Change Log: D2 May 2014 Points tables added

Greenhouse Gas Emissions

Aim of Credit

To encourage the reduction of greenhouse gas emissions associated with the use of energy in building operations.

Credit Criteria

0	**Conditional Requirement**	This Conditional Requirement must be met in order for a project to be illegible for Green Star certification. Compliance with this requirement may be demonstrated using a modelled performance approach or a deemed-to-satisfy approach as outlined in Compliance Requirements.
1	**Greenhouse Gas Emissions Reduction – Deemed-to-Satisfy Pathway**	Up to 5 points out of 20 points are available where it is demonstrated that the building's predicted greenhouse gas impact has been reduced by employing 'best practice' attributes. This criterion may be applied to NCC Class 3 to Class 9 buildings, as described in Compliance Requirements.
2	**Greenhouse Gas Emissions – Modelled Performance Pathway**	Up to 20 points are available where it is demonstrated that there is a percentage reduction in the predicted energy and greenhouse gas performance of the proposed building. Points are awarded based on the proposed building's predicted ability to reduce its predicted consumption and emissions towards net 'zero operating emissions'. While this pathway does not require the installation of renewable energy sources, it does reward their installation by providing additional point incentives when installed on site. There are three options outlined in Compliance Requirements for this pathway. This criterion may be applied to NCC Class 2 to Class 9 buildings in different ways, as described in Compliance Requirements.

Compliance Requirements

Where the National Construction Code (NCC) is referenced, the applicable version is that referenced in the Building Surveyor's report for the project or the version of the NCC that is current at the date of the project's registration for Green Star certification.

Change Log: D2 May 2014 Points tables added

0- Conditional Requirement

This criterion must be satisfied in order for a project to be eligible for a certified Green Star rating.

0.1 Deemed-to-Satisfy (DTS) Pathway – NCC Classes 3 to 9

Demonstrate compliance with all DTS requirements as outlined in Section J of the National Construction Code provisions applicable to the project.

0.2 Modelled Performance Pathway

There are 3 options for demonstrating compliance with the Conditional Requirement when using this pathway.

0.2.1 NCC Class 5 – Office (DTS using NABERS Energy Commitment Agreement)

This option recognises NABERS Energy Commitment Agreements, where a full peer review of the building design and associated energy performance simulation assessment has been completed by a NABERS-recognised Independent Design Reviewer. The scope of the NABERS Energy rating is base building only, and applies to offices (Class 5) only.

A minimum 4.5-Star NABERS Energy 'Commitment Agreement' is deemed-to-satisfy this Conditional Requirement.

0.2.2 NCC Class 2 - Multi Unit Residential (DTS using NatHERS)

This option applies only to Class 2 dwellings and the immediate adjacent areas used for access to dwellings and which provide common amenities for use by residents only.

A minimum NatHERS 0.5-star rating improvement on the minimum legislated area-weighted average and worst-case NatHERS star rating for the state or territory jurisdiction applicable to the building location, satisfies this Conditional Requirement.

0.2.3 NCC Classes 2 to 9 - Reference Building Pathway

In order to satisfy this Conditional Requirement, the Proposed Building greenhouse gas emissions are less than those of the equivalent Benchmark Building.

Specifically, the Benchmark Building represents a 10% improvement on the Reference Building (a building which achieves minimal compliance with the NCC Section J DTS provisions) satisfies this Conditional Requirement.

Change Log: D2 May 2014 Points tables added

1. Deemed-To-Satisfy Pathway

Up to 5 points are awarded where it is demonstrated that the Class 3 to 9 parts of a building comply with the following requirements.

