day CO_2 Emissions"

IF "Total Misaligned 365 Day CO_2 Emissions"/"Reference Total CO_2 emissions" > 0.05
Display the Data Quality and Data Synchronisation warnings to the Assessor

(Note: Synchronisation and Measurement Period warnings apply only where the energy uses affected <u>collectively</u> contribute more than 5 per cent to the total CO_2 emissions)

(Note: Synchronicity and Measurement Period warning(s) are given after the entry of all energy data has been completed. The software must allow the user to go back to previous pages to modify input data.)

10.   Obtain Relevant 365 Day Energy Consumptions

IF Separable Energy Deductions Electrical > 0
OR IF Separable Energy Deductions Non-Electrical > 0

For each fuel used, software calculates Relevant 365 Day Consumption (fuel) as:

Relevant 365 Day Consumption [fuel] =
365 Day Energy Consumption [fuel] – 365 Day Separable Energy [fuel]

ELSE software sets:
Relevant 365 Day Consumption [fuel] = 365 Day Energy Consumption [fuel]

(Note: "Relevant 365 Day Consumption [electricity]" is needed separately later)

11.   Obtain Relevant 365 Day Non-electric Energy Consumption

11.1   Software calculates the Relevant 365 Day Non-electric Energy Consumption from all sources other than electricity as:

Relevant 365 Day Non-electric Energy Consumption =
Sum for all fuels, omitting "Relevant 365 Day Consumption [electricity]", of individual "Relevant 365 Day Consumption [fuel]"

12.   Obtain 365 Day Contribution from On-site Renewable (OSR) Energy sources and output from other LZC

(Note: OSR/LZC energy sources may be either "Electricity" or "Thermal" – ie "Heating" or "Cooling", and that there may be more than one OSR/LZC source of each type)

BEGINNING OF OSR/LZC ENTRY LOOP

Software prompts Assessor "Do you want to enter details for an On Site Renewable or LZC energy source? Y/N"

If response is "N", then bypass OSR/LZC entry procedures *(for Electricity, Heating and Cooling)* and go to **END OF OSR/LZC ENTRY LOOP**

If response is "Y"
Software prompts the Assessor to specify a [Renewables type] for the OSR/LZC
Software allocates a [number] to the OSR/LZC entry

("[number]" = 1 for the first OSR entered, "[number]" = 2 for the second.. etc)
Software prompts the Assessor to specify whether this "[Renewables type][number]"
provides "Electricity", "Heating" or "Cooling"

If response is "Electricity" go to the **Beginning of OSR/LZC Electricity entry loop**

If response is "Heating" go to the **Beginning of OSR/LZC Heating entry loop**
If response is "Cooling" go to the **Beginning of OSR/LZC Cooling entry loop**

12.1 Beginning of OSR/LZC Electricity entry loop

Software prompts Assessor for energy measurement details of "[Renewables type]
[number]"

Software prompts Assessor to enter:
"Metered OSR [Electricity] Energy" *(kWh)* supplied by OSR source
and the associated
"Start Date of Energy Measuring Period OSR [Electricity]" and
"End Date of Energy Measuring Period OSR [Electricity]"
from these Software calculates
" OSR [Electricity] Metering Period" *(days)*

IF Start Date or End Date of the Energy Measuring Period OSR [Electricity] is not
within 31 days of the Assessment period Start Date and End Dates,
THEN software generates a warning to the Assessor:
"Measuring period for "[Renewables type][number]" is out synchronisation with the
Assessment Period"
"This OSR cannot be displayed on the DEC"
Software sets Metered OSR [Electricity] Energy to ZERO

IF "OSR [Electricity] Metering Period" – 365 is > 15 or < -15
Then software generates messages to the Assessor:
"Measuring Period for "[Renewables type][number]" is outside the acceptable +/-
15 day limits."
"This OSR cannot be displayed on the DEC"
Software sets Metered OSR [Electricity] Energy to ZERO

IF "Metered OSR [Electricity] Energy" > 0

Software calculates "365 Day OSR [Electricity] Energy [Renewables type]
[number]" as:

"365 Day OSR [Electricity] Energy [Renewables type][number]" =
Metered OSR [Electricity] Energy x 365/OSR [Electricity] Metering Period *(kWh)*

RETURN TO BEGINNING OF OSR/LZC ENTRY LOOP

12.2 Beginning of OSR/LZC Heating entry loop

Software prompts Assessor for energy measurement details of "[Renewables type]
[number]"

