GREEN BUILDING COUNCIL SOUTH AFRICA

TECHNICAL MANUAL

INTERIORS V1

JANUARY 2015

TOOL DEVELOPMENT SPONSORED BY:

Standard Bank

SAINT-GOBAIN

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Technical Manual. The GBCSA offers a formal certification process whereby persons may apply for a particular building to be assessed for compliance with the criteria specified in this Technical Manual upon payment of the relevant fee and execution of the required documentation by the applicant. The assessment of such compliance is carried out by the Assessor(s), and applicants are required to demonstrate achievement of all relevant credits by the provision of relevant documentary evidence. Only certified buildings are entitled to use and display the 'Green Star SA™' trademark and to refer to the relevant Green Star SA rating. Any use of this Technical Manual other than in accordance with this procedure does not entitle the user or any other party to promote any rating applied for or achieved using this Technical Manual.

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Acknowledgements

GREEN STAR SA – INTERIORS

The Green Star SA – Interiors v1 rating tool has been adapted from the Australian Green Star – Interiors Tool, under license from the Green Building Council of Australia. The tool has established individual environmental measurement criteria with particular reference to the South African marketplace and environmental context.

The Green Building Council of South Africa (GBCSA) would like to acknowledge all the parties who have worked on and supported the development of the Green Star SA – Interiors v1 rating tool.

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Standard Bank

SAINT-GOBAIN

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Green Star SA Technical Advisory Group Members

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2014 GBCSA TECHNICAL STEERING COMMITTEE

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Bruce Kerswill

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CHANGE LOG

The GBCSA reserves the right to correct errors and omissions in the Green Star SA - Interiors v1 rating tool as necessary. The changes noted in this change log do not reflect Technical Clarifications or Credit Interpretation Request rulings. Project teams are advised to check the GBCSA website and the specific credits within the Green Star SA – Interiors technical manual for the latest TC and CIR rulings. The changes noted in this change log also do not represent changes to points awarded for credits, or changes to credit criteria. The changes noted below are those of minor nature related to the operation of the rating tool and associated calculators.

Reissue Date	Changes
November 2014	V1 release
December 2014	V1 General Intro section: minor format changes
January 2014	Added the Water credits and minor format changes

Green Star SA Certification

The property industry is well-placed to deliver significant long-term environmental improvements using a broad range of measures. More importantly, it is unique in that it can directly influence and create behavioural changes at all stages of the supply chain. However, there are inherent barriers within the industry that often act to ensure that efficiency measures are not adopted, despite the fact that a strong business case can be made for their implementation. Most significantly, these barriers relate to the developer/contractor/owner divisions or split incentives that often result in the benefits of efficiency or improved performance measures not accruing to the party that initiated them.

The Green Building Council of South Africa (GBCSA) was created in order to address some of these barriers. The GBCSA's objective is to promote sustainable development and the transition of the property industry towards sustainability by promoting green building programs, technologies and design practices. A key priority for the GBCSA has been the development of a comprehensive environmental rating system for buildings, known as Green Star SA.

Green Star SA separately evaluates the environmental initiatives of designs, projects and/or buildings based on a number of criteria, including energy and water efficiency, indoor environment quality and resource conservation.

Green Star SA was created to:

- Establish a common language and standard of measurement for green buildings;
- Promote integrated, whole-building design;
- Identify building lifecycle impacts;
- Raise awareness of green building benefits;
- Recognise environmental leadership; and
- Transform the built environment to reduce the environmental impact.

Green Star SA will have rating tools for different phases of the building lifecycle (design, construction, operations, refurbishment or fitout) and for different building classes (office, retail, healthcare, education, residential, industrial, public buildings etc.).

Green Star SA has built on existing systems and tools in overseas markets, most notably the Green Star system developed by the Green Building Council of Australia (GBCA), by adapting

and establishing individual environmental measurement criteria relevant to the South African marketplace and environmental context.

Green Star SA rating tools use the best regulatory standards to encourage the property industry to improve the environmental impact of development. The rating tools embrace local standards and guidelines, where applicable, to benchmark this improvement.

The GBCSA has developed Green Star SA to provide industry with an objective measurement for green buildings. In assessing those elements that should be rated and to drive change in the market, the GBCSA has been diligent in focusing on areas of environmental impact that are a direct consequence of a building's briefing, design, construction and maintenance – that is, those outcomes that can be directly influenced by stakeholders within the property industry.

Green Star SA establishes a number of categories under which specific key criteria are grouped and assessed. This framework is used by each and every Green Star SA rating tool.

The basic Green Star SA structure is shown below.

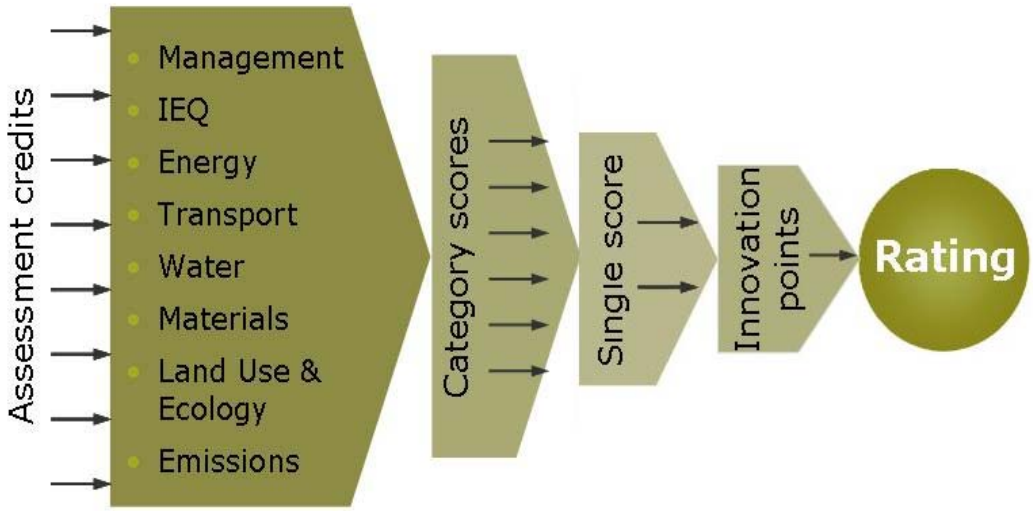

***Figure 1**: Structure of the Green Star SA rating system*

Green Star SA Certification

Green Star SA rating tools include nine separate environmental impact categories:

- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use and Ecology;
- Emissions; and
- Innovation.

Each category is divided into credits, each of which addresses an initiative that improves or has the potential to improve a design, project or building's environmental performance. Points are awarded in each credit for actions that demonstrate that the project has met the overall objectives of Green Star SA and the specific aims of the Green Star SA rating tool.

Category Score

The Category Score is determined for each category based on the percentage of credits achieved, as follows:

$$\text{Category Score} = \frac{\text{Number of points achieved}}{\text{Number of points available}}$$

For example, if 10 Energy points are achieved out of a total available of 26 then the Category Score is 38.5%.

Single Score

The single (i.e. overall) score is determined by adding together all the Category Scores plus the Innovation points. The maximum possible score for the categories is 100, with an additional five points available for Innovation, making the maximum attainable score in Green Star SA – Interiors V1 tool 110.

The Green Star SA - Interiors rating is determined by comparing the overall score with the rating scale shown below.

Green Star SA Certification

Overall Score	Rating	Outcome
10-19	One Star	Not eligible for formal certification
20-29	Two Star	Not eligible for formal certification
30-44	Three Star	Not eligible for formal certification
45-59	Four Star	Eligible for Four Star Certified Rating that recognises/rewards 'Best Practice'
60-74	Five Star	Eligible for Five Star Certified Rating that recognises/rewards 'South Africa Excellence'
75+	Six Star	Eligible for Six Star Certified Rating that recognises/rewards 'World Leadership'

***Table 1**: Green Star SA – Interiors rating tool scores*

As indicated above, the minimum Green Star SA rating is One Star and the maximum is Six Stars. In keeping with its position that Green Star SA recognises and rewards market leaders, the GBCSA will only formally certify interior fitouts that achieve a Green Star SA rating of Four, Five or Six Stars.

GREEN STAR SA ACCREDITED PROFESSIONALS

To encourage the adoption of environmental initiatives from the earliest project stages throughout design, construction and operation of a building, all Green Star SA rating tools award points in the Management category to projects that have a Green Star SA Accredited Professional as a member of their team. Furthermore for the Interiors tool, it is a mandatory requirement that submissions are put forward by a Green Star SA Accredited Professional.

In the case of Green Star SA – Interiors, a separate Interiors AP accreditation will exist, distinct from that of the Design / As Built tools.

Green Star SA Accredited Professionals are experienced building industry representatives who have demonstrated their understanding of the Green Star SA rating system and the benefits of high environmental performance. To become a Green Star SA Accredited Professional, candidates must attend a GBCSA Green Star SA Accredited Professional course

and pass the associated exam. Refer to the GBCSA website (http://www.gbcsa.org.za) for further details. The GBCSA has developed an on-line directory of Green Star SA Accredited Professionals (see http://www.gbcsa.org.za) to enable easy identification and provide the contact details of these qualified service providers.

ASSESSMENT CREDITS

The Green Star SA – Interiors rating tool is divided into nine environmental categories, each of which has a number of credits.

For each credit the following topics are described in this Technical Manual:

- Aim of Credit;
- Credit Criteria;
- Documentation Requirements;
- Additional Guidance;
- Background; and
- References & Further Information.

Points are awarded within credits for achieving performance-based objectives and for adopting policies and procedures to improve a project's environmental impact.

In some instances credits (or points within credits) may not be applicable. This situation usually depends on the nature of the building and the inclusion or otherwise of a variety of typical building features. These specific instances are clearly defined in this Technical Manual. Whenever a credit is deemed 'Not Applicable', points are not awarded, and instead are excluded from the Points Available, used to calculate the Category Score. This modification prevents distortion of the Category Score (up or down) for issues that cannot be addressed and are not applicable to the project.

ELIGIBILITY

To be eligible for Green Star SA - Interiors rating assessment, projects must meet each of the following four Eligibility Criteria:

1. Spatial Differentiation
2. Space Use

3. Conditional Requirement
4. Timing of Certification

CONFIRMING ELIGIBILITY

It is the responsibility of each project team to check the most current Eligibility Criteria on the GBCSA website at the time of registration and to ensure that their project is eligible.

Whenever unsure, project teams can request an eligibility confirmation from the GBCSA by forwarding a brief description of the project to interiors@gbcsa.zendesk.com.

Registration does not guarantee assessment; no project will be assessed if it is deemed ineligible against the Eligibility Criteria current at the time of registration.

The GBCSA reserves the right to deny eligibility to assessment of any project that is deemed to compromise the Green Star SA brand, and to revise these criteria to better achieve the goals of the Green Star SA rating tools.

ELIGIBILITY CRITERION 1: SPATIAL DIFFERENTIATION

To be eligible for a Green Star SA - Interiors rating, the project must be clearly distinct. Functionally distinct projects are those that are clearly differentiated from another project in the same space. Note that the rating can only be for the entire fitout (as defined by the lease agreement between the tenant and the building owner) and not part of a fitout. Individual Floors of buildings or departments within a tenancy can be certified in their own rights for a fitout, but these must be spatially distinct with well-defined physical boundaries and the certification will apply only to this area (for example a large corporate or government tenant may phase certification per floor or department).

Shared building services (e.g. HVAC plant or water treatment) or amenities (e.g. waste rooms or bicycle facilities) do not affect the projects' eligibility for Green Star SA assessment. Typically such spaces are governed by a lease/contract or are building owner occupied spaces - this would typically determine what the entity is that is being certified. Where this is not the

case, projects are required to submit a pre-submission eligibility query to the GBCSA via interiors@gbcsa.zendesk.com.

ELIGIBILITY CRITERION 2: SPACE USE

To meet the Space Use criterion, the project must be a fitout project within a building. The fitout must be a single type, or a combination of the following space types as defined by SANS 10400:

A1	Entertainment and public assembly
A2	Theatrical and indoor sport
A3	Places of instruction
A4	Worship
B1	High risk commercial service
B2	Moderate risk commercial service
B3	Low risk commercial service
C1	Exhibition hall
C2	Museum
E2	Hospital
E3	Other institutional (residential)
E4	Health care
F1	Large shop
F2	Small shop
F3	Wholesalers' store
G1	Offices
H1	Hotel
H2	Dormitory
H5	Hospitality

Table 2: *Eligible Space Types*

Green Star SA Certification

ELIGIBILITY CRITERION 3: CONDITIONAL REQUIREMENTS

In order to achieve a Green Star SA – Interiors Rating, the project's submission must be submitted by a Green Star AP Accredited Professional (Interiors). As such, the Man-1 credit within the rating tool must be targeted and achieved in order to achieve certification.

ELIGIBILITY CRITERION 4: TIMING OF CERTIFICATION

Green Star rating tools correspond to specific phases within a building project, and as such certification must be achieved within the timeframe applicable to the relevant rating tool.

- Round 1 Submissions must be received within 12 months of the practical completion date or if there is no practical completion date, then the beneficial occupation date.

PRE- CERTIFICATION OF DOCUMENTS

Although the certification applies to individual projects, the GBCSA has created the opportunity for the certification process to take into account instances where groups of fitout projects belonging to the same owner (portfolios or franchise) apply the same standard documents. The intent of this is to ensure that the certification process is practically applicable and does not create any unnecessary administrative burden and costs to such projects. The GBCSA calls this ***pre-certification*** of standard documents.

A list of documents which can be pre-certified is available on request but the project team can also motivate additional documents (not listed by GBCSA) which they feel applies across a number of projects, and the GBCSA will assess whether the documents are suitable for pre-certification.

A guideline detailing the procedure for having portfolio documents 'pre-certified' is available from the GBCSA on request (interiors@gbcsa.zendesk.com) or in the 'General Section' of the GBCSA's Certification Engine (www.certificationengine.org).

Green Star SA Certification

CERTIFICATION PROCESS

Up to date information on the Green Star SA certification process is outlined in detail on the GBCSA website (www.gbcsa.org.za) and Certification Engine (www.certificationengine.org).

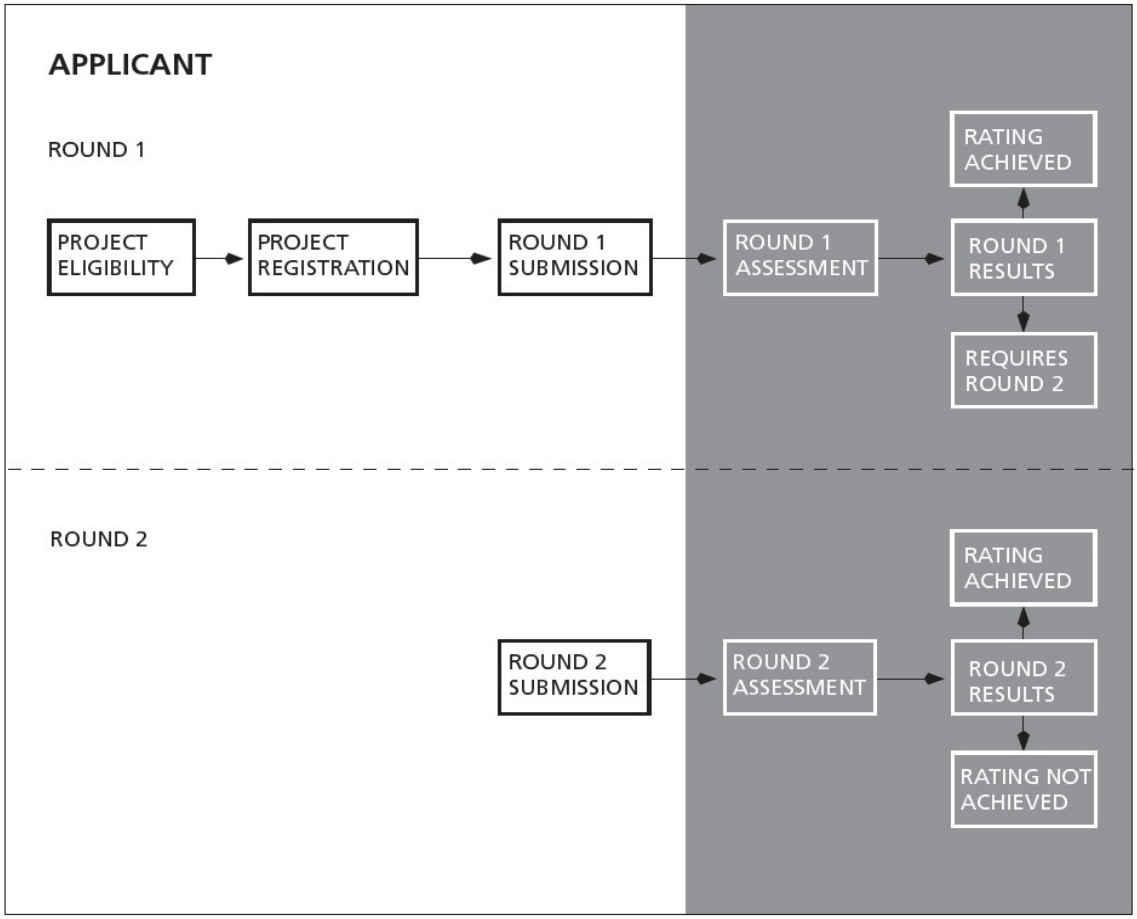

Figure 2: *Overview of certification process.*

Registration

Registering a project with the GBCSA declares the intent to pursue certification under a specific rating tool and is the first step in the certification process. Registration establishes a connection with the GBCSA and gives the project access to essential information and assistance with the submission process. Projects should register as soon as possible during

the project. Registration takes place through a form in the Green Star SA certification section of the GBCSA website (www.gbcsa.org.za).

Preparing the Submission(s)

Once your project is registered, the project team should prepare documentation to satisfy the Green Star SA credit documentation requirements. The Green Star SA – Interiors Accredited Professional, whether externally appointed or part of the internal building management team, should take responsibility for the quality of submission.

It is important to ensure that documentation for all claimed credits adheres to the Documentation Requirements outlined in the Green Star SA – Interiors Technical Manual.

Assessors will not award the point(s) unless it is demonstrated that all the requirements have been met exactly as detailed in the Technical Manual.

Round 1 Submission

From the date of receipt of the project's submission of all targeted credits (Round 1), the GBCSA will provide the assessment results in 7 weeks.

Projects must submit all required documents via the Certification Engine (www.certificationengine.org).

The GBCSA will conduct a pre-assessment submission quality review of a project submission prior to the commissioning of a review by the Assessors. A project may be required to resubmit the submission prior to assessment if the submission quality review suggests that the quality of the submission would result in an erroneous or extended assessment. There is no fee associated with the pre-assessment completed by the GBCSA.

Round 1 Assessment

The Assessor(s), will review the submission. Recommendations will then be made to the GBCSA on the rating which should be awarded. The GBCSA reserves the right to question the findings of the Assessor(s).

The GBCSA will forward the results of the Assessment to the project contact and the applicant. At this point a rating could be achieved and the certification process completed.

However, the Assessors may request additional information from the applicant supporting their claims, or may request corrections to certain credits not achieved. In such a case, the project team must submit the required documentation for credits 'to be confirmed' in a Round 2 submission.

Round 2 Submission

Upon receipt of the results of the Round 1 Assessment, the project may be required to submit documentation for credits 'to be confirmed'. The project will be required to provide the Round 2 submission within 1 month of Round 1 Assessment results being issued. Each project has only one opportunity for resubmission (Round 2), which may include:

- Additional/revised documentation to demonstrate fulfilment of Credit Criteria;
- New credits not targeted in Round 1. Note however that there will not be the opportunity for two rounds of assessment on these credits.

From the date of receipt of the Round 2 submission at the GBCSA offices, the GBCSA provide the Round 2 assessment results in 5 weeks.

Round 2 Assessment

Assessment of the Round 2 submission will follow the procedures outlined above for Round 1 assessment.

CERTIFIED RATING AWARDED

If the assessment validated the project's achievement of the required score, the GBCSA will award a Certified Rating and notify the Applicant.

CERTIFIED RATING NOT AWARDED

If a desired Certified Rating is not achieved, the project may in certain circumstances be eligible to Appeal select credits for a fee to re-asses – an appeal process applies only where a project is within 5 points of a certification threshold (4, 5 or 6 Star). Please contact the GBCSA for further details.

GENERAL SECTION SUBMISSION REQUIREMENTS

The following documents must be included in the General section of the submission

Green Star SA Certification

- **Site drawing showing extent of the fitout and project site**. Where no drawings are available, an aerial photograph (such as those obtained from Google Maps or similar) is acceptable provided the building and site extent are clearly marked.
- **Area schedule showing full NLA** of the project seeking certification.
- **Completed Scoresheet, AP Declaration & Submission Checkist** (all contained in 'Scoresheet & General Info' spreadsheet.
- **Any relevant GBCSA correspondence, clarifications or approved alternatives** (TC's and CIR's).

Updating Green Star SA- Interiors

UPDATING THE RATING TOOL

Green Star SA – Interiors was developed on the basis of information available at the time of its development. Some issues have not been addressed in Green Star SA – Interiors due to the following:

- Cost of undertaking assessment and concerns of the reliability and accuracy of data relevant to South Africa (e.g. embodied energy, Life Cycle Assessment);
- Lack of clear benchmarks or guidelines relating to buildings; and
- Lack of standards of measurement in South Africa and availability of suppliers' data (e.g. material toxicity).

As more research is undertaken in the green building area, Green Star SA rating tools are updated to reflect new information, practices, tools and references.

Green Star SA rating tools may also be updated as a result of credit interpretations from the certification process. In these cases, the GBCSA reviews the credit and, if the new credit interpretation is adopted, the relevant Green Star SA rating tool and the associated Technical Manual is updated to reflect the change. All Green Star SA tools have an allocated version number to reflect these changes.

Green Star SA rating tools may also be revised on the basis of stakeholder feedback.

Feedback on Green Star SA – Interiors

The GBCSA encourages feedback on all Green Star SA rating tools, including Green Star SA – Interiors.

Feedback can be sent to interiors@gbcsa.zendesk.com for consideration by the GBCSA.

Glossary

Accredited Professional - A building professional who has attended the Green Star SA Accredited Professional training course, has passed the associated examination and is registered with the Green Building Council of South Africa as an Accredited Professional.

Active Cooling/Heating - A heating or cooling process or system which consumes a form of primary energy to store, collect and distribute thermal energy in order to provide space heating or cooling within a building.

Active Solar Strategies - Mechanisms, such as photovoltaics, which are designed to actively collect the energy of sunlight and use it.*

AFFL – Above Finished Floor Level

Adhesive – Any substance used to bond one surface to another by attachment. Adhesives include bonding primers, adhesive primers, and adhesive primers for plastics. (SCAQMD Rule 1168)

Admittance – A measure of how easy it is for heat to be absorbed/emitted by a construction: the rate of heat flow between the internal surface of a construction and the environmental temperature in the space, for each degree of deviation of the space temperature about its mean value (W/m2K).

Air Exchange Rate – The rate at which outside air replaces indoor air in a given space.*

Air Handling Unit (AHU) - Equipment that includes a fan or blower, heating and/or cooling coils, regulator controls, condensate drain pans, and air filters.*

Alternative Energy - Energy from a source other than the conventional fossil fuel sources of oil, natural gas and coal.

Alternative Energy Sources - Energy sources that can be substituted for the conventional sources such as fossil fuels (coal, oil, natural gas), nuclear power, and large scale hydroelectric power, e.g. solar, wind, geothermal, biomass.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) - See http://www.ashrae.org.

Asbestos - A naturally occurring soft fibrous mineral commonly used in fireproofing materials and considered to be highly carcinogenic in particulate form.

Assembly – [add definition, e.g. product made up of subcomponents of varying materials such as workstation).]

Assessor - A person or persons, independent of the GBCSA, independent of the project client, design team and contractor, nominated by the GBCSA, knowledgeable and with experience in the

green building industry, or who has such other appropriate assessment qualifications as the GBCSA may from time to time determine.

Biodiversity - The totality of living animals, plants, fungi and micro-organisms in a region; the variety of life in all forms, levels and combinations.*

Biomass – Biological material from trees, grasses, agricultural crops or waste. It can be used as a material for manufacturing, though it is most commonly used to generate electricity or heat. It is considered a renewable resource, with a low CO_2 coefficient.

Blackwater - Water which has been mixed with waste from toilets. Blackwater requires biological or chemical treatment and disinfection before reuse.

Building - The base building development seeking Green Star SA certification.

Building Envelope - The exterior surface of a building's construction: the walls, windows, roof and floor; also referred to as 'building shell'.*

Building Management System (BMS) - The BMS automatically controls the building services systems to maintain temperature, humidity, ventilation rates and lighting levels to pre-determined load requirements and to provide safe, efficient operation of equipment.

Building Research Establishment Environmental Assessment Method (BREEAM) - The UK based BREEAM green building rating system assesses the environmental performance of both new and existing buildings. See http://www.breeam.org

Building User's Guide – A simple and easy to use guide for the non-technical building user which, through practical recommendations, encourages the use of the green building features of the design.

Carbon Dioxide (CO_2) - Odourless gas commonly sourced by respiration, and is the result of the oxidation (including active combustion and respiration) of carbon based substances; it has been widely used as a measure of the ventilation adequacy of a space; a principal greenhouse gas.

Carbon Monoxide (CO) - An odourless gas that is given off during the process of incomplete combustion. Breathing in of CO gas reduces the ability of the blood to absorb oxygen and can be fatal.

Chartered Institute of Building Services Engineers (CIBSE) - See http://www.cibse.org

Chlorofluorocarbons (CFCs) - An organic compound made of chlorine, carbon, and fluorine. Commonly used in refrigerants or blowing agents which cause ozone depletion when released in the atmosphere.

Glossary

Client - The building/project owner or tenant responsible for the development/refurbishment of the building and for the engagement (directly or indirectly) of the design team and the contractor.

Climate Change - The change expected to occur to the world's climate due to human activities that emit greenhouse gases, such as burning fossil fuel (cars and electricity generation) and deforestation.

Chain of Custody (CoC) - A tracking system that allows manufacturers and traders to demonstrate that timber comes from a forest that is responsibly managed in accordance with the FSC Principles and Criteria. It tracks the flow of certified wood through the supply chain and across borders through each successive stage - including processing, transformation and manufacturing - all the way to the final product.

Cogeneration - The simultaneous production of electrical or mechanical energy (power) and useful thermal energy from the same fuel/energy source.*

Commissioning - The process of putting building services systems into active service. This includes testing and adjusting HVAC, electrical, plumbing and other systems to assure proper functioning and adherence to design criteria, and instructing building representatives in their use.

Common Area - Areas used by two or more tenants and/or third parties and not under the control of any one tenant such as common entrances, lobbies, corridors, stairs, and elevators.

Computational Fluid Dynamics (CFD) - Numerical analysis of fluid flows. A computer is used to perform the millions of calculations required to simulate the interaction of fluids, for example looking at air movement within buildings.

CSIR - Council for Scientific & Industrial Research

Contaminant - A substance that is not naturally present in the environment or that is present in unnatural concentrations or amounts, and which can (in sufficient concentration) adversely alter an environment.

Contract Value - The Rand value that will be required to complete the works for the entire project, including site works (landscaping, external paving, etc). The contract value must include contractor fee, contingencies and any other items included as part of the contract amount, but exclude demolition works, consultants fees, design fees, project management fees, VAT, works outside the site area, and buildings or areas within the site that are not being assessed for purposes of Green Star SA.

Contractor - The main contractor or builder engaged to complete the scope of works for the project.

Construction Commencement - The time at which the Project Site is handed over from the Principal Agent to the Contractor to commence the scope of works of the contract.

Glossary

Conventional delivery - A space that, prior to fitting out, was delivered with:

- Ceilings, floor coverings and lighting systems; and
- Ducts from air supply and return risers, electrical and hydraulic services are installed above the ceiling from the riser throughout the fitout areas.

Credit Interpretation Request (CIR) – CIRs are submitted prior to assessment by a project that clearly meets the Aim of Credit but does not adhere to the stated Credit Criteria of the relevant Technical Manual. CIRs are considered by the GBCSA with the consultation from the Technical Advisory Group and other independent consultants, and the resulting rulings may set precedent and be used to update Green Star SA rating tools.

Cross Ventilation - When air flows naturally along one or more breeze paths, between ventilation openings on opposing or adjacent walls of a space or via a combination of wall and roof openings.

Daylighting - The controlled admission of natural light into a space, used to reduce or eliminate electric lighting.

Daylight Autonomy (DA) - The fraction of occupied times per year, when the required minimum illuminance level at a point can be maintained by daylight alone.

Daylight Factor (DF) - The proportion of internal illuminance (light level) compared to the external illuminance, expressed as a percentage. Daylight Factor represents the proportion of external light which illuminates a given internal surface.

Daylight Illuminance (DI) - The illuminance (light level) achieved from daylight

Deemed to Satisfy (DTS) - Prescriptive provisions which satisfy performance requirements, or stated level of performance

DEAT - Department of Environmental Affairs and Tourism (South Africa). See http://www.deat.gov.za.

Design for Disassembly - A philosophy of product design where a product is designed to be readily and easily disassembled at the end of its useful life with the use of non-specialist tools, and where parts can be separated into elemental components for re-use, recycling or re-processing.

Design Team - The professionals normally engaged in the design and contract administration of a building project. These typically include architects, engineers (e.g. structural, civil, mechanical, electrical, hydraulics, fire etc.), project manager, cost consultant and building surveyor plus other specialists including green building consultant, landscape architect, acoustics consultant, façade engineer, lighting consultant, etc.

Glossary

Displacement ventilation – supply air is introduced to the space at or near the floor level, at a low velocity, at a temperature only slightly below the desired room temperature. The cooler supply air 'displaces' the warmer room air, creating a zone of fresh cool air at the occupied level. Heat and contaminants produced by activities in the space rise to the ceiling level where they are exhausted from the space. This results in an efficient and low power ventilation system.

DHW – Domestic Hot Water

DOH - Department of Health (South Africa) See http://www.doh.gov.za.

DOT - Department of Transport (South Africa) See http://www.dot.gov.za.

DWA - Department of Water Affairs (South Africa) See http://www.dwa.gov.za.

Ecolabel - seal or logo indicating a product has met a certain environmental or social standards

Eligible Project - A project that complies with the requirements contained in the Green Star SA Eligibility section of this Technical Manual.

Embodied Energy -Energy that is used during the entire life cycle of the commodity for manufacturing, transporting and disposing of the commodity as well as the inherent energy captured within the product itself; this term does not always correlate to the life cycle environmental impact.*

Emissions - The release of gases, liquids and/or solids from any process or industry; liquid emissions are commonly referred to as effluents.*

Emission Controls - Any measure that reduces emissions into air, water or soil. The most effective emission controls involve the redesign of the process so less waste is produced at the source.*

Environmental Impact - Any change to the environment, whether adverse or beneficial, wholly or partially resulting from human activity, industry or natural disaster.*

EMP – Environmental Management Plan

EMS – Environmental Management System

EPA – Environment Protection Authority/Agency

Equivalent Area - The area of a sharp edged circular orifice which would pass the same air flow rate and at the same applied pressure difference as a ventilation opening.

Fair Market Value - The equivalent market value of an existing item or material within a project which is claimed as reused for the purposes of Green Stare SA.

Fitout – [provide definition]

Glossary

FFL – Finished Floor Level

Fly ash - The solid residue derived from incineration processes. Fly ash can be used as a substitute for Portland cement in concrete.

Forest Stewardship Certification (FSC) - A certification system for timber products which confirms that timber has been harvested in a sustainable manner.

Global Warming Potential (GWP) - Global Warming Potential provides a measure of the potential for damage that a chemical has relative to one unit of carbon dioxide, the primary greenhouse gas.

Green Building - A Building that incorporates design, construction and operational practices that significantly reduce or eliminate its negative impact on the environment and its occupants; an opportunity to use resources efficiently while creating healthier environments for people to live and work in.

Green Building Council of South Africa (GBCSA) - A national, not-for-profit organisation that is committed to developing an environmentally sustainable property industry for South Africa by encouraging the adoption of green building practices. See http://www.gbcsa.org.za.

Greenhouse Effect - (1) The warming of the earth‘s surface and lower atmosphere as a result of carbon dioxide and water vapour, which absorb and reradiate infrared radiation, in the atmosphere; (2) An intensification of this warming effect from human-induced increase in carbon dioxide and other greenhouse gases in the atmosphere from the burning of fossil fuels.*

Greenhouse Gases (GHGs) - are gases in an atmosphere that absorb and emit radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect.*

Greywater - Waste water recovered from basins, showers, washing machines and other water sources that do not contain food or human waste.

Grid - A term used to describe the network of wires and cables which transport electricity from a power plant.*

Gross Floor Area (GFA) - The total floor area of all parts of a building that are permanently covered and can be protected from the elements but excluding car parking areas, measured at each covered floor level over the external walls to the external finished surface. For the purposes of the Green Star SA submission, Gross Floor Area must be calculated as the building Construction Area, less the area of car parking, as per Section 4.2.1 of the SAPOA publication ‘Method for Measuring Floor Areas in Buildings’. Gross floor area should be defined and used consistently throughout the Green Star SA submission.

Glossary

Gross Lettable Area (GLA)[1] - The GLA is the total area of the building enclosed by the dominant face, adjusted by deducting major vertical penetrations. It comprises the usable area plus common areas of the building but excludes car parking. GLA is therefore the area assigned for exclusive use by occupants / tenants, including common areas such as:

- Building entrance foyers
- Plant and sever rooms on tenant floors
- Toilet areas on tenant floors
- Access or circulation areas on tenant floors

Ground Water - Water beneath the earth's surface that fills pores between materials such as sand, soil or gravel. Groundwater is a major source of water for agricultural and industrial purposes and is an important source of drinking water.

Hazardous Waste - Waste that is particularly dangerous or destructive; specifically characterised by one or more of the following properties: ignitable, corrosive, reactive or toxic.*

Heating, Ventilation and Air Conditioning (HVAC) - Mechanical systems that provide heating, ventilation and air conditioning in buildings

HVAC&R – Heating Ventilation, Air-conditioning & Refrigeration

Heat Recovery Ventilation - A system that reclaims the heat from warm exhaust air exiting a building and uses it to pre heat entering fresh air.*

Hydrochlorofluorocarbons (HCFCs) - HCFCs are found in refrigerants and blowing agents that cause ozone depletion when released in the atmosphere.

Hydrofluorocarbons (HFCs) - HFCs are commonly used to replace HCFC refrigerants and blowing agents to reduce the ozone depletion potential (ODP); however, HFC products have a high Global Warming Potential (GWP).

Illuminance - The luminous flux incident on a unit area of a surface. The unit is the lux which is one lumen per square meter.

Independent Commissioning Agent - An experienced and qualified commissioning agent who carries out commissioning on behalf of the building owner or tenant

Indoor Air Quality (IAQ) – [add definition]

Indoor Environment Quality (IEQ) - Covers issues such as indoor air quality, thermal comfort, illumination, daylight, views, acoustics and occupant control of building systems.

[1] Method for Measuring Floor Areas in Buildings -SAPOA

Glossary

Integrated Fitout - A fitout where the tenancy design and construction is fully coordinated with the base building design and construction. This includes finishes, services and fitout to all areas, both common and fitout-specific, with services fully installed at each floor. The definition of integrated fitout for purposes of Green Star SA is a fitout space where:

- All ceilings, floor coverings, lighting systems, mechanical, electrical and hydraulic services, partition walls, and finishes are installed, fit for purpose for the fitout occupant, prior to leasing.

Interdependent Projects - Projects that share services and amenities.

IPCC – Intergovernmental Panel on Climate Change

ISO 14001:2004 - An international standard published by the International Organisation for Standardization (ISO) which specifies a set of management standards that help organisations administer and control a company's environmental impact and compliance with regulations.

Landfill - An area where solid waste is deposited. In a suitable area, a hole in the ground is lined so that materials will not escape, and is filled with layers of rubble/waste as the waste is progressively deposited. When completely filled, it is typically capped and sealed.

Leadership in Energy and Environmental Design (LEED) - The US-based LEED Green Building Rating System® is a voluntary, consensus based national standard for developing high performance, sustainable buildings. See http://www.usgbc.org/leed.

Life Cycle - All phases associated with the life of a product (i.e. creation, distribution, sale, installation, use, care and disposal/reuse/recycle).*

Life Cycle Assessment (LCA) - An evaluation of the environmental effects of a product or activity holistically, by analysing the entire life cycle of a particular material, process, product, technology, service or activity. The LCA consists of three complimentary components: inventory analysis, impact analysis, and improvement analysis, together with an integrative procedure known as scoping.*

Light Pollution - Waste light which is excessive, misdirected, or obtrusive artificial light from buildings that is directed upward to the sky or is directed away from the site.

Luminaire - A complete lighting unit consisting of a lamp (or lamps) with the housing designed to distribute the light, position, and protect the lamp and connect it to the power supply.

Luminous Efficacy - A measure of how well a light source produces visible light; the ratio of luminous flux to power

Glossary

Maintained illuminance - The average illuminance over the reference surface at the time maintenance has to be carried out by replacing lamps and/or cleaning the equipment and room surfaces (if applicable).

Material Cost - The cost of a material may include transport/shipping costs to the project site, but may not include installation costs, labour, equipment for installation, contractor fees, contingencies, VAT or any other amounts.

MDS – Manufacturer's Data Sheet.

Mechanical Ventilation - Ventilation systems which use fans or other electrically operated air movement devices to provide ventilation to a building. Wind driven turbine ventilators and mechanically operated windows are not classified as 'mechanical ventilation'.

Mechanically Assisted Natural Ventilation (MANV) systems - Systems that rely, partially or fully, on fans to move non-conditioned air through a space

Mixed-Mode Ventilation - An approach to ventilating a building that relies on natural ventilation in certain seasonal conditions and is supplemented by mechanical ventilation when needed to maintain occupant comfort

Mould - Mould is a fungus that typically grows in a filamentous cobweb like mass under damp conditions and is capable of producing staggering numbers of reproductive spores in as little as a few days. Moulds are non-chlorophyll containing entities, which require organic matter, living or dead, for survival. Moulds are extraordinarily diverse in character and their relationship with humans span the positive (e.g. food, antibiotics) to the negative (e.g. pathogens, antigens, toxins).*

Natural Ventilation -The process of supplying and removing air in building spaces by natural means, by using openings in the façade (e.g. windows), non-powered ventilators, solar chimneys and infiltration processes.

NLA – Net Lettable Area

Nominated Area (NA) - A credit specific dynamic area definition used to delineate the area that is relevant to individual credits. Refer to each credit and the modelling protocol guide for the credit-specific definition of the Nominated Area.

Non-Potable Water - Water collected on-site, such as rainwater or stormwater, or recycled/recovered from a previous use such as blackwater or greywater recovery. It does not include water from rivers, lakes or groundwater (bore water) unless the water has previously been used.

Non Renewable Resources - Resources that cannot be replaced in the environment (e.g. fossil fuels) because they form at a rate far slower than their consumption.*

Glossary

Occupied Space (OS) - Occupied Space refers to all areas within the building where a person is expected to work for periods longer than one continuous hour per day. Occupied areas include, but are not limited to office, retail areas, communal areas, changing facilities, kitchens, laboratories (provided that other functional requirements do not supersede the credit requirements), first aid facilities, lobby, and similar.

Occupied Space excludes any warehouse, shop floors, or any other areas related to the industrial process activity, except for those outlined above. Enclosed circulation areas, fire stairs, storerooms, toilets, tea kitchens, changing facilities, bathrooms, display areas, IT equipment rooms and plant rooms are also excluded from this definition.

OFA – Occupied Functional Area

OH&S – Occupational Health & Safety

O&M – Operations and Maintenance

Ozone (O3) - A naturally occurring, highly reactive, irritating trace gas comprising of tri atomic oxygen formed by recombination of oxygen in the presence of ultraviolet radiation.*

Ozone Depletion - Destruction of the Earth's ozone layer, which can be caused by the photolytic breakdown of certain chlorine and/or bromine containing compounds (e.g. chlorofluorocarbons), which catalytically decompose ozone molecules.*

Ozone Depleting Potential (ODP) - ODP provides a measure of the potential damage that a chemical has relative to that of refrigerant type CFC11. CFC11 has an ODP of one and is the most damaging of CFCs.

Ozone Hole - A thinning break in the ozone layer. Designation of the amount of such depletion as an 'ozone hole' is made when the detected amount of depletion exceeds 50%. Seasonal ozone holes have been observed over the Antarctic and Arctic regions, part of Canada, and the extreme northeast United States.*

Ozone Layer - The protective layer in the stratosphere layer of the atmosphere, about 24 kilometres above the ground, that absorbs some of the sun's ultraviolet rays, thereby reducing the amount of potentially harmful radiation that reaches the earth's surface.*

Passive Cooling/Heating - A process of cooling/heating a building in which no power or fuel is consumed. This is distinct from natural ventilation, which relates only to air supply and extract, although natural ventilation may provide passive cooling in some weather conditions. Other examples of passive cooling include cooling from thermal mass, while passive heating strategies include heating using solar gains through windows and reducing infiltration to prevent heat escaping.

Glossary

Passive Design - Design that reduces the energy consumption of a building by taking advantage of natural heating, cooling and lighting.*

Passive Solar Design - Design that uses the inherent characteristics of a building rather than mechanical systems to capture heat and light from the sun.*

Photovoltaics - The use of semiconductor technology to generate electricity directly from the sunlight.*

Pollution - Generally, the presence in the environment of a substance that, because of its chemical composition or quantity, prevents the functioning of natural processes and produces undesirable environmental and health effects; can be seen as the human-induced alteration of the physical, biological, chemical and radiological integrity of water and other media.*

Post-Consumer Recycled Content - A product composition that contains some percentage of material diverted from the product user's waste stream. Post-consumer waste is a waste type produced by the end consumer of a material stream; that is, where the waste-producing use did not involve the production of another product.

OR

The percentage of material in a product that was previously consumer waste, that is, the material was generated by household, commercial, industrial, or institutional end-users and can no longer be used for its intended purpose and includes returns of materials from the distribution chain. Examples include construction and demolition debris, materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking).

Post-Industrial Recycled Content – (also known as pre-consumer recycled content) - A product composition that contains some percentage of manufacturing waste material that has been reclaimed from a process generating the same or a similar product. This includes returns of material from the distribution chain, but excludes re utilisation of materials such as re work, re grind or scrap generated in a process and capable of being reclaimed within the same process that generated it. Pre-consumer waste is commonly used in manufacturing industries, and is often not considered recycling in the traditional sense. *

Potable Water - Water that is treated to a level that is drinkable and safe to be consumed.

Practical Completion - The stage of completion where the works or a section thereof, as certified by the principle agent, is substantially complete and can effectively be used for the purpose intended (JBCC Series 2000).

Glossary

Precautionary Principle - The decision-making principle that advises that, in face of uncertainty, the best course of action is to assume that a potential problem is real and should be addressed.*

Predicted Mean Vote (PMV) - PMV is an index that predicts the mean value of the votes of a large group of persons on the 7-point thermal sensation scale, from +3 (hot) to -3 (cold), based on the heat balance of the human body. Thermal balance is obtained when the internal heat production in the body is equal to the loss of heat to the environment. In a moderate environment, the human thermoregulatory system will automatically attempt to modify skin temperature and sweat secretion to maintain heat balance. A PMV of –1 to +1 corresponds to a Predicted Percent Dissatisfied (PPD) of no more than 25% (i.e. 25% of people are dissatisfied or uncomfortable). A PMV of –0.5 to +0.5 corresponds to a PPD of 10%. A PMV of zero would still mean 5% of occupants are dissatisfied or uncomfortable.

Predicted Percent Dissatisfied (PPD) - PPD is an index that establishes a quantitative prediction of the percentage of thermally dissatisfied people who feel too cool or too warm. For the purposes of the international standard (ISO 7730) quoted in the Technical Manual, thermally dissatisfied people are those who will vote hot, warm, cool or cold on the 7-point thermal sensation scale (PMV).

Principal Agent - The party named in the contract data and/or appointed by the employer with full authority and obligation to act in terms of the agreement (JBCC Series 2000).

Primary Function - The space function accounting for over 50% of the GFA

Primary Space - All areas where a person is expected to work, or remain for an extended period of time, including, but not limited to:

- Offices, either open plan or private;
- Classrooms, laboratories, computer labs;
- Ward rooms, nurse's stations, clinic rooms;
- Kitchen and preparation areas where food is being sold;
- Retail / sales floor, exhibition halls, galleries (unless exclusion is justified), multi-purpose rooms (as a general setting); and,
- Industrial spaces, warehouse areas, shop floors, work stations.

These examples are indicative, and the project is encouraged to submit a Credit Interpretation Request to ensure that all spaces have been accurately defined. The predominant use of the space determines the space type classification. Where the functional requirements of the space demand specific ventilation conditions (e.g. laboratories, auditoriums, cinemas, or archives) the exclusion must be justified by the project team in a Credit Interpretation Request.

Glossary

Project Site - The land or place on, over, under, in or through which the scope of works is to be completed, as defined for the purposes of Green Star SA certification.

Project Team - Comprising the Design Team members and Construction Team members; generally those responsible for the definition, delivery and completion of the scope of works for the project.

Psychrometric Chart - A chart showing the air's dry and wet bulb temperatures, humidity, moisture content and enthalpy. It is used by mechanical engineers to illustrate the condition (temperature, humidity and enthalpy) of air at each point of the air conditioning process. This information assists with sizing air conditioning equipment to maintain comfortable internal air temperatures and relative humidity.

PPB – Parts Per Billion

PPM – Parts Per Million

Rapidly renewable materials - Agricultural products, both fiber and animal, that take 10 years or less to grow or raise and can be harvested in a sustainable fashion**.**

Reclamation - Restoration of materials found in the waste stream to a beneficial use that may be other than the original use.*

Recyclable - Commonly referred to as the ability of a product or material to be recovered from, or otherwise diverted from, the solid waste stream for the purposes of recycling.*

Recycled Content - Materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre consumer) or after consumer use (post-consumer). Pre consumer material does not include materials normally reused by industry within the original manufacturing process, and is also termed 'post-industrial'.*

RCA – Recycled Concrete Aggregate.

Recycling - A process by which materials that would otherwise become waste are collected, separated or processed and returned to the economic mainstream to be reused in the form of raw materials or finished goods. Horizontal Recycling – A recycling system that turns a majority of the original product back into a similar product as the original. Down-cycling – a term coined to disparagingly describe creation of a product of lesser intrinsic value manufactured from a material at the end of its service life that had higher initial end use value. Upcycling – a subjective term used to describe the creation of a product with higher intrinsic value, manufactured from a material at the end of its useful life, which had a lower initial end use value.*

Refurbishment - The upgrading of either (or both) a building's fabric and services with the aim of enhancing its ability to attract tenants, improve rental growth and maximise market value.

Glossary

Refurbishment (Full) – Where a building, or portion of a building, is vacated and withdrawn from stock for refurbishment, including replacement of plant and services. Refurbishment (Partial) – Where a building or portion of a building is vacated and withdrawn from stock for refurbishment, which normally is restricted to cosmetic improvements.

Relative Humidity RH) - Ratio of the amount of water vapour in air at a specific temperature to the maximum capacity of the air to hold moisture at that temperature.

Remediation - Efforts to counteract some or all of the effects of pollution after it has been released into an environment.*

Renewable Energy - An energy source that, from an earth perspective, is continually replenished and can be used without depleting its reserves. These sources include sunlight (solar energy) and other sources such as, wind, wave, biomass, geothermal and hydro energy.

Renewable Resources - a natural resource which can be replenished with the passage of time, either through biological reproduction or other naturally recurring processes. Some renewable resources have an endless supply, such as solar energy, wind energy and geothermal pressure, while other resources are considered renewable even though some time or effort must go into their renewal, such as wood and leather.

Reverberation - In simple terms, the persistence of sound in a space, or echo

Schematic Design - First phase in the design of a project in which an architect interior designer or engineer prepares schematic diagrams that provide a general view of the components and the scale of the project after detailed discussions with the client (owner).

Secondary space - All areas used to support the principal activity of the primary space. These spaces will be regularly occupied; however a single person is unlikely to remain within for more than 2 hours. Examples of secondary space include:

- Meeting rooms, boardrooms;
- Auditoriums, gyms, seminar rooms (if not intended for regular classes);
- Waiting rooms, and any diagnostic area where no specific lighting requirements exist;
- Cafeterias, restaurants, seating areas, office breakout areas, food courts;
- Stockrooms.

Where the project team is unsure of whether a space is primary or secondary, it is recommended that the project team either submits a Credit Interpretation Request for confirmation, or, classify the space as a primary space.

Glossary

Corridors that are exclusively used for transit between spaces (i.e. do not act as a foyer, lounge, waiting space, or reception), and are bound on both sides by a wall these are excluded from the nominated area. Where a corridor is part of a shared space, this corridor, or section of a corridor, cannot be excluded and is considered part of the adjacent space.

Shared Building Infrastructure - Infrastructure shared by two or more buildings, including, but not limited to: waste services, delivery yards, toilet facilities and car parks

Shell and core - A space that, prior to fitting out, was delivered with:

- No ceilings, floor coverings, lighting systems and partition walls, and
- Ducts from air supply and return risers finish within 1m of the face of the riser.

Sick Building Syndrome - (1) A human health condition in which infections linger, caused by exposure to contaminants within a building as a result of poor ventilation; (2) Building whose occupants experience acute health and/or comfort effects that appear to be linked to time spent therein, but where no specific illness or cause can be identified. Complaints may be localised in a particular room or zone, or may spread throughout the building and may abate on leaving the building.*

South African Bureau of Standards (SABS) - See http://www.sabs.co.za

South African National Standard (SANS) - Standards written by SABS which are normally not mandatory unless referenced by legislation.

South African Property Owners Association (SAPOA) - See http://www.sapoa.org.za

Source Reduction - As applied to solid waste, reducing the generation of waste in the first place as opposed to later re-using or recycling waste.*

Specifications - Specifications refer to written documentation that are prepared for and submitted to a contractor, at the tender stage of a project, in order for a contractor to price a building development. Many credits require extracts from specifications to be submitted to show compliance with their Credit Criteria. Circumstances under which alternatives to extracts to specifications are allowed to be submitted in compliance with the Documentation Requirements of a credit, are provided in the 'Standard Documentation Types – Guidance' section of this Technical Manual.

Suitably Qualified Professional - A person suitably experienced by profession, training, or demonstrable experience, to calculate, confirm, commit or provide comment on, the field, subject or topic as required for the purpose of 'Documentation Requirements' as necessary.

Supporting Documentation -With reference to 'Documentation Requirements'; other documentation submitted within the same credit of a submission.

Glossary

Take back - a concept associated with product stewardship, placing responsibility on brand-owners, retailers, manufacturers or other supply chain partners to accept products returned by consumers once they have reached the end of their useful life. Products may then be recycled, treated or sent to landfill.

Technical Working Group (TWG) - An advisory panel convened by the GBCSA and designated as the 'Technical Working Group'.

Tenancy Fitout Guide (TFG) -A detailed guide for the design team responsible for the fitout containing information on the green building features of the base building and recommendations on how to achieve the green building potential of the tenancy.

Test Reference Year (TRY) -A year's worth of recorded hourly weather data which represents a 'typical' year of weather data for that specific location.

Tertiary space - All areas which are either transient spaces, or accessed intermittently. Examples of these areas include: back of house areas, corridors, hallways, plant rooms, storage facilities, or similar.

Thermal Comfort - A means of describing occupant comfort which takes into account air temperature, radiant temperature, humidity, draught, clothing value and activity rates.

Tri-Generation - A form of energy generation where electrical energy is produced on-site (typically via gas) whilst at the same time waste heat is extracted from the equipment to provide energy to other systems (such as mechanical systems).

TVOC – Total Volatile Organic Compounds

Useable Area (UA)^2 - Area capable of exclusive occupation by the tenant. The total area of the building enclosed by the Dominant Face, adjusted by deducting all Common Area and Major Vertical Penetrations

Uniform Design Sky - A modelled design sky with a standard, constant illuminance across the entire hemisphere.

VAV Systems - Variable Air Volume air conditioning systems

Ventilation - The process of supplying and removing air in building spaces by natural or mechanical means.

Ventilation Opening - An opening in the external wall, floor or roof of a room, which is designed to allow air movement into or out of the building or room by natural, passive means.

[2] Method for Measuring Floor Areas in Buildings -SAPOA

Glossary

Virgin Materials - Previously unprocessed materials. A tree that is cut into lumber to make pallets is an example of a virgin material. Lumber recovered from broken pallets to make new pallets is not a virgin material but a recyclable material (US EPA).

Visual Light Transmittance (VLT) - Refers to the amount of visual light a material allows to be transferred through itself.

Volatile Organic Compounds (VOCs) - VOCs are organic compounds that produce vapours readily at room temperature and normal atmospheric pressure.

WC – Water Closet (i.e. toilet)

WHB – Wash Hand Basin

Waste Management Plan (WMP) - A document which outlines how construction and demolition waste will be collected for recycling and recycled, and how the recycling of that waste will be recorded.

Work Setting - A table or workstation with a chair. Tables which have more than one chair provided are considered to be equivalent to one work setting for each two chairs provided.

Xeriscape - Water-conserving landscape or landscape requiring no additional watering. For Green Star SA purposes, it is acceptable to irrigate a xeriscape garden during the first year, but once established the landscape must not be irrigated.

* Definitions taken from ‗Glossary: Green Glossary for High Performance Green Buildings' (2004), produced in partnership by Antron and IFMA (International Facility Management Association).

Technical Manual & Submission Guidance

A GUIDE TO THE STRUCTURE OF GREEN STAR SA CREDITS

Aim of Credit

Asserts which environmental issue this credit is targeting, what the guiding principles behind the credit are, and what the desired environmental outcomes are.

Credit Criteria

Explains clearly how the Aim of Credit section is to be met. Where the Aim of Credit is the guiding principle, Credit Criteria outlines measures that must be undertaken within a project to achieve it. It is important to read this section carefully as every project must meet the criteria outlined in this section for the credit to be awarded. This section also outlines how points are either awarded or 'Not Applicable' within the Green Star SA rating tool.

Documentation Requirements

Describes the requirements that a project needs to meet for its submission to be successful when assessed by the Assessors.

All projects must meet the Documentation Requirements to be awarded the credit points. Please note that the Assessors are not in a position to make assumptions on this matter, but must make a decision based on evidence provided. All documentation must therefore be provided to the letter of the Technical Manual. In addition, the Assessors reserve the right to request additional documentation in order to clarify any credit point.

Each credit has a submission checklist that lists the documentation requirements for the assessment of a rating. All evidence collated must meet requirements set out in the documentation section of each credit in the Technical Manual

Additional Guidance

This section contains additional information which is applicable to some projects. All information in Additional Guidance is mandatory. The Assessors reserve the right to determine whether or not the project needs to meet the requirements of this section.

Background

Explains why the issue in the credit is important, with relevant information and statistics; it also explains how the issue is pertinent to the type of project addressed by the tool.

Technical Manual & Submission Guidance

References & Further Information

All credits within the Green Star SA rating tools are based on research; some of this research is provided as reference material in this section.

Credit List

Credit	Credit Name	Points Available
Management Category		**12.5**
Int-Man-1	Green Star SA Accredited Professional	1
Int-Man-2	Commissioning & Tuning	2
Int-Man-3	Occupant Users' Guide	1
Int-Man-4	Environmental Management	1.5
Int-Man-5	Construction Waste Management	2
Int-Man-6	Work space efficiency	2
Int-Man-7	Green Lease	2
Int-Man-8	Learning Resources	1
Indoor Environmental Quality Category		**23**
Int-IEQ-1	Quality of Internal Air	4
Int-IEQ-2	Thermal Comfort	2
Int-IEQ-3	Lighting Comfort	3
Int-IEQ-4	Visual Comfort	3
Int-IEQ-5	Acoustic Quality	2
Int-IEQ-6	Reduced Exposure to Air Pollutants	5
Int-IEQ-7	Mould Prevention	0.5
Int-IEQ-8	Ergonomics	2
Int-IEQ-9	Indoor Plants	1.5
Energy Category		**14**
Int-Ene-1	Greenhouse Gas Emissions	12
Int-Ene-2	Electrical Sub-metering	2
Transport Category		**4**
Int-Tra-1	Commuting Mass Transport	1
Int-Tra-2	Local connectivity	1
Int-Tra-3	Alternative Transport	2

Credit List

Credit	Credit Name	Points Available
Water Category		**8**
Int-Wat-1	Potable Water	6
Int-Wat-2	Water Sub-metering	2
Materials Category		**30**
Int-Mat-1	Operational Waste Management	2
Int-Mat-2	Furniture	8
Int-Mat-3	Assemblies	8
Int-Mat-4	Flooring	6
Int-Mat-5	Wall coverings	3
Int-Mat-6	Local Sourcing	2
Int-Mat-7	Sundries Materials Sourcing	1
Land Use and Ecology Category		**4**
Int-Eco-1	Site selection	4
Emissions Category		**4.5**
Int-Emi-1	Light Pollution	1.5
Int-Emi-2	Impacts from refrigerants and insulants	3
Innovation Category		**10**
Int-Inn-1	Innovative Strategies & Technologies	10
Int-Inn-2	Exceeding Green Star SA Benchmarks	
Int-Inn-3	Environmental Design Initiatives	

Summary of Credit Categories

Management

The credits within the Management Category encourage and reward the adoption of features and attributes that enable and support good environmental management practices throughout the different phases of a project's development and its on-going operation.

The intention throughout the category is to improve the environmental performance of projects by influencing areas where decision-making is critical. It rewards the implementation of processes and strategies that minimise negative environmental impacts during fitout construction. The category also promotes practices that ensure a fitout project will be used to its maximum operational potential.

Indoor Environment Quality

The Indoor Environment Quality (IEQ) category aims to encourage and reward initiatives that enhance the comfort and well-being of fitout for occupants. The credits within the category address issues including air quality, pollutants and occupant comfort and rewards project teams that achieve increased comfort and well-being and provide comfortable and healthy spaces for their occupants.

Through the IEQ category, Green Star SA - Interiors aims to achieve environmental performance improvements in a manner that also improves occupants' experience of the space. For example, reductions in energy consumption could easily be achieved by avoiding the installation of heating and/or cooling systems, but this would potentially be at the expense of the occupant comfort and wellbeing. The IEQ category recognises that buildings are designed for people and as such improvements to sustainability should never be made at the expense of occupant health and wellbeing. By rewarding both energy efficiency and indoor environment quality, the Green Star SA rating system promotes and rewards a holistic approach to sustainability that results in multiple benefits.

Energy

The Energy category aims to reward fitouts that can reduce their overall operational energy consumption below that of a comparable standard practice fitout. Such reductions help to reduce greenhouse gas (and other related) emissions, lower overall energy demand as well as

Summary of Credit Categories

maximise fitouts' operational efficiency and reduce operating costs for building owners and users.

The category aims to facilitate reductions in operational energy consumption by facilitating efficient energy usage and encouraging the utilisation of energy generated by low-emission sources. It also seeks to encourage further maximisation of efficiencies through the selection of low-energy appliances and equipment, and the implementation of good lighting design.

Transport

The Transport category aims to reward projects that can facilitate a reduction of the dependency of occupants on private car use as an important means of reducing overall greenhouse gas emissions.

Motor vehicles in general and private cars in particular, are responsible for many forms of pollution. Climate change is impacted by motor vehicle use indirectly due to the high amounts of energy (and therefore emissions) required to manufacture cars and build supporting infrastructure and services, as well directly as the transport fuels combusted lead to greenhouse gas emissions within exhaust fumes. Car exhaust fumes also increase the levels of polluting particles in the air, which are a contributing cause of asthma and other respiratory illnesses.

If reliance on motor vehicle transportation is to be reduced, it is necessary to maximise alternative options. Rather than limiting access to private fossil fuel vehicles, the Transport category aims to encourage and reward initiatives that reduce the need for their use. This may include initiatives that encourage and make possible the use of mass transport like trains, buses and minibus taxis, as well as pedestrian and cycling opportunities. Of all of these alternatives, walking is the most 'sustainable', with no associated embodied energy or pollutants; cycling similarly does not pollute the environment.

Water

The Water category aims to encourage and reward initiatives that reduce the consumption of potable water through measures such as the incorporation of water efficient fixtures and building systems and waste water reuse.

Summary of Credit Categories

Reductions in operational water consumption may be achieved through maximisation of water-efficiency within a project, as well as through the utilisation of reclaimed water sources. In the case of fitouts, further water efficiencies can be gained through the selection of efficient appliances and equipment and the selection of base buildings that have already implemented efficient fixtures, fittings and systems.

Materials

The credits within the Materials Category target the consumption of resources through selection and reuse of materials, and efficient management practices. The basic concepts of the category are to reduce the amount of natural resources used, reuse whatever materials can be reused, and recycle whenever possible.

The credits are intended to reduce the environmental impacts associated with the use of materials. This is done through credits that reward improvements across the range of fundamental considerations: responsible sourcing; embodied impacts, resource efficient design and health and safety.

Land Use and Ecology;

The Land Use & Ecology category aims to reduce the negative impacts on sites' ecological value as a result of urban development and rewards projects that minimise harm and enhance the quality of local ecologies.

Emissions

The Emissions Category aims to assess the environmental impacts of emissions generated by fitouts. Negative impacts commonly associated with fitout emissions include damage to the ozone layer through refrigerant leaks or disturbances to native animals and their migratory patterns as a result of light pollution.

Innovation

The Innovation category is included within Green Star SA – Interiors PILOT rating tool as a way of encouraging, recognising, and rewarding the spread of innovative practices, processes and strategies that promote sustainable communities and cities.

Summary of Credit Categories

The Innovation category also acknowledges efforts which demonstrate that sustainable development principles have been incorporated into the wider process of designing and procuring buildings (such as collaborative working practices), as well as any positive environmental influence brought to bear on the wider geographic area in which the project is located. These efforts are recognised over and above any credit obtained in other categories.

Innovation points are awarded at the discretion of the GBCSA. Any single initiative will only be awarded to three projects under the same rating tool before no longer being considered 'innovative' and rewarded within this category.

INT-Man-1 Accredited Professional

POINTS AVAILABLE **1**

AIM OF CREDIT

To encourage and recognise the engagement of professionals who can assist the project team with the integration of Green Star SA aims and processes throughout all stages of a fitout's design and construction phases.

CREDIT CRITERIA

One point is awarded where:

- A member of the design team is a Green Star SA Accredited Professional – Interiors and has;
  - Been contractually engaged by the Tenant or Building Owner to provide green building advice based on Green Star SA from the schematic design phase through to practical completion;

AND

  - Provided guidance to the project team regarding, or was responsible for, the Green Star SA documentation submission compilation.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Proof of accreditation 2. GBCSA's Submission Template

Proof of accreditation must take the form of either:

- A copy of the nominated Green Star SA Accredited Professional – Interiors' accreditation certificate;

OR

- A screenshot of the relevant page of the online Green Star SA Accredited Professional - Interiors Directory, found on the GBCSA website.

GBCSA's Submission Template from the client in the form of signed correspondence, confirming the engagement/appointment of the Green Star SA Accredited Professional – Interiors by;

- Detailing the date of engagement/appointment (i.e. dates from/to); and
- Describing their scope of works and confirming that they have provided guidance to the project team regarding, or were responsible for, the Green Star SA submission compilation from the time of schematic design until construction completion.

INT-Man-1 Accredited Professional

POINTS AVAILABLE 1

ADDITIONAL GUIDANCE

To be deemed 'engaged', in line with the Aim of Credit, the Green Star SA Accredited Professional – Interiors must contribute substantially to the project and the submission compilation.

Where the Green Star SA Accredited Professional's scope of works is outlined in a fee proposal provided to the Building Owner, upon which they are engaged, the fee proposal may be submitted to demonstrate the 'scope of works' aspect of the 'Statement of confirmation', or the fee proposal itself is signed by the Building Owner..

Should the role of the Green Star SA Accredited Professional be fulfilled by different individuals throughout the project program, the evidence listed under Documentation Requirements must be submitted for each Accredited Professional. Where the 'Statement of Confirmation' makes reference to the company appointed for Accredited Professional services, and not the individual Accredited Professionals, a signed letter from the appointed company must be provided listing all individuals fulfilling the role of Accredited Professional on the specific project.

BACKGROUND

The Green Star SA Accredited Professional credit rewards the on-going involvement of a Green Star SA Accredited Professional - Interiors throughout all stages of a fitout's design and development. The involvement of qualified individual(s) from a project's outset ensures that many major sustainability initiatives can be implemented in the earliest stages of that project's design and construction, resulting in better environmental outcomes.

Green Star SA Accredited Professional Interiors Course:

The GBCSA runs a 3 part programme which provides a comprehensive overview of the GBCSA Green Star SA rating system for the Interiors tool which is intended for the objective measurement and rating of the environmental performance of interior fit-outs. . It provides insight into all major aspects that should be considered in the design and construction of green interiors. The programme consisting of an online course, a live workshop and an online exam, culminates in the Green Star SA Accredited Professional - Interiors (GSSA AP I) accreditation which equips the professional with the knowledge of how to use the Interiors tool.

The online course gives an in depth; technical understanding of the tool and the workshop gives a high level overview and a good sense of the application of the tool. Both of these components can be done as standalone courses and can be completed in an order of preference of the participant.

To be eligible to write the exam, one needs to have completed both the online course and the workshop.

REFERENCES & FURTHER INFORMATION

GBCSA Website – Accredited Professionals directory
http://www.gbcsa.org.za/network/directories/accredited-professionals/

INT-Man-1 Accredited Professional

POINTS AVAILABLE 1

TECHNICAL CLARIFICATIONS

There are currently no technical clarifications that have been issued for this credit.

INT-Man-2 Commissioning and Tuning

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise effective commissioning and tuning processes during a project's design and construction phase that ensure all services and installations can operate to their optimal design potential.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

Commissioning

For tenants larger than 5000m^2:

One point is awarded where:

- Comprehensive pre-commissioning and commissioning activities are performed for all nominated systems.

AND

- The works outlined above are done in exact accordance with the CIBSE Commissioning Codes or ASHRAE Commissioning Guideline 1-1996.

AND

- Operation and Maintenance (O&M) Manuals are provided to the tenant for all nominated systems

OR

For tenants smaller than 5000m^2:

One point is awarded where:

- Commissioning is performed for all nominated systems provided within the fitout (as applicable) in accordance with system/equipment/appliance manufacturer‘s commissioning specifications or requirements;
- Operation and Maintenance (O&M) Manuals are provided to the tenant for all nominated systems

Tuning

One point is awarded where:

- Prior to occupation, the Tenant commits to a tuning process of all nominated systems and implements a comprehensive tuning program that;
- Continues for a period of no less than 12 months after commencement;
- This process includes requirements for:
    - Verification that nominated systems are performing to their design potential;

- Quarterly Reviews of environmental performance against environmental targets;
- Collection of user feedback to match the occupant's needs and the system performance;
- Adjustment of all the systems to account for all deficiencies; and
- Management, communication, and assignment of responsibilities for the tuning process within the team.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
Where the point for commission is being claimed 1. GBCSA Submission Template 2. Index page(s) from O&M Manual(s) *And for tenants smaller than 5000m^2* 3. Letters from Contractors with completed commissioning checklists *And for tenants larger than 5000m^2* 4. Commissioning Plan 5. Extract(s) from the Commissioning Reports *Where the point for tuning is being claimed* 6. Tuning contract / letter of appointment

GBCSA Submission Template prepared by a suitably qualified professional that describes how the Credit Criteria has been met by:

- Identifying each system that is to be commissioned;
- Identifying the parties responsible for the commissioning, and
- Identifying what commissioning process will be applied
- Describing the basic function and operation of the services incorporated in the fitout, including initiatives intended to enhance energy efficiency, minimise greenhouse gas emissions, conserve water, and improve indoor environmental quality

Index page(s) from O&M Manual(s) clearly listing the areas covered in the Operation & Maintenance Manuals (O&M).

Letters from Contractors with completed commissioning checklists indicating what aspects of the installation the contractor has commissioned and confirmed as completed as per the design intent. Refer to additional guidance for a template for the 'commissioning checklists'.

Commissioning plan clearly demonstrating the requirements detailed in the Additional Guidance.

Extract(s) from the commissioning r**eports** clearly demonstrating:

- That all systems have been commissioned in accordance with either CIBSE Commissioning Codes, or ASHRAE Guidelines or according to manufacturer specifications; if applicable
- Commissioning dates, records of all commissioning testing undertaken, list any future
- testing, and a written list of outstanding commissioning issues (if applicable); and
- The outcomes and changes made to the systems as a result of the commissioning process, accounting for all of the recommendations;

Tuning contract(s) / letters of appointment signed by the Tenant, clearly demonstrating the contractual requirement for;

- The scope of works, program, milestones/dates, and deliverables of the fitout tuning program;
- Listing the roles and responsibilities of the various parties to be involved during this period
- A 'Tuning Report' to be generated by the tuning team once the fitout tuning program has been finalised.

ADDITIONAL GUIDANCE

Nominated Systems

Examples of systems that may need to be commissioned include, but are not limited to:

- Lighting controls;
- Electrical systems that are not covered by the Electrical Certificate of Compliance (such as setting of timer switches or any other controls that need to be specifically set to the particular requirements of the tenant);
- Hydraulic systems (such as gas and water supply distribution systems, rainwater, greywater, blackwater, and stormwater systems);
- Mechanical systems (such as HVAC and refrigeration systems; mechanically operable systems such as blinds and actuated shading devices);
- Management and Control System (BMCS);
- Meters (energy and water) and monitoring system,
- Irrigation system and controls,
- Domestic hot water (such as boilers, heat pumps, and solar collectors, excluding standard hot water cylinders); and
- Any other system that will have an impact on the indoor environment quality, or the energy or water consumption of the building.

Commissioning Checklists (for tenants smaller than 5000m^2:

The following commissioning checklist template must be used as a basis for what must used and attached with the letter from the contractor, to which the design team may want to add other requirements but that are not required for Green Star SA assessment:

Project Name:	
Company name of the Tenant:	
Address of the tenancy:	
Company name of the contractor:	
System that has been commissioned: (e.g. lighting controls)	
Date of commissioning:	

Commissioning Checklist (contractor to tick relevant items and complete info where appropriate during the onsite commissioning)		
Item checked:	**Operating as designed** (yes/no)	**Inspection Notes or Readings Taken** (any comments made during inspection)
For e.g. under lighting controls: *Motion control sensors in all meeting rooms and system response*	*yes*	*All motion sensors set to 75% sensitivity*
Daylight Dimming control	*yes*	*Dimming control set to dim open plan area area lights down to 100 lux when adequate daylight is detected*
Etc etc		

Commissioning Plan

It is good practice to develop a commissioning plan that includes the objectives, or basis of the design; the scope of the plan – all systems to be commissioned; list the commissioning team, and their responsibilities; the general sequence of commissioning and incorporated within the construction programme; the proposed commissioning procedures; witnessing requirements; and subcontractor commissioning reports.

Pre-commissioning

Pre-commissioning is specified systematic checking of a completed installation to confirm its state of readiness for commissioning. All pre-commissioning checks should be recorded on a pre-commissioning checklist to be provided by the design engineer or Commissioning Agent. As many of these checks as possible should be carried out off-site. The installer shall certify that the following checks have been completed prior to commissioning by the commissioning engineer (a signed checklist is recommended showing completion date of check). The pre-commissioning checklist should be passed to the commissioning engineer and can form part of the O&M manual. The installer should also sign this certificate or a separate pre-commissioning certificate to certify that installation is complete.

It is recommended that the person responsible for commissioning management produces a pre-commissioning certificate. CIBSE provides the following example wording:

The (name or describe) system installed in the above building has been fully installed and is ready for commissioning. It has been installed in accordance with the previously agreed specification and/or functional description of the system and design intent

Before commissioning major plant, the pre-commissioning should ensure the following:

As a minimum, the control system should be pre-commissioned to allow the building services plant to operate under 'manual' running conditions.

<u>Water systems:</u>

- Systems have been cleaned. and flushed to remove any debris, appropriate debris collectors and flushing facilities are incorporated. This is essential before commissioning commences.
- A pressure test certificate for the installation is completed.
- All regulating, isolating and control valves are in place and operating correctly.
- Flow measuring devices are in place and in the correct location for accurate measurement (including pressure tappings).
- The system is vented.
- Pump flow rate is adjusted to provide the specified flow rate.

Air systems:

- Ductwork air leakage testing is performed and certificates issued, where specified.
- Systems are cleaned and blown through to remove any debris; appropriate cleaning and inspection facilities are incorporated. This is essential before commissioning commences.
- Dampers are in the correct location and fully functional.
- Fire/smoke dampers are open.
- Test holes are drilled and sealed with removable plugs.
- In situ flow measuring devices (e.g. Wilson Flow Grid) are installed, where specified.
- Regulation of the fan(s) to provide the specified flow rate.

Packaged equipment:

- Plant and controls are fully commissioned and functional, ready for integration with other plant/systems.
- Control equipment inputs/outputs are in the specified format for connection to the main control system.
- Support services such as power and balanced water supplies are provided.

Commissioning

A project can demonstrate compliance with this criterion by showing that the pre-commissioning and commissioning activities have been performed based on the approved standards. As such, to demonstrate compliance, the following must be documented:

- The contractual construction documentation or specifications must list the requirements for commissioning each nominated system. It cannot simply be stated that systems must be commissioned to the relevant standard. Instead, the documentation must require a list of the design parameters for the system; the required commissioning activities; how each system is intended to operate; and the acceptable tolerances during commissioning. For example, documentation must include divisions of responsibilities, pre-commissioning procedures, commissioning requirements, witnessing requirements, phased completion requirements (if needed), post occupancy checks, and any training requirements for the operator.

Chartered Institution of Building Services Engineers (CIBSE) Commissioning Codes

Commissioning is defined by CIBSE as the advancement of an installation from the state of static completion to full working order to the specified requirements. It includes the setting to work of an installation, the regulation of the system and the fine-tuning of the system.

Commissioning of buildings and building services is vitally important to the safe and energy efficient operation of buildings but it is not always carried out – or carried out systematically. The CIBSE Commissioning Codes set out clearly and systematically the steps required to commission building

services in a proper and timely manner and will make a significant contribution to achieving properly commissioned buildings. This key step in the construction of a building enables the systems to operate as they were designed to do.

CIBSE Commissioning Code M: Commissioning Management

This code provides an overview of the management arrangements required to ensure that building services systems are commissioned to meet the objectives of the U.K Building Regulations. It is applicable to the management of commissioning of all building services systems, including new-build and retrofit applications. Commissioning of specific systems is addressed by the following:

- CIBSE Commissioning Code A: Air distribution systems
- CIBSE Commissioning Code B: Boilers
- CIBSE Commissioning Code C: Automatic Controls
- CIBSE Commissioning Code L: Lighting
- CIBSE Commissioning Code R: Refrigerating systems
- CIBSE Commissioning Code W: Water distribution systems

ASHRAE Guideline 1-1996 - The HVAC Commissioning Process

The purpose of this guideline is to describe the commissioning process that will ensure heating, ventilating, and air-conditioning (HVAC) systems perform in conformity with design intent. The procedures, methods, and Documentation Requirements in this guideline cover each phase of the commissioning process for all types and sizes of HVAC systems, from predesign through final acceptance and post-occupancy, including changes in building and occupancy requirements after initial occupancy. This guideline provides procedures for the preparation of documentation of:

- Owner's assumptions and requirements;
- Design intent, Basis of Design, and expected performance;
- Verification and functional performance testing; and
- Operation and maintenance criteria.

This guideline specifically details the process for:

- Conducting verification and functional performance testing and
- Maintaining system performance to meet the current design intent after initial occupancy.

This guideline also includes a program for training of operation and maintenance personnel.

Demonstrating the application of the CIBSE Commissioning Codes

To provide Project Teams with further guidance regarding the information which would be expected to be included within Commissioning Report(s) demonstrating the use and adherence to the CIBSE Commissioning Codes, this information, as per the Codes, may include, but is not limited to, the following;

- Particular and definitive commissioning specifications from the design engineer of each service/discipline setting out clearly what is expected of the commissioning specialist (independent or otherwise). This should include commissioning tolerances on all commissioning parameters and a clear description of how it is intended that the system

should operate and the design parameters. The design engineer should also produce 'cause and effect' sheets showing how the design is intended to operate. Also, commissioning specification details of safety controls and interlocks to protect the equipment and personnel during the commissioning process;

- Requirements for witnessing including full details of tolerances applicable to all parameters;
- Commissioning program including specific period of time for client witnessing;
- Appropriate health and safety risk assessment and method statements for the tasks to be completed;
- Commissioning method statement for each system;
- Pre-commissioning checklists for each system;
- Commissioning checklists; and,
- Commissioning certification for each system countersigned by the design engineer, commissioning specialist (independent or otherwise) and the accepting authority (where relevant), and including the record sheets provided in each CIBSE code.

The above items have been determined from a review of the CIBSE Commissioning Codes identifying key issues to be addressed with regards to the correct documentation of a CIBSE Commissioning Code compliant commissioning process of building services.

This list is not exhaustive and it is expected that all Project Teams complete their own review of the CIBSE documents and synthesize the important information which they, in their professional opinion and experience, believe are important and represent an improvement from conventional commissioning practices in South Africa and demonstrate the use of the CIBSE Commissioning Codes.

Commissioning Reports

Commissioning Reports are intended to provide a concise overview of the entire commissioning process and outcomes for each discipline (as applicable). It is a summary document of the key findings and outcomes as indicated in the commissioning records. Complete sets of actual commissioning datasheets or commissioning records should not be submitted, however Project Teams are encouraged to submit extracts to support the commissioning report (i.e. for major plant and equipment only).

Tuning

Prior to occupation, the tenant must commit to a tuning process of all nominated systems. At a minimum, the commitment must include quarterly measurement via a formal tuning process. The tuning must utilise data measured from the monitoring of the systems and via occupant feedback of conditions. At the end of the tuning period, the client must commit to take steps to adjust the nominated systems to account for all deficiencies.

This requirement can be performed every three months during the first 12 months of occupation, or every three months during the first 24 months of occupation. The scope of the tuning works will determine the relevant tuning period.

Operations & Maintenance Manuals

The O&M manual should be properly indexed. Terminology and references used must be consistent with the physical identification of component parts. Ensure that approved final copies of the O&M manuals are provided at handover.

Ensure that the O&M manuals meet the requirements of the commissioning standard being used, which includes, but not limited to, the following:

- Written description of system operation
- Control strategy/logic diagrams recording the version of any configuration software installed at handover
- Details of system application software configuration
- Description of user adjustable points
- Commissioning record details
- Detailed data sheets for all control components and equipment wiring circuit details including origin, route and destination of each cable
- Comprehensive instructions for switching on, operation, switching off, isolation, fault finding and procedures for dealing with emergency conditions
- Instructions for any precautionary measures necessary
- Instructions for the routine operation of the control system including simple day-to-day guidance for those operating the control system with limited technical skill
- Instructions for servicing and system upkeep
- Provision for update and modification
- Recommendations, if appropriate, regarding access for maintenance, and risk assessments for maintenance.

BACKGROUND

The Commissioning & Tuning credit aims to ensure that commissioning and tuning are undertaken to the highest possible standard, so that projects operate to their optimum operational potential throughout the building life cycle.

Few spaces work as initially intended by their design teams. As responsibility passes from the design team to the occupant or Management Entity, there are significant opportunities for processes to go wrong, for misunderstandings, and for strategy to give way to practical expediency.

Evidence suggests that the initial cost of implementing good design, commissioning and tuning processes are recovered many times over through operational savings, improved staff performance, and the avoidance of costly construction and/or service problems. An effective design review and well documented commissioning and tuning processes can assist projects in meeting their design intent and realising their sustainability targets. Conversely, poorly executed or documented commissioning and tuning can result in projects that perform below their operational capacity.

REFERENCES & FURTHER INFORMATION

American Society of Heating, Refrigeration and Air-Conditioning Engineers
http://www.ashrae.org

Building Commissioning Association
http://www.bcxa.org

The Building Services Research and Information Association
http://www.bsria.org

California Commissioning Collaborative
http://www.cacx.org

Chartered Institution of Building Services Engineers
http://www.cibse.org

Commissioning Specialists Association
http://www.csa.org.uk

The Building Services Research and Information Association, Feedback for Better Building Services Design (AG 21/98), 1998
http://www.bsria.co.uk

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Man-3 Occupant users' guide

POINTS AVAILABLE **1**

AIM OF CREDIT

To encourage and recognise information management that enables fitout occupants and users to understand the environmental interventions and optimise the fitout's environmental performance.

CREDIT CRITERIA

One point is awarded where:

- A simple and easy-to-read 'Occupant Users' Guide', which includes information relevant for the end users, is created and made available to the fitout owner and occupants

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Occupant Users' Guide

Occupant Users' Guide which includes all the required information as outlined in the Additional Guidance.

ADDITIONAL GUIDANCE

The Occupants Users' Guide, at a minimum, must include the following sections and information (where applicable):

Design Initiatives

- Descriptions of the project systems designed to enhance energy efficiency and minimise greenhouse gas emissions, and the measures that must be taken during operation to maximise their effectiveness;
- Descriptions of the project initiatives intended to enhance and minimise water use and the measures that must be taken during operation to maximise their effectiveness;

Targets & Benchmarks

- Outline the energy, water and waste targets or benchmarks;
- Describe the automated energy and water metering strategy for the fitout (if applicable);
- Information on simple strategies for saving energy and water;

INT-Man-3 Occupant users' guide

POINTS AVAILABLE 1

Basic Functions of systems

- Description of basic function and operation of all of the nominated systems (where applicable), and whom to contact for maintenance information or complaints;
- Nominated systems include but are not limited to:
  - Lighting controls;
  - Electrical systems (such as electrical generation, electrical supply, distribution systems, sensors, timers, security and alarm systems);
  - Hydraulic systems (such as gas and water supply distribution systems, rainwater, greywater, blackwater, and stormwater systems);
  - Mechanical systems (such as HVAC and refrigeration systems; mechanically operable systems such as blinds and actuated shading devices);
  - Management and Control System (BMCS); and
  - Any other system that will have an impact on the indoor environment quality, or the energy or water consumption of the building.
  - Meters (energy and water) and monitoring system,
  - Irrigation system and controls,
  - Domestic hot water (such as boilers, heat pumps, and solar collectors)

Transport Opportunities

- Details on the alternative transport facilities (such as cyclist facilities) available and including (where applicable), local public transport information, maps and timetable links, bike paths, access to and the location of, local amenities;

Waste & Recycling

- Description of the operational waste requirements for the users
- Information on recycling, including what can be recycled, where the waste storage areas are and the schedules for waste and recycling removal;
- Information on any other waste management processes present, such as composting or worm farm facilities (if applicable);

Appliances

- Descriptions of any energy and/or water efficient appliances provided within the fitout;
- Information on the applicable certification scheme under which the appliances are certified;

Further Information

- Details and links to other information such as websites, publications, and organisations relating to energy and water conservation, efficient building operation, indoor air quality or sick building syndrome, and environmentally friendly design features.

The Occupant Users' Guide must be a concise and user-friendly document, suitable for a layperson. It is not intended as a supplementary document to the Operations & Maintenance Manual for maintenance staff, and as such must not include detailed information on maintenance and spare parts, etc.

Simplified diagrams are aimed, and intended, for the use of the fitout occupants and need to communicate the depicted service/system in a very basic and clear way that can be readily understood by the general public. Any drawing/diagram that contains technical detail generally is not considered to be “simplified”.

For basic function and operation, it is not necessary to describe the function of simple amenity taps, or lighting systems without automatic control features. The intent of providing information on basic function and operation is only intended for those systems whose use and operation may not been immediately intuitive to fitout occupants. For example, the basic functions of a lighting system that includes daylight sensors or occupancy sensors would need to be described; however a lighting system with only simple manual controls (i.e. on/off switches) would not.

The provision of a building Operation and Maintenance (O&M) manual does not meet the Building Users’ Guide requirement. The O&M manual typically only provides detailed specialist information required by building manager and staff/contractors, not information intended for occupants.

BACKGROUND

This credit addresses the need to properly inform fitout occupants, users and owners about the best ways to use and operate their Green Star rated fitout and the positive impact that sustainable construction has on the environment.

In order for the sustainable benefits of a Green Star SA rated fitout to be fully realised, all user groups need to take an active role in the operation of that fitout. Often, new technology installed in sustainable fitouts can be confusing to occupants that are unfamiliar with such systems, which can result in sustainable technology that is not operated as intended or that operates below its full potential.

An example of incorrect usage resulting in inefficiencies would be when building users are not informed on how to correctly use a motion detection lighting system. If those occupants turn main light switches on and off manually, rather than utilising the motion detection system as intended, the energy use efficiencies associated with the system are effectively negated. Similarly, recycling facilities are only beneficial if fitout users are educated and informed about how and why such facilities should be used and how they benefit the environment.

Sustainable projects also represent a valuable opportunity for the education of fitout occupants and general public on the environmental benefits of sustainable design and construction. With appropriate signage and educational spaces situated throughout a fitout, useful information can be displayed to the benefit of all user groups and, more broadly, the community.

REFERENCES & FURTHER INFORMATION

Bobenhausen, C., ‘Sustainable O&M Practices’, Whole Building Design Guide, 2008
www.wbdg.org/resources/sustainableom.php?r=health_care

Green Building Council Australia, Clean Up Your Business Guide, 2007
http://www.gbca.org.au/publications/gbca-clean-up-your-business-guide/1417.htm

Queensland Government - Department of Public Works, Ecologically Sustainable Office Fitout Guideline, 2000
http://www.hpw.qld.gov.au/SiteCollectionDocuments/EcologicallySustainableOfficeFitoutGuideline.pdf

Sydney Harbour Foreshore Authority, Green Building User Guide: Enabling a Sustainable Future, 2008
http://www.shfa.nsw.gov.au/content/library/documents/24FF67C1-FB9B-965C-AE1E7766A6CDC65E.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Man-4 Environmental Management

POINTS AVAILABLE **1.5**

AIM OF CREDIT

To encourage and recognise the adoption of a formal environmental management system in line with established guidelines during construction.

CREDIT CRITERIA

Up to 1.5 points are awarded independently as follows:

Environmental Management Plan (EMP)

Half a point is awarded where:

- The Contractor implements a comprehensive, project-specific Environmental Management Plan (EMP) throughout the construction phase of the project (i.e. from construction commencement to practical completion) in accordance with **Table 1** provided in the additional guidance;

  AND

- The Contractor and Sub-Contractors demonstrate compliance with the EMP;

  AND

- The EMP explicitly addresses how the energy, water, waste, and indoor air quality impacts from construction works are managed, reported, and minimized through the implementation of an environmental management plan, in accordance with the Additional Guidance.

Environmental Management System (EMS)

Half a point is awarded where:

- The Contractor has valid ISO14001 Environmental Management System (EMS) accreditation throughout the construction phase of the project (i.e. from construction commencement to practical completion);

  AND

- All Sub-Contractors working on the project and engaged by the Contractor adhere to all applicable ISO14001 or EPA requirements.

OR

- The Contractor has a valid EMS in place, in accordance with the EPA South Australia Small Business Environmental Management Solutions, or in accordance with **Table 2** provided in the Additional Guidance.

Monitoring construction impacts

Half a point is awarded where:

- The construction impacts from energy, and water usage, as well as waste generation have been monitored, tracked, and documentary evidence of this is submitted to the GBCSA

INT-Man-4 Environmental Management

POINTS AVAILABLE **1.5**

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
Where first point claimed: 1. Environmental Management Plan, in accordance with **Table 1** in the Additional Guidance *Additionally where second point claimed:* 2. Current ISO14001 certificate OR 3. EMS deemed to satisfy criteria, in accordance with **Table 2** in the Additional Guidance 4. 3. Statement of confirmation from Contractor *Additionally, where the third point claimed* 5. Construction environmental management monitoring data

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Environmental Management Plan prepared by a suitably qualified professional that is comprehensive, project-specific, and:

- Addresses all points of the EMP template provided in **Table 1** below, and which is adapted where necessary for site conditions and where additional information or specific details are required
- Demonstrates that energy, water, waste, and indoor air quality impacts from construction works are managed, reported, and minimized through the implementation of an environmental management plan.
- Includes an Indoor Air Quality (IAQ) Management Plan, compiled in accordance with the criteria set out in Chapter 3 of the SMACA guidelines.
- Demonstrates that sub-contractors are obliged to adhere to the provisions of the EMP.
- Outlines the roles and responsibilities of each individual involved in environmental management of the construction site and designating the individual responsible for monitoring and auditing compliance with the requirements of the EMP.
- Signed off by the Contractor confirming implementation of the EMP from commencement of construction.

ISO14001 certificate of the Contractor that is current and valid throughout the entire construction phase of the project, demonstrating that an appropriate EMS is operating within the company

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EMS deemed to satisfy criteria, in accordance with **Table 2** in the Additional Guidance

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Statement of confirmation in the form of signed correspondence from the Contractor confirming;

- The dates of construction commencement and practical completion; and
- That any Sub-Contractors who worked on project did adhere to all applicable ISO14001 requirements.

Construction environmental management monitoring data must be submitted to the GBCSA, in the format prescribed in the Additional Guidance.

ADDITIONAL GUIDANCE

Environmental Management Plan

Table 1 below provides an EMP template that project teams can use during construction. The EMP template must be adjusted with any relevant project specific information and details. The EMP must be produced by a suitably qualified professional or the Contractor, be specific to the project and it must be clear that the Contractor and all Sub-Contractors are contractually required to adhere to it. Compliance with the relevant sections of the EMP must be demonstrated as below in **Table 1**

Commencement of Construction

Construction commences from the point at which the site is mobilised by the Contractor to implement the fit out scope for the tenancy. In instances where there is an existing tenancy which is going to be redone, the point of commencement must include the removal/gutting of the existing tenancy. Any items of the existing tenancy that are reused should not be considered waste and will be rewarded in the materials calculators.

Table 1: Interiors fitout EMP template

√		PRE – CONSTRUCTION PHASE CHECKLIST
	Statutory Requirements	• Prior to any construction works commencing, it is the responsibility of the Client to provide a list of all applicable environmental, land use and building permitting conditions together with the respective approved permits to the independent appointed ESO (Environmental Site Officer). • The EMP must be signed off by the appointed Contractor and ESO prior to Site Works commencing.
	Works Demarcation of Site Works	• It is the responsibility of the appointed Contractor to physically demarcate the area that site works will take place within, prior to construction works commencing. • Should there be no external works (i.e. outside the physical bounds of the tenant space, then site demarcation is not required. • Access to the site will be restricted to authorised personal and members of the public must be prohibited from the site unless prior arrangements have been made with the Contractor. Access to the site will be through designated and security controlled access points.
	Induction Training	• The Contractor and Site Managers are to undergo at least one environmental induction training session facilitated by the appointed ESO. • The Contractor is to ensure that all staff and sub-contractors are familiar with the requirements of the EMP. .
	Working hours	• Working hours shall be determined by the local authority and the Contactor shall abide by these at all times. • Any adjustments to the approved working hours shall be in writing from the local authority and in consultation with the appointed ESO.
	Responsibilities	• The EMP must clearly define the roles and responsibilities of the appointed Contractor, ESO, Site Manager, Principal Agent and the Local Authority.
√		CONSTRUCTION PHASE CHECKLIST

INT-Man-4 Environmental Management

POINTS AVAILABLE **1.5**

	Public Awareness	• All occupants of directly adjoining properties must be notified of the proposed construction phase activities at least two (2) weeks before construction works commence.
	Fuels and Lubricants	• A dedicated and demarcated area must be defined with drip trays beneath any equipment that utilises fuels or lubricants • On site spill remediation measures (such as but not limited to Spillsorb) must be in place and the Contractor must be familiar with how to operate the equipment in the event of a spill. • A fuel/lubricant spill management protocol must be produced by the Contractor and approved by the ESO prior to construction commencing. • Material Safety Data Sheets (MSDS) must be available where fuel and lubricant products are stored, to ensure that appropriate action can be taken in the event of a spill. • Spilled fuel and lubricants are considered hazardous waste and as such must be disposed of as hazardous waste and be collected by suitably licensed Contractor. • Chain of Custody documentation must be provided for all waste collections on site. • Any spills are to be recorded in the On-Site Environmental Register, and this must include any remedial actions.
	Liquid Waste Management	• Cement /Screed / Tile Grout / Paint contaminated water must be fed to a lined and bundled container, drum or sedimentation pond, neutralised and suitably regularly disposed of (e.g. decanted to a drum and collected by a licensed waste contractor). • Chain of Custody documentation must be provided for all waste collections on site. • Contaminated water must not be directed to any stormwater systems.

	Solid Waste Management	• The National Waste Management Strategy waste hierarchy illustration is shown below and this will also be used as a guideline by the Applicant for all design informants and operations on Site.  Figure 1: Waste management hierarchy The objects of the Waste Act are structured around the steps in the waste management hierarchy, which is the overall approach that informs waste management in South Africa. Therefore, the NWMS follows the waste management hierarchy approach. The waste management hierarchy consists of options for waste management during the lifecycle of waste, arranged in descending order of priority. All stakeholders must apply the waste management hierarchy in making decisions on how to manage waste. • Solid Waste must be clearly categorised by the Contractor into separate waste streams. • No dumping may take place on site or in any instance related to the site works. • The Contractor must provide clearly marked waste receptacles for categorised as well as a storage area for identified hazardous waste (to be collected by a licensed Contractor). • Waste receptacles must be regularly serviced and emptied to ensure that there is no overflow. • In instances of receptacles exposed to the external atmosphere (i.e. outside of the tenant/occupant space being fitted) and elements (such as wind), then shade netting shall be used to cover he receptacles to limit possible airborne impacts.
	Hazardous waste management	• Separate storage areas for hazardous materials must be identified and demarcated prior to site works commencing. • Should hazardous materials be stored or used on site in any form or manner then the Contractor shall have appropriately trained and experienced personnel (in line with statutory) requirements) to attend to any emergencies on site relating to hazardous material spills or exposures to site staff or visitors. • The Contractor shall provide proof of the above.
	Ablution facilities	• Chemical Toilets are to be provided on site at a ratio of at least on chemical toilet for every 15 workers. Clean water and soap shall be made available on site for use by workers. • Should Chemical toilets be located externally then these toilets are to be secured in a manner that ensures that they are not blown over by the wind.

	Fire safety	• The Contractor shall have appropriately trained and experienced personnel (in line with statutory requirements) to attend to any fire related emergencies on site. • Proof of the above must be provided by the Contractor. • Fire equipment on site must be provided by the Contractor and must be in line with statutory requirements.
	Health and Safety	• Contractors will at all times comply with the Occupational Health and Safety Act (1993) and ensure that suitably trained personnel audit the site on a weekly basis to ensure compliance. • Proof of the above must be provided by the Contractor.

	Noise Impacts	• Statutory requirements oblige Contractors to ensure that they cannot make 'unreasonable' noise at the following times:
		  ○ Sundays and public holidays
		  ○ Before 06H00 and after 17H00 on Saturdays
		  ○ Before 08H00 and after 18H00 on any other day than those listed above.
		• These requirements can only be adjusted if there is an emergency that threatens life or property; or if the authorities have given special permission.
		• The Contractor must ensure that suitable measures are in place to mitigate potential noise impacts through the use of appropriate equipment, appropriate scheduling of noisy activities and proactive engagement with surrounding tenants/occupants to timeously advise them of any potential noise impacts.
		• The Contractor will ensure that there is no music on site that causes a disturbance to surrounding tenants/occupants.

	Demolitions Works	• The Contractor will ensure that any demolition works is carried out by a suitably qualified and experienced service provider. • All materials generated through demolition works will be clearly catalogued and sorted for possible re-use, recycling or disposal (through a licenced service provider).
	Traffic Impacts	• The Contractor shall ensure that all potential traffic related impacts (from demolitions and constructions works) are identified and approximately quantified prior to site works commencing. • The Contractor shall ensure that any traffic related impacts are mitigated in consultation with the local authority traffic services or a suitably qualified traffic engineer, prior to construction works commencing.
	Resource Management	• The Contractor must develop a method statement that explains the impacts associated with energy, water and waste on the project and identify appropriate measures to manage, report and mitigate these impacts.

	IAQ	• The Contractor must implement measures to manage the indoor air quality (IAQ) in accordance with recommended control measures of Chapters 3 and 4 of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2003. In particular, the Contractor IAQ management plan, compiled in accordance with the criteria set out in Chapter 3 of the SMACA guidelines must demonstrate how the following sections in Chapter 3 have been implemented in the project: o Section 3.2 HVAC protection: o 3.2.1 'HVAC protection: supply side' o 3.2.2 'HVAC protection: central filtration' o 3.2.3'HVAC protection: return side' o 3.3.6 'Cover seal' if the VOC credit is not pursued o 3.5 'Housekeeping'

Indoor Air Quality (IAQ) Management Guidelines

The EMP must include provisions for managing the indoor air quality for the construction works. The provisions must meet or exceed the recommended control measures of Chapters 3 and 4 of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition 2007 as listed below. This standard was developed primarily to address the air quality and pollution controls of the HVAC system during construction and renovation works of a building. While the guideline is primarily intended to be used on an occupied building, the information contained within it is equally applicable to new construction.

As a minimum, the IAQ provisions of the plan must include:

i. The protection of the ducting and HVAC equipment during construction and

ii. The reduction of project materials' capacity to absorb emissions from significant sources of contaminants by protecting them during construction.

Plan must be in accordance with the following SMACNA Guidelines sections:

- Section 3.2.1 'HVAC protection: supply side'
- Section 3.2.2 'HVAC protection: central filtration'
- Section 3.2.3'HVAC protection: return side'
- Section 3.3.6 'Cover seal' if the VOC credit is not pursued
- Section 3.5 'Housekeeping'

Environmental Management System

ISO14001 Certification

ISO14001 is a requirement of the Contractor and must be valid for the entire construction phase of the project. All Sub-Contractors working on the project and engaged by the Contractor must adhere to the requirements of the EMS.

ISO14001 alternatives

For smaller organisations (fewer than 20 full time employees) simpler tools other than ISO14001 are acceptable where the results are externally available to customers and the public and internally to staff and other building occupants. An external auditor's report confirming evidence of effective use of the EPA South Australia Small Business Environmental Management Solutions (EMS) checklist below must be provided to achieve the credit, or alternatively the Contractor must supply the relevant information outlined in **Table 2** as deemed-to-satisfy compliance.

Table 2: Deemed to satisfy requirements

Action	Documentation required to demonstrate compliance
Checklist step 1: Has the principal Contractor committed to addressing the environmental issues related to the organisation's activities, products and services?	Statement of confirmation listing some of the organisations activities/products that demonstrate a commitment to environmental issues
Has the principal Contractor written an environmental policy that includes a commitment to: a) Prevent pollution b) Continuous improvement c) Comply with environmental regulations?	Environmental Policy
Has this policy been provided to all staff?	Statement of confirmation
Is the environment policy displayed in the workplace and available to the public?	Statement of confirmation/Photograph
Checklist step 2: Have all the business' aspects and impacts been identified?	Aspects and Impact register
Has the principal Contractor's staff been consulted on these impacts?	Statement of confirmation and a short description of how this was done
Have the impacts been prioritised using the risk assessment rating system in the EPA reference?	Aspects and Impact register
Have all the legal requirements for the business been established and documented?	Legal register
Has an Environmental Action Plan been documented	Action Plan

for these impacts?	
Has each action been allocated to the responsible person?	Responsibilities identified in the Action Plan
Checklist step 3: Has the hierarchy of controls been used to decide on actions to eliminate or reduce impacts on the environment?	Environmental Action Plan
Has/have a procedure / s for implementation of the Environmental Action Plan been developed and communicated to all staff?	Statement of confirmation and a short description of how this was done
Has an emergency response plan been prepared and documented?	Emergency response plan
Has this been communicated to all staff?	Statement of confirmation and a short description of how this was done
Have training needs been identified?	Training assessment
Has this training been undertaken?	Evidence of training provided
Checklist step 4: Has a procedure been developed for regularly checking the environmental impacts of the business and activities?	Environmental Action Plan
Has the principal Contractor audited their Environmental Management System?	Review register
Is regular monitoring taking place, and being documented?	Track record of resources being monitored and how often (at a minimum, energy water and waste should be monitored)
Is there a procedure in place to ensure that the business' compliance with legal requirements is updated and documented?	Aspects and Impacts register
Has a procedure been developed for reporting and correcting non-conformance?	Environmental Action Plan
Checklist step 5: Has the Environmental Management System been reviewed on a regular basis?	Review register
Has this review evaluated the suitability, adequacy and effectiveness of the Environmental Management System, and taken into account any non-conformance?	Review register
Have any changes that the review has identified, been implemented (including an update of the Environmental Action Plan)?	Review register
Has the review and any changes been documented?	Review register

The deemed to satisfy criteria checklist must be accompanied by the documentation outlined in **Table 2** above, summarised below as:

1. An environmental action plan that includes:
    a. Aspects and Impact register
    b. Review register
    c. Emergency response plan
2. An environmental policy
3. A statement of confirmation from the Contractor confirming:
    a. Some of the organisations activities/products that demonstrate a commitment to environmental issues
    b. That all policies and related documentation have been communicated to staff, explaining how this was done
    c. Evidence of training provided

Construction environmental management monitoring data

To comply with this criterion, project teams are required to monitor and record the following environmental resource impact totals during the construction period:

- Energy consumption (measured in kWh)
- Potable water consumption (measured in kL)
- Waste generation (measured in kg)
- Waste recycled (measured in kg)

These results must be communicated to the GBCSA, via the credit submission documentation.

BACKGROUND

The aim of the credit is to encourage and recognise the adoption of a formal environmental management system in line with established guidelines during construction. It rewards project teams for three things:

- Implementing an EMP (Environmental Management Plan)
- Implementing an EMS (Environmental Management System)
- Monitoring construction resource impacts

Fitout construction can result in environmental impacts, especially at the local level. These arise from pollution and waste generation from such activities which include painting, flooring installations and on site joinery installation, and water and energy use. It is important that responsibility is taken for creating and executing management procedures to minimise or avoid these impacts by developing project specific EMPs and adopting an EMS.

EMPs aid project teams in developing a clear and detailed action plan as to how environmental impacts will be mitigated. An EMS provides management and systems tools for organisations or project teams to control their environmental impacts and to improve their environmental performance. Both the EMP and an EMS are tools that can provide significant tangible economic and environmental benefits, including:

- Reduced raw material/resource use;
- Reduced energy consumption;
- Improved process efficiency;

- Reduced waste generation and disposal costs; and
- Utilisation of recoverable resources

REFERENCES & FURTHER INFORMATION

National Environmental Management Act, 107 of 1998, as amended: Environmental Impact Assessment Regulations R543; 18 June 2010.
http://www.environment.gov.za/polleg/legislation/natenvmgmtact/natenvmgmtact.htm

National Environmental Management Act, 107 of 1998, as amended: Environmental Impact Assessment Regulations R544; 18 June 2010: Listing Notice 1: List of Activities and Competent Authorities identified in terms of Sections 24(2) and 24D.
http://www.environment.gov.za/polleg/legislation/natenvmgmtact/natenvmgmtact.htm

National Environmental Management Act, 107 of 1998, as amended: Environmental Impact Assessment Regulations R545; 18 June 2010: Listing Notice 2 & 3: List of Activities and Competent Authorities identified in terms of Sections 24(2) and 24D.
http://www.environment.gov.za/polleg/legislation/natenvmgmtact/natenvmgmtact.htm

National Environmental Management Act, 107 of 1998, as amended: Environmental Impact Assessment Regulations R545; 18 June 2010: Listing Notice 3: List of Activities and Competent Authorities identified in terms of Sections 24(2) and 24D
http://www.environment.gov.za/polleg/legislation/natenvmgmtact/natenvmgmtact.htm

DEAT (2004) Environmental Management Plans, Integrated Environmental Management, Information Series 12, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

CSIR (2005) Guidelines for Environmental Management Plans, Western Cape
http://www.westerncape.gov.za/eng/your_gov/406/pubs/guides/G

EPA South Australia Small Business Environmental Management Solutions available for download at
http://www.epa.sa.gov.au/xstd_files/Industry/Brochure/sbes.pdf

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
http://www.smacna.org/

International Organization for Standardization ISO14001 – Environmental Management Systems
http://www.iso.org

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Man-5 Construction Waste Management

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise management practises that minimise the amount of demolition and construction waste going to disposal.

CREDIT CRITERIA

Up to two points are awarded where:

- The Contractor develops and implements a Waste Management Plan (WMP) throughout the construction phase of the project (i.e. from construction commencement to practical completion);

  AND

- The Contractor retains waste records and issues regular reports to the Tenant;

  AND

- The Contractor diverts a minimum percentage (by mass) of all demolition and construction waste for reuse or recycling, awarded as follows:
  - 30% for one point;
  - 50% for 1.5 points;
  - 70% for 2 points.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors	
Submit all the evidence and ensure it readily confirms compliance.	
1.	Short Report
2.	Waste Management Plan
3.	Regular waste reports

Short Report prepared by a relevant project team member that demonstrates how the Credit Criteria have been met by:

- Providing a tabulated summary of all categories of waste with their corresponding total quantities (in mass) as identified in the regular waste reports in accordance with the Additional Guidance
- Demonstrating that the diversion from landfill disposal percentage was achieved for the project; and
- Referencing appended receipts and other appropriate records (e.g. evidence of reuse).

Waste Management Plan developed in accordance with the Additional Guidance and implemented for the project.

Regular waste reports issued to the Tenant showing the categories of waste, their corresponding quantities (in mass) for the period, the percentage diverted from disposal and how that diverted is reused/recycled. Please refer to the Additional Guidance with regards to the regularity of reporting.

ADDITIONAL GUIDANCE

Waste Management Plan

The Waste Management Plan is to be developed prior to construction start and is to be implemented for the entire construction duration including any demolition. The Plan must detail, as a minimum, the following:

- How all generated waste is to be monitored;
- Which type of waste streams are to be collected for recycling or reuse;
- How each waste stream should be handled on site and its procedure for recycling or reuse; and
- The roles and responsibilities of those involved in the waste management process

Waste Exclusions

Any waste that is not normally sent to conventional disposal (i.e. landfill) is not addressed by this credit, such as hazardous waste that must be disposed of in accordance with applicable legislation (e.g. asbestos, contaminated fill/topsoil etc.). Quantities of such wastes must be excluded from calculations to demonstrate compliance with the credit criteria.

Waste reused on site

Projects that reused any waste must include these materials in the credit calculations as reused /recycled. For example, if project teams crush and reuse existing concrete, masonry or asphalt on site (that would otherwise be hauled off-site) or process debris into a recycled content commodity with a market value (e.g. alternative daily cover material, land reclamation material, foundation/road sub-base), these must be included in the credit calculation as reused or recycled material.

Informal recycling

Where informal recycling is utilized, the waste material must be weighed beforehand and a record of the informal recyclers collectors must be kept including their acknowledgement of collection of such materials and quantities.

Offsite waste management

Waste can be managed offsite if space constraints prohibit a tenant to effectively store and manage recyclables within the project site's available space.

Waste reports

Projects lasting less than two months, a report every two weeks is generated, for projects of 2 - 4 months a waste report should be generated every month, and for any project longer than 4 months, a waste report should be generated every two months, thereby ensuring that an average of 4-6 waste reports are also generated for fitout projects.

Waste reports must include the following information, as a minimum:

- An identification of all relevant waste streams generated on site;
- A breakdown by estimated weight (using volume to weight conversion factors) of most common material types removed from site (e.g. carpet timber, plasterboard, concrete, plastic packaging);
- Breakdown by location of where the waste was taken for recovery;
- Total amount of waste from the site diverted from landfill, reported by weight;
- Total amount of waste residual from the site that was sent to landfill, reported by weight; and
- Explain how the waste diverted from landfill is going to be reused or recycled

For guidance, an example template for communicating waste streams is provided below and has been populated with sample data. Project teams are encouraged to make use of this template and populate it with waste stream types, and their associated mass, as appropriate to their project experiences.

Table 1: Example template for communicating waste streams

Waste type	**Waste diverted from landfill**			**Waste sent to Landfill**	
	(tonnes)	Location	Recycled/Reus function	(tonnes)	Location
General Waste				20	Municipal Landfill Disposal site
Builder Rubble	25	Concrete service provider crushing site	Concrete rubble crushed for reuse		
Packaging (cardboard and plastic)	45	Waste man Disposal site	Cardboard and plastic recycled via manufacturing process		
Plasterboard				40	Municipal Landfill Disposal site
Reused Timber	10	Contractors Plant yard	Donated to local community for reuse		
Mixed metals	5	Contractors Plant yard	Resold to 3rd parties		
Carpet off cuts				1	Municipal Landfill Disposal site
Vinyl flooring off cuts				1	Municipal Landfill Disposal site
Total sent to landfill	**85**			**62**	
Total waste for project	**137**				
% diverted from landfill	**85/ 137**				
	62%				

Conversion of volume to mass

If waste is measured by volume rather than mass, the data must be converted to mass using the densities provided in Table 2.

Solid Waste Type	**Density (tonnes/m^3)**
Aluminium cans – whole	0.026
Aluminium cans – flattened	0.087
Aluminium cans – baled	0.154
Asphalt / Bitumen	0.8
Bricks	1.2
Car Batteries	0.375
Carpets	0.3
Cement Sheet	0.5
Ceramics	1
Clean Soil	1.6
Cobbles / Boulders	1.4
C**ommingled containers (plastic,** glass, steel **&** aluminium cans)	0.063
Concrete	1.5
Garbage	0.15
Garden / Vegetation	0.15
Glass bottles – whole	0.174
Glass bottles - semi-crushed	0.347
Steel cans – whole	0.052
Steel cans – flattened	0.13
Steel cans – baled	0.226
Wood / Timber	0.3
Hazardous Wastes	0.2
Insulation	0.05
Litter trap	0.75
Metals	0.9
Oil	0.8

Other Textiles	0.15
Others	0.3
Paint	0.8
Paper / Cardboard	0.1
Plasterboard	0.2
Plastic containers – whole	0.01
Pl**astic containers - whole, some** flattened	0.013
Plastic containers – baled	0.139
Rubber	0.3
Soil / Rubble<150mm	1.4

Table 2: Densities to be assumed for various solid waste types

For any materials that are not listed in **Table 2**, project teams may propose their own densities along with accompanying calculations and justifications by Credit Interpretation Request (CIR). Project teams must demonstrate within the CIR how the density was arrived at and how calculations were done. The densities of some materials can vary widely depending on their composition and manufacture (e.g. concrete could include asphalt, gravel or many other materials). The CIR must also demonstrate that calculations have taken into account the difference between the density of the material in transport/crushed form, rather than in solid form/in situ.

BACK GROUND

The Construction Waste Management credit assesses the reductions in the amount of construction and demolition waste that is sent to landfill from Green Star SA projects. It recognises that there are numerous strategies which can be used to avoid the creation of construction and demolition waste and provides designers and contractors the opportunity to implement their own waste avoidance strategies rather than prescribing specific waste avoidance measures.

Diverting waste from landfill has important environmental impacts. Firstly, resources are diverted back into a supply chain of value, thereby replacing the need for finite virgin or raw materials. Secondly, landfills in South Africa are rapidly reaching their capacity limits and serve as sources for soil and water pollution as well as methane production.

Fitout installations have a role to play in achieving the 50% waste reduction target, as well as the ultimate goal of zero waste in 2022 by aiming to recycle as much construction waste as possible, which can often be significant.

Construction waste generated in a typical fitout might include joinery items, ceiling installations, walling and flooring tiles, the packaging associated with items, off cuts and disassembled internal walls. South Africa has a growing number of recycling service providers that can assist project teams to dispose of their construction waste without having to send it to the municipal landfill. Furthermore, certain manufacturers are in the position to take back construction waste generated in a fitout to recycle and reuse.

REFERENCES & FURTHER INFORMATION

DEAT (2004) Waste Management Plans, Integrated Environmental Management, Information Series. Department of Environmental Affairs and Tourism (DEAT), Pretoria.
https://www.environment.gov.za/sites/default/files/docs/series12_environmental_management plans.pdf

Waste Management & Recycling Case Study: Best Practice Construction Waste Collections Office Fit-Out of 15 Canada Square, Canary Wharf
http://www.mskgroup.co.uk/wp-content/uploads/2014/03/KPMG_-Canary-Wharf_-Waste-Management-Case-Study.pdf

EcoRecycle Victoria Waste Wise Toolkit (page 46):
www.ecorecycle.sustainability.vic.gov.au/resources/documents/WWE_Toolkit_(Full_Version).pdf

E - Waste Association of South Africa (EWASA)
http://www.ewasa.org/

My Waste website
http://www.mywaste.co.za/

National Recycling Forum website
http://www.recycling.co.za/

The Institute of Waste Management of Southern Africa (IWMSA)
http://www.iwmsa.co.za/

Polokwane Declaration
http://soer.deat.gov.za/dm_documents/polokwane_nmZiT.pdf

Terry, A. & Moore, T. [eds] (2008), 'Waste and Sustainable Commercial Buildings' Your Building: Profiting from Sustainability
http://www.yourbuilding.org/library/Waste%20and%20sustainable%20commercial%20buildings.pdf

Matt Rendell (Cyril Sweett Ltd) and Dr David Moon (WRAP) Reducing waste in smaller construction and refurbishment projects and programmes of minor works November 2009
http://www2.wrap.org.uk/downloads/Reducing_waste_in_smaller_construction_and_refurbishment_projects_and_programmes_of_minor_works.d5fcbe0e.8083.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Man-6 Work Space Efficiency

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise the design of workspaces that promotes spatial efficiency and improvement of productivity and occupant performance.

CREDIT CRITERIA

Up to two points are awarded as follows:

Spatial efficiency

Minimum compliance requirement

To achieve any points in this credit, the project team must demonstrate that the projects' design population (occupant density) is equal to or less than the SANS 10400 part A: 2010 – Class of Occupancy for Buildings and Design Population requirements

One point is awarded where:

- It can be demonstrated how the purposes for which the fit-out is created are transferred from inception to the implemented design to result in a highly efficient use of space

Well Being / Occupant Performance

An additional point is awarded where:

- The 1st point above is achieved;
  AND
- A Post-Occupancy User Survey/ Evaluation is conducted to measure the fit-out success

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Short Report 2. Copy of the contract OR Signed Confirmation

Short Report prepared by a suitable professional that describes how the Credit Criteria has been met by:

- Demonstrating that the population density is equal to or less than the SANS 10400 part A:2010 – Class of Occupancy for Buildings and Design Population requirements
- Demonstrating how the purpose for which the fit-out is created are transferred from inception to the implemented design. This can be done for example by including within the Short Report or as separate documents the following:

- Company vision and Organisational chart
- The design brief
- Diagrams indicating spatial relationships with the different areas
- Marked up plans/layouts indicating the final design and how it relates to the process indicated above

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Copy of the Contract (for tenants with 31 or more occupants) or Signed Confirmation from the Tenant (for tenants with 30 or less occupants) clearly demonstrating the contractual requirement to undertake a Post-Occupancy Survey / Evaluation within the first 6-12 months of occupation with a minimum response rate as set out in the additional guidance. Note that in the case of the contract, it should be between the suitably qualified professional and the tenant)

Post-Occupancy Survey / Evaluation developed for the project that will be conducted with the occupants.

ADDITIONAL GUIDANCE

This credit is applicable to all the buildings types identified in the Space Use criterion, with the exception of Hotels, which includes only "back of house" areas.

To demonstrate spatial efficiency a short report must be prepared by a suitable professional describing how the benchmarks have been achieved by using SANS 10400–A (2010): Class of Occupancy for Buildings and Design Population shown in the table below or by using a ratio of net useable area to net internal area.

Class of occupancy of room or storey or portion thereof	Population
A1 - Entertainment and public assembly; A2 - Theatrical and indoor sport & A4 - Worship	Number of fixed seats or 1 person per m^2 if there are no fixed seats
E3 - Other institutional (residential) & H1 - Hotel	2 persons per bedroom
E4 - Health care	16 persons provided that the total number of persons per room is not more than 4
H5 - Hospitality	16 persons per dwelling unit provided that the total number of persons per room is not more than 4
G1 - Offices	1 person per 15 m^2
C1 - Exhibition hall; E2 – Hospital; F1 - Large shop & F2 - Small shop	1 person per 10 m^2
C2 – Museum & F3 - Wholesalers' store	1 person per 20 m^2
A3 - Places of instruction & H2- Dormitory	1 person per 5 m^2

Table 1: Design population in accordance with SANS 10400 – A (adapted from the SANS 10400-A 2010 Edition 3)

The report can also describe how different areas, furniture and fittings can be used for multi-purpose activities e.g. a standing informal meeting area in an office can double up as storage space underneath and a canteen can also be used as a training area for the staff.

INT-Man-6 Work Space Efficiency

POINTS AVAILABLE 2

Note that the following definitions and exclusions apply:

User - The user, for purposes of this credit, is defined as the person/staff member who will be using a single piece of furniture or equipment non-continuously for at least two hours during a given day.

Post Occupancy Survey / Evaluation
Post occupancy survey / evaluation, for the purpose of this credit means a systematic evaluation of opinion about buildings in use, from the perspective of the people who use them. It assesses how well buildings match users' needs, and identifies ways to improve psychological wellbeing, physical wellbeing, work performance or productivity.

Suitably qualified professional
For purposes of this, a suitably qualified professional is defined as either an industrial psychologist or a registered ergonomics professional

Post – Occupancy Survey/ Evaluation

For fitouts with 30 or fewer users, a survey must be conducted for all users. The tenant must conduct a post occupancy survey / evaluation referring to the standard questionnaire given in Table 2 below or of a similar scope. There are free websites such as http://www.snapsurveys.com/ or http://www.surveymonkey.com/ that can help facilitate administering the surveys. The submission must contain evidence in the form of survey templates, analysis reports and any other data relevant to the survey.

Survey Categories
For an occupant survey to be deemed compliant, the following survey categories need to be included:

- Work area attributes
- Space layout and ergonomics
- Wellbeing
- Effectiveness

INT-Man-6 Work Space Efficiency

POINTS AVAILABLE **2**

Table 2: Sample questionnaire

	Sample Questions
"Work" area attributes	What is the best description of the "work" area (e.g. open-plan office, cubicle, closed office, kitchen, laboratory, warehouse, home, clothing shop, teller, etc.)?
	What is the length of time (e.g. months) since moving into this "work" area?
	How many hours per day do you spend in this "work" area
	What proportion of the time are you expected to (a) sit, (b) stand, (c) move around, or (d) lie in this "work" area?
	How close is a person to the following: (a) external window, (b) atrium, (c) balcony, (d) courtyard, (e) garden?
Space layout and ergonomics	What is the occupant's satisfaction with their ability to use relevant furniture/appliances in the "work" area without physical space problems?
	What is the occupant's satisfaction with personal storage space?
	What is the satisfaction with the ability of the space to enable the occupant to interact with colleagues (or family where relevant) when necessary?
	What is the satisfaction with the ability of the space to enable the occupant to collaborate with colleagues (or family where relevant) when necessary?
	What is the satisfaction with the ability of the space to enable the occupant space to work/operate without interruptions?
	What is the satisfaction with the ability of the space to enable the occupant private space when necessary?
	What is the satisfaction with the ability of the space to be adapted to the individual preferences of the occupant (within their "work" area)?
	What is the satisfaction with the ability to move throughout the "fitout' without being impeded by "work" area obstacles?
Wellbeing	Physical wellbeing. Appropriate measures might be standardised measures of: ▪ a Sick Building Syndrome Survey ▪ Satisfaction with various physical fitness aspects (such as a lack of headaches, a healthy appetite, no problems with aerobic activity, etc.)
	Psychological wellbeing. Appropriate measures might be standardised measures of: ▪ Mental wellbeing (e.g. General Health Questionnaire or the Warwick-Edinburgh Mental Wellbeing Scale) ▪ Job satisfaction (where appropriate)
Effectiveness	Estimate your current level of performance/productivity at your "work" area (e.g. 0% to 100%)
	Estimate how you think your level of performance/productivity has changed after moving to your current "work" area (e.g. -30%, +20%, etc.)

INT-Man-6 Work Space Efficiency

POINTS AVAILABLE **2**

For fitouts with more than 30 users, a post occupancy survey / evaluation assessment must be conducted for a sample size according to **Error! Reference source not found.** and a suitably qualified professional must be engaged. Alternatively, one of the following standardised instruments can be used:

- Building Occupancy Survey System Australia (BOSSA)
- Building Use Studies (BUS) Methodology
- Centre for the Built Environment (CBE)

BOSSA - The Building Occupants Survey System Australia is an IEQ assessment system for Australia's office buildings. Buildings surveyed during this project will underpin an on-going program of architectural science research aimed at improving occupant's health, comfort and productivity outcomes from sustainable office buildings in Australia.

The BUS methodology is the original method of evaluating occupant satisfaction and has been developed over the last 30 years. It is an established, tried and tested way of benchmarking levels of occupant satisfaction within buildings against a large database of results for similar buildings. Results can be used to create solutions to improve the occupant experience and optimise building performance. The BUS methodology uses a structured questionnaire designed to extract as much information as possible from as few questions as possible. Respondents rate various aspects of performance on a scale of 1-7 and can also provide comments so both quantitative and qualitative feedback is obtained.

The CBE has two methods of evaluating occupant satisfaction: Firstly, the CBE develop new ways to "take the pulse" of buildings in operation: measuring the occupants' responses to their indoor environments, and linking them to improved physical measurements of indoor environmental quality. Secondly, the CBE study technologies that hold promise for making buildings more environmentally friendly, more productive to work in and more economical to operate. This helps the manufacturing partners to target their product offerings, and facility management and design partners to apply these new technologies effectively.

Please refer to the table below that outlines the specific areas that each instrument measures:

CBE	**BUS**	**BOSSA POE**
Office layout	Building facilities	Design & fitout
Office furnishings	Cleanliness & maintenance	Building maintenance
Thermal comfort	Meeting rooms & storage	Thermal comfort
Air quality	Thermal comfort	Air quality
Lighting	Air quality	Visual comfort
Acoustic quality	Lighting	Acoustic quality
Cleanliness & maintenance	Acoustic quality	Productivity
Productivity	Productivity	
	Personal control	
<u>Optional additions</u>:	Commuting	
Accessibility (disabilities)		
Building grounds		
Commuting		
Daylighting		
Laboratories		
Office support equipment		
Restrooms		
Safety & security		

Survey Sample Size Determination
Table 3 below summarizes the number of responses needed to create a representative sample size, depending on the number of users in the fitout (i.e. fitout occupants including full time contractor employees).

Table 3: Determining survey sample size

Population Size	Minimum responses need for the sample size
30	30
50	40
100	81
150	110
200	134
300	172
400	201
500	222
1000	206
5000	370
10000	385

BACKGROUND

All building types are designed around specific functions or purposes and how these related to the spaces constructed around them. This credit aims to reward efficient use of space for the different types of occupancies. This is achieved through design and how design can maximise efficient and effective space use by using the least amount of space without compromising individuals comfort and productivity.

Space efficiency must be balanced against its effectiveness and will encourage a reduction in rental, energy and operational costs, while improving the environment.

In the private and public sector, there has become a trend to minimise the amount of space against which rent, rates and other property rates are paid.

REFERENCES & FURTHER INFORMATION

Space Management Group (Promoting space efficiency in building design)
http://www.smg.ac.uk/rep_efficiency.html

Indoor Environment Quality and Occupant Productivity in the CH2 Building (Post occupancy summary)
https://www.melbourne.vic.gov.au/Sustainability/CH2/Evaluation/Documents/CH2_Post_Occupancy_Summary.doc

Ergonomics Society of South Africa

http://www.ergonomicssa.com/

Building Occupancy Survey System Australia – University of Sydney (BOSSA)
http://www.bossasystem.com/

Building Use Studies – Arup (BUS Methodology)
http://www.busmethodology.org.uk

Centre for the Built Environment – University of California, Berkeley (CBE)
http://www.cbe.berkeley.edu/

Snap Surveys
http://www.snapsurveys.com/

Survey Monkey
http://www.surveymonkey.com/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Man-7 Green Lease

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise collaboration between the building owner and tenants in order to manage and operate the building along environmentally sustainable principles whilst realising mutual benefit.

CREDIT CRITERIA

Up to two points are available as follows:

Disclosure

One point is awarded where:

- The tenant has a signed agreement with the building owner/landlord that demonstrates that the tenant is committed to on-going performance that requires the tenant to participate in the following environmental initiatives while occupying the space:
  - Electrical energy monitoring & reporting (minimum quarterly) and have submitted an energy management plan at the beginning of each year to the landlord;
  - Water monitoring & reporting (minimum quarterly) and have submitted a water management plan at the beginning of each year;
  - Waste reduction/recycling monitoring & reporting (minimum quarterly) and have submitted a waste management plan at the beginning of each year;

Performance

An additional point is awarded where:

- The tenant has a signed agreement with the building owner/landlord which commits the tenant to certain performance criteria in the form of a Performance Agreement.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. **Extracts from the signed agreements** OR **Signed Confirmation**

INT-Man-7 Green Lease

POINTS AVAILABLE **2**

GBCSA's Submission Template with all with all information correctly entered corresponding to all supporting documentation requirements

Extract(s) from the signed agreements OR a **Signed Confirmation** by the tenant highlighted to demonstrate compliance with the credit criteria.

ADDITIONAL GUIDANCE

Please refer to GBCSA Green Lease Toolkit (attached to this credit) for any other information regarding benefits, formation and application of a green lease.

BACKGROUND

What is the Goal of a Green Lease?

The fundamental concept that underpins a green lease is that of mutual understanding. While the details may vary from one agreement to another, the primary purpose of a green lease is:

- To improve the operational performance of green buildings; and
- To deliver to landlords and tenants an equitable share of the incremental value provided by green buildings.

A green lease seeks to achieve these goals by securing long-term operational performance through a transparent, mutually beneficial agreement between tenants and landlords that governs:

- The base building and fit-out quality in buildings;
- The contractual requirements of facilities managers;
- The behaviour of tenants from an environmental perspective; and
- Regulation of governing bodies (through continuing education).

What is a Green Lease?

'Green Lease' is a general term that describes a document for negotiating green building attributes between the owner and the tenant of a building. It does not necessarily refer only to a lease agreement but could also represent:

- A Service Level Agreement (SLA)
- Memorandum of Agreement (MOA)
- Lease annexures
- Special lease terms and conditions
- Building/property/facility management guidelines or rules

A green lease is an adaptation of a traditional lease. It is primarily a set of legally binding rights and obligations - a contract. The parties both agree that the landlord will provide the temporary use and

enjoyment of the premises in return for the payment of rent by the tenant. It must contain the essential terms of a contract and, in particular:

- There must be consensus on the essential elements of the contract;
- Both parties must have the capacity to enter into the contract;
- Performance of the contract must be physically possible; and
- It must include any legal formalities such as the length of the lease and lease termination requirements.

The key difference with a green lease is the assignment of responsibilities and financial obligations related to occupying and owning a green building. The responsibilities to do, and to pay, are often split. Typically, the tenant carries the responsibility to pay and the landlord the responsibility to do.

What are the commercial benefits of 'Green Leases'?

The Property Owner's Perspective:

- The core asset (i.e. the building) is maintained in accordance with its environmentally sustainable design.
- As a consequence, the building achieves maximum rental returns and occupancy rates.
- Owner's costs of maintaining the asset are minimized.
- Owner is able to offer a product to meet tenants requirements.
- Owner benefits from a lifestyle cost-benefit analysis whereby tenants actively seek out premises that provide sustainable design with ongoing sustainable building management and operation.
- Owner is able to meet Corporate Social Responsibility requirements.
- Owner benefits from an improved public image and related marketing position.

The Tenant's Perspective:

- The premises provide a safe, productive and 'green' work environment.
- Tenant benefits financially from lower operating costs/service charges through reduced energy and water consumption rates.
- Tenant is able to meet Corporate Social Responsibility requirements.
- Tenant benefits from an improved public image and related marketing position.

Please refer to GBCSA Green Lease Toolkit for any other information regarding benefits, formation and application of a green lease.

REFERENCES & FURTHER INFORMATION

GBCSA Green Lease Toolkit, South Africa 2012

The Green Lease Handbook, Council of Australian Governments (COAG), 2012
http://www.gbca.org.au/gbc_scripts/js/tiny_mce/plugins/filemanager/Green-Lease-Handbook-20120907-PDF.pdf

Tenants Guide to Green Leases, Council of Australian Governments (COAG), 2012
http://www.gbca.org.au/gbc_scripts/js/tiny_mce/plugins/filemanager/Tenants-Guide-to-Green-Leases-20120907-PDF.pdf

The Real Property Association of Canada
http://www.realpac.ca

Jones Lang LaSalle, Perspectives in sustainable tenants strategies, 2013
http://www.joneslanglasalle.com/GSP/en-gb/Documents/GSP/GreenLeases-10reasonswhyyoushouldhaveone.pdf

Green Lease – Commercial Lease Arrangements for Sustainable Buildings
http://www.ogierproperty.com/commercialproperty/commercialguides/greenleasescommercialleasearrangementsforsustainablebuildings/

Pinsent Masons, The Pinsent Masons Sustainability and Energy Toolkit, 2012
http://www.pinsentmasons.com/PDF/DevelopmentofGreenLeasees.pdf

http://www.ogierproperty.com/commercialproperty/commercialguides/greenleasescommercialleasearrangementsforsustainablebuildings/

http://www.us.jll.com/united-states/en-us/news/2005/tenants-and-landlords-see-value-in-sustainably-managed-office-space-with-green-leases

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

GREEN LEASE
TOOLKIT

GREEN BUILDING COUNCIL SA

SAPOA

ACKNOWLEDGEMENTS

The Green Building Council of South Africa (GBCSA) and the South African Property Owners Association (SAPOA) would like to acknowledge everyone who worked on and supported the development of the Green Lease Toolkit.

We would specifically like to thank all the individuals and organisations who provided expertise, feedback and input to the development of the Toolkit. Their guidance is greatly appreciated.

PROJECT CONSULTANT

WSP Green by Design in collaboration with Real FMG Property Management for their extensive research, project management and steering:

Richard Palmer ..... WSP Green by Design
Simon Berry ..... WSP Green by Design
Kerry Miller ..... Real FMG Property Management

SPONSORSHIP

The development of the Green Lease Toolkit was co-funded by the Green Building Council of South Africa and South African Property Owners Association.

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Zuleikha Gaibie ..... Woolworths

FOREWORD

Synchronising DESIGN WITH OPERATION

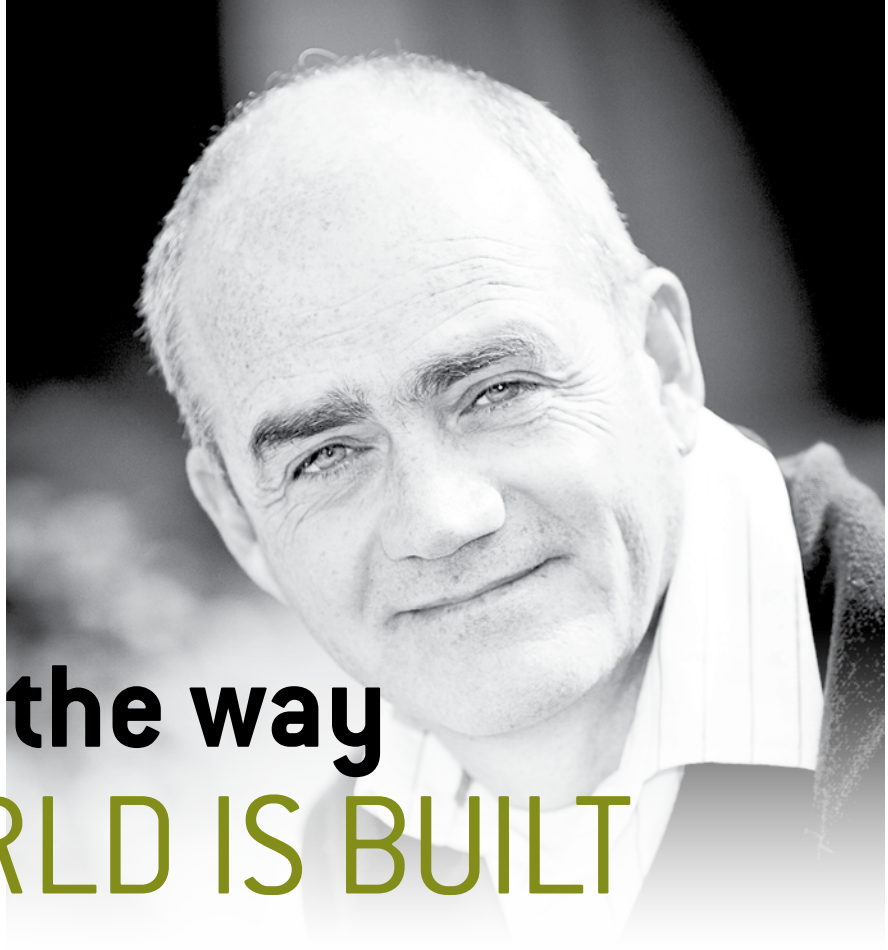
"We are happy to have played a role in bringing a practical mechanism to the South African industry which begins to satisfy these needs."

South African property owners have persistently waited and asked for resources to help them take advantage of the purported operational benefits of well-designed and well-built buildings. There has also been a call for guidance on how to better operate more conventional building stock.

We are happy to have played a role in bringing a practical mechanism to the South African industry which begins to satisfy these needs. With buildings providing up to 40% of greenhouse gas abatement potential, it is imperative that we synchronise the design and construction of new buildings, with the efficient and responsible operation of both these buildings and our existing building supply.

This Green Lease Toolkit is a positive step toward the efficient operation of our buildings and will unlock the shared benefits of collaborative decision-making in the built environment.

Neil Gopal
CEO
SAPOA



Changing the way
THE WORLD IS BUILT

The South African built environment has undergone, and continues to undergo, a great deal of change and the Green Building Council of South Africa is proud to be at the forefront of that change. Significant progress has been made in ensuring that our buildings – for home, work or play – are designed and constructed in environmentally sustainable and resource efficient ways, yet comparatively less has been done around the operation of these buildings.

The Green Lease Toolkit offers a platform to address and reshape the way we operate our buildings.

Brian Wilkinson
CEO
GBCSA

"The Green Lease Toolkit offers a platform to address and reshape the way we operate our buildings."

GREEN BUILDING COUNCIL OF SOUTH AFRICA (**GBCSA**)

The GBCSA is an independent, non-profit company that was formed to lead the transformation of the South African property industry to environmental sustainability.

We aim to ensure that all buildings are designed, built and operated in an environmentally sustainable way allowing South Africans to live and work in healthy, efficient and productive environments.

The GBCSA is one of 90 members of the World GBC alongside Australia, the United States and the United Kingdom.

Buildings are one of the main contributors to climate change. A number of international reports state that buildings represent the single largest opportunity for greenhouse gas abatement, outstripping the energy, transport and industry sectors combined.

Designing, building and operating in a green manner is an opportunity to use resources efficiently and address climate change while creating healthier and more productive environments for people to live and work in.

GREEN BUILDING COUNCIL
OF SOUTH AFRICA

SOUTH AFRICAN PROPERTY OWNERS ASSOCIATION (**SAPOA**)

SAPOA is committed to protecting the interests of the commercial and industrial property sectors, in terms of ownership, management and development.

Its objectives are based on the principles of the free enterprise system as the only workable economic system and the inalienability of property ownership, not only for its members but also for the future of South Africa, and its competitiveness in the world arena.

SAPOA's aims and objectives include:

- Maintaining a unique organisation which encourages its members to share their expertise through active participation in the association
- Fostering key relationships whilst maintaining government acceptability
- Maintaining a non-political bias whilst participating in governmental legislative structures
- Contributing through excellence in educational programmes and setting quality standards
- Providing an efficient forum for responding to change
- Providing a source of information useful not only to our members but also to government at various levels and the industry as a whole, through a significant involvement in the collection and dissemination of property data and statistics.

SAPOA will continue to encourage the concept of private property ownership and development.

SAPOA

PREFACE

The management and operation of new and existing building stock has been identified as a key area for the sustainable building industry to focus on. In recognising this, the GBCSA and SAPOA have developed this Green Lease Toolkit to give the South African property industry the tools to begin to address the sustainable management and operation of buildings.

THIS GREEN LEASE TOOLKIT:

- **Is suitable for the South African leasing environment and sensitive to common market characteristics, but on a par with international green leasing principles.**
- **Uses robust methodologies established through thorough market analysis and understanding.**
- **Is applicable across all building sectors, but accounts for the appropriate leasing structures per sector in South Africa.**

The GBCSA and SAPOA have developed the Green Lease Toolkit to be useful and relevant to the South African property industry in preparing lease documents that take both green building design and operational principles into account.

The Toolkit does not simply provide guidelines; it is a practical resource which includes schedules and checklists that are transferable into lease documents. The aim of the Toolkit is to make green leases more accessible, understandable and acceptable to tenants, building owners, building managers and their representatives.

GLOSSARY OF TERMS

AC ..... Air Conditioning
HVAC .....Heating, Ventilation and Air Conditioning
BMS.....Building Management System
CFL..... Compact Fluorescent Light
CO2 .....Carbon Dioxide
FM ..... Facilities Management
FSC.....Forest Stewardship Council
GBCSA.....Green Building Council of South Africa
SAPOA..... South African Property Owners' Association
IPD .....Investment Property Databank
LED .....Light Emitting Diode
MOA ..... Memorandum of Agreement
VOC .....Volatile Organic Compound
TVOC .....Total Volatile Organic Compound

COLLABORATION

Collaboration requires an authentic meeting of minds; an interconnectedness of shared costs and benefits.

"To harness the true benefits of a green lease – landlord and tenant have to agree to work jointly to create a platform of mutual value. Rewards, gains and incentives need to be equitably distributed to find that intersect of mutual benefit."

COLLABORATION

Throughout the Green Lease Toolkit this symbol will represent the benefits of a collaborative relationship between Landlord and Tenant.

THIS TOOLKIT

is intended to provide a

·framework·

AND

+

methodologies
for negotiating the
shared benefit

+

AND

shared responsibility
of green buildings

BETWEEN

tenants & landlords

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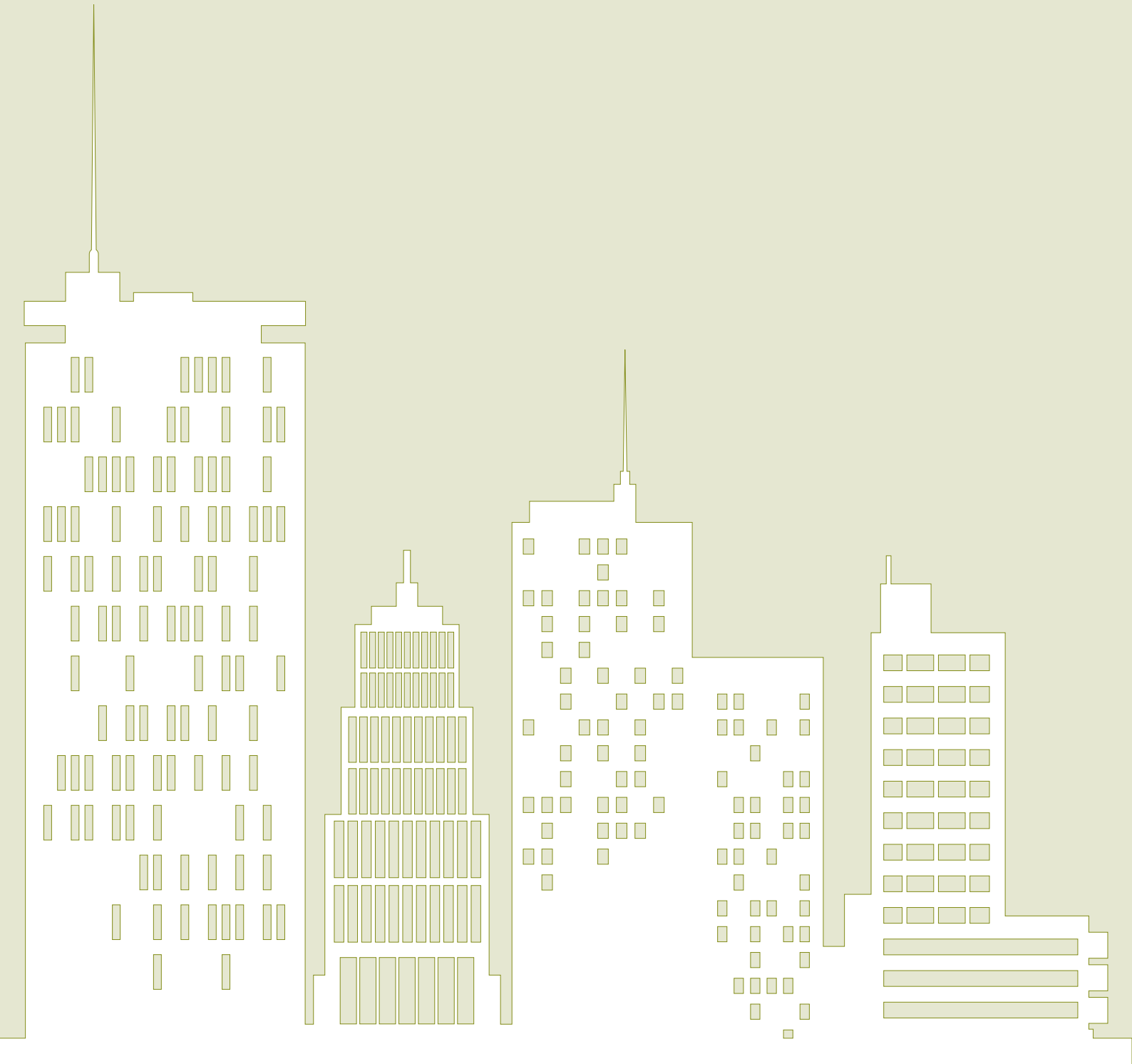
INTRODUCTION



The commercial property industry has shifted fundamentally since the emergence of the green building movement and the development of green building certification such as Green Star SA. A new balance of costs and benefits has been introduced to the property market, with landlords and tenants still navigating their way through this new territory.

Key questions have arisen over the value of ‘‘going green’’:

These potential benefits can be shared between tenant and landlord; they are not exclusive to either. Research shows that green buildings have large reputational, operational and long-term financial benefits for both landlords and tenants, but often in different ways.

‘Green Lease’ is a general term that describes a document for negotiating green building attributes between the owner and the tenant of a building. It does not necessarily refer only to a lease agreement but could also represent:

- **A service level agreement (SLA)**
- **Memorandum of Agreement (MOA)**
- **Lease annexures**
- **Special lease terms and conditions**
- **Building/property/facility management guidelines or rules**

Green leases are an emerging vehicle for both tenants and building owners to unpack this shared benefit and future-proof their respective involvement in the property industry.

24 RICHEFOND CIRCLE, UMHLANGA RIDGE:
4 Star Green Star SA - Office v1 Design & As Built

GREEN BUILDINGS AND CERTIFICATION

Before exploring the range of Green Lease options, it is important to look at the green building certification framework developed by the Green Building Council of South Africa (GBCSA). The GBCSA was founded in 2007 and adopted the Australian Green Star certification system for South Africa. There are a wide range of certification systems on the global stage, with LEED (USA) and BREEAM (UK) widely regarded alongside Green Star. Green Star SA has been amended to reflect local standards and conditions by a series of technical working groups (TWGs). Green Star SA rating tools have been developed for the following building types:

Which building typologies are catered for under the current suite of Green Star SA tools?

- **Offices**
- **Retail centres**
- **Multi-unit residential developments**
- **Public & education buildings**

The GBCSA is scoping the development of tools for existing buildings, commercial interiors and communities (at a precinct scale).

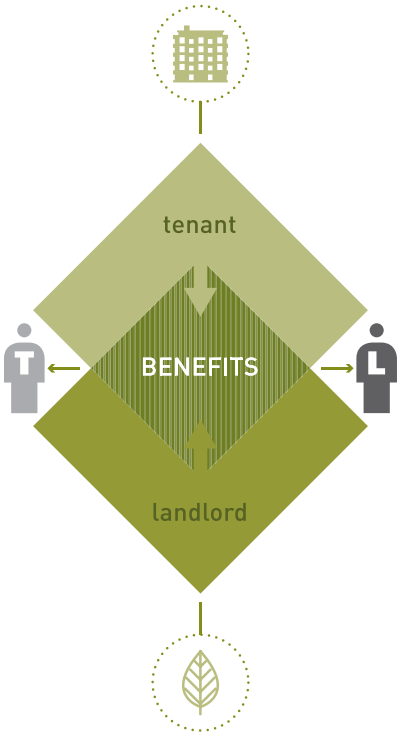
The GBCSA is also developing a rating tool for existing building performance via an Energy & Water Benchmarking tool. Similar in function to the Energy Star tool in the USA and the NABERS tool in Australia, this tool will allow property owners to establish how the annual performance of their building compares to the industry norm for a similar building in the same location.

"To achieve this, landlords and tenants must invest in, and operate buildings along sustainable principles."

PROGRESSING GREEN BUILDING DEVELOPMENT

Despite the successes achieved by green building certification, there are still some fundamental barriers to the broad roll-out of green buildings across the industry, including:

- **Differing benefits to landlords and tenants**
- **Addressing existing building stock**
- **The mechanics of lease agreements**



Ultimately, functional green buildings must achieve operational performance that improves both indoor environmental quality and reduces the negative impact on the environment. To achieve this, landlords and tenants must invest in, and operate buildings along sustainable principles.

The biggest hurdle to green development is the gap between long-term operational savings and the up-front cost of "greening" a building. Typically, landlords are responsible for the investment in the building's "potential", while the tenants are responsible for the operating costs – creating the following challenges:

- **The landlord's return on investment for efficient equipment can only materialise with increased rental and lower initial yields, rather than realised savings during the lifecycle of the equipment**
- **The tenant gains from an improved indoor environmental quality and potential utility cost savings; while the landlord isn't able to share these direct benefits**

“Each party stands to gain if the other acts, but loses if they act and the other doesn’t. The challenge is in negotiating an agreement where both parties act for green buildings to achieve an optimal equilibrium - a ‘win-win’.”

AURECON CENTURY CITY CAMPUS, CENTURY CITY:
5 Star Green Star SA - Office v1 Design

There is little incentive for landlords to invest in better buildings if tenants are going to yield all the benefit. Primary benefits to landlords are the long-term asset value of green buildings but these can only be realised with well-informed tenants.

Both parties have a reputational stake in owning or occupying green buildings but the timing of decision-making is difficult to resolve in reality.

Green buildings present a textbook example of economic game theory. Each party stands to gain if the other acts, but loses if they act and the other doesn’t. The challenge is in negotiating an agreement where both parties act for green buildings to achieve an optimal equilibrium – a ‘win-win’. An informed tenant may be willing to pay a higher base rental if the costs and efficiencies of occupation are improved, so that the joint gain needed to stimulate investment into green development, can be achieved.