1.1	**Building Envelope**	1 point is awarded where the project complies with section J1 of the NCC and a 10% increase on the required R-values specified in sections J1.3, J1.5 and J1.6 are achieved
1.2	**Glazing**	1 points is awarded where the project complies with Section J1 and J2 of the NCC and the following conditions are met: • For vertical glazing, the total energy used for orientation of each storey is not be greater than 10% of the total allowance according to the Australian Building Codes Board glazing calculator or the calculated aggregated air-conditioning energy value • For roof lights, a 10% improvement on the requirements of section J1.4 is achieved. If there are no roof lights in the building, then this item is Not Applicable
1.3	**Lighting**	1 point is awarded when the project complies with Section J6 of the NCC and the following conditions are met: • For all building types an 10% decrease on the NCC Section J6 maximum illumination power densities, as defined in Table J6.2a are achieved • Automated lighting control system(s), such as occupant detection and daylight adjustment is (are) provided to 95% of the nominated area • For Class 5 and 9a buildings, the size of individually switched lighting zones does not exceed 100 m2 for 95% of NLA.

Change Log: D2 May 2014 Points tables added

1.4	**HVAC**	*1 points is awarded when the project complies with Section J5 of the NCC and the following conditions are met:* • the required fan motor power and pump power as defined in Tables J5.2 and J5.4a is reduced by at least 10% ; and • the required minimum thermal efficiency of the water heater as defined in Table J5.4b is increased by at least 10%; and • the required minimum energy efficiency ratio for packaged air conditioning equipment and refrigerant chillers as defined in Tables J5.4d and J5.4e or MEPS, where Section J does not apply to the equipment capacity is increased by at least 10%.
1.5	**Building Sealing**	<u>Mechanically Air-Conditioned and Mixed Mode Ventilated Spaces</u> 1 point is awarded where a pressurised building air leakage test is carried out on the completed building in accordance with one of the following standards: – ASTM E779-10 – ATTMA TSL2 <u>Naturally Ventilated Spaces</u> 1 point is awarded where the building is naturally ventilated in accordance with credit IEQ – Quality of Indoor Air.

2. Modelled Performance Pathway

There are three options for this pathway. This criterion may be applied to Class 2 to Class 9 buildings, as described in the NCC.

2.1 NCC Class 5 – Office (DTS using NABERS Energy Commitment Agreement)

Up to 12 points are available when using NABERS Energy to predict the project energy performance. Points are awarded based on the base metric (kgCO2e) rather than the NABERS Energy star score. Specification and design checks for office lighting also apply.

Points are awarded on a continuous scale, hence, for example, GHG emission reduction of 27% achieves 2.53 points (not 1.87), and lighting efficacy of 1.6 W/m²/100 lux achieves 1.58 points (not 1.32). Final rounding to a whole number occurs in the Green Star total score.

Points awarded are to be calculated using the Green Star – Greenhouse Gas Emissions Credit Calculator; however the table below is a guide to the approximate points that are awarded.

Change Log: D2 May 2014 Points tables added

Credit Element	Reduction	Points Awarded*
Greenhouse gas emissions reduction (relative to 4.5-star NABERS Energy baseline)	20%	2
	40%	4
	60%	5.5
	80%	7.5
	100%	9.5
Office lighting efficacy	2.2 W/m²/100 lux	0
	1.7 W/m²/100 lux	1.5
	1.2 W/m²/100 lux	2.5

*See Greenhouse Gas Calculator for exact point distribution

This pathway recognises NABERS Energy Commitment Agreements, where a full peer review of the base building design and associated energy performance simulation assessment has been completed by a NABERS-recognised Independent Design Reviewer. The scope of the NABERS Energy rating is base building only, and applies to offices (Class 5) only. Performance at and in excess of NABERS Energy 4.5-star rating is rewarded by the credit.

This pathway may be used to assess the building as a whole where the gross floor area (GFA) of the Class 5 component is not less than 80% of the building total GFA, but the total available points will be reduced in proportion with the actual GFA (e.g. if the Class 5 GFA is 90% of the total GFA, then only 90% of the total points for this pathway will be available). Where the Class 5 GFA is less than 80% of the building total GFA, the non-Class 5 GLA must be assessed using one of the other options in this credit.