Software prompts Assessor to enter:
"Metered OSR [Heating] Energy" *(kWh)* supplied by OSR source
and the associated
"Start Date of Energy Measuring Period OSR [Heating]" and
"End Date of Energy Measuring Period OSR [Heating]"
from these Software calculates
"OSR [Heating] Metering Period" *(days)*

IF Start Date or End Date of the Energy Measuring Period OSR [Heating] is not within 31 days
of the Assessment period Start Date and End Dates,
THEN software generates a warning to the Assessor:
"Measuring period for "[Renewables type][number]" is out synchronisation with the
Assessment Period"
"This OSR cannot be displayed on the EPC"
Software sets Metered OSR [Heating] Energy to ZERO

> IF "OSR [Heating] Metering Period" – 365 is > 15 or < -15
> Then software generates messages to the Assessor:
> "Measuring Period for "[Renewables type][number]" is outside the acceptable +/-
> 15 day limits."
> "This OSR cannot be displayed on the EPC"
> Software sets Metered OSR [Heating] Energy to ZERO

> IF "Metered OSR [Heating] Energy" > 0

>> Software calculates "365 Day OSR [Heating] Energy [Renewables type][number]"
>> as:

>> "365 Day OSR [Heating] Energy [Renewables type][number]" =
>> Metered OSR [Heating] Energy x 365/OSR [Heating] Metering Period *(kWh)*

   RETURN TO BEGINNING OF OSR/LZC ENTRY LOOP

12.3 **Beginning of OSR/LZC Cooling entry loop**

Software prompts Assessor for energy measurement details of "[Renewables type]
[number]"

Software prompts Assessor to enter:
"Metered OSR [Cooling] Energy" *(kWh)* supplied by OSR source
and the associated
"Start Date of Energy Measuring Period OSR [Cooling]" and
"End Date of Energy Measuring Period OSR [Cooling]"
from these Software calculates
"OSR [Cooling] Metering Period" *(days)*

IF Start Date or End Date of the Energy Measuring Period OSR [Cooling] is not within 31 days
of the Assessment period Start Date and End Dates,
THEN software generates a warning to the Assessor:
"Measuring period for [Renewables type][number] is out synchronisation with the
Assessment Period"

"This OSR cannot be displayed on the EPC"
Software sets Metered OSR [Electricity] Energy to ZERO

> IF "OSR [Cooling] Metering Period" – 365 is > 15 or < -15
> Then software generates messages to the Assessor:
> "Measuring Period for [Renewables type][number] is outside the acceptable +/- 15 day limits."
> "This OSR cannot be displayed on the EPC"
> Software sets Metered OSR [Cooling] Energy to ZERO

> IF "Metered OSR [Cooling] Energy" > 0

>> Software calculates "365 Day OSR [Cooling] Energy [Renewables type][number]" as:

>> "365 Day OSR [Cooling] Energy[Renewables type][number]" =
>> Metered OSR [Cooling] Energy x 365/OSR [Cooling] Metering Period (kWh)

RETURN TO BEGINNING OF OSR/LZC ENTRY LOOP

END OF OSR/LZC ENTRY LOOP

12.4   *Software totals the Electricity, Heating and Cooling (thermal) energy elements of the OSR/ LZC contributions, and calculates their respective and total CO_2 savings*

For each [Renewables type][number] entered:

Where [Renewables type][number] provides Electricity:
Software calculates:
Total 365 Day OSR [Electricity] Energy =
Total 365 Day OSR [Electricity] Energy + "365 Day OSR [Electricity] Energy [Renewables type][number]"

Software calculates "CO_2 avoided by use of OSR [Renewables type][number]" as:
CO_2 avoided by use of OSR [Renewables type][number] = "365 Day OSR [Electricity] Energy [Renewables type][number]" x CO_2 Conversion Factor[electricity]

Software calculates "Percent CO_2 avoided by [Renewables type][number]" as:
"Percent CO_2 avoided by [Renewables type][number]" = 100 x "CO_2 avoided by use of OSR [Renewables type][number]"/Reference Total CO_2 emissions

Where [Renewables type][number] provides Heating energy:
Software calculates:
Total 365 Day OSR [Heating] Energy =
Total 365 Day OSR [Heating] Energy + "365 Day OSR [Heating] Energy [Renewables type][number]"

