Green Star Performance

Greenhouse Gas Emissions Calculator Guide

April 2016

1. Change Log

Release	Date	Description of changes
Green Star – Performance Version 1 **Release 1**	16/09/2015	Initial Release
Green Star – Performance Version 1 **Version 1.1**	08/04/2016	Released for Green Star – Performance v1.1, minor changes to improve clarity

2. Table of contents

Developed by the
Green Building Council of Australia

3. Intent of this guide

This guide has been developed to inform building owners, managers and operators how to target and achieve credit points for Greenhouse Gas Emissions when seeking a Green Star - Performance rating. The guide contains:

- Information on the various compliance paths that project teams may take to demonstrate that their building complies with the credit

- The data requirements for each compliance path

- Information to help guide project teams through the entire submission compilation process.

This guide is structured along the lines of the Greenhouse Gas Emissions credit. It begins with an overview of the credit then focuses on the specifics of each compliance pathway, followed by some detailed advice on data, calculations and other relevant issues. The guide is not made to be read end-to-end. It is recommended that, once familiar with the credit in general, the reader seeks information from the section of this guide relevant to the compliance pathway that they are seeking to use.

4. The Greenhouse Gas Emissions credit

Credit Aim

The intent of this credit is to encourage the reduction of greenhouse gas emissions associated with the use of energy in building operations.

Scope of the credit

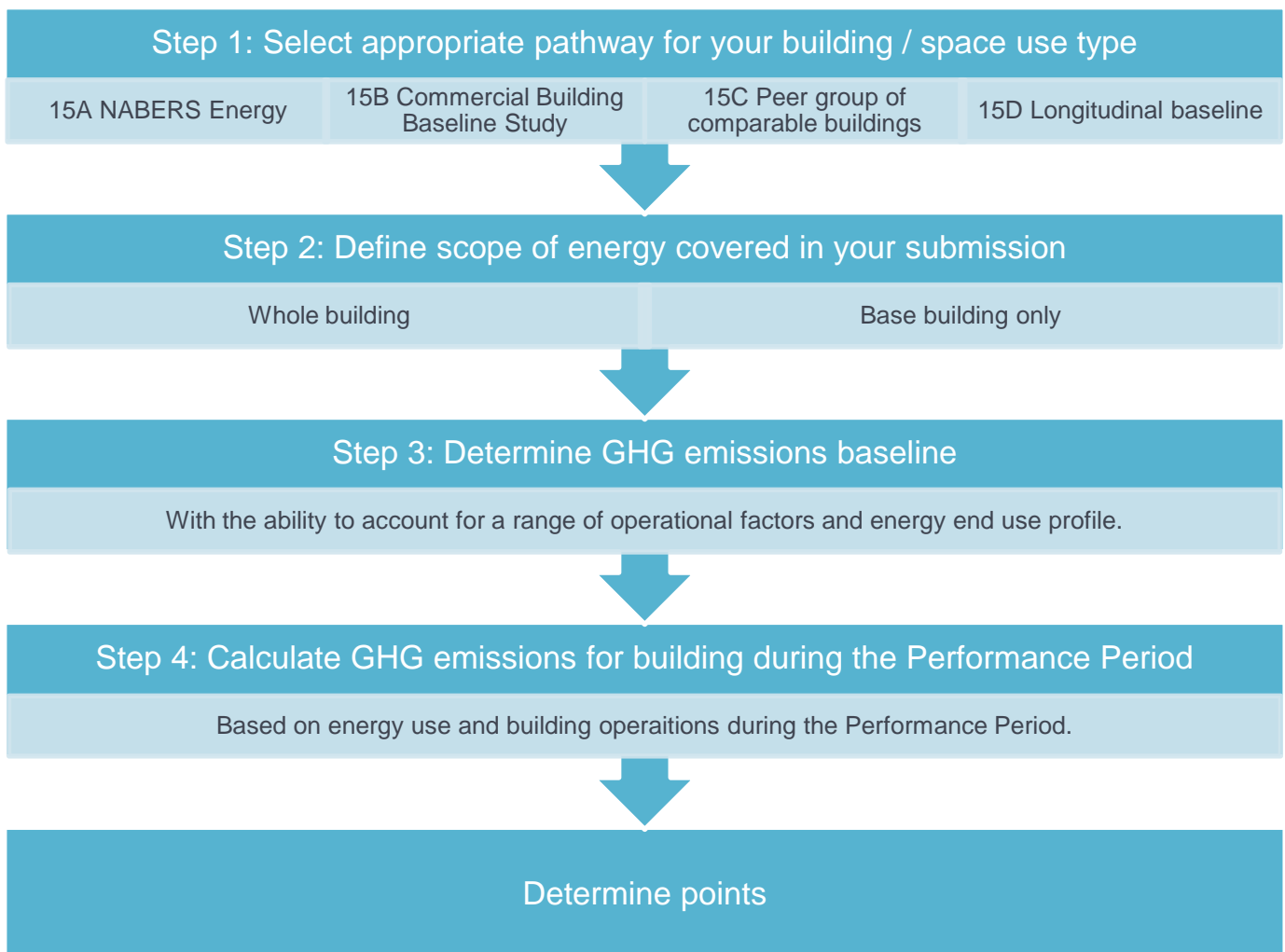The Greenhouse Gas Emissions credit focuses on greenhouse gas emissions from energy use due to building operations during the Performance Period over which a building is assessed. For the purposes of the credit, 'Energy' encompasses all the energy types used in operating these buildings, including electricity, gas, oil or diesel as per the definitions used by the National Greenhouse and Energy Reporting (NGER) scheme.

Credit Methodology Overview

The Greenhouse Gas Emissions credit sits within the energy category and focuses on Greenhouse Gas Emissions that result from energy use within the building. The credit is structured to allow flexibility and applicability to the many different building types that are eligible to be certified under the Green Star – Performance v1. This flexibility is achieved by offering a number of different pathways for compliance. Selecting an appropriate pathway is the first step (Step 1 in the below graphic) in compiling a submission for Greenhouse Gas Emissions. The four compliance pathways are:

- 15A NABERS Energy

- 15B Commercial Building Baseline Study

- 15C Peer group of comparable buildings

- 15D Longitudinal baseline

Each pathway is based on a different method for establishing a Greenhouse Gas Emissions baseline which may be appropriate to a building seeking certification. The sections that follow in this guide will provide further details on each pathway, the basis upon which it may be selected and details on the calculations.

Step 1: Select appropriate pathway for your building / space use type			
15A NABERS Energy	15B Commercial Building Baseline Study	15C Peer group of comparable buildings	15D Longitudinal baseline

Step 2: Define scope of energy covered in your submission	
Whole building	Base building only

Step 3: Determine GHG emissions baseline

With the ability to account for a range of operational factors and energy end use profile.