Since the base building energy consumption used for assessment in NABERS Energy ratings does not include office lighting (tenancy energy consumption), a proportion of the total points available for this credit are dedicated to office lighting efficacy.

Points dedicated to office lighting efficacy are awarded for lighting systems which exceed 2.2 W/m²/100 lux, up to maximum points at 1.2 W/m²/100 lux.

Change Log: D2 May 2014 Points tables added

2.2 NCC Class 2 - Multi Unit Residential (DTS using NatHERS)

Up to 10 points are available when using NatHERS to predict the project energy performance. Points are awarded based on the base metric (MJ/m²) rather than the NatHERS star rating score. Specification and design checks for lighting, HVAC, building sealing and appliances also apply.

Points are awarded on a continuous scale for the energy intensity reduction and solar hot water contribution; all other items are incremental. Final rounding to a whole number occurs in the Green Star total score.

Credit Element	**Reduction**	**Points Awarded**
Energy intensity reduction (relative to project baseline (mandated minimum average rating + 0.5-star)), and HVAC systems and comfort control		Up to 5.5
Lighting		0.25 per initiative
Domestic Hot Water	Minimum efficiency	0.37
	Solar hot water contribution (minimum nominal 30% contribution)	up to 1.48
Building Sealing	Testing completed	0.5
Appliances and Equipment	Appliance ratings not less than 1-star below maximum available	0.35 per appliance type

This option applies only to Class 2 dwellings and the immediate adjacent areas used for access to dwellings and which provide common amenities for use by residents only. Points are awarded for exceeding the mandatory requirement, and for satisfying the following criteria:

Change Log: D2 May 2014 Points tables added

2.2.1	**Lighting**	• The lighting power density is reduced by at least 10% below the maximum lighting power density allowable in NCC Section J6. This requirement applies to both sole-occupancy units and all common areas accessible by residents. Allowanced may NOT be traded between sole-occupancy units and other parts of the building; • Independent light switching must be provided to each room of each sole-occupancy unit. Where open-plan living, dining and kitchen areas are provided, each functional area must be separately switched; and • All common areas accessible by residents must be provided with automated lighting control system(s), such as occupant detection and daylight adjustment.
2.2.2	**HVAC**	<u>For spaces provided with mechanical cooling:</u> • The minimum energy star rating for the air conditioning equipment is at least 3-star (as per AS 3823.2-2011); and • The rated capacity of the air conditioning equipment does not exceed the design heating capacity by more than 20% and the design cooling capacity by more than 10%. <u>For spaces NOT provided with mechanical cooling:</u> • The minimum energy star rating for the heating equipment is at least 3-star (as per AS 3823.2-2011); • The rated capacity of the heating equipment does not exceed the design heating capacity by more than 20%; • Compliance is achieved with credit IEQ-Quality of Indoor Air; • Effective cross ventilation is provided in all naturally ventilated apartments; and • Ceiling fans are installed in all naturally ventilated apartments.

2.2.3	**Domestic Hot Water**	• The gross thermal efficiency of the primary heat source is at least 85%; and • A solar thermal heating system is provided which contributes at least 30% of the annual thermal energy requirement for water heating.
2.2.4	**Building Sealing**	<u>Mechanically Air-Conditioned and Mixed Mode Ventilated Spaces</u> A pressurised building air leakage test is carried out on the completed building in accordance with one of the following standards; – *ASTM E779-10* – *ATTMA TSL1* <u>Naturally Ventilated Spaces</u> The building is naturally ventilated in accordance with credit IEQ-1.
2.2.5	**Appliances and Equipment**	**Appliances and Equipment** Appliances of the following types are provided which all have a minimum Energy Rating of 1-star below the maximum available Energy Rating for their type: • Refrigerators/freezers • Dish washers • Clothes washers • Clothes dryers

2.3 NCC Classes 2 to 9 - Reference Building Pathway

Up to 20 points are awarded where it is demonstrated that a project's predicted energy consumption is less than that of the Reference Building, and Greenhouse Gas emissions are lower than those of the Benchmark Building. Where on-site renewable energy systems are included in the design, up to 2 supplementary points will be awarded while not exceeding the credit total.

