# Executive Summary

## Purpose of the report

In response to queries from industry on differences between EPC rating methodologies between England and Jersey, the Government of Jersey (GoJ) commissioned BRE to produce a report that will provide simplified explanations of how EPC ratings are produced for non-domestic buildings, and how compliance is assessed for new buildings, in each of Jersey and England, highlighting the differences between the two administrations.

To illustrate the methodology differences, the GoJ also requested the report to include findings of a modelling exercise where one non-domestic building is modelled for the purposes of each of Jersey EPC and England EPC in SBEM to compare outcomes for key metrics (energy use and $CO_2$ emissions of the Actual building and Reference/Notional buildings used for producing the EPC ratings).

## Content overview

Section "*SBEM underlying principles"* summarised underlying principles of the building energy performance calculations common to both England and Jersey. It provided a summary of how SBEM calculates the energy demand, energy consumption per end-use, and how fuel factors and fuel costs are then applied to produce $CO_2$ emission rates, Primary Energy rates and running costs.

Section "*Compliance methodology comparison"* provided a summary of differences between England and Jersey's methodologies for assessing compliance for new builds.

In section "*CO2 based Asset Rating comparison",* the differences between England and Jersey's $CO_2$ based Asset Ratings are summarised, and the modelling exercise presented in "*Section B – Modelling analysis"* illustrates the main differences.

Finally, an additional section "*Jersey's cost-based asset rating*" was added to briefly describe Jersey's Cost-based Asset Rating, which is not present on the England EPC.

## Key findings

1. Compliance methodology comparison

- The current compliance requirement in England (Part L 2021) set higher energy performance standards than Jersey (Part 11 2016) for newly built non-domestic buildings.
- The two administrations assess compliance based on different metrics:
    - In England, there are **two target metrics** the new building must meet or better:
        - The **Target Emissions Rate** (TER), in $kgCO_2/m^2/yr$.
        - The **Target Primary Energy Rate** (TPER), in $kWh/m^2/yr$.
    - In Jersey, there is **one target metric** the new building must meet or better:
        - The **Target delivered Energy Rate**, also called TER, in $kWh/m^2/yr$.

2. $CO_2$ Asset Rating methodology comparison

- The $CO_2$ factors are different for England and Jersey, particularly for electricity which has a much lower emission factor in Jersey than England. Therefore, for a same Energy rate, the $CO_2$ emissions will be different in England and Jersey, especially for systems which use electricity.
- Both administrations normalise the rating based on the emission rate of a Reference (naming convention in England) or Notional (naming convention in Jersey) building. The England Reference building emission rate with an improvement factor (of 23.5%) is equivalent to a building which just complies with Part L 2006 regulations and uses natural gas for space and water heating. The Jersey

Notional building emission rate is equivalent to a building which just complies with Jersey BBL11 2016 and uses direct electricity for space and water heating.

- The boundary between the B and C bands on the England EPC scale is equivalent to an $CO_2$ Asset Rating of 50 and represents the rating of the England Reference building with an improvement factor (of 23.5%) applied. The boundary between the B and C bands on the Jersey EPC scale is equivalent to an Asset Rating of 100 and represents the rating of the Jersey Notional building.
- Therefore, an identical building assessed with each of Jersey's EPC purpose of analysis and England's EPC purpose of analysis would likely find it more challenging to achieve a favourable rating on the Jersey EPC than on the England EPC, particularly taking into account the much lower emission factor of electricity in Jersey compared to that of natural gas in England.

# Table of Contents

## Introduction

The purpose of SBEM (Simplified Building Energy Model) is to produce consistent evaluations of energy use in non-domestic buildings for Building Regulations compliance assessments and for Energy Performance Certification purposes.

SBEM (with its interface, iSBEM) can be used for compliance assessments of new non-domestic buildings with Building Regulations Part L in each of England and Wales, Building Regulations Part F in Northern Ireland, and the Scottish Building Regulations Section 6. It can also be used for producing EPCs for new and existing non-domestic buildings in England, Wales, Scotland, and Northern Ireland. In the States of Jersey, SBEM has been in use since 2009 for assessing compliance of new non-domestic buildings with Part 11 (first the 2007 edition then the 2016 edition) of the Building-Bye Laws (Jersey) and was updated in 2022 to also produce Jersey EPCs for new and existing buildings.

SBEM is the calculation software that implements the National Calculation Methodology (NCM) of each nation in the UK and in Jersey. The National Calculation Methodology (NCM) is a set of specifications and policy guidance describing how a building should be modelled for the purposes of regulatory energy calculations of assessing compliance with building regulations and for producing EPC ratings. NCM Modelling Guides are bespoke for each administration.

SBEM, iSBEM, and the associated Databases are an implementation of the NCM, developed for the UK Government to be freely available to users (subject to certain licensing conditions). Other software (commercial 3rd party interfaces and Dynamic Simulation Models) have been validated and approved by the UK Government and may be used if preferred.

Both the iSBEM software and the NCM Modelling Guides of the various UK administrations supported are available to download from the UK-NCM website at www.uk-ncm.org.uk.

The basic energy calculation processes for demand and consumption in buildings are identical across all NCM Modelling Guides, but the specifications of the Reference/Notional buildings, the target metrics for building regulations compliance checks, and the procedures for deriving EPC ratings and scales differ between administrations. Therefore, confusion may sometimes occur when comparing results from different administrations.

This report aims to provide a reference point for understanding the key differences between the NCMs of England and Jersey.

Section A will provide a high-level summary comparing the National Calculation Methodologies (NCM) in Jersey and England. To illustrate the methodology differences, Section B will summarise the outcome of a short piece of analysis where one example non-domestic building is modelled for the purposes of each of Jersey EPC and England EPC in SBEM to compare outcomes for key metrics (energy use and $CO_2$ emissions of the Actual building and Reference/Notional buildings used for producing the EPC ratings).

Note on vocabulary:

- The building being assessed and modelled through SBEM is referred to as the Actual building.
- SBEM and calculation engine are used interchangeably and refer to the software implementation of the NCM calculation procedure.

## Background

iSBEM has been used in Jersey since 2009 for the purposes of assessing compliance of new non-domestic buildings with Part 11 of the Building Bye-Laws (Jersey) 2007. When we were tasked by the Government of Jersey (GoJ) in 2015 to update the iSBEM software to implement the 2016 edition of the Bye-Laws Part 11 (BBL11), we were also commissioned to develop a new software module to generate an 'illustrative' Jersey EPC to be automatically generated alongside the BBL11 compliance output document. This work was completed in 2016, and the illustrative Jersey EPC for non-domestic buildings has been available for

generation by the iSBEM software since March 2016, and it displayed a single Asset Rating (and band) which was based on $CO_2$ emissions.

In 2021, we were commissioned by the GoJ to implement further updates to the Jersey calculation methodology in the iSBEM software and to further develop the Jersey EPC to display a second cost-based rating (and band), and to allow it to be generated by the software as a purpose of analysis that is separate from compliance assessment of new builds with BBL11 so that the EPC can be generated for both new and existing non-domestic buildings.

# Section A – England vs Jersey methodology comparison

## SBEM underlying principles

SBEM is a simplified tool intended for modelling non-domestic buildings under standardised conditions for the purposes of compliance assessments and energy certification. Although SBEM's results may assist in the design process, they are not representative of how the building will be operated in reality, and they should not be used to make strategic design decisions. SBEM is not a design tool.