Step 4: Calculate GHG emissions for building during the Performance Period

Based on energy use and building operaitions during the Performance Period.

Determine points

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Once a pathway is selected and performance benchmarks are established, greenhouse gas emissions performance for a project is assessed against these benchmarks. Points are awarded on an incremental basis for improvement on the nominal minimum performance benchmark. Up to 23 points are awarded for GHG emission performance (there are 100 points for environmental performance within the entire rating tool). Projects aiming to achieve a Best Practice rating (4 Star Green Star) must demonstrate a level of improvement of 10% higher than the average performance benchmark (as shown below).
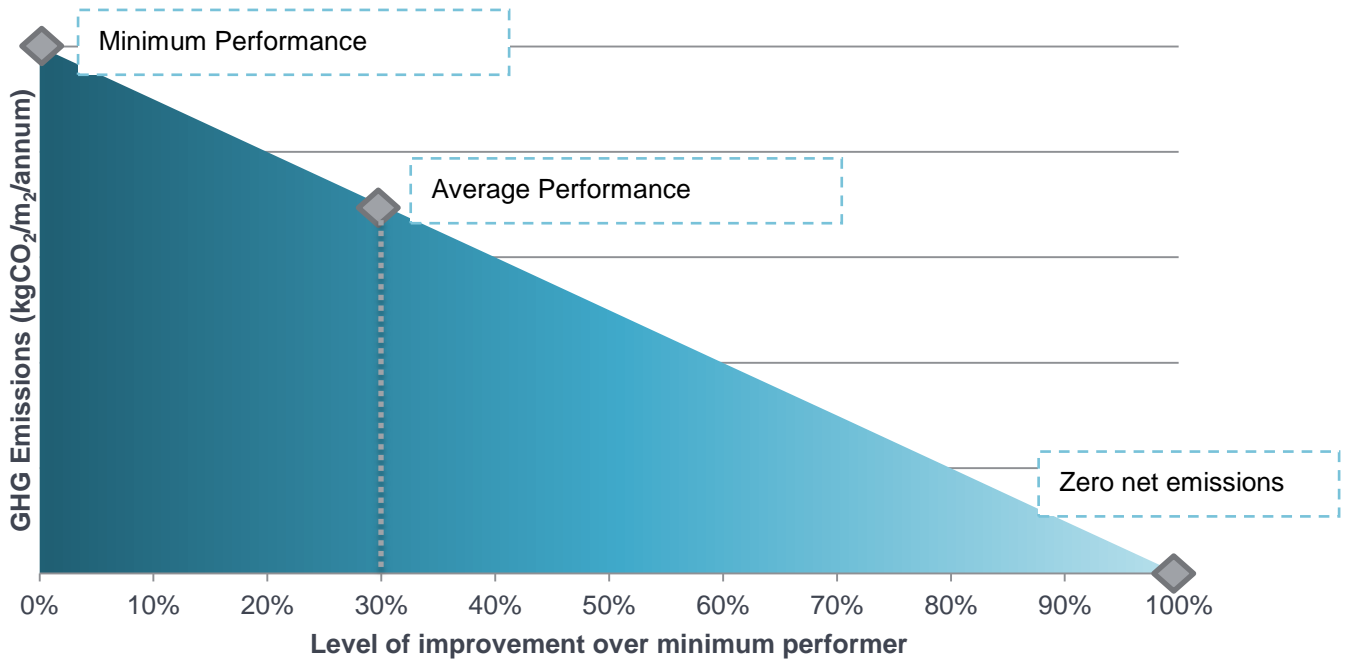
The average and minimum performance baselines, the project's GHG emissions, and consequently points achieved are all calculated within the appropriate Green Star - Performance Greenhouse Gas Emissions Calculator. Points are awarded based on Table 15.0.3 below.

For each of the four pathways, a separate calculator has been provided. All the associated data quality and requirements for each pathway is stipulated later in this guide.

Where a project team is demonstrating compliance using base building energy data only, there are three additional points available for tenant engagement. This is described in more detail later in this guide.

Table 15.0.3: Greenhouse Gas Emissions points available

Whole building		Base building only	
Percentage better than 'minimum performer'	Points	Percentage better than 'minimum performer'	Points
0% - Nominal Minimum Baseline	0	0% - Nominal Minimum Baseline	0
4%	1	5%	1
8%	2	10%	2
12%	3	15%	3
16%	4	20%	4
20%	5	25%	5
24%	6	30% - Average Performer	6
28%	7	35%	7
32% - Average Performer	8	40%	8
36%	9	45%	9
40%	10	50%	10
44%	11	55%	11
48%	12	60%	12
52%	13	65%	13
56%	14	70%	14
60%	15	75%	15
65%	16	80%	16
70%	17	85%	17
75%	18	90%	18
80%	19	95%	19
85%	20	100% - Net Zero Emissions	20
90%	21		
95%	22		
100% - Net Zero Emissions	23		

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5. Pathway 15A: NABERS Energy

Selecting this pathway

This option enables buildings which are eligible for a valid NABERS Energy Certificate to determine Greenhouse Gas Emissions performance using NABERS calculated emissions. A 'greenhouse gas emissions baseline' already exists for premises eligible for a NABERS Energy Certificate. Green Star – Performance draws on NABERS benchmarks to determine a baseline upon which projects demonstrate improvements through their certified NABERS rating.

Data requirements

Applicants must have a NABERS Energy Certificate valid during the Performance Period, obtained in line with rules set by the NABERS program, as determined by the National Administrators, the Office of Environment and Heritage NSW. The NABERS Energy Certificate used does not have to be valid throughout the whole Performance Period:

- Its expiry date must fall within Performance Period. Or;

- Its expiry date must fall within the 90 days between the end of the Performance Period and Round 1 submission for the project. Or;

- If it is a newly obtained NABERS certificate, it must have been obtained in the 90 days between the end of the Performance Period and the projects Round 1 submission (which would mean the rating is based on data from the Performance Period).

The documentation requirements of the credit will require the provision of both the NABERS Energy Certificate and accompanying NABERS Energy report. For more detail please refer to

12. Data and validation requirements.

Establishing a baseline

Using this pathway there is no need to develop an average performance baseline. Baselines are already established within the Greenhouse Gas Emissions Calculator based on the following NABERS Energy Star ratings:

- The Average Performer is predetermined as 3 Star NABERS Energy.

- The Nominal Minimum Performer Baseline is determined to be 1 Star NABERS Energy rating.

Points Allocation

There are two options that may be taken in determining points using a certified NABERS Energy rating:

1) Simple approach using the below table 15A.3 Simplified NABERS points allocation.

OR

2) Compare GHG emissions to those of a nominal 1 Star NABERS Energy building.

Simple approach

The simplified approach can be carried out exceptionally quickly, however it is not as granular as the more detailed comparative approach.

Table 15A.3 Simplified NABERS points allocation

NABERS Energy Whole Building Star Rating	Points	NABERS Energy Base Building Star Rating	Points
1.0 Minimum Baseline	0	1.0 Minimum Baseline	0
1.5	1	1.5	1
2.0	2	2.0	2
2.5	3	2.5	3
3.0 Nominal Average Performer	5	3.0 Nominal Average Performer	4
3.5	7	3.5	6
4.0	9	4.0	8
4.5	11	4.5	10
5.0	14	5.0	12

5.5	17	5.5	14
6.0	20	6.0	16
Net Zero Operating Emissions	23	Net Zero Operating Emissions	20

Comparative approach

The comparative approach requires the applicant to determine a GHG emissions benchmark using the relevant NABERS energy reverse calculator. Figures entered into the NABERS energy reverse calculator must assume the same location and operational factors as those used in the certified NABERS rating. The applicant must determine and extract the energy and Greenhouse Gas emissions for a 1 Star NABERS Energy outcome (aligned with the nominal minimum baseline).

Along with figures from the certified NABERS energy certificate and accompanying report for the building seeking certification, figures from the NABERS energy reverse calculator must be entered into the Green Star – Performance Greenhouse Gas Emissions calculator. Based on this information entered, the Greenhouse Gas Emissions calculator will determine the percentage emissions reduction and overall points able to be targeted in line with Table 15.0.3.

6. Pathway 15B: Commercial Building Baseline Study

Selecting this pathway

This option uses the published average energy intensity trends derived from the "Baseline Energy Consumption and Greenhouse Gas Emissions in Commercial Buildings" study (Commercial Buildings Baseline Study or CBBS), published by the Department of Climate Change and Energy Efficiency in November 2012, to calculate an average greenhouse gas emissions baseline. This option incorporates published energy intensity data from a number of building types and regions across Australia to determine a building emissions intensity baseline.

In addition to this study, the GBCA are committed to release benchmarks for new building types as statistically significant datasets are sourced and new benchmarks developed.

This pathway may be selected where an appropriate energy intensity figure is available for the space use types and given regional location for building seeking certification.

Where data from the study is unavailable for building space use or type, and region, then this pathway cannot be used.

Building space use types that are currently represented in the benchmarks for this pathway are:

- Privately Owned Standalone Office - Base Building

- Privately Owned Standalone Office - Whole Building

- Government Owned Standalone Office - Whole Building

- Hotel

- Retail Shopping Centres - Base Building (other than Supermarket)

- Retail Shopping Centres - Whole Building (sum of base buildings + retail tenancies, other than Supermarkets)

- Supermarket Standalone

- Public Hospital

- Private Hospital

- Public School

- Independent or Catholic School

- Tertiary Education VET Building

- Tertiary Education University Building

- Public Building (such as: Library and Community Centre)

- Law Court

- Distribution Centre*

- Warehouse (without refrigeration)*

- Warehouse (with refrigeration)*

When selecting this option, applicants must investigate the suitability of benchmarks set out in the Greenhouse Gas Emissions Calculator for the building seeking Green Star certification. Applicants must note that due to differences in a range of operational factors the benchmarks represented in this pathway may not be comparable to the building seeking Green Star certification. Applicants are encouraged to evaluate the CBBS report before selecting a benchmark from the above.

Data requirements

Applicants must have at a minimum, access to the following data on the building seeking certification to be able to compile a submission using this option within the calculator:

- Building Specific Details as listed in **Section 12 - Data and Validation Requirements**; and

- Primary Operational Variables as listed in **Section 12 - Data and Validation Requirements**

If the applicant wishes to account for additional operational variables, these must also be detailed as per Data and Validation Requirements. Examples of these additional operational variables include local climate, extended or abnormal operating hours, or other building and operational factors.

Mixed use building guidance

Where a building consists of multiple spaces with different uses, and all of which are relevant benchmarks for this pathway, the 'Building Details' tab within the 15B calculator allows for each space to be entered against that relevant benchmark.

Furthermore, a range of operational factors may also be entered within these fields which may contribute to the normalisation of benchmarks to ensure that they are relevant to the building seeking Green Star certification.

Operational variables - Input Data									
Building Details*	Description*	Functional Use (for use with Option 1(b) only)*	Area (m²)*	Hours of operation (hours / week)*	Adjusted Operational Variable 1	Adjusted Operational Variable 2	Adjusted Operational Variable 3	Duration of operation within performance period (days)*	Comments
Shopping Centre Base Building		Retail Shopping Centres Base Building (other than Supermarket)	20000	70				365	
Supermarket		Supermarket within Shopping Centre	10000	75					
Functional space 3		[Select functional use from drop down list]							
Functional space 4		[Select functional use from drop down list]							
Functional space 5		[Select functional use from drop down list]							

Figure 1 – Operational Variables Calculator layout

Operational factors and normalisation

All relevant operational factors for the building seeking Green Star certification should be entered in the 'Building Details' tab of the 15B calculator. An operational factor is relevant if it is a variable that has a significant bearing on

energy use within the building. If the project team is seeking to make adjustments to the benchmarks to account for a relevant operational factor, this must be entered in the cells provided. The Benchmark Adjustment and Normalisation section of this guide details how adjustments are made within the calculator to obtain the correct results.

Please note: adjustments to benchmarks due to operational factors or end uses are only available where these operational factors have been documented against the benchmarks within the calculator and or within the CBBS report.

7. Pathway 15C: Peer group of comparable buildings

Selecting this pathway

This pathway enables the applicant to establish a benchmark using in operation data from a group of comparable buildings to the building seeking Green Star certification. This option requires the applicant to source information to develop a relevant baseline and hence will likely require more time and effort than either 15A or 15B, it is thus recommended to pursue 15A or 15B where possible prior to pursuing pathway 15C.

Data requirements

When using this option it is the responsibility of both the applicant and project team to source all relevant information on the peer group of buildings to establish a baseline for comparison with the building seeking Green Star certification. Benchmarks of this approach are established based on:

- At least three years of operational data for a peer group of at least three buildings.

As a stepwise process this will include:

- Selecting a peer group of at least three comparable buildings. For more detail please refer to **Section 9 Peer Group Selection.**

- Sourcing all relevant building specific details as listed in **Section 12 - Data and Validation Requirements** for the peer group of buildings as well as the building seeking Green Star certification. Three years of operational data is required for the peer group of buildings.