Points are awarded on a continuous scale, hence, for example, energy consumption reduction of 11% achieves 2.1 points (not 2.0), GHG emission reduction of 27% achieves 4.32 points (not 3.2), and renewable energy contribution of 6% achieves 1.2 points (not 1.0). Final rounding to a whole number occurs in the Green Star total score.

Credit Element	Reduction	Points Awarded
Energy Consumption (Intermediate Building relative to Reference Building)	5%	1.0
	10%	2.0
	15%	3.0
	20% (maximum rewarded)	4.0
Greenhouse Gas Emissions (Proposed Building relative to Benchmark Building)	10%	1.6
	20%	3.2
	30%	4.8
	40%	6.4
	50%	8.0
	60%	9.6
	70%	11.2
	80%	12.8
	90%	14.4
	100% (maximum rewarded)	16.0
Renewable Energy Contribution (on-site only)	5%	+1.0
	10% (maximum rewarded)	+2.0

Refer to the ***Building Energy Consumption and Greenhouse Gas Emissions Calculation Guidelines*** for details of how to complete the calculation, including definition of the Reference Building.

Mixed-Use Projects

A mixed-use project or building is deemed to be a building in which no NCC usage classification that accounts for more than 80% of the building GFA (excluding car parks, etc). The overall points achieved by the project are calculated based on area-weighting of the score achieved for each part of the building. Area-weighting is calculated based on the gross floor area (GFA) to which each compliance pathway is applied. Where the whole building is assessed using the reference building performance-based approach only, no area-weighting is required as the calculation method inherently accounts for all GHG emissions from the building.

For projects classified as mixed use, each usage classification must be individually assessed, and the results of each area-weighted to give the total result for the building.

Change Log: D2 May 2014 Points tables added

Refer to the ***Building Energy Consumption and Greenhouse Gas Emissions Calculation Guidelines*** for details of how to complete the calculation, including definitions.

Incentive for installing on-site renewable energy sources

While this pathway does not require the installation of renewable energy sources, it does reward their installation by providing additional point incentives when installed on site.

Please see the ***Building Energy Consumption and Greenhouse Gas Emissions Calculation Guidelines*** for details of how to claim the incentive.

Accredited GreenPower®

Projects which have committed to procure GreenPower® can be rewarded for supporting grid-connected renewable energy supply infrastructure. In order to be able to claim this, projects must demonstrate that a supply contract is in place for a minimum period of three years after Practical Completion. The effective greenhouse gas emissions intensity of the grid electricity supply is reduced in proportion with the proportion of GreenPower® supplied. This option can only be used in conjunction with the Reference Building Pathway. For all building types, it can only be applied to the energy consumed in areas of the building or by services which are under the control of the building owner; it cannot be applied to areas or services whose electricity supply is under the control of tenants or other parties who are responsible for their own electricity supply arrangements.

Shared Services

This credit makes provision for the selection of energy supply in rewarding projects for a reduction in greenhouse gas (GHG) emissions. The intent of this approach is to reward buildings which connect to low-carbon energy sources at a utility-scale, rather than only reward those projects which produce low-carbon energy on-site.

This approach is intended to cover the procurement opportunities for energy and utility systems including the following:

- District thermal networks
- Shared combined heat and power systems
- Private wire networks with embedded renewable energy
- Accredited GreenPower
- Grid connected low-carbon energy (e.g. biomass or biogas systems)

This approach does not include carbon offsets.

Where shared systems are intended to meet the full building load for a particular energy stream, the energy contracts must clearly demonstrate that sufficient capacity is available. These contracts may take the form of Power Purchase Agreement (PPA) and Thermal Power Purchase Agreements. The agreements must be for at least three years after Practical Completion and identify supply availability and other matters related to reliance of supply.