Software calculates "Percent CO_2 avoided by [Renewables type][number]" as:

> IF the "Main Heating Fuel" is "Electricity"

Software asks assessor "Is [Renewables type][number] heating plant a heat pump?" Y/N

IF response is "Y"

Software calculates "CO_2 avoided by use of OSR [Renewables type][number]" as:
CO_2 avoided by use of OSR [Renewables type][number] =
(365 Day OSR [Heating] Energy/0.8) x CO_2 Conversion Factor[Gas]

ELSE

"CO_2 avoided by use of OSR [Renewables type][number]" =
(365 Day OSR [Heating] Energy/0.8) x CO_2 Conversion Factor[Main Heating Fuel]

"Percent CO_2 avoided by [Renewables type][number]" = 100 x "CO_2 avoided by use of OSR [Renewables type][number]"/Reference Total CO_2 emissions

Where [Renewables type][number] provides Cooling energy::
Software calculates:
Total 365 Day OSR [Cooling] Energy =
Total 365 Day OSR [Cooling] Energy + "365 Day OSR [Cooling] Energy [Renewables type][number]"

Software calculates "CO_2 avoided by use of OSR [Renewables type][number]" as:
CO_2 avoided by use of OSR [Renewables type][number] =
"365 Day OSR [Cooling] Energy/2.25) x CO_2 Conversion Factor[Electricity]

Software calculates "Percent CO_2 avoided by [Renewables type][number]" as:
"Percent CO_2 avoided by [Renewables type][number]" = 100 x "CO_2 avoided by use of OSR [Renewables type][number]"/Reference Total CO_2 emissions

Software calculates:
Total Electrical CO_2 avoided by use of OSR as:
Total Electrical CO_2 Avoided by OSR = Sum of all "CO_2 avoided by use of OSR [Renewables type][number]" that provide electricity

Software calculates:
Total Heating CO_2 avoided by use of OSR as:
Total Heating CO_2 Avoided by OSR = Sum of all "CO_2 avoided by use of OSR [Renewables type][number]" that provide Heating energy

Software calculates:
Total Cooling CO_2 avoided by use of OSR as:
Total Cooling CO_2 Avoided by OSR = Sum of all "CO_2 avoided by use of OSR [Renewables type][number]" that provide Cooling energy

12.5 Software calculates the Total CO_2 avoided by the use of OSR as:

Total CO_2 Avoided by OSR =
Total Electrical CO_2 Avoided by OSR + Total Heating CO_2 Avoided by OSR + Total Cooling CO_2 Avoided by OSR

12.6   Software converts Total CO_2 avoided by the use of OSR from kg to tonnes as:

Tonnes CO_2 avoided by OSR = Total CO_2 Avoided by OSR/1000
(Note: Histogram displays tonnes CO_2)

12.7   Software calculates Percentage Electrical Energy from On Site Renewables as:

Percentage Electrical Energy from OSR =
100 x Total 365 Day OSR [Electricity] Energy/(Relevant 365 Day Electrical Energy
Consumption + Total 365 Day OSR [Electricity] Energy)

12.8   Software calculates Total and Percentage Thermal Energy from On Site Renewables as:

Total Thermal Energy from OSR =
Total 365 Day OSR [Heating] Energy + Total 365 Day OSR [Cooling] Energy

Percentage Thermal Energy from OSR =
100 x (Total Thermal Energy from OSR)/(365 Day Energy Consumption [non-electrical] +
Total Thermal Energy from OSR)

13.   Obtain Relevant 365 Day CO_2 Emissions

13.1   Using the most recent Carbon Intensities (Conversion Factors) for each fuel
(Note: units $kgCO_2/kWh$)
(Note: CO_2 intensity conversions table previously downloaded from the CIP)

IF "365 Day Energy Consumption District Heating" > zero

Software prompts Assessor for "CO_2 Conversion District Heating" *(units $kgCO_2/kWh$)*

(This requires a statement from the 'District' heating supplier stating the CO_2 intensity (units $kgCO_2/kWh$) of the heating supplied over the preceding 12-month period)

13.2   IF "365 Day Energy Consumption District Cooling" > zero

Software prompts Assessor for "CO_2 Conversion District Cooling" *(units $kgCO_2/kWh$)*

(This requires a statement from the 'District' cooling supplier stating the CO_2 intensity (units $kgCO_2/kWh$) of the cooling supplied over the preceding 12-month period)

13.3   IF "365 Day Energy Consumption (Free Field fuel)" > zero

Software prompts Assessor for "CO_2 Conversion (Free Field fuel)" *(units $kgCO_2/kWh$)*

(This requires a statement from the Assessor stating the CO_2 intensity (units $kgCO_2/kWh$) of the "Free Field" fuel over the preceding 12-month period, and referencing a suitable form of evidence)

13.4 Software calculates "Relevant 365 Day CO_2 Emissions [fuel]" *(kgCO$_2$/year)* for each fuel from Relevant 365 Day Energy [fuel] and CO_2 Conversion Factor [fuel] as:

Relevant 365 Day CO_2 Emissions [fuel] =
Relevant 365 Day Energy [fuel] x CO_2 Conversion Factor [fuel]   *(kgCO$_2$/year)*

13.5 Software calculates Relevant 365 Day TCO_2 Emissions [fuel] *(CO$_2$/year)* for each fuel as:

Relevant 365 Day TCO_2 Emissions [fuel] =
Relevant 365 Day CO_2 Emissions [fuel]/1000   *(TCO$_2$/year)*

(Note: carbon emissions in Tonnes CO$_2$/year)

13.6 Software calculates "Relevant 365 Day Total CO_2 Emissions" *(kgCO$_2$)* as the sum of all the "Relevant 365 Day CO_2 Emissions [fuel]" for each fuel and energy supplied as:

Relevant 365 Day Total CO_2 Emissions = the sum of all:

Relevant 365 Day CO_2 Emissions [fuel]

Where [fuel] may include Electricity; Natural Gas; LPG; Biogas; Oil; Coal; Anthracite; Smokeless fuel (inc coke); Biomass; District Heating; District Cooling; (Free Field fuel)

13.7 Software calculates Thermal CO_2 avoided by use of OSR as:

Thermal CO_2 Avoided by OSR =
Total Heating CO_2 Avoided by OSR + Total Cooling CO_2 Avoided by OSR

13.8 Software calculates Total CO_2 avoided and Percentage of Total CO_2 avoided by use of On Site Renewables

13.9 Total CO_2 Avoided by OSR =
 (Thermal CO_2 Avoided by OSR + Total Electrical CO_2 Avoided by OSR)

Histogram CO_2 Avoided by OSR = Total CO_2 Avoided by OSR/1000
(Note: Histogram displays tonnes CO$_2$)

13.10 Percentage of Total CO_2 Avoided by OSR =
100 x (Thermal CO_2 Avoided by OSR + Total Electrical CO_2 Avoided by OSR)/(Reference Total CO_2 emissions + Thermal CO_2 Avoided by OSR + Total Electrical CO_2 Avoided by OSR)

13.11 Software calculates "Relevant 365 Day Total TCO_2 Emissions" *(TCO$_2$/year)* as:
Relevant 365 Day Total TCO_2 Emissions =
Relevant 365 Day Total CO_2 Emissions/1000   *(TCO$_2$/year)*

(Note: Converts from kg CO$_2$/year to Tonnes CO$_2$/year for summary table)

14. Determine building Total Usable Floor Area (TUFA)

Software calculates "TUFA" as:

TUFA = TUFA Category[##1] + TUFA Category[##2] + ……. + TUFA Category[##5]

(Note: sum of all the (up to 5) individual benchmark category TUFAs)

15. Determine Total Area for DEC Assessment (TADA)

15.1 Software calculates Total Area for DEC Assessment "TADA" as:

TADA = TUFA – Separable Energy Area

OPERATIONAL RATING CALCULATOR

16. Calculate the Operational Rating (OR) and Grade

16.1 Software calculates the Relevant 365 Day Total Carbon Density as:

Relevant 365 Day Total Carbon Density =
Relevant 365 Day Total CO_2 Emissions/TADA

IF Number of Building Categories >1

Software calculates the Operational Rating as:

Operational Rating =
(100 x Relevant 365 Day Total Carbon Density/Composite Benchmark) with the **result rounded to the nearest integer**

Software sets OR Calculation flag to "Composite Rating "

ELSE

Software calculates the Operational Rating as:

Operational Rating =
(100 x Relevant 365 Day Total Carbon Density/DD & Occ Corrected CO_2 Density)
with the result **rounded to the nearest integer**