- Sourcing Primary Operational Variables as listed in **Section 12 - Data and Validation Requirements**.

- Sourcing relevant secondary operational variables and energy end-use breakup for the peer group of buildings as well as the building seeking Green Star certification. These will be required to ensure that benchmarks established by the peer group of buildings are able to be adjusted and normalised for relevance to the building seeking Green Star certification. For more detail please refer to **Section 10 - Benchmark Adjustment and Normalisation.**

Operational factors and normalisation

More than any other pathway 15C requires detailed operational information to ensure that benchmarks established are relevant to the building seeking Green Star certification. For more information please refer to information within Peer Group Selection followed by Benchmark Adjustment and Normalisation.

Alternative compliance

Benchmarks within this approach are established based on at least three years of operational data for a peer group of at least three buildings. The GBCA is open to alternate peer group benchmarks.

For example: If a larger peer group of buildings was available then it may be acceptable to formulate a baseline based on fewer years' worth of data. All proposals for alternative approaches should be submitted through a credit interpretation request.

8. Pathway 15D: Longitudinal benchmarking

Selecting this pathway

This pathway allows the applicant to establish a benchmark based on a longitudinal study of greenhouse gas emission performance based on previous year's operations. It is a pathway most suitable when a project is not eligible for pathways 15A, 15B, or 15C.

Data requirements

Project teams must establish a greenhouse gas emissions Average Performance Baseline based on five concurrent years of historical energy performance data sourced from within the ten years of operation, prior to the beginning of the performance period.

Applicants must have access to the following data on the building seeking certification as a minimum to be able to compile a submission using this option:

- Building Specific Details as listed in **Section 12 - Data and Validation Requirements**; and

- Primary Operational Variables as listed in **Section 12 - Data and Validation Requirements**

If the applicant wishes the benchmarks to account for local climate, extended or abnormal operating hours, or other building and operational factors in the normalised energy use benchmarks energy end use breakup will also be required as specified in Data and Validation Requirements.

Operational factors and normalisation

Because 15D is a self comparison, it is unlikely that any operational factor or end use adjustments will have to take place unless there have been changes to the building or its use. If a change has occurred to the building, then normalisation and end-use adjustment functionality is included in the 15D calculator to account for this. Examples of material changes to the building may include:

- Changes to floor area as a result of a building upgrade or extension.

- Changes to space use that have a material impact on water consumption which may include changes to occupant amenity that have a material impact on water consumption.

For a full and detailed explanation of benchmark adjustments please refer to **Section 10 - Benchmark Adjustment and Normalisation.**

9. Peer group selection

Overview

For pathways 15B and 15C, an appropriate peer group needs to be selected that will be used to determine the greenhouse gas emissions baseline. In the absence of average building performance benchmark data, the peer group comparison provides a suitable method of determining an emissions baseline.

For pathway 15B, the greenhouse gas emissions baseline can be directly determined from tables published in the credit based on the building's functional use. Further work is required under Pathway 15B for mixed use facilities.

For pathway 15C, building owners and managers can nominate their own peer group comprising 3 or more comparable buildings. Relevant data must then be collected and analysed to determine the greenhouse gas emissions baseline from which the rating building's performance is assessed.

Note that buildings eligible for a NABERS Energy Certificate (15A) are not required to select a peer group as a greenhouse gas emissions baseline is already determined using this approach. Similarly, the selection of a peer group is not required under 15D as this method involves a comparison against a longitudinal baseline from the building itself.

The selection of an appropriate peer group is essential to achieving an accurate and fair rating comparison. A number of comparable eligibility requirements must be met when selecting the peer group; these are presented in the following sections.

The peer group comparison option is open to significant variability between building specific characteristics and operational characteristics of different buildings and building types; therefore, a detailed normalisation procedure is required to limit this variability from considerably influencing the rating.

Peer Group Comparison Methodology

The following sections provide guidance in selecting an appropriate peer group of comparable buildings.

Primary Use Definition

The 'Primary Use' of a building is defined as the primary activity that covers at least 80% of the buildings operations, inclusive of 'primary use – support areas'.

'Primary use – support areas' are any miscellaneous areas which support the primary building operations and activities. These include administrative office, store rooms, toilets and common/public areas.

Comparable Eligibility Requirements

For buildings to be deemed comparable, they must satisfy a number of eligibility criteria, which include the following:

- Buildings must exhibit the same 'primary use' type. Where a building is deemed 'mixed use', it must satisfy the requirements outlined in Options for mixed use premises (over page).
- The difference in total gross building area must be less than ±50% of the rated buildings area unless agreed otherwise.
- The weekly hours of operation of the comparable buildings must be within ±10% (prior to normalisation) unless agreed otherwise.

- Building applicants must provide evidence to support the 'primary use' or 'mixed use' percentages claimed herein by providing marked up floor plans which clearly identify the various functional spaces that the building consists of.
- Building owners and managers must compare the end uses of each comparable building with that of the rated building to ensure that they feature similar energy systems.
- Determine availability of data for each building in comparable peer group. Only buildings which exhibit comprehensive energy source data and end use break up data are eligible.

Options for mixed use premises

For a building to be classified as a 'primary use', at least 80% of the buildings gross area must be used for the same primary activity, inclusive of supporting administration areas. However, it is estimated that many buildings will exhibit 'mixed use' spaces; and the determination of a buildings 'primary use' (hence the ability to directly compare this to a set of peer group buildings) will therefore be a non-trivial task.

Mixed use buildings can be rated but careful attention must be paid to selecting an appropriate peer group. Mixed use buildings will most likely include various functional spaces, each with its own operating variables and energy intensity. As such, the rated building cannot simply be measured against other mixed use buildings without reviewing the similarities and/or differences in use within each major functional space.

Two options exist for 'mixed use' building owners and operators to determine a peer group emissions baseline:

1. **Weighted averages approach:** Pro-rata gross building area into various functional spaces (uses) and construct an area weighted average performer based on single primary use peer group buildings (e.g. a university building that exhibits 30% laboratory, 20% lecture theatres and 50% classroom/administration can be compared to three separate peer group buildings, each exhibiting at least 80% primary use in each of laboratory, classroom and lecture theatre functional uses). This may be the preferred approach for building owners and managers seeking to use pathway 15B;

2. **Comparable functional spaces approach:** Demonstrate through a CIR with appropriate supporting documentation that 'mixed use' peer group buildings are comparable to the rated building due to:

   a) large number of mixed functional spaces (e.g. consider a case where such a large number of functional use spaces exist in both peer group and rated buildings that they can be deemed comparable); or,

   b) similar functional use breakup between the comparable buildings;

The comparability may be a combination of qualitative and quantitative analysis. This approach may be preferred by building owners and managers seeking to use Pathway 15C.