Change Log: D2 May 2014 Points tables added

Refer to ***Shared Services and Low-Carbon Energy Supply Assessment Guidelines*** for more details.

Guidance

Alternative Compliance Methods

A Credit Interpretation Request (CIR) may be submitted to the Green Building Council of Australia (GBCA) when a registered project wishes to advocate for an alternative yet equivalent method of meeting Compliance Requirements. This is a formal process, reviewed by the GBCA (or other independent external assessors, depending on the complexity of the issue).

Building Sealing and Air Tightness Leakage Testing

This describes the use of a fan to pressurise and depressurise the building interior in order to determine the rate of air leakage through the building envelope under positive and negative pressure. This test method has been widely adopted in Europe, including in building codes, as a means of assessing and controlling the additional energy burden imposed on buildings by the heating and cooling load due to infiltration. This is the first time that such a requirement has been included in a voluntary or mandatory code in Australia.

Owing the limited knowledge of the performance of the Australian building stock, no performance standards have been specified at this time, but these may be introduced in later versions of Green Star – Design & As Built. The following guidelines are offered regarding 'good practice' and 'best practice' outcomes for various building types (CIBSE TM23, 2000):

Building Type	**Air Permeability (m^3/hour/m^2 at 50 Pa)**	
	Good Practice	**Best Practice**
Dwelling (natural ventilation)	10.0	5.0
Dwelling (mechanical ventilation)	50	3.0
Office (natural ventilation)	7.0	3.5
Office (mechanical ventilation/air conditioning)	3.5	2.0
Retail superstore	3.0	1.5
Industrial	10.0	3.5

Note that testing results may be stated as one of two variables: air leakage index or air permeability. The values are similar, but differ in terms of the building envelope area used for normalisation. The air leakage index is based on the internal envelope surface area of the walls, roofs and floors, but only where floors are NOT in contact with the ground (i.e.

suspended floors); air permeability is based on the internal envelope surface area of the wall, roofs, and floors, irrespective of whether any floors are in contact with the ground.

Accredited GreenPower®

GreenPower® is a voluntary government-accredited program that enables energy providers to purchase renewable energy on behalf of customers. It is a joint initiative of the ACT, NSW, SA, QLD, and VIC state governments. The GreenPower® accreditation guarantees that renewable electricity bought from energy retailers meets stringent environmental standards. The program independently audits the renewable energy sector to ensure that when customers buy accredited GreenPower® products, the money paid is invested in the development of new infrastructure in the renewable energy sector. For more information refer to www.greenpower.com.au.

Change Log: D2 May 2014 Points tables added

Documentation Requirements

Where the National Construction Code (NCC) is referenced, the applicable version is that referenced in the Building Surveyor's report for the project or the version of the NCC that is current at the date of the project's registration for Green Star certification.

The project team must clearly identify the version of the NCC on which the submission for assessment is based.

'Design Review' Submission (Optional)

Project teams are to submit information/documentation marked with an asterisk* for 'Design Review'.

As Built Submission

All project teams are to submit the following documentation:

Submission Template

- Summary of how the project meets the credit criteria.*****
- Details about how each criteria has been achieved.
- Supporting Documentation, which will vary depending on the pathway chosen as outlined below.

Completed Green Star – Design & As Built Energy Calculator*

Project teams are required to provide documentation supporting credit compliance. The following documents may be used to demonstrate compliance, depending on the approach taken by project teams:

1. Deemed To Satisfy Pathway

- **Documentation** showing compliance the National Construction Code*****
- **As Built Lighting Installation Drawing(s)** identifying the control zone sizes and the luminaire switch and control sensor locations
- **Extract(s) from the Commissioning Report** demonstrating (through supporting evidence) that the lighting system has been commissioned and operates as intended by the design.
- **Building Sealing test report** including details of test methodology and air flow rates, and statement of the building air permeability achieved.