SBEM calculates monthly energy use (kWh), $CO_2$ emissions (and primary energy in the case of England) and, in the case of Jersey, fuel costs, associated to building services in the building (for the regulated end uses of: space heating and cooling, hot water, lighting, ventilation fans, pumps, and controls) under standardised operating conditions.

The standardised conditions allow consistent comparisons and minimise variations between assessments, and refer to the following:

- Weather – The same weather dataset will be used across all assessments of buildings from a given region. By selecting the appropriate weather location, the engine will apply the relevant external air temperature, solar data, and wind speeds and directions.
- Standard parameters to describe how each zone (space) in the building is used – An activity type from the NCM Activity Database is assigned by the user for each zone in the building being modelled, allowing the engine to apply the appropriate standard assumptions (from the NCM Activity Database) on things like heating and cooling set-point temperatures, required ventilation rates, required illuminance, occupation density, and times of use, etc. The assessor also collects, and inputs into the software, information on the building's geometry, fabric, and systems, which combined with the standard assumptions, allow the software to calculate the monthly and annual energy use of the building for the abovementioned regulated end-uses of energy.

In brief, SBEM:

- calculates the lighting energy use, based on a standardised illuminance level for each activity, taking into account the glazing area, glazing properties, light source, and lighting control systems, etc.
- calculates the water heating energy use, based on a standardised hot water requirement for each activity, taking into account system performance, and storage and distribution losses, etc.
- calculates the space heating and cooling energy use by first carrying out an energy balance to calculate the heating and cooling demands using heat gains and losses, taking into account standardised internal conditions for each activity, external weather conditions, building fabric, building systems performance, etc.
- calculates the energy use for ventilation fans, pumps, and controls (auxiliary energy) based on a standardised fresh air rate for each activity, taking into account systems performance, building infiltration rate, etc.
- aggregates the monthly consumed, i.e., delivered energy for the regulated end uses (space heating, space cooling, water heating, lighting, and auxiliary for fans and pumps) into an annual

total value which is then divided by the building floor area to comprise the Building Energy Rate (BER) for the Actual building.

- calculates the energy generated from contributions from any renewable on-site systems such as solar thermal systems, PV systems, wind turbines, and CHP generators, where applicable in the building.
- aggregates the consumed energy by fuel source and converts it into equivalent $CO_2$ emissions by applying the fuel's $CO_2$ emission factor (kgCO2/kWh) to the corresponding energy use figure as follows:

  **$CO_2$ emissions ($kgCO_2$) = Energy use (kWh) x $CO_2$ emission factor (kgCO2/kWh)**

  The fuel costs and primary energy consumption are calculated in a similar manner by simply replacing the $CO_2$ emission factor by a fuel cost factor (£/kWh) or a primary energy factor (kWhPE/kWh) in the above equation.

Note that $CO_2$ emission factors, primary energy factors, and cost factors are required for each fuel type and vary for each administration. In particular, the $CO_2$ emission factor of electricity for the administration will be dependent on the local electricity mix (what fuel sources contribute to the electricity grid). Each administration has a different electricity mix, and therefore the $CO_2$ emission factor of electricity can vary greatly between administrations. In Jersey, we understand that the electricity mix is mostly made up of low $CO_2$ French nuclear sources, leading to a low $CO_2$ emission factor for electricity.

Further details on the calculations in SBEM, the BS ISO standard algorithms used, and the assumptions made are provided in the SBEM Technical Manual, which is also available from the www.uk-ncm.org.uk.

## Compliance methodology comparison

The procedure for new non-domestic buildings in both England and Jersey to demonstrate compliance with building regulations is by comparing the annual energy use and/or $CO_2$ emissions of the Actual building against those of a comparable building of the same size, geometry, and use as the Actual building but with fabric and services efficiencies specified in accordance with compliance regulations in the respective administration. This comparable building is referred to as the 'Notional' building in England, and the 'Reference' building in Jersey.

A 'Notional' or 'Reference' building model serves to generate target delivered energy, $CO_2$ emission, or primary energy rates which the Actual building must meet or better. The choice of the metric to assess compliance can vary among administrations, depending on policy goals.

The full procedures to establish compliance in Jersey and England are detailed in the NCM Modelling Guides for Jersey and England, respectively. Key divergence points are described in **Table 1**.

Table 1 Summary of differences between England and Jersey's compliance methodologies

| | England's compliance process | Jersey's compliance process |
|---|---|---|
| **Regulations currently in place** | 2021 Edition of the Approved Document L - Conservation of fuel and power, Volume 2: Buildings other than dwellings.<br><br>This superseded the 2013 Part L and 2013 Notional building and established a $CO_2$ emission target that aims to deliver a 27% reduction compared to that of the 2013 Part L. It also added the second compliance target metric of primary energy. | 2016 edition of the Bye-Laws Part 11<br><br>The Building Bye-Laws (Jersey) 2007 – Part 11 - Technical Guidance Document 11.2A .<br><br>When Jersey updated their building regulations in 2016 to supersede the previous edition, we understand that they based their 2016 Reference building for compliance on England's 2013 Notional building for compliance in the 2013 Part L. |
| **Key divergence points between England's 2021 'Notional' and Jersey's 2016 'Reference' buildings specifications** | The English 2021 Notional building specifications generally have higher standards for:<br>• fabric performance (for opaque elements see England NCM Modelling Guide Table 1 and Jersey NCM Modelling Guide Table 1; for glazed elements see England NCM Modelling Guide Table 4 and Jersey NCM Modelling Guide Table 4)<br>• air tightness (England NCM Modelling Guide Table 3 and Jersey NCM Modelling Guide Table 3)<br>• efficiencies of space heating/cooling and hot water systems (England NCM Modelling Guide Tables 8, 9, 10, and Jersey NCM Modelling Guide Tables 5 and 6)<br><br>In addition, the 2016 English Notional building is specified with photovoltaics, where the Jersey Reference building does not have any renewable energy systems. | |
| **Different standard assumptions** | The England weather database allows the user to select from 14 available weather locations in UK | The Jersey weather database consists of one Jersey weather dataset |
| **Different compliance metrics** | The English 2021 Notional building generates **two target metrics** which the Actual building must meet or better:<br><br>The **Target Emissions Rate** (TER), or the Notional building's annual emissions in $kgCO_2/m2$.<br><br>The **Target Primary Energy Rate** (TPER), or the Notional building's annual primary energy rate in $kWh_{PE}/m^2$. | The Jersey 2016 Reference building only generates **one target metric** which the Actual building must meet or better:<br><br>The **Target delivered Energy Rate**, also called TER, in $kWh/m^2$. |

## EPC rating methodology comparison

**The Notional/Reference building for producing asset ratings**

Similarly to compliance, the procedure for generating EPC ratings in both England and Jersey also calls upon a Notional/Reference building.

The difference, however, compared with compliance assessments, is that the Reference/Notional building is not used to set a specific target to be met. It is rather used to normalise ratings as described below.

EPC ratings are based on:

- a given metric calculated for the Actual building, where the metric may be the $CO_2$ emission rate ($kgCO_2/m^2$), the Primary Energy rate ($kWh_{PE}/m^2$), the running Cost (£/$m^2$)
- and the same metric calculated for the Notional/Reference building.

Which are then presented as a ratio:

$$Metric_{Actual} / Metric_{Notion/Reference}$$

This ratio forms the basis for the EPC rating. It is what is meant by 'normalising' the rating; the $Metric_{Actual}$ is normalised with respect to the $Metric_{Notional/Reference}$ in order to produce a ratio equal to 1 when the $Metric_{Actual}$ is equal to the $Metric_{Notional/Reference}$. The ratio will be lower than 1 if $Metric_{Actual}$ is smaller than $Metric_{Notional/Reference}$, and it will be higher than 1 if $Metric_{Actual}$ is greater than $Metric_{Notional/Reference}$.

The ratio may be manipulated to be presented in a variety of ways, for example, to establish scales from 0 to 100, where 100 is the best possible score, or the opposite from 100 to 0, where 0 is the best possible score. The ratio can be further processed via a linear function, where the Actual building's score increases linearly with respect to the ratio, or a non-linear function which enables varying the 'progress' or the building's score with respect to the ratio.

The ratio is also a helpful benchmark to establish the rating band for a building which just meets the Notional/Reference building's standard.

## $CO_2$ based Asset Rating comparison

*Notional/Reference specification comparison*

In England, the building used for normalising the Asset Rating is referred to as the 'Reference' building. In Jersey, the building used for this same purpose is referred to as the 'Notional' building.

The full specifications of Jersey's Notional building and England's Reference building are detailed in the NCM Modelling Guides for Jersey[1] and England[2], respectively. The key divergence points between the two buildings are described in **Table 2**, and can be summarised as follows:

- the fabric specifications of the England Reference building are generally worse performing than the Jersey Notional building
- Jersey Notional building is heated with electricity (both space and water) whereas the England Reference building is heated with natural gas (both space and water).

[1] Jersey 'Notional' specifications are detailed on pages 7-19 and 33 of the NCM Modelling Guide Jersey (uk-ncm.org.uk), the fuel factors (page 41 of that Guide)

[2] England 'Reference' building whose specifications are detailed on pages 46-51 of the NCM Modelling Guide England (uk-ncm.org.uk), using the specific England location's weather data set, fuel factors (page 59-60 of that Guide)

- the $CO_2$ emission factor of electricity in Jersey is much lower than the $CO_2$ emission factor of natural gas in England (Figure 1 and Figure 2)

The consequence of the points above is that the Jersey Notional building will likely have lower emissions than the England Reference building. Further, in Jersey, building which are inefficient and whose main heating fuel has an emission factor that is worse than that of electricity, for e.g., oil, would generally find it challenging to achieve favourable ratings on the Jersey EPC scale.

**Table 2 Summary of specifications and key divergences between England's Reference building and Jersey's Notional building**

| | **England 'Reference' building for EPC ratings** | **Jersey 'Notional' building for EPC ratings** |
|---|---|---|
| **Fabric** | The England 'Reference' building for the Asset Rating is based on the standards in the 2002 England & Wales Part L.<br><br>Note: the fabric specifications of the England Reference building are generally worse performing than the Jersey 'Notional' building for Asset Ratings. | The Jersey 'Notional' building's fabric is identical to Jersey's 2016 "Reference" building, which is used in assessing compliance with the 2016 BBL11 |
| **Systems** | The space heating and hot water generation services **always use natural gas** irrespective of whether a fuel other than natural gas is used in the Actual building or natural gas is even available in the locality of the Actual building. The seasonal efficiency of the gas boiler used is 73% for space heating and 45% for water heating. | The space heating and hot water generation services **always use electricity** (direct electric heat source, 90% efficient for space heating and 95% efficient water heating - taking account of distribution losses of 10% for space heating and 5% for hot water) regardless of what is used in the Actual building. |
| **Weather datasets** | Selected from 14 available weather locations in UK | One Jersey Weather dataset |
| **$CO_2$ factors** | The fuels $CO_2$ emission factors used for the England purpose of analysis are provided in Figure 1.<br><br>Note:<br>• the natural gas $CO_2$ emission factor is slightly lower for England than Jersey<br>• the electricity $CO_2$ emission factor is much lower for Jersey than England | The fuels $CO_2$ emission factors used for the Jersey purpose of analysis are provided in Figure 2. |

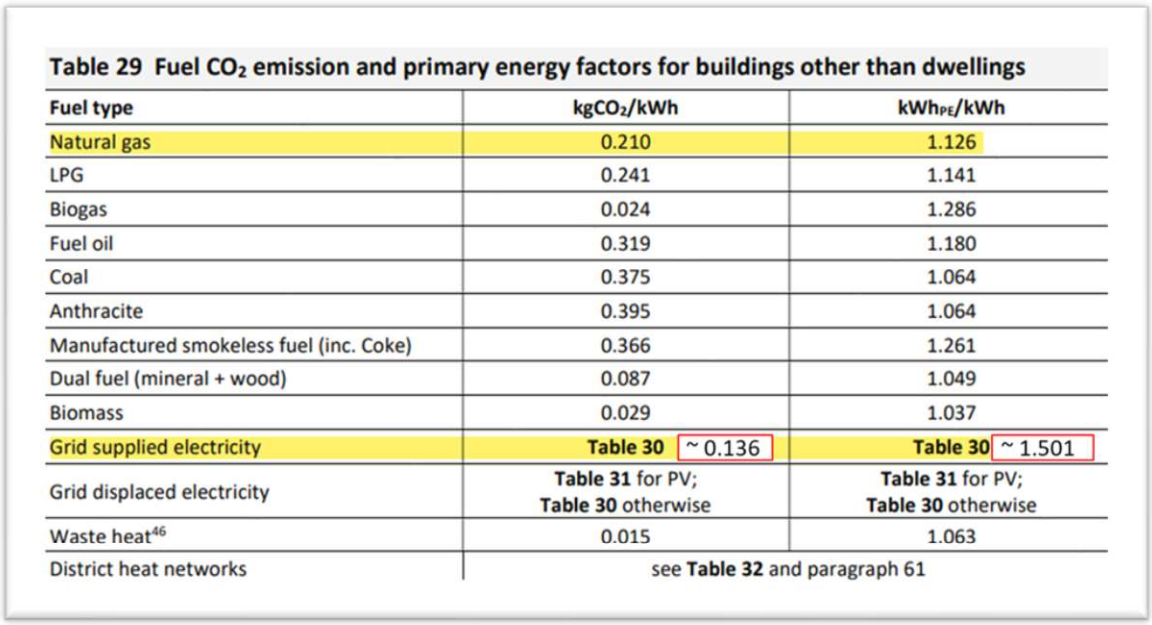


**Table 29 Fuel $CO_2$ emission and primary energy factors for buildings other than dwellings**

| Fuel type | $kgCO_2/kWh$ | $kWh_{PE}/kWh$ |
|---|---|---|
| Natural gas | 0.210 | 1.126 |
| LPG | 0.241 | 1.141 |
| Biogas | 0.024 | 1.286 |
| Fuel oil | 0.319 | 1.180 |
| Coal | 0.375 | 1.064 |
| Anthracite | 0.395 | 1.064 |
| Manufactured smokeless fuel (inc. Coke) | 0.366 | 1.261 |
| Dual fuel (mineral + wood) | 0.087 | 1.049 |
| Biomass | 0.029 | 1.037 |
| Grid supplied electricity | **Table 30** ~ 0.136 | **Table 30** ~ 1.501 |
| Grid displaced electricity | **Table 31** for PV; **Table 30** otherwise | **Table 31** for PV; **Table 30** otherwise |
| Waste heat[46] | 0.015 | 1.063 |
| District heat networks | see **Table 32** and paragraph 61 | |

Figure 1 Screenshot of Table 29 from the England NCM Modelling Guide with highlighted (in yellow) natural gas and electricity factors. The England NCM uses variable monthly CO2 emission and primary energy factors for electricity, which are equivalent to the annual factors that are circled in red.

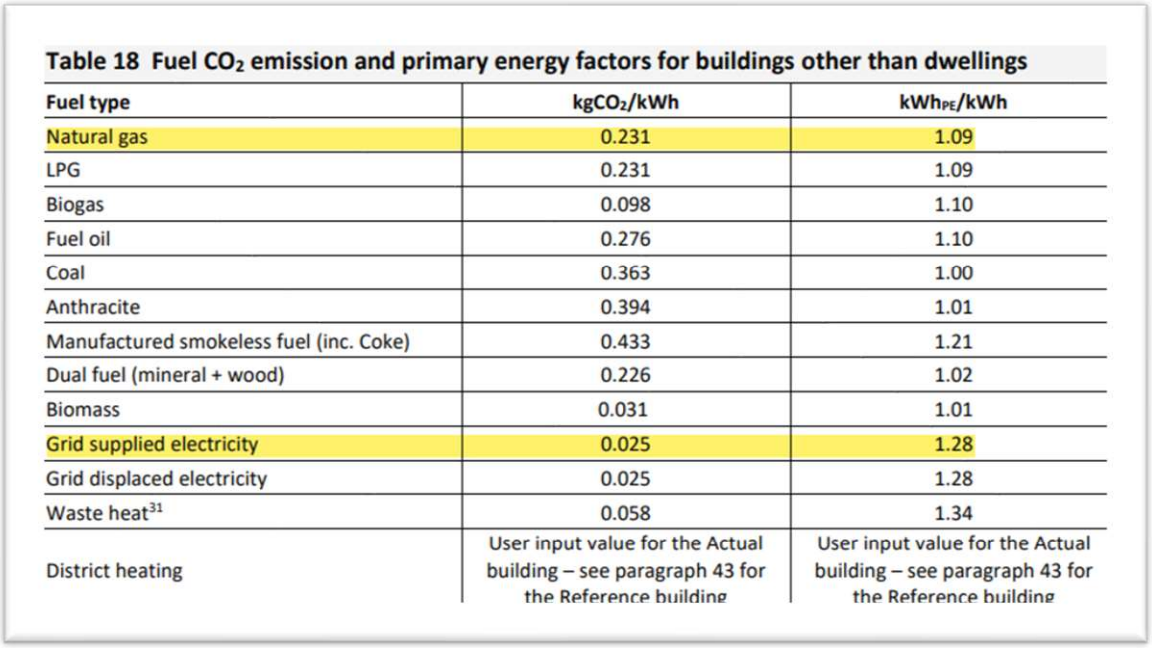


**Table 18 Fuel $CO_2$ emission and primary energy factors for buildings other than dwellings**

| Fuel type | $kgCO_2/kWh$ | $kWh_{PE}/kWh$ |
|---|---|---|
| Natural gas | 0.231 | 1.09 |
| LPG | 0.231 | 1.09 |
| Biogas | 0.098 | 1.10 |
| Fuel oil | 0.276 | 1.10 |
| Coal | 0.363 | 1.00 |
| Anthracite | 0.394 | 1.01 |
| Manufactured smokeless fuel (inc. Coke) | 0.433 | 1.21 |
| Dual fuel (mineral + wood) | 0.226 | 1.02 |
| Biomass | 0.031 | 1.01 |
| Grid supplied electricity | 0.025 | 1.28 |
| Grid displaced electricity | 0.025 | 1.28 |
| Waste heat[31] | 0.058 | 1.34 |
| District heating | User input value for the Actual building – see paragraph 43 for the Reference building | User input value for the Actual building – see paragraph 43 for the Reference building |

Figure 2 Screenshot of Table 18 from the Jersey NCM Modelling Guide with highlighted (yellow) natural gas and electricity factors.

## Comparison of $CO_2$ based rating calculations

Table 2 Side by side comparison of England and Jersey CO2 Asset Rating equations and band distribution

| | England | Jersey |
|---|---|---|
| The Asset Rating equation | **$BER_{CO2}$** = the Actual building's $CO_2$ emission rate, in $kgCO_2/m^2$ per annum<br><br>**$RER_{CO2}$** = the Reference building's $CO_2$ emission rate<br><br>**$SER_{CO2}$** = the Standard $CO_2$ Emission Rate where<br>**$SER_{CO2}$** = **$RER_{CO2}$** × improvement factor where the improvement factor is 0.765 (to improve it from 2002 Part L standards to 2006 Part L standards and make it approximately equivalent to the emissions of a gas-fuelled naturally ventilated, heated and cooled building which just complies with 2006 England & Wales Part L).<br><br>The Asset Rating (AR) is the ratio of the $CO_2$ emission rate from the Actual building (i.e., the BER) to the Standard Emission Rate (i.e., SER), with the result normalised such that the SER is equivalent to an Asset Rating of 50:<br>**$AR = 50 \times BER_{CO2}/SER_{CO2}$**<br><br>The AR is rounded to the nearest whole number.<br><br>• If the amount of $CO_2$ emissions from the Actual building is equal to the SER, i.e., BER = SER, then the Asset Rating of the Actual building will be 50.<br>• if the Actual building produces more $CO_2$ emissions than the SER, i.e., BER > SER, then the Asset Rating of the Actual building will exceed 50.<br>• If the Actual building produces less $CO_2$ emissions than the SER, i.e., BER < SER, then the Asset Rating of the Actual building will be below 50.<br>• If the Actual building has net zero $CO_2$ emissions (via renewables), i.e., BER = 0, then the Asset | **$BER_{CO2}$** = the Actual building's $CO_2$ emission rate, in $kgCO_2/m^2$ per annum<br><br>**$NER_{CO2}$** = the Notional building's $CO_2$ emission rate, in $kgCO_2/m^2$ per annum<br><br>The Asset Rating (AR) is the ratio of the $CO_2$ emission rate from the Actual building (i.e., the $BER_{CO2}$) to the $CO_2$ emission of the Notional building (i.e., the $NER_{CO2}$) normalised so that the Notional building has an Asset Rating of 100:<br>**$AR = 100 \times (BER_{CO2} / NER_{CO2})$**<br><br>The AR is rounded to the nearest whole number.<br><br>• If the amount of $CO_2$ emissions from the Actual building is equal to that from the Notional building, i.e., BER = NER, then the Asset Rating of the Actual building will be 100.<br>• If the Actual building produces more $CO_2$ emissions than the Notional building, i.e., BER > NER, then the Asset Rating of the Actual building will exceed 100.<br>• If the Actual building produces less $CO_2$ emissions than the Notional building, i.e., BER < NER, then the Asset Rating of the Actual building will be below 100. |

| | | |
|---|---|---|
| | Rating of the Actual building will be 0.<br>• If the Actual building displaces more $CO_2$ emissions (via renewables) than it generates, i.e., BER < 0, then the Asset Rating of the Actual building will be less than 0, i.e., negative. | • If the Actual building has net zero $CO_2$ emissions (via renewables), i.e., BER = 0, then the Asset Rating of the Actual building will be 0.<br>• If the Actual building displaces more $CO_2$ emissions (via renewables) than it generates, i.e., BER < 0, then Asset Rating of the Actual building will be less than 0, i.e., negative. |
| **The rating bands distribution** | The border between band B and band C on the England EPC scale is a rating of 50 and reflects a building in England which gas-fuelled, heated and cooled, and just complies with the 2006 England & Wales Part L.<br><br>EPC bands are evenly distributed with 25 points in each.<br><br>The England Minimum Energy Efficiency Standard (MEES) is a rating of E.<br><br>Figure 3 provides a visual summary of the rating band distribution. | The Jersey EPC was mainly based on the England EPC for non-domestic buildings. The EPC scale was, however, set so that the bands are 50 rating points in each (rather than 25).<br><br>The border between band B and band C on the linear EPC scale corresponds to a rating of 100 and is also the AR of the Notional building.<br><br>Figure 4 provides a visual summary of the rating band distribution. |

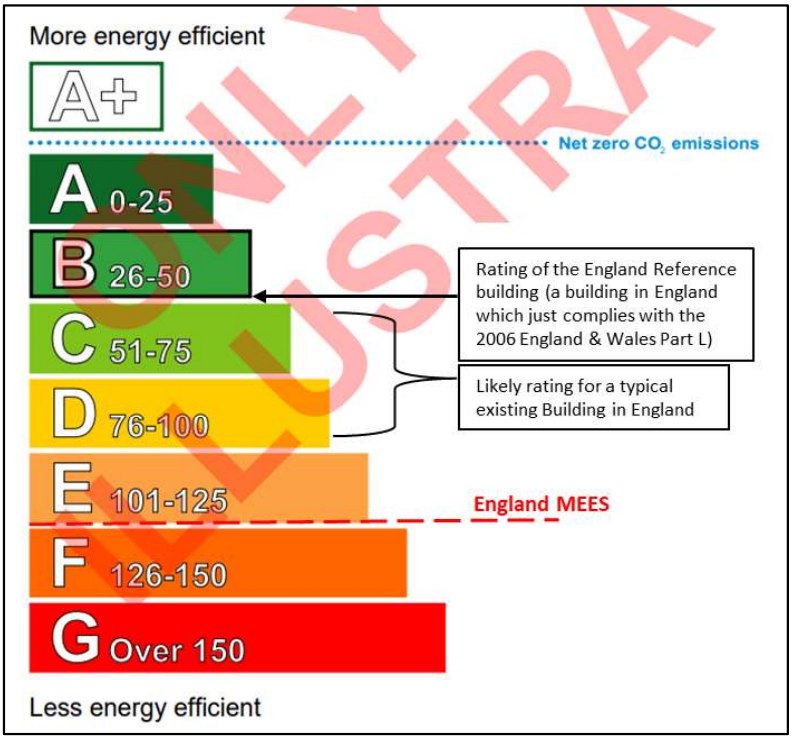



Figure 3 CO2 Asset Rating bands of England EPC (produced from illustrative building in iSBEM v6.1.e)

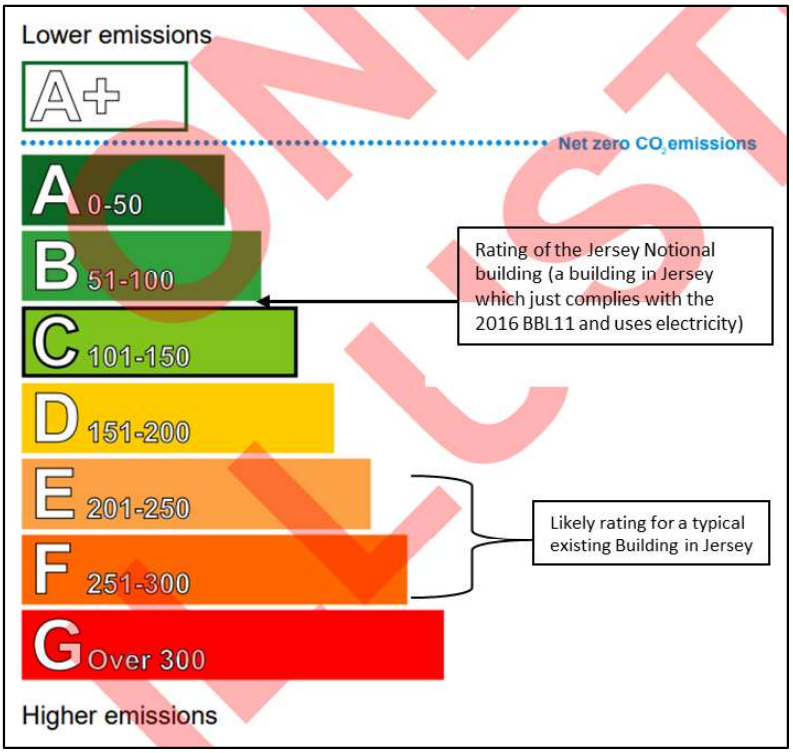



Figure 4 CO2 Asset Rating bands of Jersey EPC (produced from illustrative building in iSBEM v6.1.e)

## Jersey's cost-based asset rating

The assessment of the Actual building's running costs is described with the Cost Asset Rating (CAR). The CAR is based on the Actual Building's Energy costs (£/m2) (BEC), which is normalised with the Jersey Reference building's Energy costs also known as the Target Energy Costs (TEC).

Note here that the building used for normalising the cost-based Asset Rating is the same 2016 Jersey Reference building used for compliance assessment against Jersey's 2016 Building Bye Laws Part 11 (BBL11), where the Reference building follows the same fuel for space heating and hot water as the Actual building. This is because fuels that emit more $CO_2$ emission than electricity are sometimes cheaper than electricity, and GoJ did not wish to encourage fuels which emit more $CO_2$ emissions than electricity.

The cost-based rating follows the equation below:

$$\boldsymbol{CAR = [1 - (\frac{BEC}{TEC}\ /6.5)]\ * 100}$$

Where

*BEC* = Building Energy Costs, the Actual building's annual energy costs (£/m$^2$)
*TEC* = Target energy costs, the Reference Building's annual energy costs (£/m$^2$)

To establish this equation, we bounded the rating between:

- 100 to represent net-zero running costs (CAR = 100 when $BEC/TEC$ = 0.0).
- And 0 to be representative of the worst performing buildings. When devising the CAR with GoJ, BRE conducted a study (in 2021/2022) of the UK non-domestic building stock (as a proxy for the Jersey building stock) in order to establish the ratio BEC/TEC that worst performing buildings may get. The study concluded that the worst performing building probably would present a ratio ~6.5. Therefore, the cost rating was established in order to have the rating equals 0.0 at $BEC/TEC$ = 6.5

The rating bands were then established as follows (Figure 5):

- The lower boundary of band B sits where BEC/TEC=1 (i.e., CAR = 84.7), that is when a building just passes compliance with BBL11.
- The lower boundary of band D represents the typical building stock, which the UK non-domestic building stock study suggested to sit at BEC/TEC=2.5 (i.e., CAR = 57).
- In between BEC/TEC=0 (i.e., CAR = 100), BEC/TEC=1, BEC/TEC=2.5 and BEC/TEC=6.5 (i.e., CAR = 0) the distribution of bands is equally distributed.

Note: that If the Actual building exports (via renewables) more energy than it imports, it can lead to negative building energy costs (BEC < 0), therefore, leading to a rating which can exceed 100.

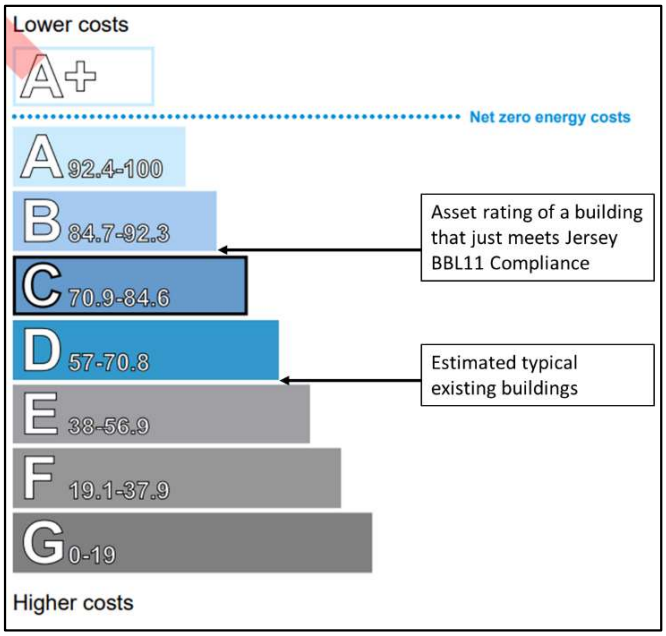



Figure 5 Cost-based Asset Rating bands for Jersey EPC (figure produced from an illustrative building in iSBEM v6.1.e)

# Section B – Modelling analysis

## Methods

The purpose of this exercise was to compare and contrast what the buildings will achieve under the Jersey and England methodologies and provide a reference as to why values are different. As such, one non-domestic building was modelled in the current version of iSBEM (v6.1.e) through each of the following purposes of analysis:

- EPC Jersey
- EPC England (with weather location: London)

The selected building is an office building with electricity supplied heating and air conditioning (i.e., space heating and cooling), and electricity supplied hot water.

The following output key metrics were compared:

- The energy use and $CO_2$ emissions of the Actual building in each case.
- The energy use and $CO_2$ emissions of the Notional building used for producing the Asset Rating in Jersey, and the Reference building used for producing the Asset Rating in England (against which the Actual building's results are compared).
- The EPC $CO_2$-based ratings and bands in each case.

## Results

Figure 6 shows the annual energy use per square meter of total floor area for:

- The Actual and Jersey Notional Building, for the office building run through Jersey EPC purpose of analysis in iSBEM,
- The Actual and England Reference building for the model of the same office building run through England's EPC purpose of analysis in iSBEM.

The results presented in Figure 6 show the Jersey Notional building is much more energy efficient than the England Reference building, which is explained by the difference in specifications described in **Table 2**, summarised below:

- The Jersey Notional building's fabric is better performing than the England Reference building's fabric
- The Jersey Notional building uses 90% efficient direct electric space heating and 95% efficient water heating (taking account of distribution losses of 10% for space heating and 5% for hot water), whereas the England Notional building uses a natural gas boiler with a system efficiency of 73% for space heating and 45% for water heating. Therefore, system efficiencies are better in the Jersey Notional than the England Reference

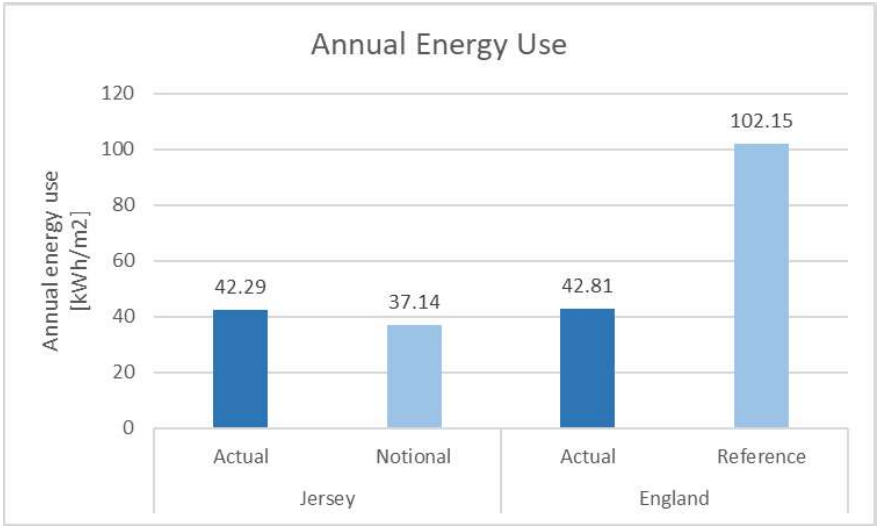



Figure 6 Annual energy use per $m^2$ of total floor area for a same office building modelled in SBEM v6.1.e through both Jersey EPC purpose of analysis and England EPC purpose of analysis.

Figure 7 shows the annual $CO_2$ emissions per square meter of total floor area for:

- The Actual and Jersey Notional Building for the office building run through Jersey EPC purpose of analysis in iSBEM,
- The Actual and England Reference building for the model of the same office building run through England's EPC purpose of analysis in iSBEM.

Figure 7 highlights the following two key points:

- Where the Actual building has very similar annual energy use ($kWh/m^2$) in Jersey and England in Figure 6, the corresponding $CO_2$ emission rates diverge (emission rate is obtained by multiplying the fuel factors, in kg/kWh, by the kWh figure). This is explained from the difference in the electricity mix of Jersey and England since Jersey has a cleaner energy source for its electricity as it largely comes from French nuclear sources, whereas England's electricity mix is more dependent on fossil fuel sources. This is reflected in the $CO_2$ emission factors for electricity in Figure 1 and Figure 2.

- The gap further widens in the $CO_2$ emissions of the Jersey Notional and England Reference buildings because the England Reference building space and water heating systems are fuelled by natural gas, whereas the Jersey Notional heating system is fuelled by direct electricity for these services.

Applying the equations described in Table 2, we get the ratings and bands shown in Figure 8.

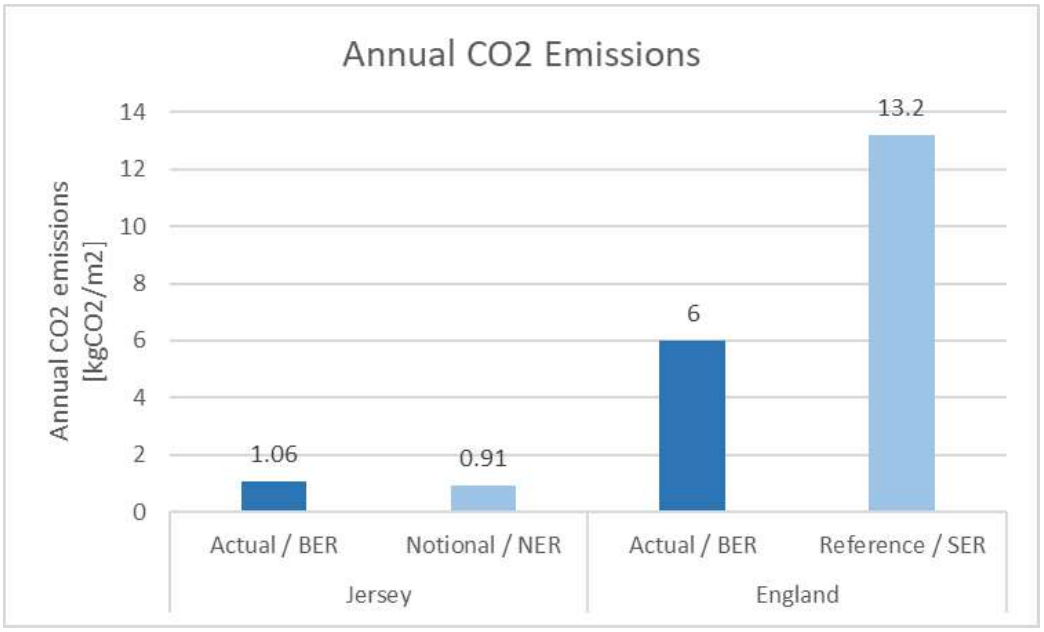



Figure 7 Annual $CO_2$ emissions per $m^2$ of total floor area for a same office building modelled in SBEM v6.1.e through both Jersey EPC purpose of analysis and England EPC purpose of analysis.


Figure 8 left: CO2 Asset Rating scale of Jersey showing the Asset Rating of the office building under the Jersey EPC purpose of analysis, right: CO2 Asset Rating scale of England showing the Asset Rating of the same office building under the England EPC purpose of analysis.

## Discussion

The Jersey EPC purpose of analysis results of the modelled building produces a worse Asset Rating and band than in the England EPC purpose of analysis. As described in Section "*CO2 based Asset Rating comparison*", new buildings in Jersey which use direct electricity for space and water heating and just comply with 2016 BBL11 will sit around the bottom of band B and above on the Jersey rating bands. On the other hand, buildings in England which just comply with 2006 England & Wales Part L will sit around the bottom of band B and above on the England rating bands.

Essentially, England is setting lower standards to achieve a band B than Jersey.

This is because England introduced the $CO_2$ Asset Rating with the 2006 Part L regulations current at the time, aiming to improve the building stock in comparison to the 2006 Part L building regulations.
Jersey introduced the $CO_2$ Asset Rating with the 2016 BBL11 regulations current, therefore, aiming to improve the Jersey building stock in comparison to the 2016 BBL11.

The two countries have two different starting points and political goals, and, therefore, two different rating scales to reflect the starting point and goals.

If the GoJ where to decide the Jersey $CO_2$ Asset Rating methodology does not reflect the political ambitions, GoJ could decide to revise the methodology, perhaps for example:

- By downgrading the specifications of the Jersey Notional building, i.e., to make its energy and $CO_2$ emissions performance worse and setting lower standards for achieving band B on the EPC scale.
- By narrowing the bands the EPC scale to trigger quicker enhancements in the rating as improvement measures get implemented in an existing building.
- By applying a non-linear rating scale so that ratings increase faster, or slower, relative to the Jersey Notional building when improvement measures are introduced to a building, allowing for upgrading bands faster, or slower, for a given change in energy efficiency.

# Conclusions

The purpose of this report was to provide simplified explanations of the methodologies for how compliance is assessed for new buildings and how EPC ratings are produced for non-domestic buildings in each of Jersey and England, highlighting the differences between the two.

To do so, section "*SBEM underlying principles"* summarised the underlying principles of the building energy performance calculations common to both England and Jersey. It provided a summary of how SBEM calculates the energy demand, energy consumption per end-use, and how fuel factors and fuel costs are then applied to produce $CO_2$ emission rates, Primary Energy rates and running costs.

Section "*Compliance methodology comparison"* provided a summary of differences between England and Jersey's methodologies for assessing compliance. The main take away being that current compliance requirement in England (Part L 2021) set higher energy performance standards than Jersey (BBL11 2016) for newly built non-domestic buildings.

In section "*CO2 based Asset Rating comparison"* the differences between England and Jersey's $CO_2$ based Asset Ratings were summarised, and the modelling exercise presented in "*Section B – Modelling Analysis"* allowed to illustrate the main differences:

- The $CO_2$ factors are different for England and Jersey, particularly for electricity which has a much lower $CO_2$ emission factor in Jersey than England. Therefore, for the same energy use, the $CO_2$ emissions will be different in England and Jersey, depending on the fuel used, especially for systems which use electricity.
- Both administrations normalise the rating based on the emission rate of a Reference (naming convention in England) or Notional (naming convention in Jersey) building. The England Reference building $CO_2$ emission rate is used to produce a Standard Emissions Rate which is equivalent to a building which just complies with the 2006 England & Wales Part L regulations and uses natural gas for space and water heating. The Jersey Notional building emission rate is equivalent to a building which just complies with Jersey BBL11 2016 and uses direct electricity for space and water heating.
- The boundary between bands B and C on the England EPC rating scale represents the rating of the Reference building with an improvement factor, i.e., Standard Emission Rate. The boundary between bands B and C on the Jersey EPC represents the rating of the Notional building.
- The outcome is that an identical building assessed with Jersey's EPC purpose of analysis and England's EPC purpose of analysis would likely find it more challenging to achieve a favourable rating on the Jersey EPC than on the England EPC, particularly taking into account the much lower emission factor of electricity in Jersey compared to that of natural gas in England.

Finally, an additional section "*Jersey's cost-based asset rating*" was added to briefly describe Jersey's Cost-based Asset Rating, which is not present on the England EPC.

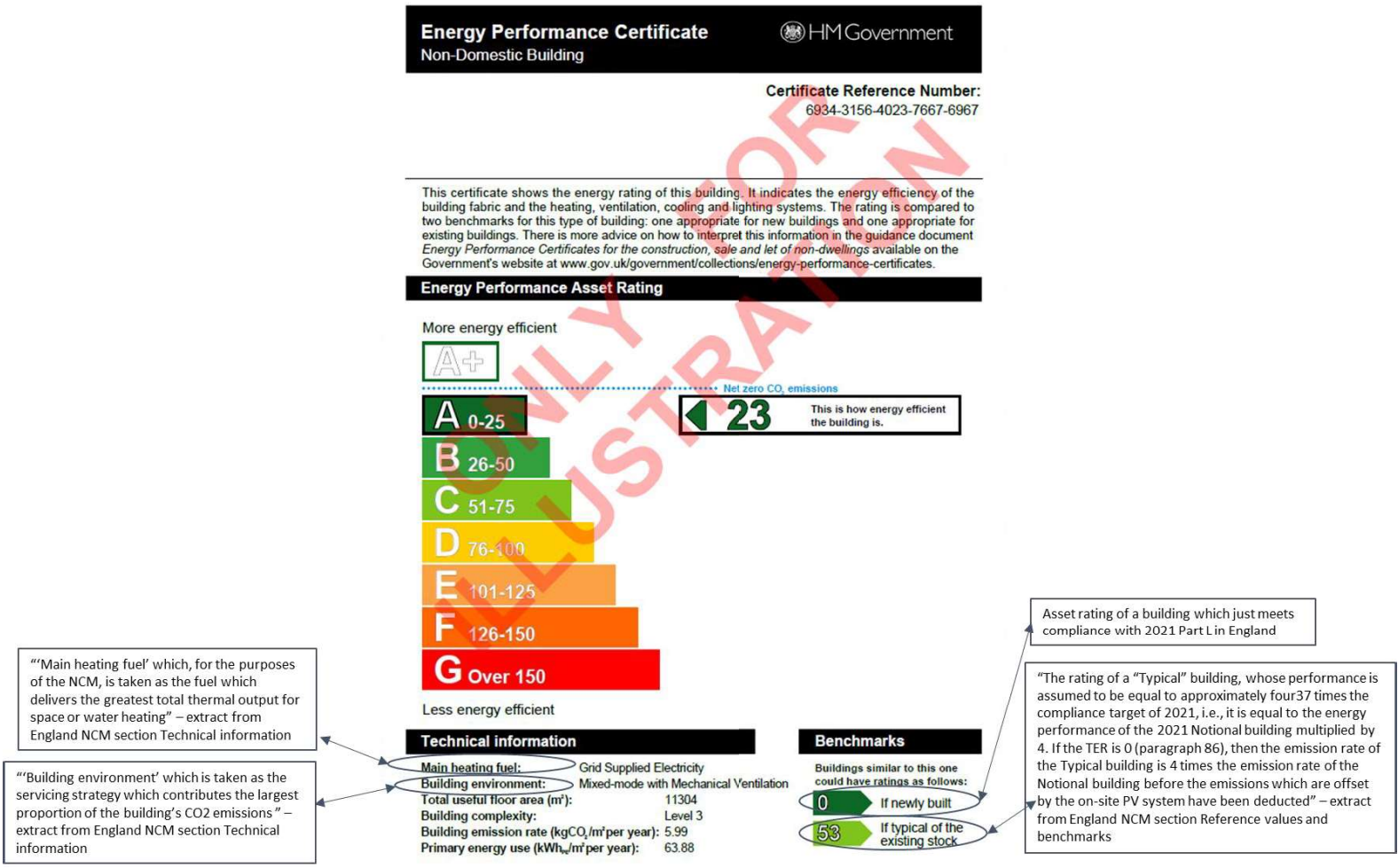
# References

England NCM Modelling Guide 2021 edition (Sep 2022) - link

Jersey NCM Modelling Guide 2022 edition - link

## Appendix A Output EPC from office building with terms definitions

First page of England EPC_certificate for the office building modelled as part of *Section B – modelling analysis*



Second page of England EPC certificate for the office building

## Administrative information

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

| | |
|---|---|
| **Assessment Software:** | iSBEM v6.1.e using calculation engine SBEM v6.1.e.0 |
| **Property Reference:** | UPRN-000000000000 |
| **Assessor Name:** | Joe Bloggs |
| **Assessor Number:** | ABCD123456 |
| **Accreditation Scheme:** | Information not available |
| **Assessor Qualifications:** | NOS3 |
| **Employer/Trading Name:** | |
| **Employer/Trading Address:** | |
| **Issue Date:** | 19 Sep 2023 |
| **Valid Until:** | 18 Sep 2033 (unless superseded by a later certificate) |
| **Related Party Disclosure:** | Not related to the owner |

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 9428-1829-4840-6774-5794

## About this document and the data in it

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

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

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

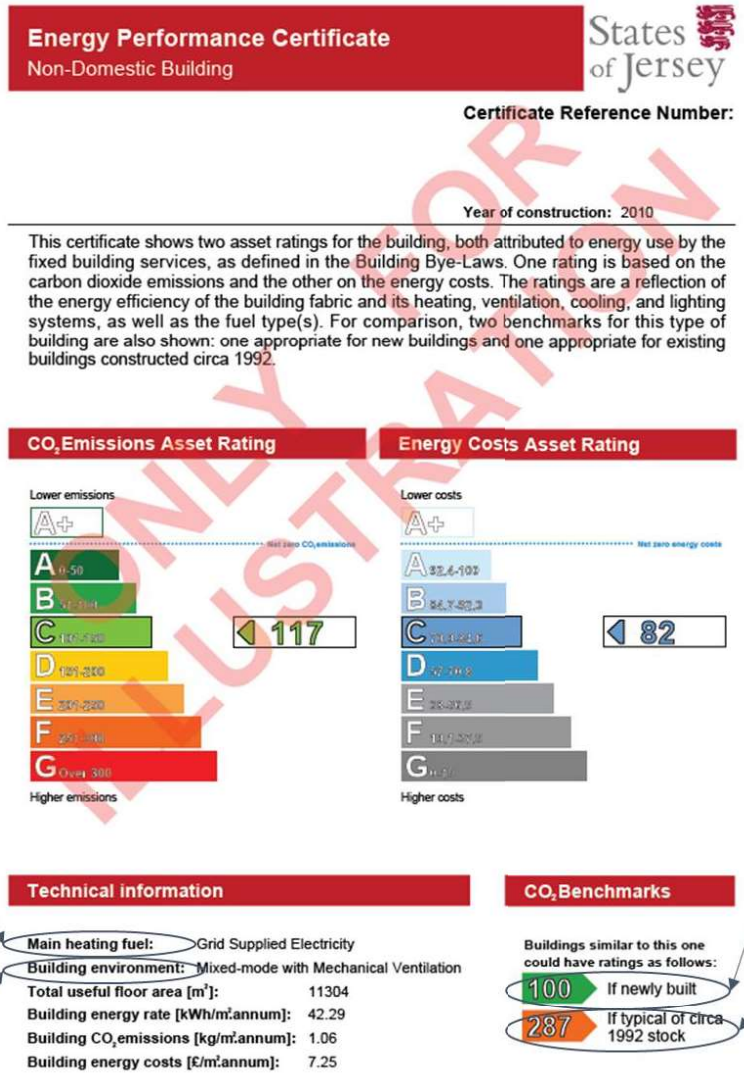
There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at: www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises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

## Opportunity to benefit from a Green Deal on this property

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

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

First page of Jersey EPC certificate for the office building modelled as part of *Section B – Modelling Analysis.*



**Energy Performance Certificate**
Non-Domestic Building

States of Jersey

**Certificate Reference Number:**

**Year of construction:** 2010

This certificate shows two asset ratings for the building, both attributed to energy use by the fixed building services, as defined in the Building Bye-Laws. One rating is based on the carbon dioxide emissions and the other on the energy costs. The ratings are a reflection of the energy efficiency of the building fabric and its heating, ventilation, cooling, and lighting systems, as well as the fuel type(s). For comparison, two benchmarks for this type of building are also shown: one appropriate for new buildings and one appropriate for existing buildings constructed circa 1992.

**$CO_2$ Emissions Asset Rating**

Lower emissions
A+
A 0-50
B
C
D 101-150
E 151-200
F 201-250
G Over 250
117
Higher emissions

**Energy Costs Asset Rating**

Lower costs
A+
A £2.4-10.2
B £4.7-52.3
C
D
E
F
G
82
Higher costs

**Technical information**

| | |
|---|---|
| **Main heating fuel:** | Grid Supplied Electricity |
| **Building environment:** | Mixed-mode with Mechanical Ventilation |
| **Total useful floor area [m²]:** | 11304 |
| **Building energy rate [kWh/m².annum]:** | 42.29 |
| **Building $CO_2$ emissions [kg/m².annum]:** | 1.06 |
| **Building energy costs [£/m².annum]:** | 7.25 |

**$CO_2$ Benchmarks**

**Buildings similar to this one could have ratings as follows:**

100 If newly built

287 If typical of circa 1992 stock



"'Main heating fuel' which, for the purposes of the NCM, is taken as the fuel which delivers the greatest total thermal output for space or water heating" – extract from England NCM section Technical information

"'Building environment' which is taken as the servicing strategy which contributes the largest proportion of the building's CO2 emissions " – extract from England NCM section Technical information

The CO2 rating of the Reference building used for assessing compliance with the 2016 BBL11

The CO2 Asset rating calculated for a building that is typical of buildings constructed in Jersey circa. 1992. Using a few approximations, it was agreed to represent this 1992 building as having 2.87 x the energy consumption and emissions of the 2016 Jersey Reference building that is used for setting the compliance target for new builds.

Second page of Jersey EPC certificate for the office building

## Administrative information

| | |
|---|---|
| **Assessment Software:** | iSBEM v6.1.e using calculation engine SBEM v6.1.e.0 |
| **Building Permit Number:** | |
| **Assessor Name:** | Joe Bloggs |
| **Assessor Number:** | ABCD123456 |
| **Accreditation Scheme:** | Information not available |
| **Employer/Trading Name:** | |
| **Employer/Trading Address:** | |
| **Related Party Disclosure:** | Not related to the owner |
| **Issue Date:** | 19 Sep 2023 |
| **Valid Until:** | 18 Sep 2033 (unless superseded by a later certificate) |

**Recommendations for improving the property are contained in Report Reference Number:**

Report Ends