Should the applicant be unable to identify suitable buildings for use as a peer group, pathway 15D which involves self comparison should be pursued.

1.1.1 Selection of peer group

The selection of the peer group is performed by the building applicant and is subject to GBCA third party peer review. The applicant may make use of any sources of data they have available to them, whether this be from external parties or from the applicant's own internal portfolio. At least three buildings must be selected to constitute a valid peer group.

The applicant building must clearly specify all of the functional spaces within the building to determine whether the building is a 'primary use' or 'mixed use' building.

1.1.2   Procedure

The following procedure presents a generalised method for selection and determination of peer group comparability:

1. Determine whether the rated building is eligible for 'primary use' or 'mixed used' categories (i.e. 80% primary use coverage);

    a) If primary use, search for buildings with the same primary use for peer group;

    b) If mixed use, determine the number and size of different functional spaces in rated building and select comparable peer group buildings based on either a 'weighted averages' or 'comparable functional spaces' approach as per options for mixed use premises.

2. Evaluate the following building specific characteristics for both the rated building and the peer group buildings, in order to determine whether the peer group satisfies the Comparable Eligibility Requirements:

    a) Building Area – appropriate to the building type (e.g. net lettable area, gross floor area, effective area, usable floor area, etc)

    b) Functional use types in the building

    c) Combined area of each functional use type

    d) Locality and climate zone, based on Postcode

    e) Weekly hours of operation

    Note that neither energy use nor greenhouse gas emissions are to form part of the evaluation criteria.

3. Compare peer group buildings and determine if Comparable Eligibility Requirements have been satisfied.

4. Proceed with performance period emissions calculation.

10. Benchmark adjustment and normalisation

In order to make a direct comparison between baseline and performance period emissions in order to determine greenhouse gas emissions performance, a building's emissions baseline must be 'normalised' such that the baseline and performance period can be directly compared on a 'like for like' basis. The normalisation process is as follows:
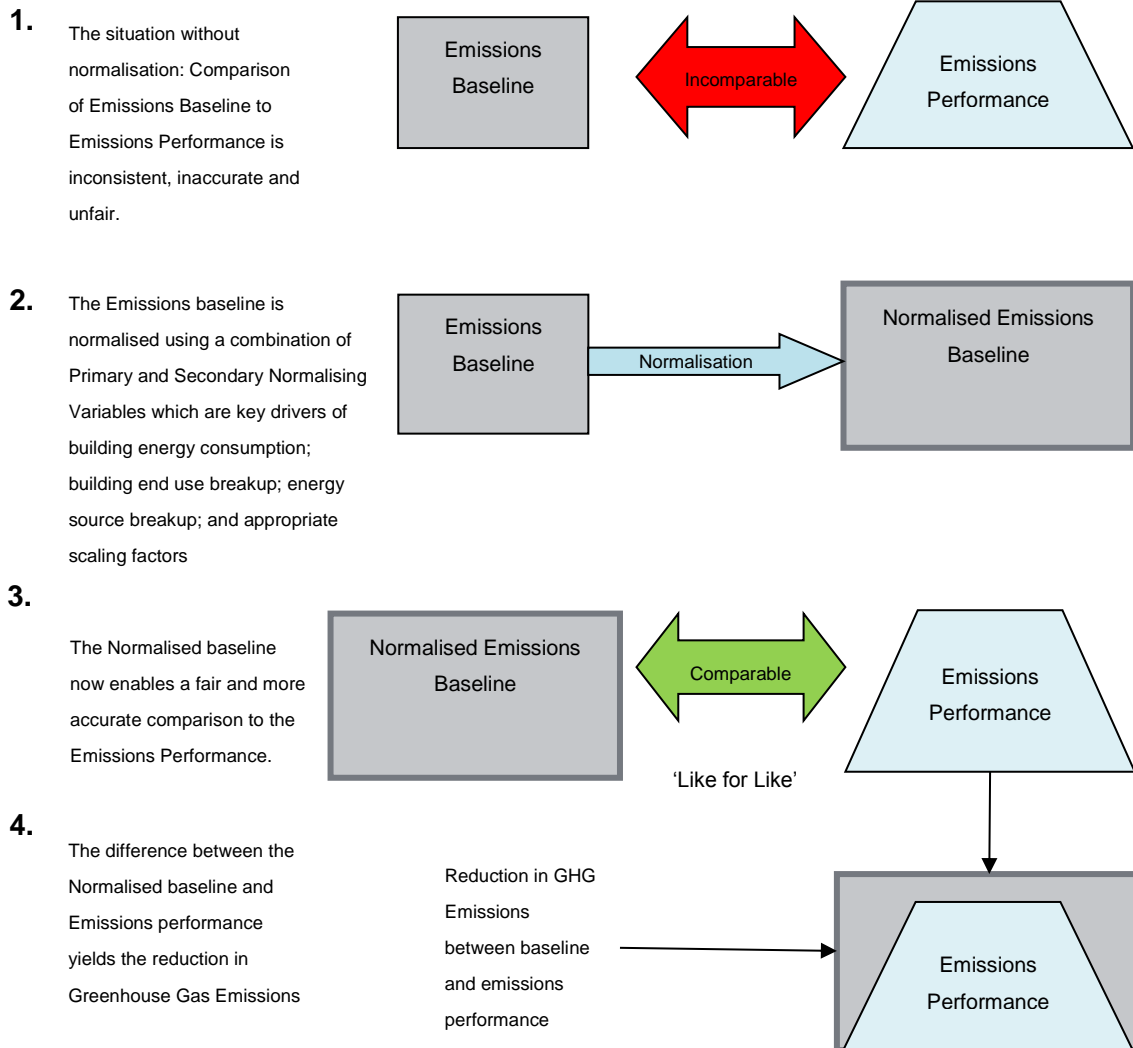
1. The situation without normalisation: Comparison of Emissions Baseline to Emissions Performance is inconsistent, inaccurate and unfair.

2. The Emissions baseline is normalised using a combination of Primary and Secondary Normalising Variables which are key drivers of building energy consumption; building end use breakup; energy source breakup; and appropriate scaling factors

3. The Normalised baseline now enables a fair and more accurate comparison to the Emissions Performance.

4. The difference between the Normalised baseline and Emissions performance yields the reduction in Greenhouse Gas Emissions

Figure 2: Normalisation Infographic

The Peer Group comparison approach has the most potential for significant variability between the emissions baseline and the emissions performance period. Therefore, for buildings eligible for 19C Peer Group Comparison, a detailed normalisation procedure has been defined to ensure application of fairness and consistency throughout the rating tool. The normalisation procedure is presented in the following flow diagram:
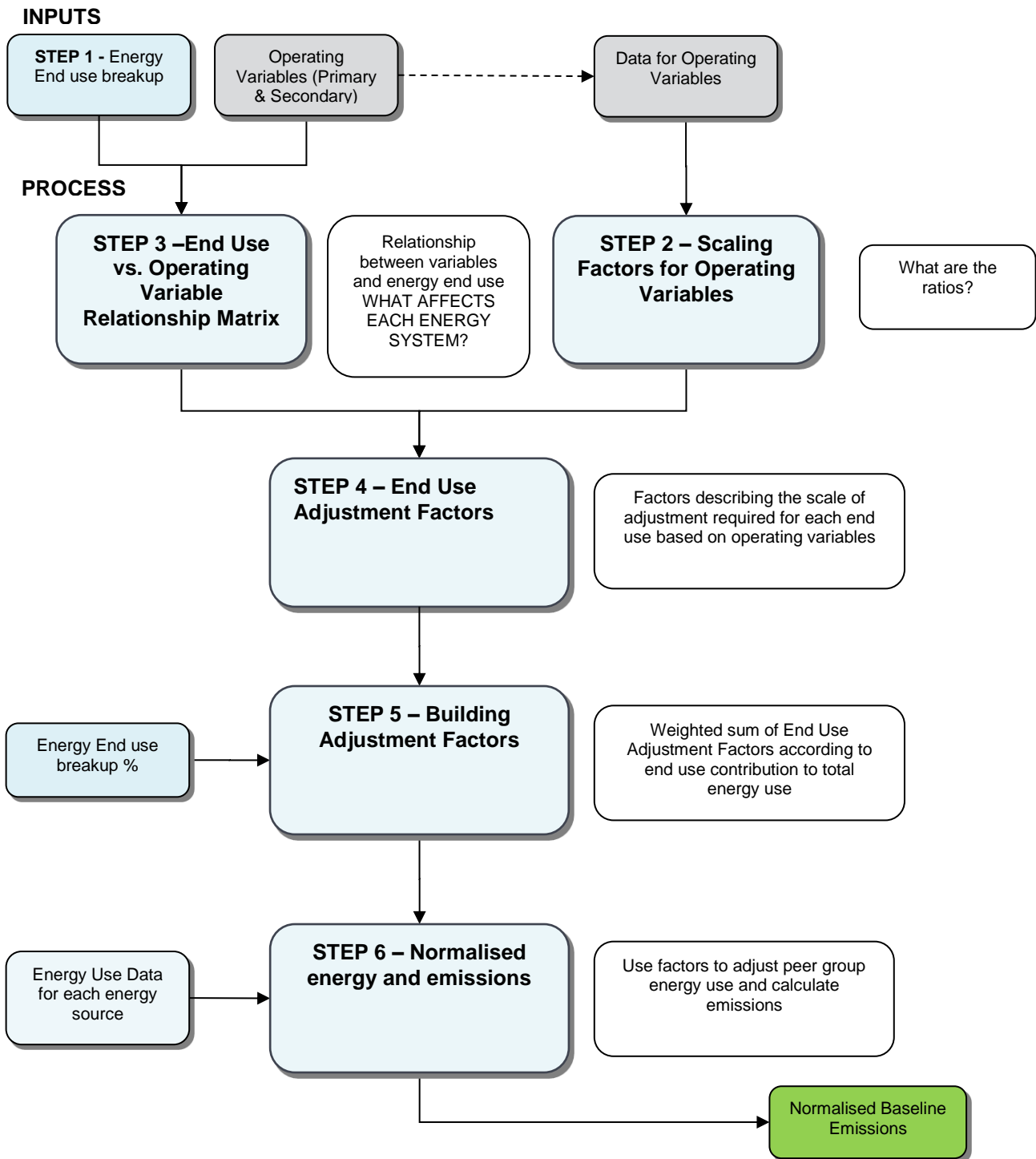
INPUTS

| STEP 1 - Energy End use breakup | Operating Variables (Primary & Secondary) | - - - → | Data for Operating Variables |

PROCESS

| STEP 3 –End Use vs. Operating Variable Relationship Matrix | Relationship between variables and energy end use WHAT AFFECTS EACH ENERGY SYSTEM? | STEP 2 – Scaling Factors for Operating Variables | What are the ratios? |

STEP 4 – End Use Adjustment Factors

Factors describing the scale of adjustment required for each end use based on operating variables

Energy End use breakup % → **STEP 5 – Building Adjustment Factors**

Weighted sum of End Use Adjustment Factors according to end use contribution to total energy use

Energy Use Data for each energy source → **STEP 6 – Normalised energy and emissions**

Use factors to adjust peer group energy use and calculate emissions

Normalised Baseline Emissions

Figure 1 – Normalisation Procedure

The key steps of the normalisation process are described below. These steps occur once the peer group has been selected, the operating variables have been defined and appropriate data has been collected. The other key input into this process is the collation of an energy use breakup, preferably for each energy source.

Step 1 – Obtain an energy use break up for each energy source

The first step is to obtain data relating to building end use - the proportion of total energy used within each energy use system.

Qualitative analysis was conducted when the peer group was chosen to identify peer group buildings that exhibited similar functional space use (i.e. activities). With this in mind, it is assumed that the peer group will have similar energy end uses as the rated building. As a result, a single common building end use break up will be obtained for each energy source. If there is sufficient difference, then separate end use break ups should be obtained.

Building owners and managers must source or develop an end use breakup of the buildings energy consumption. Building owners are required to provide their own evidence of end use breakup and how it was determined, which will be assessed by the certified assessors.

This will form a key component of the normalisation process. End use breakups allow more accurate normalisation as it facilitates the separate adjustment of each energy end use based on its own set of operating variables

Step 2 – Calculate scaling factors for Operating Variables

Scaling factors are calculated for operating variables for each peer group building and annual period. These factors represent the scaling required to 'resize' a particular operating variable (i) for annual period ((j) from the peer group building (k) to the rated building.

Scaling factors are calculated using the following equation:

$$Scaling\ Factor_{i,j,k} = \frac{Annual\ value\ for\ Operating\ Variable(i)for\ Building\ to\ be\ Rated}{Annual\ value\ for\ Operating\ Variable(i)for\ Annual\ Period\ (j)\ for\ Peer\ Group\ Building(k)}$$

A sample calculation is shown in the example below for the scaling required between two buildings for the operating variable: Operating Hours. The example data is as follows:

Operating Variable	Rated Building	Comparable Building
Operating Hours	85	80

The calculation of scaling factor for Operating Hours will be:

$$Scaling\ Factor_{Operating\ Hours} = \frac{85}{80} = 1.0625$$

Step 3 – Develop end use versus operating variable relationship matrix for each energy source

This involves qualitatively analysing the relationship between each operating variable and the energy end use systems within the group of buildings.

Essentially the aim is to nominate the operating variables for each energy end use that would cause a change in the size or scale of its contribution to the overall building total energy use.

This is conducted by simply reviewing each energy end use in isolation and asking the following question for each operating variable:

Would changes in this operating variable cause changes in the resultant end use?

Working through this process a relationship matrix for energy end use versus operating variables is developed. Within the matrix, each variable is flagged (i.e. TRUE or FALSE) depending on whether that operating variable is a key influence on energy consumption for each energy end use (i.e. variables that have a significant influence on energy consumption for each end use will be flagged to be included in the normalisation analysis).

The reason for this detail is to obtain a more accurate normalisation of each peer group building than would be achieved by simply scaling its entire annual energy use by a factor such as area. Simple scaling doesn't adequately account for multidimensional changes that may affect each energy use system differently.

For example, scaling by area doesn't account for changes in energy use due to operating hours or climate zone and vice versa. More importantly some variables affect all end use systems, whilst others relate to specific end use only.

Electricity						
	End Use					
Operational Variables	Space Cooling	Lighting	Total Equipment	Domestic Hot Water	Other Electrical Processes	Ventilation
Cooling degree days	TRUE					
Heating degree days						
Adjusted Area	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Adjusted Hours	TRUE	TRUE	TRUE		TRUE	TRUE
Beds						
Annual Occupancy Factor	TRUE		TRUE	TRUE		
Operational variable 3						

Natural Gas						
	End Use					
Operational Variables	Space Heating	Domestic Hot Water	Pool Heating	Sterilization Equipment	Other Gas Use	0
Cooling degree days						
Heating degree days	TRUE					
Adjusted Area	TRUE	TRUE	TRUE	TRUE	TRUE	
Adjusted Hours	TRUE					
Beds						
Annual Occupancy Factor	TRUE	TRUE				
Operational variable 3						

Figure 4 -End use versus operating variable relationship matrix

From the above matrix, it is shown that the amount of energy required for electric Space Cooling is influenced by:

- the need for cooling (in the form of Cooling Degree Days),
- the area to be conditioned,
- the hours of operation and the level of occupancy.

It is not influenced by the need for heating (in the form of Heating Degree Days) or the number of beds.

Guidance Tips

Given the synergies between peer group members, a simplified approach using common data for energy end use and the relationship matrix can be applied to all buildings. Alternatively this approach can be applied separately for each

peer group building, which would enable more accurate accounting for end uses' energy mix, minor differences in the mix of services delivered at each site or onsite technologies.

Some knowledge of building end use systems may be required as well as some background knowledge as to how these systems are implemented on site.

In the approach above, if an energy end use (i.e. the table columns) is not linked to any particular operating variable, then it won't be scaled in the next step. Essentially it is treated as a load with a fixed value – it still exists as it is represented in the end use break up.

Building owners and managers are to identify (i.e. TRUE or FALSE) which operating variables are key drivers for energy consumption for each energy end use (i.e. variables that have a significant influence on energy consumption for each end use will be flagged to be included in the normalisation analysis).

Step 4 – Calculate End Use Adjustment Factors

The next step is to combine the data for Scaling Factors with the Relationship Matrix to calculate End Use Adjustment Factors. The qualitative TRUE values in the relationship matrix are replaced with the scaling factors for the relevant operating variable.

The End Use Adjustment Factor is then calculated by multiplying all applicable scaling factors that apply to a single energy end use.

Step 5 – Calculate Building Adjustment Factors

Once all End Use Adjustment Factors have been determined, these are in turn aggregated as a weighted sum of building end use to form a Building Adjustment Factor. Building Adjustment Factors are calculated for each peer group building, annual period and energy source.

What does this mean?

The operating variables and energy end use data has been used to determine an adjustment factor or multiplier for each peer group building and energy source.

Step 6 – Calculate normalised energy use and emissions for peer group

Normalised Energy Use

The Building Adjustment Factors are applied to the energy use data for the peer group buildings resulting in a like-for-like peer group.

Normalised Greenhouse Gas Emissions

To calculate the normalised Greenhouse Gas Emissions, multiply emissions factors by the Normalised Energy Use.

Note that the same emissions coefficients are applied to all annual periods as well as being applied to each building. The factors that are chosen should be those that are relevant to the rated building, which serves to place all buildings in the same geographical area.

Finally, the greenhouse gas emissions baseline (i.e. the Average Performer) is determined by taking the average of all annual emission values for all the buildings in the peer group.

11. GreenPower and Greenhouse Gas Emissions Offsets

GreenPower

Purchasing GreenPower® is an option to reduce the greenhouse gas impact of the energy buildings consume. The use of GreenPower®, for the purposes of this credit, is an acceptable practice to reduce operational greenhouse gas emissions. When entering utility information into the 'Building Details' section of the calculator, GreenPower® can be selected. For the purposes of Green Star – Performance, GreenPower® is treated as a renewable, net-zero carbon electricity source.

Please note: The purchase of GreenPower cannot be used to satisfy the minimum performance level for Green Star - Performance certification of four stars or higher.

Greenhouse gas emissions offsets

Greenhouse gas emissions offsets purchased against the asset or by the controlling entity used to offset emissions covered within the scope of the GHG emissions credit are deemed acceptable, dependent on the project team satisfying a number of conditions as outlined under General Guidance.

General guidance

The following are a list of general principles that must be met when seeking to use greenhouse gas emissions offsets within this credit:

- There must be clear and documented carbon accounting and links between offsets purchased to the operational emissions of the building seeking Green Star certification.

- There must be transparent reporting of the purchase and surrender of offsets against the asset or controlling entity. For example a public listing on an greenhouse gas emissions offset register.

- The greenhouse gas emissions offsets purchased must meet the standards set out in the National Carbon Offset Scheme (NCOS) regulated by the Federal Government of Australia. The version of the National Carbon Offset Standard used must be the current standard during the Performance Period of the project.

For more information on the National Carbon Offsets Standard please visit http://www.environment.gov.au/climate-change/carbon-neutral/ncos

It is recommended that projects seeking to use GHG emissions offsets within the Green Star – Performance submission submit a credit interpretation request to confirm their approach and documentation for the submission.

NCOS Carbon Neutral Program

If a buildings operation is certified as carbon neutral under the NCOS carbon neutral program, then the following supporting documentation may be used to demonstrate offsets purchased against the asset (no CIR necessary):

- The NCOS Public Disclosure Summary;

- Evidence of purchase and cancelling of NCOS eligible offsets; and

- The most recent independent audit report (only if produced during the Performance Period. It is noted that this audit only occurs every second year under the NCOS Carbon Neutral Program).

For more information on the National Carbon offsets program please visit http://www.environment.gov.au/climate-change/carbon-neutral/carbon-neutral-program

12. Data and validation requirements

Types of data

The below table lists the type of data that may be required for your submission dependent on the selected pathway.

Data Type	Required Data
Building Specific Details	• Building Name
	• Contact Details
	• Building Address, Postcode and State or Territory
	• Building Type, description and industry type
	• Primary Building Use
	• Start Date for the annual performance period
	• Energy billing data and/or verified interval data associated with the performance period, covering all energy sources crossing the building boundary and consumed on-site.
	• Consumption data must completely cover both baseline and performance periods.
	• Where non-utility interval data is provided, requirements include:
	• Electricity Account details including supplier, meter number, account number, and description of coverage.
	• Verification of Non-Utility Interval Meter Data as per Section 5.4.
Primary Operational Variables	• Building Area
	• Hours of operation
	• Heating and cooling degree days (informed by building postcode). This will be automated by a spreadsheet based Greenhouse Gas Emissions calculator and it is explained here for transparency and clarity

Secondary Operational Variables	• At least one secondary operational variable which has specific relevance to that building type and which has a significant impact on energy consumption within the rated building.
	• In addition, the variable must apply to each comparable building when using Pathway 15C – Comparable Building Peer Group.
End Use Breakup	• An end use breakup which covers all energy consuming end use systems within the building boundary.
	• The end use breakup may be derived from various sources (including energy audits, sub-metering, or from similar building types) and is subject to GBCA and third party assessor review.
	• End use break ups can also be derived from data published in the Commercial Building Baseline Study.
	• The end use breakup may be a total energy breakup or split into various energy sources.

Standards for acceptable data

Energy consumption

Standards for acceptable energy source data are provided below, in order of preference:

- Utility bills (revenue data)

    o Utility bills from a verified utility showing consumption and demand figures for the performance period, including meter reading times/dates and meter identification.

- MDA utility metered interval data (revenue data)

    o Electronic records including spreadsheets from verified MDA utility data showing consumption and demand figures for the performance period. This includes meter reading times/dates and meter identification.

- Non-utility metered interval data (non-revenue data):

    o Electronic records including spreadsheets which show consumption and demand figures for the performance period, including reading times/dates and meter identification.

    o Non-utility meters must be validated according to Section 5.2.2 – Non-utility meter validation.

    o Non-utility meters must have an accuracy of at least Class 1 quality.

      o   If requirements of 1, 2 or 3 cannot be met, building owners may apply for an alternative methodology to the GBCA through a Credit Interpretation Request (CIR).

Energy end-use information

Building owners and managers are required to source a comprehensive energy end use breakup from an acceptable data source. Acceptable sources are listed as follows, in order of preference:

- Commissioning a current Energy Audit report or use of previous existing Energy Audit report

    o   Audit reports will have been conducted to either a Level 2 or Level 3 standard as per the Australian and New Zealand Audit standard (AS/NZS 3598:2000). Audit reports should be no older than three years from the start date of the performance period.

- End use sub-metering

    o   Break ups from sub-metering should be such that they cover a full 12 months operation and be capable of separating energy by end use, not simply functional areas. The sub-metering should cover the entire building.

- Comparable Building End use Breakup

    o   An energy use break up from a building may be used subject to suitable justification that the comparable building is representative (i.e. that it satisfies the comparability requirements) and is based on one of the accepted data sources listed here (e.g. audit report, sub-metering).

- Commercial Buildings Baseline Study average end use breakups

    o   A representative energy use break up from a published source may be used once subject to suitable justification. End use break ups published within the Commercial Building Baseline Study are deemed one acceptable source.

- If none of the required data sources from 1-5 can be incorporated, building owners may apply for an alternative methodology to the GBCA through a Credit Interpretation Request (CIR).

    o   Where end use breakups are based on separate energy sources (i.e. separate electricity and gas end use break ups), these may be used for greater consistency in normalisation.

Energy end-use adjustments

- Building owners and managers have the option to perform a series of end use adjustments to the comparable buildings to effectively adjust the end use breakup such that a 'like for like' comparison is enabled between the rated and peer group buildings.

- End use adjustments are to account for specific, known differences that will prevent a fair comparison. These may include additional or missing energy end uses, or special events that have caused non-routine consumption. Examples of this may include dissimilar end uses between buildings, i.e. a commercial kitchen or café present in one building and not another, a periodic site shutdown due to renovation or extreme weather event, or other potential events or end-uses that lead to non-routine consumption.

- Where end use adjustments are necessary, a number of options are available to building owners and managers for performing adjustments. Acceptable methods are listed as follows, in order of preference:

Measure the energy consumption associated with the end use to be adjusted.

The total energy consumption associated with the adjusted end use may be measured by means of separately sub-metering the end use and subtracting from the total building consumption. This option is only available where the comparable building has a dissimilar end use in addition to the rated building end use breakup (e.g. a comparable building has a data centre, whereas the rated building does not).

Data from a recent energy audit report.

The results from a recent energy audit report may be used to determine the necessary end use adjustment. Energy audits must have been completed to either a Level 2 or Level 3 standard as per the Australian and New Zealand Audit standard (AS/NZS 3598:2000).

Use published KPI's or suitable reference sources to calculate adjusted end use consumption.

Where available, building owners and managers may use published source data and other reference material to calculate the end use adjustment. Published data and reference material may take the form of published energy efficiency guides and reports, best practice guidelines and existing benchmarks, published source data, manufacturer's guidelines or other source material which can be verified and approved by the GBCA.

Calculate a suitable adjustment KPI based on the other buildings in the comparable peer group.

Where data is available, a relevant adjustment KPI may be calculated using consumption data and system or activity metrics from other comparable buildings in the peer group. For example, where one building in the comparable peer group does not have a café with significant gas end use consumption, then an average café gas consumption intensity (MJ/m2) may be estimated and applied to the building without café end use to determine the appropriate end use adjustment.

Calculate a suitable adjustment KPI based on the rated building.

Where data is available, a relevant adjustment KPI may be calculated using consumption data and system or activity metrics from the rated building, and then applied to the other comparable buildings in the peer group to estimate the required consumption adjustment. For example, where the rated building has a data centre end use, and the comparable buildings don't, then an adjustment KPI may be determined from the rated building and applied to each of the peer group comparable buildings.

Adjustments are only applied to peer group buildings. Each adjustment must be accompanied by clear reasoning and documentation. All adjustment methods will be subject to a GBCA peer review and approval process before credit points can be awarded.