2.1 NCC Class 5 – Office (DTS using NABERS Energy Commitment Agreement)

- Signed copy of the **NABERS Energy Commitment Agreement***
- **Independent Design Review report** outlining the results to the Energy Efficiency Review of your project.

Change Log: D2 May 2014 Points tables added

2.2 NCC Class 2 - Multi Unit Residential (DTS using NatHERS)

Documentation showing compliance with the National Construction Code***** for every point claimed in the Submission Template. For building fabric may be include:

- NatHERS report issued to the Building Certifier at time of Building Approval.
- Evidence of fabric elements being installed with the specified requirements, including but not limited to:
  - Window Energy Rating Scheme (WERS) certificates; and
  - Calculations of wall, roof and floor R values.

2.2.1 Lighting

- **As Built lighting plan** identifying the control zone and the luminaire and switch locations
- **Extract(s) from the commissioning report** demonstrating (through supporting evidence) that the lighting system has been commissioned and operates as intended by the design.

2.2.2 HVAC

- **Demonstrate** that each dwelling thermal type has been designed to provide effective natural ventilation.

2.2.3 Domestic hot water

- **Extract(s) from the commissioning report** demonstrating (through supporting evidence) that the lighting system has been commissioned and operates as intended by the design.

2.2.4 Building Sealing

- **Building sealing test report** including details of test methodology and air flow rates, and statement of the building air permeability achieved.

2.2.5 Appliances and Equipment

- **Schedule** identifying all appliances installed in the building, and the manufacturer and model of each
- **Manufacturers' documentation** or information from www.energyrating.gov.au confirming the energy star rating applicable to each product
- **Information from www.energyrating.gov.au** confirming the highest energy star rating applicable to each product type

2.3 NCC Classes 2 to 9 - Reference Building Pathway

- **Energy modelling report*** in accordance with the ***Building Energy Consumption and Greenhouse Gas Emissions Calculation Guidelines*** following the structure of the guide:
  - Clearly identifying all default values used (e.g. occupant density);
  - Clearly identifying all of the design-driven inputs and referencing drawings; whenever assumptions are used, they must be justified and conservative; and
  - Clearly corresponding to the design.

Change Log: D2 May 2014 Points tables added

- **Extract(s) from the specification(s)*** demonstrating that all the inputs used in the energy simulation are reflected in the current design.
- **Extract(s) from the Commissioning Report** demonstrating (through supporting evidence) that the building has been commissioned and operates as intended by the design (i.e. as described in the energy modelling report).
    - For naturally ventilated spaces, demonstrating that the building operates as a naturally ventilated office space in accordance with AS1668.2-2002 and requires no mechanical air-conditioning for occupancy.
- **As built drawings** demonstrating that the facade details and materials are the same as described in the energy modelling report.
    - For naturally ventilated spaces, drawings for each naturally ventilated space showing openings, with dimensions clearly indicated, and ventilation inlets and outlets.

Mixed Use Projects

All documentation required to demonstrate compliance with each relevant pathway as defined in the documentation requirements above.

Shared Services

- Procurement Contract Approach*
    - Power Purchase Agreement (PPA) and Thermal Power Purchase Agreements for *three years after practical completion* identifying supply availability (including proportion of GreenPower) and guaranteed GHG emission factor.
- Design Analysis Approach
    - Design Intent Report (DIR) for the utility identifying its characteristics and associated GHG coefficient calculations.
    - Power Purchase Agreement (PPA) and Thermal Power Purchase Agreements* for *three years after practical completion* identifying supply availability (including proportion of GreenPower) and an operational plan which corresponds with the DIR.

Refer to the ***Shared Services and Low-Carbon Energy Supply Assessment Guidelines*** for more details regarding the above documents.

Design and construction documentation for the energy utility are ***not*** required for the purposes of the Green Star submission for the buildings.

Change Log: D2 May 2014 Points tables added

Please provide feedback on the technical content of this credit: