Methodology for the production of Display Energy Certificates (DEC)

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Summary

This manual describes the methodology adopted in Ireland for the calculation of a building energy rating for public display and Display Energy Certificate (DEC). The DEC is designed for public display and incorporates the operational energy rating for public display and other relevant performance information. The DEC for public display is an indicator of operational performance of a building which expresses the annual primary energy consumption associated with the operation of the building as a percentage of a value that would be considered typical for the particular type of building. An indicator of performance with regard to carbon dioxide emission is also included on the DEC certificate. This is derived from the annual carbon dioxide emission per unit of area of the building caused by its consumption of energy relative to a value that would be considered typical for the particular type of building.

Guidance is given on the scope and requirements of the Regulations applying to large public buildings and on how these are applied. While this guidance aims to explain how the requirements will work in practice, any interpretation of the Regulations is offered only as a guide, and should not be considered as carrying legal authority. Only the courts can provide an authoritative interpretation of the law. Therefore, it is important to read and understand the Regulations as well.

The methodology described in this document is an adaptation of the methodology developed for Display Energy Rating of buildings occupied by public bodies in England and Wales. Permission of the Department of Communities and Local Government (DCLG) London to adapt this methodology for use in Ireland is gratefully acknowledged.

Section 1

Introduction

The implementation of the Energy Performance of Buildings Directive in Ireland introduces a number of requirements with regard to the carrying out of Building Energy Rating (BER) assessments, the preparation of BERs and the provision and/or display of BER certificates. The issuing authority for all such ratings and certificates in Ireland is the Sustainable Energy Authority of Ireland (SEAI).

For any rating to be useful it is necessary that the various forms of energy consumption (expected or experienced) be brought together on a common basis so that the performance of one building can be compared with that of another. Ireland has decided that

a) The common unit should be primary energy consumption associated with the delivered energy used at the building level since this is a key driver for energy policy.

b) The rating should be expressed as a grade on an A-G scale in a similar manner to many household appliances. Each main division on the scale is further subdivided so as to more easily distinguish differences in performance and facilitate progression to better ratings as performance improves.

c) The BER certificates should contain a secondary rating on the basis of CO_2 emissions associated with the energy use involved as this reflects the importance of CO_2 in relation to our national climate change strategy.

The precise method of carrying out BER assessments and calculation of BERs varies with the type and purpose of the rating involved, as does the format of BER certificate produced. This document deals with the requirement for large buildings occupied on or after 9th January 2013 and frequently visited by the public, which must secure and display a valid DEC in a prescribed format in a prominent place. The purpose of this particular requirement is to ensure that large buildings set an example in taking environmental and energy considerations into account and that this is clearly demonstrated to the public. In particular, it is intended to discourage misuse of heating, air-conditioning and ventilation systems and to encourage organisations to monitor, control and reduce energy use in buildings. For this reason Ireland has decided that this type of BER should be derived from an ‘operational rating’ of the building – referred to in this document as an ‘operational BER’. The certificate produced is designed for public display and is called a Display Energy Certificate (DEC). The DEC is designed for public display and incorporates an operational Building Energy Rating (BER) and other relevant performance information.

An operational rating is defined as 'a numeric indicator of the amount of energy consumed during the occupation of the building over a period of 12 months'. The operational BER displayed on the DEC is derived from this and is a measure of the annual primary energy consumption per unit of area of the building associated with the delivered energy

consumed compared to a value that would be considered typical for the particular type of building, i.e.

(Building primary energy consumption/Building area) x 100)/Typical primary energy consumption per unit area

To enable the performance of one building to be compared with another, the calculation underpinning the operational BER has several factors which can be adjusted. Each building is categorised and this determines which benchmark the building will be compared with. The benchmarks represent energy use of a typical building of that type, under a number of standardised conditions for temperature, occupancy and proportion of non-electrical energy used. Under certain circumstances, these benchmarks may be adjusted according to location, occupancy and the ratio of non-electrical energy used. Certain buildings have activities which span more than one of the building categories. In these cases it is possible to develop a bespoke composite benchmark which will be relevant to that specific building and the activities it houses.

This document provides details of the assumptions and conventions underpinning the methodology. Frequently Asked Questions (FAQs) relating to the production and display of DECs are available at www.seai.ie/ber

Section 2

Scope

This guidance describes the national methodology for the production of display energy certificates (DEC) to be used for public display in large buildings, in accordance with the requirements of the European Union (Energy Performance of Buildings) Regulations 2012 (S.I. 243 of 2012). These Regulations implement the requirements of the Energy Performance of Buildings Directive (Directive 2010/31/EC) of the European parliament and of the Council in Ireland. Article 13 of these Regulations specifies that *"where a total useful floor area over 500 m 2 of a building for which an energy performance certificate has been issued in accordance with Article 12(1) is occupied by public authorities and frequently visited by the public, the energy performance certificate is displayed in a prominent place clearly visible to the public."* and "*where a total useful floor area over 500 m 2 of a building for which an energy performance certificate has been issued in accordance with Article 12(1) is frequently visited by the public, the energy performance certificate is displayed in a prominent place clearly visible to the public."*

Section 3

Applicable Conventions

3.1 Basis for the DEC

An operational BER is based on an operational energy rating of a building derived from the actual energy use of the building in operation. An operational rating is defined as a numeric indicator of the amount of energy actually consumed during the occupation of the building over a period of 12 months. The operational BER represents the performance of the building relative to the performance of a typical building of its type. It is derived by comparing the energy consumption of the building with the benchmark energy consumption of other buildings representative of its type, calculated according to the methodology set out in this document and expressed as a grade on an A - G scale.

3.1.1 Operational BER:
Buildings often use more than one form of energy but simply adding together annual consumptions of, for example, gas and electricity is unhelpful in any accounting as the forms of energy represent different primary energies, different costs, and give rise to different carbon emissions. From an energy perspective, the important factor is the primary energy represented by the particular combinations of delivered energies actually consumed in the building, i.e. the primary energy equivalence of the energy actually used. This is calculated from the delivered energy consumption of the building. It is intended that quantification of the delivered energy consumed is based as far as possible on meter readings. So that uses of different forms of energy can be added together and compared on a common basis, Ireland has adopted this equivalent primary energy as the common unit on which energy performance assessment is based. The operational BER can be expressed as follows:

(Building primary energy consumption/Building area) x 100)/Typical primary energy consumption per unit area)

A building with performance equal to one typical of its type would therefore have an operational BER of 100. A building that resulted in zero primary energy consumption would have an operational BER of zero, and a building that resulted in twice the typical primary energy consumption would have an operational BER of 200. If the building is a net energy generator, it would still be given an operational BER of zero – it is not possible to achieve a rating less than zero.

3.1.2 CO_2 Performance:
The question of carbon dioxide (CO_2) emissions is also considered as particularly critical and central to the national climate change strategy. For this reason, the Display Energy Certificate (DEC) also contains an assessment of CO_2 emission performance calculated in a manner analogous to the calculation of the operational BER, i.e. a measure of the

annual CO_2 emission per unit of area of the building caused by its actual consumption of energy, compared to a value that would be considered typical for the particular type of building.

3.1.3 Relevant time periods:
There are three separate but related time periods involved in the implementation of the DEC system. These are the *period of validity* of the DEC, the *assessment period* on which the operational BER is based and the *measurement period* to which fuel use measurements actually apply.

The **Period of Validity** is *365 days commencing on a date proposed by the relevant public body and accepted by SEAI (the Nominated Date*). This must be within a limited period of the end of the Assessment Period. The **Assessment Period** is *the one-year period (365 days) over which the energy inputs for the calculation of the operational BER are considered to have been used*. Ideally this would be the same as the **Measurement Period** which is *the period for which fuel use is actually measured or estimated*. In reality the different forms of energy consumed are likely to have been measured over different periods, and may be displaced in time from each other. This is acceptable provided there is an acceptable relationship between the assessment period and the measurement period for all fuels. Requirements with regard to assessment and measurement periods are dealt with in sub-sections 3.3.2 and 3.3.3 below.

3.3.4 Trend data:
Since one purpose of the DEC is to encourage and demonstrate performance improvement over time, performance data for previous years, where available, is also included on the certificate.

3.1.5 DEC Content:
In summary, the DEC, which should be displayed in a prominent place, contains the following key elements:

- An operational BER for the building expressed as a grade on a scale expressing the equivalent primary energy consumption per unit floor area as a percentage of a value that would be considered typical for the particular type of building;
- A primary energy indicator expressed in terms of primary energy use per unit floor area;
- a CO_2 performance indicator shown as a position on a linear scale representing the annual CO_2 emission per unit of area of the building caused by its consumption of energy as a percentage of a value that would be considered typical for the particular type of building) together with a numerical indicator of the CO_2 emissions of the building;
- histograms of trends in energy and CO_2 performance in up to three most recent years.

Within this simple description, though, each of the terms used requires further clarification

so that buildings can be compared on an even basis.

3.2 Defining the building

This methodology applies to buildings, or parts of buildings designed, or altered, to be used separately. In an ideal situation each building has its own energy meters or, where only part of a building is occupied by the authority that needs to display a DEC, that part is metered separately.

Where there is a group of buildings on a site that is metered only at site level, then each building should normally be assessed individually. The energy used by each building is determined from the site energy consumption on a simple area weighted basis. The process of disaggregating the energy on an area weighted basis means that the DEC for each building will be the same and equivalent to a DEC that would have been obtained if a site based assessment had been carried out.

3.2.1 Building area

The building area measurement specified in the legislation is the Total Useful Floor Area (TUFA). This is the same as the Gross Internal Area (GIA) commonly used in commercial property surveying, and for which measurement conventions are based on the SCS/IAVI Measuring Practice Guidance Notes. The method of measurement of total useful floor area is also set out in Technical Guidance Document L of the Building Regulations, which states that *'linear measurements for the calculation of wall, roof and floor areas and building volumes should be taken between the finished internal faces of the appropriate external building elements'*

In this convention:

a the area of sloping surfaces such as staircases, galleries, raked auditoria, and tiered terraces should be taken as their area on plan; and

b areas that are not enclosed such as open floors, covered ways and balconies are excluded.

Some building sectors commonly use alternative measures of area, notably Net Lettable Area (NLA) for the commercial office sector, and Sales Floor Area (SFA) for retail premises. Where these are the only measurements available for these building types, then the calculation may use standard, conservative, conversion factors to obtain GIA from NLA or SFA. These conversion factors, and the building categories for which they may be applied, are defined in the benchmark information described later. The only alternative to using these defined conversion factors would be to measure and provide the total useful floor area directly.

Alternative normalising metrics, such as the number of hotel beds, could be used as part of a non-regulatory, sector specific, initiative. However, these cannot be used to develop a legal DEC nor can they be displayed in a way that might cause any confusion with an 'official' DEC.

3.2.2 Accessible unconditioned areas

Within the Total Useful Floor Area, some covered areas may be untreated (not heated, cooled or ventilated), and are termed accessible unconditioned areas (for example habitable attics and basements). Although these areas are excluded for the purposes of calculation of ratings, data on these areas (measured in terms of useful floor area) are recorded as part of the data entered into the calculation procedure. Each accessible unconditioned area is recorded together with a description of the purpose of the area, so that these can be included in the output data file and be available for subsequent analysis.

Note that where a benchmark is available for the accessible unconditioned space, then a composite benchmark approach should be adopted.

3.3 Determining energy consumption and carbon emissions

The ultimate aim is that all energy flows into the building will be metered. However, it is permitted to use data on energy supply and/or energy consumption estimates provided by the utility companies. The periods covered by these readings and estimates should correspond, within specified limits, to the assessment period on which the used to derive the rating.

It is necessary for 95 per cent or more of the energy consumption of the building to be metered or estimated within acceptable limits. Where insufficient metered or estimated energy consumption information is available to carry out the calculation, a default primary energy consumption rate of double the amount typical for the type of building is assumed giving a G rating for the building. The CO_2 indicator is also set at double the typical value.

3.3.1 Separable energy uses

The aim of the rating methodology is to compare the annual energy consumption of the building with that of a building typical of its type. In some cases, though, the building may include activities that consume energy and which are not considered typical of that building type. Including these activities could reduce the validity of the comparison, and so it may be reasonable to subtract these separable energy uses in certain circumstances.

Allowed separable uses are included as part of the benchmark information described later. No other energy uses may be separated for the assessment. The allowed separable energy uses are:

- Regional server room
- Trading floor
- Bakery oven
- Sports flood lighting
- Furnace, heat treatment or forming process
- Blast chilling or freezing.

The building types for which each particular separable use is acceptable is also specified in the benchmark information.

In order for an energy use to be treated as a separable energy use, the energy assessor must verify that the energy use:

- Is one of the separable energy uses applicable to the benchmark selected for the type of building being assessed,
- Has permanently metered energy use
- Has measured energy use for the assessment period derived from meter readings
- Has associated floor area measured and recorded
- Has a documented review of energy use and efficiency with improvement proposals
- Complies with any other criteria indicated in the benchmark information defining the separable energy use

In order to be able to isolate and remove the annual separable energy consumption from the total, any separable energy uses must be separately metered. This is to ensure that the adjustment is based on robust evidence and will also encourage the installation of sub-meters. The separable energy Measurement Period must be within the range 365 +/- 7 days, and the measurement period must be aligned to begin within +/- 31 days of the beginning, or end within +/- 31 days of the end, of the assessment period. Otherwise, the separable energy use will not be accommodated and discounted in the calculation.

Information on the energy consumption (by supply type) and the floor area of any separable energy use is recorded as part of the data collection process The measured separable energy use energy demand is not presented on the DEC but might be used later to develop or refine further benchmarks.

Where an energy assessor identifies a particular function involving energy use differing significantly from the remainder of the building but which does not qualify to be treated as a separable energy use, the assessor might alternatively deal with the space separately, using the same method as the remainder of the building, as the subject of a composite rating, as indicated later.

3.3.2 The assessment period

The operational BER is based on annual energy consumption, which is defined as the energy consumed over the assessment period of 365 days. This constant number of days has been selected in preference to one calendar year, remaining as 365 days rather than 366 in leap years. The Assessment Period is *the one-year period (365 days) over which the energy inputs for the calculation of the operational BER are considered to have been used*, and is aligned with the measurement period of the main heating fuel used in the building. If the main heating fuel is measured over a period of exactly one year (365 days), then the Assessment Period is the measurement period. Otherwise either the start date of the assessment period is taken as the start date of the measurement period of the main heating fuel, or the end date is taken as the end date of that measurement period.

3.3.3 Energy measurement periods

The measurement period is *the period for which fuel use is measured or estimated*. The ideal situation would be where all energies are metered over the same one-year period. However it is recognised that, at least during the early years of carrying out assessments, the different forms of energy consumed are likely to have been measured over different periods, and may be displaced in time from each other. Provided the differences in period length are within reasonable limits, the calculation accommodates these by extrapolating or interpolating from shorter or longer measurement periods. Displacements in time (or lack of synchronisation) between the measurement periods of different fuels could, also make the measurements incompatible and so displacements beyond certain limits cannot be used to produce a reliable result. In such cases, and in the initial period, the energy assessor will need to obtain estimates over a compatible period from the energy supplier.

Where actual energy measurements and utilities supplier estimates cannot be obtained, or where the data obtained do not satisfy the duration and synchronisation limits, default rating values must be used as outlined above. The default rating grade is set as 'G' based on default primary energy consumption twice the energy consumption benchmark of the building type selected.

The method of extrapolating or interpolating energy use from measurement periods that are not exactly one year depends on the use of the energy. The main heating energy needs to be treated differently to the energies used for other purposes. Uses of energy other than for space heating are considered to be relatively constant in use throughout the year, and so correction is applied on a pro-rata basis according to the length of the measurement period.

The main heating energy is considered to be at least partially weather dependent, and so the measured energy is corrected in proportion to the number of heating degree days in the measured and in the ‘extrapolation’ or ‘interpolation’ periods. However, where there are metered Separable Energy Uses, any metered ‘separable’ use of the main heating fuel must be subtracted from the total before the degree day correction is applied. The metered separable energy use must first be adjusted to a measurement period equal to that of the main heating fuel, and this adjustment is applied on a simple pro-rata daily basis. The degree day corrected component of the main heating fuel consumption and the ‘separable’ use of the main heating fuel, itself re-adjusted to a 365 day period, are then added together to form the adjusted 365 day total consumption of the main heating fuel.

Where the main heating fuel is electricity, and the heating electricity is not separately metered, then a ‘default’ value for the proportion of the electrical consumption deemed to be used for heating is obtained using the benchmark information. This proportion is then treated as being weather dependent, and the degree day correction applied to this proportion.

For the main heating fuel only, if the measurement period does not include complete months at its beginning and end, then the number of degree days in those part-months included is obtained in simple proportion to the number of days that are included in those months. So if the measurement period begins on the 6th day of a month having 31 days,

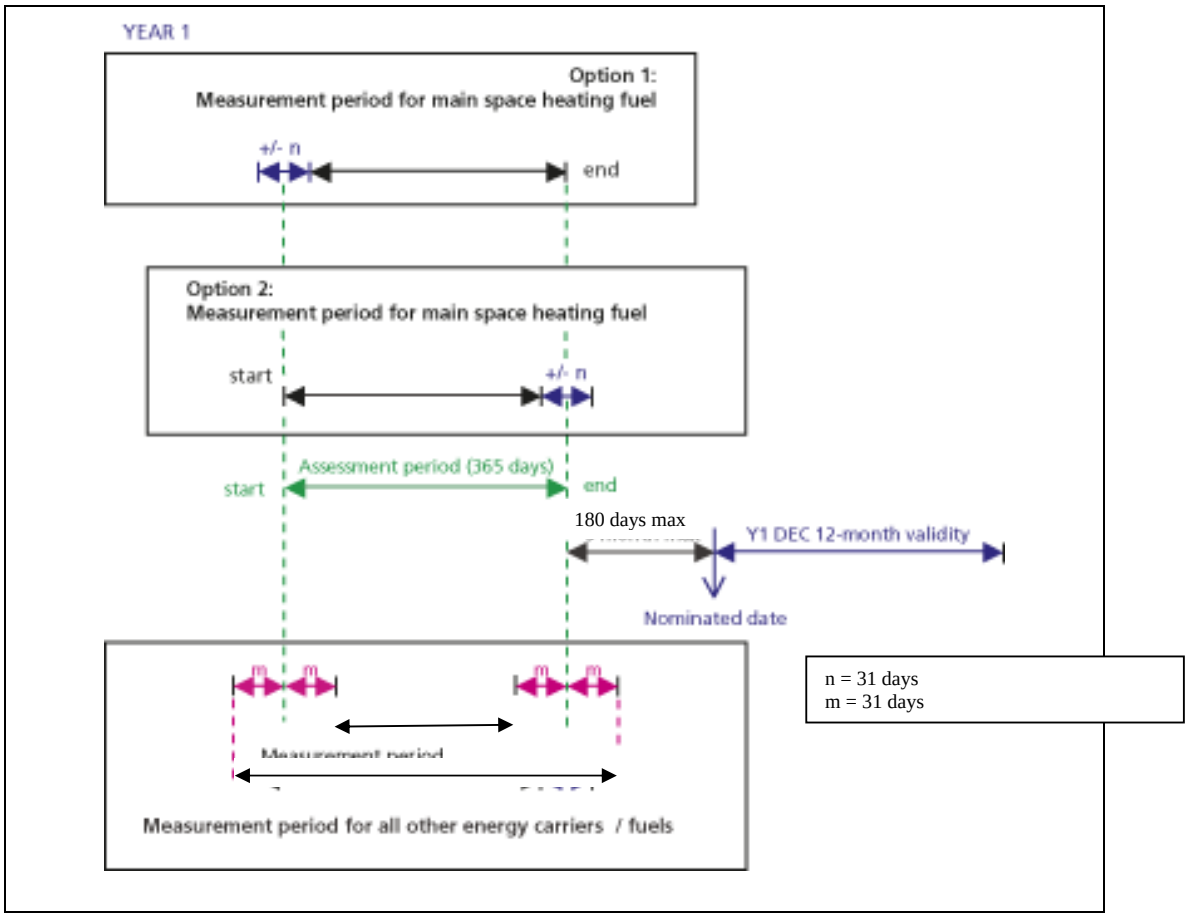
and ends on the 5th day of a month having 30 days, then the number of degree days in the month that the measurement period started would be multiplied by [(31 – 6)/31] to obtain the relevant number of degree days, and the number in the end month would be multiplied by [5/30]..

Initially energy measurement periods of 365 days +/- 31 days will be accepted in the calculation.

For fuels other than the main heating fuel, the start and end dates of the energy measurement periods must be aligned with the start and end dates of the assessment period within +/- 31 days or these will not be accepted in the calculation. A similar relaxation of this requirement as outlined above for the main heating fuel is allowed for fuels where delivery data is currently the only reliable available data. Figure 3.1 below shows the principles of the allowable tolerances on energy measurement period length, the alignment of the assessment period either with the start or the end of the measurement period for the main heating fuel, and the alignment of other energy measurement periods with the assessment period. Further details are available in Appendix 1.

The energy assessor may wish to examine the start and end dates of all the measured energies, or utility estimates of energy, that are available, before setting the start or end date of the assessment period to align with the start or end date of the main heating fuel measurement period. This may help to determine whether one option is preferable to the other, as one alignment option may bring the measurements within tolerance and the other may not.

Figure 3.1: The principles of aligning measurement periods and the assessment period



3.3.4 On-site Renewables and other Low Carbon Technologies

If there is on-site generation of electricity from a renewable energy source or from CHP, this would be reflected in a reduced grid mains electricity demand (and with CHP, an increased fossil fuel demand). Similarly solar thermal heating would normally lead to a lower fossil fuel demand. Consequently, meter readings are not adjusted. However it would be good practice to meter the outputs of all low and zero carbon sources in the building so that the efficiency of the building itself can be assessed as part of any non-regulatory assessment framework.

3.3.5 Energy exports

The intention is that energies are measured net of any energy exports. Energy export is not common at present but may become so in the future. Where energy meters are of the net measurement type the energy exported from the building will automatically be subtracted from the energy imported, and the meter reading provides the net energy consumption (energy imported) of the building.

Where imported and exported energies are metered separately, then ideally the import and export meters should be read at the same time, so that the net energy imported can be found simply by subtracting the exported energy from the imported energy.

Where imported and exported energies are metered separately, but not over the same periods, then limits must be put on the discrepancy between the two measuring periods,

and on their alignment with the Assessment Period. Acceptable limits on the exported energy measurement period are:

- Measurement period length of 365 +/- 31 days
- Start date of the measurement period within +/- 31 days of the start date of the Assessment Period
- End date of the measurement period within +/- 31 days of the end date of the Assessment Period.

Where exported energy is not metered, or is metered over periods that are outside these acceptable tolerances for period length and alignment with the Assessment Period, then the exported energy cannot be taken into account in the calculations.. Estimates are not acceptable.

Provided that the exported energy measurement periods are within acceptable tolerances, the exported energy is subtracted from the imported energy, of the same fuel, before any other adjustments are applied to the measured net imported energy.

3.3.6 Primary energy and carbon dioxide conversion factors

For each fuel used at the building level there is a particular energy overhead involved in its production and an equivalent primary energy use which takes account of this overhead. Similarly for each fuel there is an associated CO_2 emission. Standard factors can be used to estimate the primary energy consumption and CO_2 emissions associated with the consumption of fuel at the building level. Similar considerations apply to electricity usage - there is an implied primary energy usage and CO_2 emission associated with each unit of electricity used at the building level and these can be estimated by use of standard conversion factors. For electricity and most fuels, national values of conversion factors to be used to estimate primary energy use and CO_2 emissions from data on delivered energy have been determined by government and are used in the calculation procedure for this purpose. These factors are one of a number of resources made available to all accredited energy assessors by SEAI.

Where fuel consumption is measured in terms of mass or volume (e.g. for solid and liquid fuels) rather than in energy terms (e.g. kWh), the energy content of the measured fuel consumption should be derived using the Gross Calorific Value of the fuel under normal conditions. The energy content of the fuel consumed over the assessment period may then be converted to CO_2 emissions by using the conversion factors specified. Gross calorific values for all main fuels are also available from SEAI.

3.4 Typical energy consumption (benchmarks)

Building performance can only usefully be compared with other buildings that carry out the same or similar functions. It is not helpful to compare, for example, an office with a

hospital, and so different performance benchmarks are required for each type of building function.

The Chartered Institution of Building Services Engineers (CIBSE) have prepared operational benchmarks for 29 main categories of building, and have listed together the different types of building and use that would be included within each of the general category descriptions. These benchmarks are expressed in terms of delivered energy density ($kWh/m^2/yr$), and are expressed separately as the electrical and non-electrical (fossil-thermal) components of the benchmark. Representative emissions densities ($kgCO_2/m^2/yr$) are also indicated, using representative CO_2 emission factors, for information only and not for use in the calculation procedure (see CIBSE TM46: Energy Benchmarks).

For the purposes of DEC a primary energy density benchmark is required to allow for the calculation of the primary energy rating of the building. A CO_2 density benchmark is also required to allow for calculation of the buildings CO_2 performance.

For a building category with an ‘Electrical’ delivered energy density benchmark of 'E' ($kWh/m^2/yr$) (as defined in CIBSE TM 46) and a ‘Non-electrical’ energy density benchmark of 'N' ($kWh/m^2/yr$), the primary energy density benchmark 'P' ($kWh/m^2/yr$) is found using standard primary energy factors for electricity and gas obtained from the SEAI for electricity (P_E, $kWh/m^2/yr$) and for gas (P_G, $kWh/m^2/yr$) (representing the Non-electrical consumption) as:

$$P = (P_E \times E) + (P_G \times N) \qquad (kWh/m^2/yr)$$

Similarly the CO_2 density benchmark "C" is derived as

$$C = (C_E \times E) + (C_G \times N) \qquad (kgCO_2/m^2/yr)$$

where C_E and C_g are the standard CO_2 factors for electricity and gas, respectively.

The benchmarks have been prepared to represent building use under a number of standardised conditions:

- The weather year is standardised at 2021 degree days per year, to the base 15.5°C
- A defined occupancy period is noted for each category individually
- A standard proportion of the non-electrical energy density benchmark that is considered to be related to the heating demand is noted for each building category individually.

The purpose of these factors is explained in the following sections as they may form part of the procedure of adjusting the benchmarks to better represent the characteristics of a building being assessed, where the energy assessor believes that the basic benchmark should be adjusted to the location and use of that building. In general, adjustments are applied separately to the electrical and non-electrical benchmarks and the adjusted

primary energy density benchmarks and CO_2 density benchmarks derived from these adjusted values.

The full set of benchmarks, including assumptions underlying them and associated supporting data to be used for adjustment of benchmarks are published by CIBSE in TM46: Energy Benchmarks.

3.4.1 Adjusting the benchmark for location (weather region)

The category benchmark is always adjusted according to the 'history' of temperature in the building location, for the one-year assessment period over which the operational BER is to be calculated. The adjustment is based on the number of monthly degree days over the 12-month assessment period for the region in which the building is located. The adjustments are for heating degree days only, and no adjustment for cooling degree days is undertaken. SEAI provides the assessor with degree day data for a range of weather stations and the assessor chooses the data for the station nearest to the building being assessed.

Where the assessment period does not include complete months at its beginning and end, the number of degree days in those part-months is calculated in simple proportion to the number of days that are included in those months. So if the assessment period begins on the 6th day of a month having 31 days, and ends on the 5th day of a month having 30 days, then the number of degree days in the month that the assessment period started would be multiplied by [(31 – 6) / 31] to obtain the relevant number of degree days, and the number in the end month multiplied by [5 / 30].

Only that part of the energy density benchmark that is related to heating demand is adjusted for number of degree days. In a simple case where, for example:

Standard degree days for the category is	S (dd)
Degree days in the assessment period, for the specific location, is	L (dd)
Electrical energy density benchmark is	E ($kWh/m^2/yr$)
Non-electrical energy density benchmark is	N ($kWh/m^2/yr$)
Proportion of Non-electrical benchmark related to heating is	X (%)

the degree day adjusted thermal density benchmark (N_{dd}) is:

$$N_{dd} = [N \times (1 - X/100)] + [(N \times X/100) \times (L/S)] \quad (kWh/m^2/yr)$$

and the resulting 'dd corrected' primary energy density benchmark becomes

$$P_{dd} = (P_E \times E) + (P_G \times N_{dd}) \quad (kWh/m^2/yr)$$

Similarly the CO_2 density benchmark becomes

$$C_{dd} = (C_E \times E) + (C_g \times N_{dd}) \quad (kgCO_2/m^2/yr)$$

3.4.2 Adjusting the benchmark for longer hours of occupancy

Where the energy assessor can demonstrate that the building is occupied for significantly

longer periods than the standard hours quoted for in the benchmark category, and where the benchmark information includes a numerical factor allowing correction for extended hours of use to be made, then the degree day corrected benchmark may be adjusted for the extended occupancy. Suitable forms of evidence to support the extended occupancy hours claim are detailed below and in paragraph 4.2.7. Where relevant, the benchmark information includes separate correction factors for occupancy period for the electrical and the non-electrical energy density benchmarks. The benchmark information contains:

- Benchmark (standard) hours per year (SH)
- Maximum allowed hours per year (MH)
- Percentage increase in electrical benchmark at maximum allowed hours per year (E_{add})
- Percentage increase in fossil-thermal benchmark at maximum allowed hours per year (N_{add})

Where, for example, it can be shown that a the actual use of a building is “AH” hours per year, then new degree day and occupancy (dd&occ) corrected electrical ($E_{dd\&occ}$) and non-electrical ($N_{dd\&occ}$) energy densities may be calculated as:

$$E_{dd\&occ} = E \times (1 + [(AH – SH)/(MH – SH)] \times (E_{add}/100)) \qquad (kWh/m^2/yr)$$

and

$$N_{dd\&occ} = N_{dd} \times (1 + [(AH – SH)/(MH – SH)] \times (N_{add}/100)) \qquad (kWh/m^2/yr)$$

and the resulting “dd&occ” corrected primary energy density benchmark becomes

$$P_{dd\&occ} = (P_E \times E_{dd\&occ}) + (P_G \times [N_{dd\&occ}]) \qquad (kWh/m^2/yr);$$

and the CO_2 density benchmark becomes

$$C_{dd\&occ} = (C_E \times E_{dd\&occ}) + (C_G \times [N_{dd\&occ}]). \qquad (kgCO_2/m^2/yr)$$

To obtain the annual occupancy hours the energy assessor must use the appropriate occupancy measurement systems as indicated for each benchmark category in the benchmark information. The two systems of defining annual occupancy hours are:

- The number of hours per year that the number of recorded occupants exceeds 25 per cent of the nominal maximum occupancy, or
- The number of hours per year that the building is fully open, according to published opening hours

The energy assessor must obtain attendance records, survey results or published opening hours and calculate the annual occupancy hours. This information is to be collated into an Annual Occupancy Hours Record and signed off by the occupants’ premises manager before the energy assessor uses the occupancy data in the calculation procedure.

Where different parts of the building (falling within the same benchmark category) have different occupancies the lowest occupancy must be used, unless an assessment of occupancy in each part is made and the occupancies combined using the percentages of overall floor areas, ie using an area-weighted average.

Where occupancy adjustment is required in a multi-use building assessment, that is, one employing more than one benchmark category in a composite benchmarking procedure (see paragraph 3.4.3 below), the Annual Occupancy Hours must be calculated as above for each category for which an occupancy adjustment is relevant.

3.4.3 Mixed-use assessment: composite benchmarks

A composite benchmark may be needed where the activities in the space assessed span more than one building category with a separate benchmark, for example an office with an integral leisure centre. The use of a composite benchmark requires that the area attributable to each building category is known and measured separately.

Where the energy for each activity is separately metered, and each activity area exceeds 1,000m^2, a separate DEC for each area may be produced. Where the activity areas do not exceed 1,000m^2, separate DECs may be produced on a voluntary basis. Alternatively, and in all instances where the energy for each activity is not separately metered, an overall DEC should be produced. The operational rating in this DEC will use a composite benchmark based on an area-weighted average of the benchmarks of each building category.

Where this composite benchmark approach is used, the energy assessor should choose which activity area, hence which building category, will be described as the Main Benchmark Category. This will be the largest area where the main heating fuel is used.

In creating a composite benchmark, a primary energy density benchmark (and CO_2 density benchmark) is created for each identified building category initially. This is done in the same manner as outlined above for a building characterised by a single category. Any adjustments necessary for weather and occupancy should be applied to these benchmarks, as outlined above, before creating composite benchmarks. The composite primary energy density and CO_2 density benchmarks for the building are then derived on an area weighted basis.

Where a building is characterised as representing n categories (a, b,.....n) for benchmark purposes, and these categories have related useful floor areas, A[a], A[b], ….. A[n], respectively, the composite primary energy density benchmark is derived as follows:

$$P_{dd\&occ}\,[comp] = ((P_{dd\&occ}[a] \times A[a])+(P_{dd\&occ}[b] \times A[b])+..+(P_{dd\&occ}[n] \times A[n]))/(A[a] + A[b] +.….+ A[n])$$

where

$P_{dd\&occ}$ [comp] = composite primary energy density benchmark, adjusted as required;

$P_{dd\&occ}[a]$ = primary energy density benchmark for area [a], adjusted as required;

$P_{dd\&occ}[b]$ = primary energy density benchmark for area [b], adjusted as required;

$P_{dd\&occ}[n]$ = primary energy density benchmark for area [n], adjusted as required.

Similarly the CO2 density benchmark is derived as follows:

$$C_{dd\&occ}\,[comp] = ((C_{dd\&occ}[a] \times A[a])+(C_{dd\&occ}[b] \times A[b])+..+(C_{dd\&occ}[n] \times A[n]))/(A[a] + A[b] +.\ldots+ A[n])$$

where

$C_{dd\&occ}$ [comp] = composite CO_2 density benchmark, adjusted as required;

$C_{dd\&occ}[a]$ = CO_2 density benchmark for area [a], adjusted as required;

$C_{dd\&occ}[b]$ = CO_2 density benchmark for area [b], adjusted as required;

$C_{dd\&occ}[n]$ = CO_2 density benchmark for area [n], adjusted as required.

The software allows up to five separate benchmarks to be used to calculate a composite benchmark. Where building uses are initially considered to span more than five benchmark categories, the energy assessor should review the benchmarks, and aggregate the areas of those building activities that have similar benchmarks. When aggregating areas that have different benchmarks, the lowest benchmarks should be selected to calculate the operational BER.

3.4.4 Application to groups of buildings on a site

Each qualifying building must display its own DEC. For many campus style facilities, metering is at the site level rather than at the individual building level. In such cases it is reasonable to disaggregate measured site energy into the energy use at building level for each building on an area-weighted basis.

The process of disaggregating the energy on an area-weighted basis means that the ratings for each building will be the same and equivalent to the values that would have been obtained if a site-based calculation had been carried out.

On some sites, individual buildings may have dedicated metering, and in such a situation, building specific DECs should be produced wherever possible, i.e. where

a) The individual building(s) have acceptably measured energy consumption data for most (at least 95%) of fuels used in the building; AND
b) There is an appropriate benchmark for that category of building; AND
c) The individual building(s) falls within the public display requirement.

For the remaining buildings on the site, DECs should be based on the whole site

consumption, excluding those buildings that are separately assessed, using an area-weighted distribution of energy consumption. The benchmark should be based on the site benchmark, but adjusted by the energy consumption associated with the benchmarks for the buildings that have been separately assessed.

For example, even if a theatre block at a teaching hospital had its own fuel consumption data, e.g. metered gas and electricity, a separate DEC cannot be produced for the theatre block, since there is no benchmark data for theatre blocks. A site based DEC must be used as there is benchmark data for a teaching hospital. However, if the separately metered building was an administration building (ie essentially an office), it could be benchmarked independently, and the revised site benchmark BM_R for the remaining buildings would be

$$BM_R = \frac{(A_{site} * BM_{site} - A_{office} * BM_{office})}{(A_{site} - A_{office})}$$

Where a DEC is based on site-based data, the situation should be reviewed each time the DEC is updated to check whether additional metering or appropriate new benchmark data have become available in the period since the previous DEC was produced which would allow additional building based DECs be produced.

Note: the requirement for a DEC only applies to buildings over 1,000m^2. Consequently, if the total area of the buildings on a site exceeds 1,000m^2, but this comprises several individual buildings, none of which is greater than 1,000m^2, there is no requirement for any DEC. If one or more buildings exceed 1,000m^2, there is a requirement for a DEC for each such building.

Further information is contained in a FAQ section on the SEAI website.

3.5 The Rating Scale

The operational BER is expressed as a grade point on a scale which represents the relevant total primary energy associated with the delivered energy to the building over the assessment period as a percentage of the degree day and occupancy corrected primary energy density benchmark $P_{dd\&occ}$.for the building type. The result is expressed as a percentage, rounded to the nearest whole number.

In the case of a composite benchmark assessment, the relevant total primary energy associated with the delivered energy to the building over the assessment period is divided by the overall composite primary energy density benchmark ($P_{dd\&occ}$ [comp]).

The format of the scale is similar in structure to the format determined for other BER introduced in the context of implementing the EPBD.

The A to G banding, with subdivisions, of the scale is determined as:

Table 3.5: Rating Scale		
Calculated values	**rating bands**	
0 to 8.5	A1	A
8.5 to 17	A2	
17 to 25	A3	
25 to 33.5	B1	B
33.5 to 42	B2	
42 to 50	B3	
50 to 58.5	C1	C
58.5 to 67	C2	
67 to 75	C3	
75 to 87.5	D1	D
87.5 to 100	D2	
100 to 112.5	E1	E
112.5 to 125	E2	
125 to 150	F	F
More than 150	G	G

3.6 The DEC

The DEC contains the following key elements:

:

- An operational BER for the building with performance expressed as a grade on a subdivided A - G scale. The ratio expresses the equivalent primary energy consumption per unit floor area as a percentage of a value that would be considered typical for the particular type of building;
- A primary energy indicator expressed in terms of primary energy use per unit floor area;
- a subsidiary CO_2 performance indicator shown as a position on a linear scale representing the annual CO_2 emission per unit of area of the building caused by its consumption of energy as a percentage of a value that would be considered typical for the particular type of building) together with a numerical indicator of the CO_2 emissions of the building;

- histograms of trends in energy and CO_2 performance in up to three most recent years.
- A Building identifier, e.g. name, address. This should be sufficient to uniquely identify the building;
- Basic building technical information, e.g. building type, floor area, main heating fuel, main heating/cooling type, sufficient to assist understanding of the more detailed information contained on the certificate;
- A unique DEC number, provided by SEAI;
- Period of validity of the certificate. This commences on a Nominated date chosen by SEAI. The period is for 365 days. For other than the first DEC for a building, there should be no gap from period covered by previous DEC but there may be overlap of up to 90 days where this facilitates preparation of the DEC taking account of the fuel measurement system and consumption data available ;
- Unique assessor number. Each assessor is assigned an unique assessor number;
- Primary electrical and heating energy per unit floor area for the building being assessed and for the relevant benchmark building type. For the building this is the net primary energy figure, excluding separable energy and any renewable energy generated on-site, derived for the assessment period of 365 days.

3.7 Implementation software and related information

Nationally approved software has been developed by SEAI to facilitate the calculation of BER for public display. This may be downloaded from the SEAI website, www.SEAI.ie/ber.

A number of the factors needed to support the calculation of the BER are standardised so that all energy assessors make use of the same approved data. Approved data is provided and maintained up to date by SEAI. The data is updated every quarter and includes:

- The Approved Benchmark Information, providing the electricity and non-electrical energy densities (benchmarks), the reference degree days and approved conversion and adjustment factors for the building categories, and a tabulation showing how indicative building types are ‘allocated’ to the building benchmark categories. These are sourced from CIBSE and updated in line with updates provided by CIBSE.
- The approved monthly degree day information for the weather regions of the Ireland.

- A list of assessors

These factors are made available by SEAI.

Section 4

Collecting data for the assessment

4.1 The data required

Prior to carrying out an assessment, the energy assessor needs to ensure that adequate data is available (including supporting evidence, where required) under the following headings:

- Building category (or categories, where composite benchmarking used)
- Location (building name, address, post code)
- Basic technical characteristics of the building
- Separable energy uses if any
- Total Useful Floor Area of the building (and how it has been obtained) or other allowed area metric, including Total Useful Floor Area attributable to each benchmark category (where composite benchmark used) and to separable energy use (where exists)
- Recorded hours of occupancy.
- Energy consumption (meter readings or suppliers estimates) and measurement period
- Results of previous DEC assessments, where they exist.

4.2 Gathering data

4.2.1 Building category

The building needs to be placed in one of the 29 benchmarking categories. A summary of the available categories is provided by the software, indicating the types of buildings that fall within each category. Further guidance on the benchmarking categories is available from the Chartered Institution of Building Services Engineers (CIBSE) TM 46. The energy assessor must select the relevant benchmark category applicable to the building uses.

Where a building has a mix of uses that would place parts of the building in different benchmark categories, it is possible to construct a composite benchmark. For example, in a school with a swimming pool, that part of the school excluding the swimming pool would be assigned the benchmark for schools and seasonal public buildings. The swimming pool would be assigned the benchmark for a swimming pool. The composite benchmark is the area weighted average of the two category benchmarks i.e.:

Composite BM = [(school BM x area of school without pool) + (pool BM x area of pool

centre)]/(Area of school without pool + area of pool centre)

If a composite benchmark is used, the assessor must select the relevant benchmark categories. For this approach, the total useful floor area applicable to each benchmark category and (if occupancy adjustment is to be used) the relevant occupancy information (see Section 4.2.7) must be available.

4.2.2 Location

The name and address is required to identify the building location.

4.2.3 Basic Technical Characteristics of the Building

The assessor must have knowledge of the main energy uses within the building. In particular, the fuels used, the main fuel used to provide space heating and how the building is heated and ventilated, e.g. whether mechanical ventilation or air-conditioning is used.

4.2.4 Separable energy uses

Separating out certain energy uses is an optional part of the DEC calculation procedure where specific conditions are met. It increases the relevance of the main energy rating if a building has certain specified ‘process’ energy uses which are not currently included in the benchmark typical building.

Separable energy uses are energy uses within a building’s overall metered energy consumption which may be reported separately from the main energy rating of the building, along with their associated floor area.

This part of the procedure is simply omitted if the building has no metered separable energy use, and all the building’s energy is then counted in the main assessment. If there are unmetered separable energy uses, this provides an incentive to meter them for future assessments.

See section 3.3.1 for allowed separable energy uses and criteria.

No other energy uses may be separated from a building’s assessment. The energy assessor will also need to confirm that the separable energy use has been assessed for efficiency in the past two years. If all these conditions are fulfilled the metered energy used by the separable energy use can be deducted form the total measures consumption. This is done automatically in the software.

The DEC software requests the energy consumption (by supply type) and floor area of any separable energy use. Energy assessors may only enter this information if they have completed a Separable Energy Record which is signed off by the occupant’s premises manager. In cases where the separable energy use is intermittent or seasonal the energy assessor will need to give special consideration to how the measurement period is entered into the software. Ideally the meter readings for the separable energy use should coincide

with the main readings.

As the separable energy consumption is deducted from the total consumption for the building so must the area of the building occupied by the separable use be deducted from the TUFA. The energy assessor will need to obtain this area by measurement or from plans. Where the separable use is outside, such as sports flood lighting, the area to be deducted will be zero.

4.2.5 Total Useful Floor Area

The operational BER is based on Gross Internal Area (GIA) or Total Useful Floor Area (TUFA), but other measures of area are allowed as listed in Table 4.2.5.The energy assessor will need to enter which measure of area is being used into the software and calculate the area from plans or by measurement. Where no plans exist, the energy assessor should produce a sketch of the building outline and mark all relevant dimensions on it. Where external dimensions are used it will be necessary to allow for the wall thickness when calculating the GIA or one of the allowed alternatives. All calculations should be shown on the plan or sketch.

Other definitions of floor area are often used to normalise energy demand: eg net internal floor area (ie that which is occupied as working space) or treated floor area (ie gross internal area less unheated spaces). These alternative floor areas should NOT be used as the basis for the energy rating. However, such metrics can be used as a way of determining TUFA where so approved in the methodology.

Table 4.2.5 Allowable alternatives to Total Useful Floor Area

Category	Name	Brief Description	Approved alternate floor area	Default multiplier applied to alternate area to obtain TUFA
1	General office	General office and commercial working areas	Net lettable area (NLA) measured as RICS	1.25
3	General retail	General street retail and services	Sales Floor Area (SFA)	1.80
4	Large non-food shop	Retail warehouse or other large non-food store	Sales Floor Area (SFA)	1.80
5	Small food store	Small food store	Sales Floor Area (SFA)	1.35
6	Large food store	Supermarket or other large food store	Sales Floor Area (SFA)	2.00

For example, for rented offices, net lettable area is the norm, and this can be used in conjunction with a conservative ratio of net to gross area to deliver the required value of TUFA. In this context, conservative means a value which is the maximum likely value of the ratio of the net to gross areas, thereby delivering the smallest TUFA (and hence the most pessimistic operational rating). The allowed ratios are listed in the table below.

If a composite benchmark is to be used, the total useful floor area applicable to each benchmark category must be available.

4.2.7 Recorded Hours of occupancy

Occupancy adjustment is an optional part of the rating procedure which can increase the relevance of a DEC in buildings whose occupancy differs from the benchmark occupancy value. In those circumstances where occupancy adjustments are allowed, the listed energy consumption benchmarks are altered according to the actual occupancy of the building. Occupancy adjustment is applied to the chosen benchmark. The calculation procedure is detailed in paragraph 3.4.2

In order to incorporate occupancy adjustment, there must be robust documentary evidence of the occupancy of the building, based on attendance records, survey results or published opening hours. If suitable documented evidence of occupancy is not available, or where actual occupancy is the same as the benchmark occupancy, then the adjustment is omitted and the normal unadjusted energy benchmarks are used. If occupancy is high but undocumented this provides an incentive to obtain the occupancy data for future assessments.

If occupancy adjustment is to be used with a composite benchmark the assessor must the relevant occupancy information must be available for each benchmark category involved.

Suitable evidence is detailed in paragraph 3.4.2 and includes a valid assessment and record of the occupancy of the building. Each benchmark category is associated with a reference level of occupancy. Where appropriate, the software adjusts the benchmark according to the occupancy data provided by the energy assessor.

4.2.8 Energy consumption and measurement period

Adequate energy data is critical to the validity of a DEC. The energy assessor needs to gather data on the annual consumption of each fuel, electric, fossil, biofuel, district heating, etc. and also details of the measurement period for each. This data may need adjusting, according to the provisions of section 3.3.3.

METERED ENERGY USE

Ideally the energy assessor will have access to meter readings and the dates on which the readings were taken. In principle, an accurate meter reading of fuel and electricity consumption should be taken annually. If the date of meter reading, or other means of measurement, differs from the correct annual date, the date should be recorded. The energy assessor will select readings with start and end dates which as near as possible cover 365 days, and calculate the consumption from the difference between readings. The

consumption and dates are entered into the software, which will adjust the consumption to 365 days. If the measurement period is outside the tolerances detailed in Section 3.3 and Appendix 1 the software will default to an operational rating grade G - the poorest rating grade.

An alternative acceptable source of energy consumption data is utility bills. These may include estimates, which may be used if there is no other source of accurate readings. When estimates are used, energy assessors must specify that the data entered in the software is estimated. There should not be any reason to use estimated readings after the first year, as the requirement for readings will by then be fully understood.

Only estimates from utilities suppliers may be used. Other bespoke estimates, whether derived by the accredited energy assessor or other experts, will result in a default G rating.

NON-METERED ENERGY CONSUMPTIONS

If bulk fuels like oil, LPG (Liquefied Petroleum Gas), coal or biomass are used, consumption may not be metered and may have to be estimated from delivery notes and stock measurements (See Section 3.3). The energy assessor will need to obtain records of deliveries and a statement of the stock level at the start and end of the measurement period. The energy assessor will need to obtain a signed statement by a responsible person that the stock level was measured and details of the method used. The applicable tolerances are defined in Section 3.3 and Appendix 1- including more relaxed tolerances acceptable initially but which it is intended to discontinue as soon as practicable. The energy assessor will convert the fuel consumption in kg or litres to kWh and enter this figure together with the start and end dates of the measurement period.

Where fuel consumption is measured in terms of mass or volume (eg for solid and liquid fuels) rather than in energy terms (eg kWh), the energy content of the measured fuel consumption should be derived using the gross calorific value of the fuel under normal conditions (see further details in section 3.3.6). The energy content of the fuel consumed over the assessment period may then be converted to primary energy consumption and CO_2 emissions by using the conversion factors specified in the guidance (and available from SEAI). As with metered energy use, if the measurement period is outside the tolerances detailed in Section 3.3 and Appendix 1 the software will default to the poorest rating grade, grade G.

DISTRICT HEATING AND COOLING

If heating or cooling is supplied from district heating or cooling then the annual readings of the relevant meters should be used. These will have to be supplemented by a statement from the system operator specifying the primary energy consumption and the CO_2 emissions associated with the delivered energy i.e. kWh primary energy per kWh of delivered energy, and kg of carbon per kWh of delivered energy. The suppliers of these services are required to calculate, from their own energy records, the primary energy consumption and CO_2 content per kWh of energy supplied.

Calculations should take account of the annual average performance of the whole system (including all heat/cool/power generating plant, any heat recovery, rejection, or dumping

and the distribution circuits). The assessment of primary energy consumption and CO_2 content per kWh should be accompanied by a report signed by a suitably qualified person, detailing how the factors have been derived.

The energy assessor will need a copy of this report together with the start and end dates for the measurement period and the kWh of energy delivered.

Recording energy used for separable energy uses is covered in section 4.1.4.

4.2.9 Results of previous DEC

After first renewal of a DEC and in subsequent years, the certificate must display the operational BER for the previous two years, as long as the building has not undergone a change of use or occupier during that time, in which case previous operational BERs are no longer relevant or required. Operational BERs for previous years may also be included in the first DEC if data for calculation is available.

Appendix 1

Rules re Assessment Period and Energy Measurement Periods

The key time periods relevant to the preparation of a DEC - period of validity, assessment period and measurement period - are defined and the relationship between them described in Section 3. To give building owners some flexibility in their meter reading dates, the measurement periods for the different fuels and energy carriers (electricity, gas, oil, etc.) used by a building do not have to coincide exactly with each other or with the assessment period. In this regard, the following rules apply:

Selection of Assessment Period

1. Two alternative options are available to define the Assessment Period. The energy assessor may choose either option with the intent of minimising any data quality issues associated with alignment of measurement and assessment periods (see following text).

   Option 1: The end date of the 365 day Assessment Period coincides with the end date of the measurement period for the main fuel used for space heating

   Option 2: The start date of the 365 day Assessment Period coincides with the start date of the measurement period for the main fuel used for space heating

   Note: coupling the assessment period to the measurement period of the main heating fuel should minimise extrapolation errors created by the dependence of heating fuel use on weather.

Measurement period duration tolerance (rules are applicable to all fuels)

2. For all fuels, energy carriers, and separable energy uses, the measurement period is the period of time elapsed between two meter readings, manual, automatic, or estimates from utilities suppliers.
3. The measurement period for the main fuel used for space heating, and for all other fuels and energy carriers, must be:
   a. 365 +/- n days where n = 31 days.
   b. Where the measurement period is outside the tolerance defined in (5a), an estimate from utilities suppliers must be obtained and must be within the same tolerance defined in (3a).
   c. Where no estimate is available from utilities suppliers, or the estimate is outside the tolerance defined in (3a), a default rating of G, the poorest grade, is awarded. This allows the occupier to discharge its duties under the regulations,

but also provides an incentive to improve metering to produce a more accurate and likely better operational BER.

Synchronicity of measurement periods (rules are applicable to fuels other than the main fuel used for space heating)

4. The start date of the energy measurement period for all fuels and energy carriers, other than the main fuel used for space heating, should be within +/- m days of the start day of the Assessment Period.
5. The end date of the energy measurement period for all fuels and energy carriers, other than the main fuel used for space heating, should be within +/- m days of the end day of the Assessment Period.
6. For both (4) and (5) above:
    a. m should be taken as 31 days.
    b. Where the start or end dates of the measurement periods are outside the synchronicity range defined in (6a) above, an estimate from utilities suppliers must be obtained and must be within the same synchronicity defined in (6a).
    c. Where no estimate is available from utilities suppliers, or the estimate is outside the tolerance defined in (6a), a default a default rating of G, the poorest grade, is awarded. This allows the occupier to discharge its duties under the regulations, but also provides an incentive to improve metering to produce a more accurate and likely better operational BER.

    Note: A similar relaxation of this requirement as outlined in the note to 5c above for the main heating fuel is allowed for fuels where delivery data is currently the only reliable available data.

Extrapolation/interpolation rules

7. Extrapolation or interpolation of data for the main fuel used for space heating to the 365-day Assessment Period will be pro-rata the relative degree days for the Measurement Period and the Assessment Period. A ‘default’ value for degree day dependency of xx per cent [to be extracted from CIBSE benchmarks table] (as indicated for the specific building type) will be assumed and applied to the proportion of the fuel consumption that the benchmark suggests should be used for heating. The extrapolation or interpolation should be calculated on a daily basis using:

    (monthly degree days)/(number of days in the month)
8. Extrapolation or interpolation of data for all other fuels and energy carriers to the 365-day Assessment Period will be linear (i.e. pro-rata to the relative number of days in the respective measurement period and the Assessment Period).
9. For buildings which use electricity for most or all of their space heating, the

adjustment to the 365-day assessment period will be pro-rata the relative degree days for the measurement period and the Assessment Period. A ‘default’ value for degree day dependency of xx per cent [to be extracted from CIBSE benchmarks table] (as indicated for the specific building type) will be assumed and applied to the proportion of the electricity consumption that the benchmark suggests should be used for heating. The extrapolation or interpolation should be calculated on a daily basis using:

(monthly degree days) / (number of days in the month)

Separable energy uses

10. Some separable energy uses may be discounted from operational BER calculations. Allowed separable energy uses are defined for each benchmark category and building type in the CIBSE benchmarks tables. No other separable energy uses can be discounted.

11. Measurement period tolerance: the separable measurement period must be 365 days +/- n_s where n_s = 7 days. Where the measurement period is outside the allowed range, the separable energy use cannot be discounted.

12. Measurement period synchronicity: the separable measurement period must be within +/- m_s of the assessment period start date and end date, where m_s = 31 days. Where the measurement period is outside the allowed range, the separable energy use cannot be discounted.

Consecutive measurement periods

13. There must be no gaps between consecutive (year-on-year) measurement periods, but overlaps of no more than 3 months are allowed to enable building occupiers to change the start date of their measurement periods.

On-site Renewables and other Low Carbon Technologies

14. The following rules apply for on-site renewables and other low carbon technologies:

    (a) Measurement period tolerance: rules 2 and 3 applies.

    (b) Synchronicity: rules 4 to 6 apply.

    (c) Overlaps: rule 13 applies.

Energy exports

15. Only metered energy exports may be taken into consideration.

16. It is assumed that, in most instances, either readings of energy exports meters will take place at the same time as readings of energy imports, or the results will be defined automatically by a net meter. Either way, accounting for energy exports (ie deducting energy exports from imports) should be done before assessing the tolerance or synchronicity of the fuels used by the building.

17. Where meter readings of energy exports are not aligned on meter readings of energy imports, the following rules apply:

    i. Measurement period tolerance: rules 2 and 3 applies.

ii. Synchronicity: rules 4 to 6 apply.

iii. Overlaps: rule 13 applies.

18. Exports outside the boundaries defined in paragraph 18 cannot be accounted for in the operational BER calculations.

19. Deducting energy exports from energy imports may only be undertaken on a same fuel basis. For example, kWh of electricity exports may be deducted from kWh of electricity imports, and so on for any other fuels imported or exported from the site.

Other issues

20. For fuels and energy carriers that collectively account for less than 5 per cent of the total primary energy consumption associated with the building, no data quality warning checks are carried out.

21. The benchmark for the main fuel used for space heating will be corrected to the regional degree days applicable to the Assessment Period selected.

22. The above definitions apply for leap years, ie assessment and measurement periods should be extrapolated or interpolated to 365 days (not 366 days).

Appendix 2 - Draft DEC