16.2 The [OR Grade] (Label) is determined by the OR (%) according to:

IF Operational Rating > 150   OR Grade = G
ELSE IF Operational Rating > 125   OR Grade = F
ELSE IF Operational Rating > 100   OR Grade = E
ELSE IF Operational Rating > 75   OR Grade = D
ELSE IF Operational Rating > 50   OR Grade = C
ELSE IF Operational Rating > 25   OR Grade = B
ELSE IF Operational Rating > or = 0   OR Grade = A

17.   Calculate the Non-electrical Energy and Electrical Energy Ratios

IF Number of Building Categories >1
(compares the Relevant 365 Day Non-electrical and Electrical Energies with the composite benchmark components calculated earlier:
    CBE   = Composite Benchmark Electrical
    CBNE   = Composite Benchmark Non-Electrical
These are converted back to energy densities using the Standard CO_2 conversion factors from the CIP for Electricity and Gas)

Software calculates:
DD & Occ Corrected Electricity Energy Density =
Composite Benchmark Electrical *(CBE)*/"CO_2 Conversion Factor[Electricity]"
and
DD & Occ Corrected Non-Electricity Energy Density =
Composite Benchmark Non-Electrical *(CBNE)*/"CO_2 Conversion Factor [Gas]"
(Note: results are in kWh/m^2)

ELSE

Software calculates:
DD & Occ Corrected Electricity Energy Density =
DD & Occ Corrected Electricity CO_2 Density/"CO_2 Conversion Factor [Electricity]"
and
DD & Occ Corrected Non-Electricity Energy Density =
DD & Occ Corrected Non-Electricity CO_2 Density/" CO_2 Conversion Factor[Gas]"

Software calculates Electrical Energy Density as:
Electrical Energy Density =
Relevant 365 Day Consumption (electricity)/TADA

(Note: for the Technical Table, (electricity) here will also include (heating electricity) where this has been either entered directly or derived from the overall electricity use)

17.1 Software calculates Electrical Energy Ratio as:
Electrical Energy Ratio =
100 x Electrical Energy Density/DD & Occ Corrected Electricity Energy Density
with the **result rounded to the nearest integer**

17.2 Software calculates Non-Electrical Energy Density as:
Non-Electrical Energy Density =
Relevant 365 Day Consumption (Non-Electricity)/TADA

(Note: for the Technical Table, (Non-electricity) here means the sum of all fuels that are not electricity – so the sum does not include "heating electricity")

17.3 Software calculates Non-Electrical Energy Ratio as
Non-Electrical Energy Ratio =
100 x Non-Electrical Energy Density/DD & Occ Corrected Non-Electricity Energy Density
with the **result rounded to the nearest integer**

(Note: Electrical and Non-electrical Ratios are calculated as whole number Percentages)

18. Generate and display the full Technical Table

The Technical Table to be displayed to the Assessor contains the following:

Annual energy use, CO_2 emissions, and performance indicators:

- Total energy in the year concerned (Fuel and heat) (kWh):
  "Relevant 365 Day Consumption (Non-Electricity)"

- Total energy in the year concerned (Electricity) (kWh):
  "Relevant 365 Day Consumption (electricity)"

- Resulting total CO_2 emission (tonnes CO_2):
  "Relevant 365 Day Total TCO_2 Emissions"

- Separable energy use deducted #1 (Fuel and heat) (kWh):
  "[Description]365 Day Separable Energy [Non-Electrical]" *(1st [Description] entered)*

- Separable energy use deducted #1 (electricity) (kWh):
  "[Description]365 Day Separable Energy [Electricity]" *(1st [Description] entered)*

- Separable energy use deducted #1 (CO_2 emissions) (tonnes CO_2):
  "[Description]365 Day Separable CO_2 Emissions"/1000 *(1st [Description] entered)*
  (Note: result converted here to tonnes CO_2)

- Separable energy use deducted #2 (Fuel and heat) (kWh):
  "[Description]365 Day Separable Energy [Non-Electrical]" *(2nd [Description] entered)*

- Separable energy use deducted #2 (electricity) (kWh):
  "[Description]365 Day Separable Energy [Electricity]" *(2nd [Description] entered)*

- Separable energy use deducted #2 (CO_2 emissions) (tonnes CO_2):
  " [Description]365 Day Separable CO_2 Emissions"/1000 *(2nd [Description] entered)*
  (Note: result converted here to tonnes CO_2)

- Calculated performance indicators(Fuel and heat) (kWh/m² p.a.):
  "Non-Electrical Energy Density"

- Calculated performance indicators(Electricity) (kWh/m² p.a.):
  "Electrical Energy Density"

- Calculated performance indicators (CO_2 emission) (kgCO_2/m²):
  "Relevant 365 Day Total Carbon Density"

- Reference performance benchmarks corrected (Fuel and heat) (kWh/m²):
  "CBNE" (where Composite Benchmark was used), or
  "DD & Occ Corrected Non-Electricity Energy Density" (where single benchmark was used)

- Reference performance benchmarks corrected (electrical) (kWh/m²):
  "CBE" (where Composite Benchmark was used), or
  "DD & Occ Corrected Electricity Energy Density" (where single benchmark was used)

- Reference performance benchmarks corrected (CO_2 emission) ($kgCO_2/m^2$):
  "CB" (where Composite Benchmark was used), or
  "DD & Occ Corrected Total CO_2 Density" (where single benchmark was used)

- Benchmark ratio and Operational Rating (Fuel and heat):
  "Non-Electrical Energy Ratio"

- Benchmark ratio and Operational Rating (electrical):
  "Electrical Energy Ratio"

- Benchmark ratio and Operational Rating (CO_2 emissions):
  "Operational Rating"

- Operational Rating grade (A-G):
  "OR Grade"

- Fossil fuel energy displaced (fuel and heat):
  "Total Thermal Energy from OSR"

- Fossil fuel energy displaced (%age kWh displaced):
  100 x ("Total Thermal Energy from OSR"/("Relevant 365 Day Consumption [Non-Electricity]" + ("Total Thermal Energy from OSR")

- Grid electrical energy displaced (electricity):
  "Total 365 Day OSR [Electricity] Energy"

- Grid electrical energy displaced (%age kWh displaced):
  100 x ("Total 365 Day OSR [Electricity] Energy"/("Relevant 365 Day Consumption [electricity]" + ("Total 365 Day OSR [Electricity] Energy")

Building Types:

For Benchmark Categories from [1] up to [5] *(where entered):*

- Benchmark Category ##:
  "Benchmark Category [##]" *(Category [1] should be the Main Benchmark Category)*

- Benchmark Category ##, Area (m^2):
  TUFA Category[##]

- **Total Usable Floor Area:**
  "TUFA"

- Total accessible unconditioned area (m^2):
  "Unconditioned Floor Area"

- **Separable:**

For each Separablewww use entered, eg, Separable type #1:

- Separable type #1:
  "[Description]" *(1ˢᵗ "[Description]" entered)*
and
- Area for Separable type #1:
  " [Description]Separable Energy "Area" " *(1ˢᵗ [Description])*

- **Total Area for DEC Assessment (TADA):**
  "TADA" *(ie, the TUFA with Separable Energy use areas removed)*

19. Generate the draft DEC

Generate:
(a) DEC pdf marked draft
(b) transitional output data file (xml) which is the same as final output data file less the RRN
(c) full Technical Table

DEC generation module to generate:
(a) RRN
(b) final DEC pdf
(c) input, output and header data files

All data input is done at calculation module level

If no UPRN is entered this should not halt the process, only a draft DEC can be generated

Temporary transitional files can be saved half way through the process to enable Assessors to come back to the files and continue work

19.1   The software prompts the Assessor:

> "Do you want to generate"
> - DEC?
> - Input Data File?
> - Output Data File
> - DEC, and Input and Output Files?

19.2   According to Assessor response, software generates:

> - the draft of the DEC (.pdf)

> - the OR/DEC calculation input file (XML)

> - the OR/DEC calculation output file (XML)

> *(Need to automate: (Insert "Expiry Date" which is 12 months from the <nominated date>, which is no more than three months after the period over which the rating displayed on the certificate has been calculated)*

19.3 For buildings with a Welsh Postcode, software offers the option of generating the DEC in the Welsh language.

END OF DATA ENTRY AND CALCULATION PROCEDURE

Generate the draft Advisory report

20.1 IF the "Valid Until" date on an existing report is later than "Current Date + one year

Assessor is given the option of omitting the report generation procedure

ELSE

CONTINUE TO ADVISORY REPORT GENERATOR

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