REGULATORY FRAMEWORK

VODAFONE SITE SOLUTION INNOVATION CENTRE, MIDRAND:
6 Star Green Star SA – Office v1 Design

Another important consideration is the availability of regulatory framework within which green leases will function. Fully binding green leases will need a framework of standards or legislation in order to enforce operational performance.

The major catalyst for the introduction of green leases in Australia was the federal government's decision not to occupy any building that did not achieve a 4.5 star NABERS rating. NABERS is the operational rating system for carbon emissions in Australia. South Africa is in the process of developing a similar system. More recent legislation relating to mandatory disclosure, has further strengthened the Australian regulatory framework and has had a positive impact on green leasing. The carbon emissions legislation in the UK has played a similar role in framing green leases.

In South Africa, SANS 10400 part XA and the voluntary standard SANS204 make up the regulatory framework relevant to energy efficiency in buildings. These were promulgated in November 2011 and apply only to new and refurbishment projects. At this point, it does not mandate operational energy use, but it may form the basis of future mandatory operational regulation.

There is potential for Green Star SA to play a regulatory role if it becomes a requirement for government buildings in the future. Nevertheless, many government building tenders and Public Private Partnerships (PPP) projects have started specifying Green Star SA certification as a requirement.

The absence of regulation governing the operational energy use of buildings means that performance-driven green leases with penalties ("hard" green leases) are unlikely to be widely adopted in the short term. For this reason, this guide provides a range of alternative solutions from mutual disclosure of performance through to mandatory performance.

1.1 WHAT IS THE GOAL OF A GREEN LEASE?

NEDBANK PHASE II, SANDTON:
4 Star Green Star SA - Office v1 Design & As Built

The fundamental concept that underpins a green lease is that of mutual understanding. While the details may vary from one agreement to another, the primary purpose of a green lease is:

- **To improve the operational performance of green buildings**
- **To deliver to landlords and tenants an equitable share of the incremental value provided by green buildings**

A Green Lease seeks to achieve these goals by securing long-term operational performance through a transparent, mutually beneficial agreement between tenants and landlords that governs:

What are the governing principles on which a green lease should be based?

- **The base building and fit-out quality in buildings**
- **The contractual requirements of facilities managers**
- **The behaviour of tenants from an environmental perspective**
- **Regulation of governing bodies (through continuing education)**

1.2
WHO IS THIS TOOLKIT FOR?

LANDLORDS AND DEVELOPERS

This Toolkit is a resource for property owners to help them develop green leases for their portfolios. It is intended to provide both a broad background to green buildings and the respective benefits, as well as a sample Memorandum of Agreement that can be used in actual green leases.

It provides information on the requirements that landlords should have of their facilities managers and the elements of tenant behaviour that have an effect on the operational performance of a building.

It also expands on the background and long-term benefits of owning green buildings. Equipped with more information, developers could be more receptive to considering the environmental impact of the design and construction of their buildings. They will also be better positioned to evaluate the shared benefits (for example, slightly higher rents and lower operating costs) as well as the long-term payback and re-fit considerations.

TENANTS

The Toolkit informs tenants of what to take into account when considering leasing green office space and the benefits of improved indoor environmental quality. It identifies some best practice guidelines for business operations and underscores the role of tenants in delivering optimal operational green buildings.

It includes a sample Memorandum of Agreement to optimise the benefit of leasing green office space.

LETTING AGENTS

For letting agents the Toolkit gives a thorough understanding of the green building market and the areas of shared benefit for both landlords and tenants. As the intermediaries between landlords and tenants, letting agents can use the Toolkit to help with negotiations between tenants looking for green offices and landlords hoping to develop green space.

INVESTORS AND ANALYSTS

The correlation between green buildings and market performance has been demonstrated globally. Green leases are one of the keys to achieving optimal market performance in the construction and provision of sustainable buildings. This Toolkit is a valuable guide for investor decisions with respect to leasing characteristics of property funds.

GOVERNMENT

In most markets with established green building industries, governments have taken a lead in demanding green space for tenancies as well as pioneering new ground with government-owned buildings. This guide is intended to provide government with a framework to guide their selection of future buildings as well as any policy decisions with respect to green buildings.

It is anticipated that this Toolkit will facilitate the development of a sound regulatory framework for future green building development.

1.3 LEASING SCENARIOS

The Green Lease Toolkit covers a range of leasing scenarios:

	New Buildings	Existing Buildings and Refurbishments
New Leases	✓	✓
Lease Renewals	✗	✓
Re-developement or Relocation	✗	✓

1.4 WHAT IS A GREEN LEASE?

A green lease is an adaptation of a traditional lease. It is primarily a set of legally binding rights and obligations - a contract. The parties both agree that the landlord will provide the temporary use and enjoyment of the premises in return for the payment of rent by the tenant.

It must contain the essential terms of a contract and, in particular:

- **There must be consensus on the essential elements of the contract**
- **Both parties must have the capacity to enter into the contract**
- **Performance of the contract must be physically possible**
- **It must include any legal formalities such as the length of the lease and lease termination requirements**

As with all leases, a green lease contains provisions to deal with matters where either party fails to perform on its responsibilities or where occupation and possession become impossible because of an external factor. So there are provisions for breach, for damage and destruction and for alternative dispute resolution.

One of the major benefits of a green lease is that it offers an opportunity for the relationship between tenants and building owners to be transparent in their respective goals of providing and occupying a sustainable building. It is in the commercial interests of both parties to maintain their part of the deal, as the overall performance of the building is reliant on both parties meeting their commitments.

One of the most significant parts of a green lease is the fact that it lists the responsibilities of the parties, including:

- **Each party's responsibilities for certain actions or interventions**
- **Each party's financial obligations**

NEDBANK RIDGEVIEW, UMHLANGA RIDGE:
4 Star Green Star SA - Office v1 Design

A green lease is structured in a similar way to a traditional lease. The main difference is the assignment of responsibilities and financial obligations related to occupying and owning a green building - obligations that don't exist in a conventional building.

The responsibilities to do, and to pay, are often split. Typically, the tenant carries the responsibility to pay and the landlord the responsibility to do. This division is defined by the type of lease agreement and it is essential to carefully unpack these responsibilities to create the 'win-win' situation needed for the creation of green spaces.

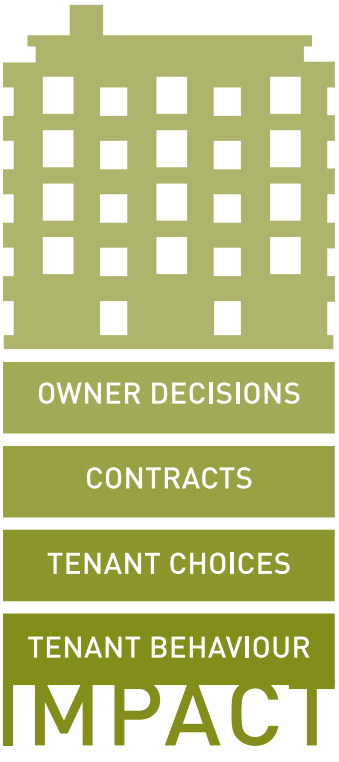
It's important to establish a clear line between the landlord's and the tenant's responsibilities.

Beyond the core lease clauses, a green lease can also include a range of supporting documentation, policies or guidelines. Any supporting documents must be referenced directly in the lease clauses.

These documents could include:

- **Environmental Management Plans**
- **Fit-out design guidelines**
- **Procurement procedures**
- **Sectional title, house or centre management rules**
- **Waste disposal guidelines**
- **Preferential parking rules**
- **Metering and monitoring protocols**

An example of measuring and reporting performance is to install water meters to track the consumption of water, and the associated costs, to encourage changed behaviour and usage patterns. Similarly, to detect operational problems when electricity consumption is abnormally high.



1.5 IMPACT OF A GREEN LEASE

There are four key areas of behaviour that green leases will impact on:

- **Building owner investment decisions (base building design)**
- **Building facilities management contracts**
- **Tenant investment decisions (fit-out design)**
- **Tenant behaviour**

These will be addressed through a series of best practice guidelines and an example of a Memorandum of Agreement.

SUMMARY

A green lease is an adaptation of a traditional lease that offers an opportunity for the relationship between tenants and building owners, to be transparent in their respective goals of providing and occupying a sustainable building.

Green leases are an emerging vehicle for both tenants and building owners to unpack the shared benefit of sustainable buildings.

The fundamental concept that underpins a green lease is that of mutual understanding.

To date, Green Star SA Rating tools have been developed for the following building types:

- **Offices**
- **Retail centres**
- **Multi-unit residential developments**
- **Public & education buildings**

Additionally, the GBCSA is in the scoping stage of tool development for: existing buildings, commercial interiors and communities.

The Green Lease Toolkit has been developed for:

- **Landlords and developers:**
  - Seeking to build reputational value, increase portfolio asset values and to conform to corporate reporting
- **Tenants:**
  - Seeking green space for productivity, operational cost savings, corporate reporting and reputational reasons
- **Letting agents:**
  - Who require a sound basis on which to secure tenants for green assets, or office space for green tenants
- **Investors:**
  - Who seek contractual frameworks upon which additional investment in green assets may be based on
- **Analysts:**
  - Who require criteria on which to inform investment advice and analysis
- **Government:**
  - To inform current and future leasing guidelines and building regulations

2

GREEN LEASE PRINCIPLES

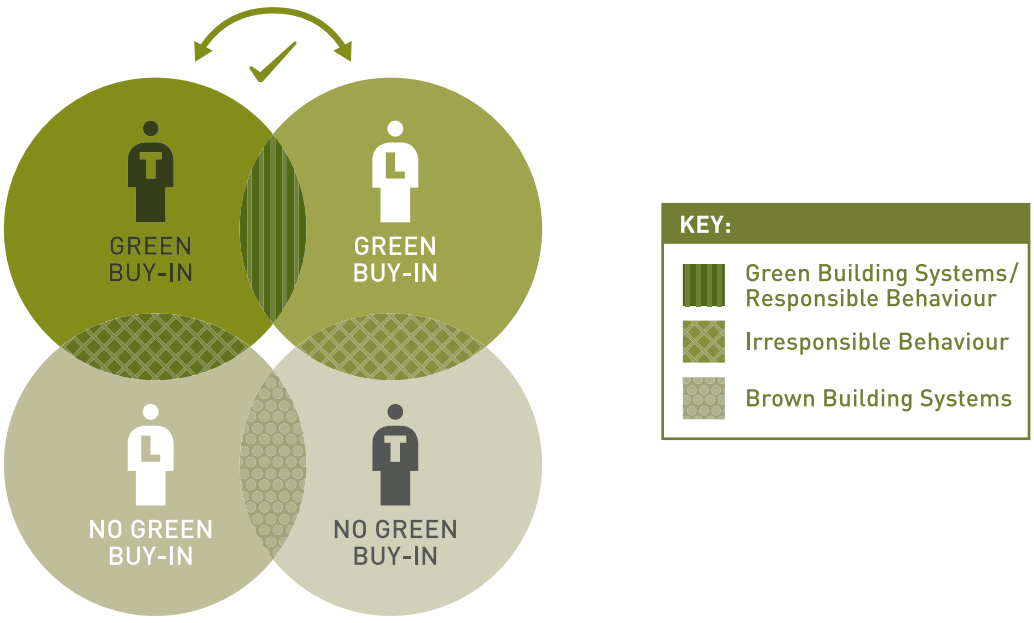
2.1 PROCESS

Perhaps the most important principle in moving towards a green lease is the negotiation of the shared benefit of owning and occupying operationally green buildings. Consensus and mutual understanding of the benefits of green buildings are critically important in securing green lease agreements.

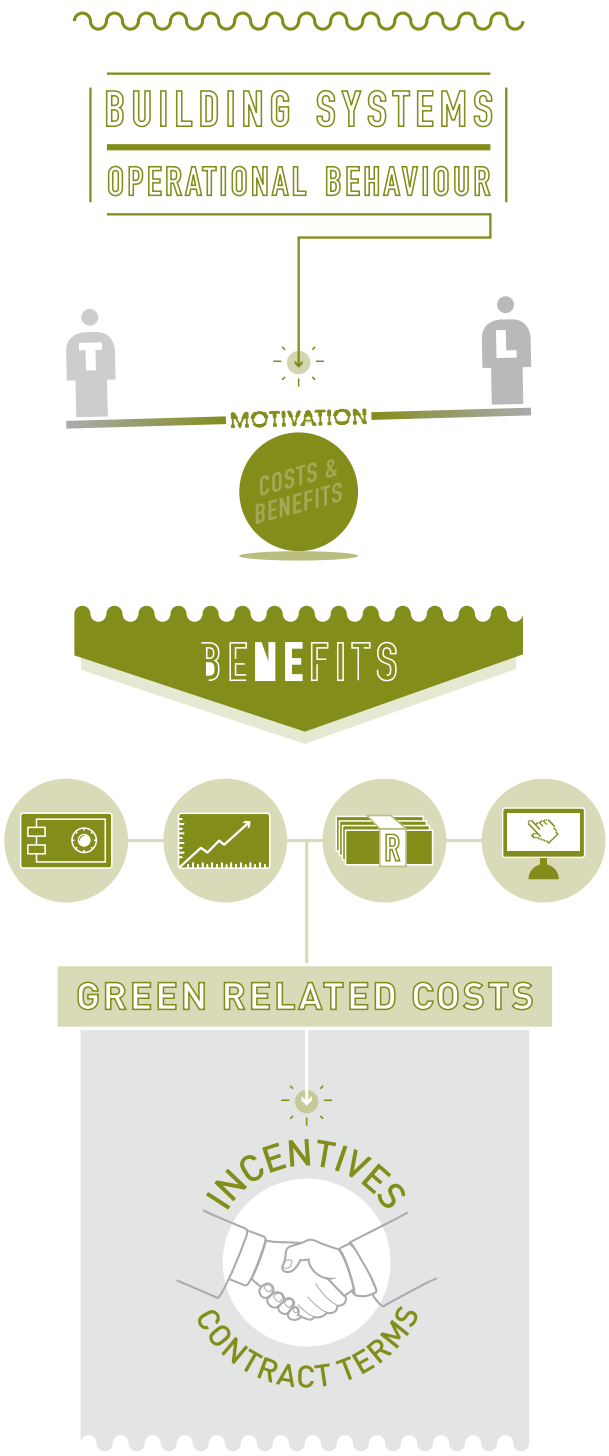
There are three key facts that must be understood by both the landlord and the tenant:

1. **There are benefits to the landlord in owning green buildings but these benefits are linked to the behaviour of tenants.**
2. **There are benefits to the tenant in occupying a green building but these benefits rely on systems provided by the landlord.**
3. **Neither the landlord nor the tenant will realise the benefits from either owning or occupying a green building if they do not understand, and act for, the shared benefit.**

This diagram illustrates how the benefits for tenants and landlords are linked when both, neither or either of the parties understands:



"A clear differentiation must be made between landlord benefits and the benefits that will be derived by tenants."



It is only when both the building systems and the operational behaviour are aligned that both parties get the optimal outcome.

This provides a framework for:

- **Understanding the balance of motivation for the tenant and landlord (which will vary on a case-by-case basis)**
- **Understanding the costs and benefits to each party:**
  - Benefits:
    - Asset value
    - Productivity
    - Operational cost savings
    - Marketing
  - Costs:
    - Higher initial construction/ implementation or capital costs
    - Higher rental
- **Understanding the existence of split incentives: who implements, who pays and who benefits (this will depend on the prevailing lease type)**
- **Agreeing on contractual terms to the benefit of all parties**

The first step in discussions must therefore be to understand the balance of motivation for each party. A clear differentiation must be made between landlord benefits and the benefits that will be derived by tenants.

This understanding of the shared, but different, benefits will set the scene for negotiations over the specific lease clauses applicable to the building type and specific parties.

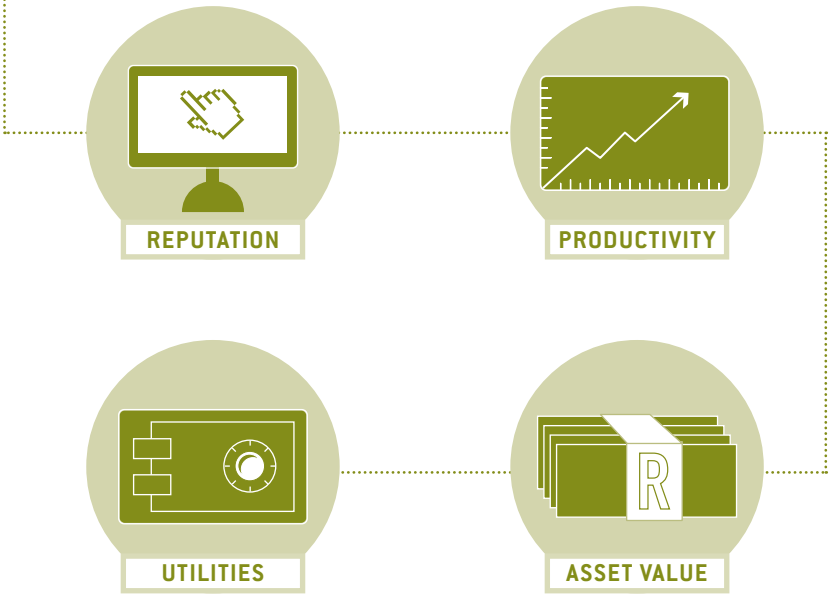
2.2
WHAT ARE THE BENEFITS OF GREEN LEASES?

The primary benefit of green leases is in owning and occupying operationally efficient and sustainable buildings.

Some of these benefits will be primarily for tenants, others primarily for landlords and some shared. However, all are interlinked and rely on both parties - and their agents and contractors and employees - acting for their shared benefit. There is also the key benefit of reduced environmental impact.

Green leases are a mechanism for regulating the delivery of this shared value, but it is important to note that the value is in the physical outcome of better buildings, rather than in the language of the lease itself.

The following benefits will now be explored in detail:



REPUTATION

One of the primary drivers of modern green building certifications (of both the asset and its operational performance) is the marketing and reputational benefit for owners and tenants of owning or occupying green buildings. Many companies and organisations use green buildings to demonstrate their corporate commitment to sustainability and as a measure of their regard for the people who work for them. For example, Nedbank South Africa and Growthpoint Properties have made green a core reputational value and this is reflected in them occupying several Green Star SA certified buildings. Internationally, companies such as Toyota, 3M, Interface, HOK Architects, Lend Lease and Grocon have all built similar green reputations.

PRODUCTIVITY AND STAFF RETENTION

Green buildings have been shown to improve staff retention. Staff turnover is a significant cost to companies and providing cutting-edge work environments is a key retention strategy. Healthier workplaces are also an attraction to tenants as healthy staff are less likely to leave the company and take sick leave.

Productivity is a critical consideration as salaries and wages are the largest cost for most tenants. Buildings with a focus on indoor environmental quality (IEQ) have been shown to have a positive impact on the health and productivity of building occupants.

The key elements of IEQ are:

- **Air quality (fresh air provision and removal of pollutants)**
- **Natural light**
- **Thermal comfort**

"Productivity is a critical consideration as salaries and wages are the largest cost for most tenants."

PRODUCTIVITY AND STAFF RETENTION
(continued)

In her key-note address at the 2011 Annual GBCSA Convention & Exhibition, Professor Vivian Loftness (Carnegie Mellon University, School of Architecture) quoted research from a wide range of sources on the benefits of natural light and fresh air for building occupants including:

- **An 11% improvement on triple-multiplication tasks for controlled task-lighting (400 lux fixed and 300 lux variable) compared to a fixed 700 lux ambient lighting level.** [1]
- **A 6.8% reduction in risk of exposure to colds for workers with indoor CO_2 less than 100ppm above outdoor levels, compared to those with levels greater the 100ppm above outdoor levels.** [2]
- **Reduction in hospital stays of between 26% and 41% for patients in bright, sunlit rooms compared to dull rooms.** [3]
- **Reduction in sick leave, hospital stay length and medical services for building occupants in naturally ventilated offices compared to air-conditioned offices.** [4]
- **Reduction in post-operative stays for patients with views of natural scenes compared to blank walls.** [5]

Other research on indoor environmental quality and productivity:

- **University of San Diego, Sustainability CBRE: Green Buildings and Productivity by Lisa Collichio**
- **Research publications by United States Green Building Council - www.usgbc.org**

"**11%**
IMPROVEMENT ON TRIPLE-MULTIPLICATION TASKS FOR CONTROLLED TASK-LIGHTING..."

[1] **Nishihara, N., Nishikawa, M., Haneda, M., and Tanabe, S.** *(2006) Productivity with Task and ambient lighting system evaluated by fatigue and task performance, Proceedings of Healthy Buildings 2006, Lisbon, Portugal.* [2] **Myatt, TA, SL Johnston, Z Zuo, M Wand, T Kebadze, S Rudnick and DK Milton** *(2004) Detection of Airborne Rhinovirus and Its Relation to Outdoor Air Supply in Office Environments. American Journal of Respiratory and Critical Care Medicine, v169.* [3] **Choi, Joonho.** *(2005). Study of the Relationship between Indoor daylight Environments and Patient Average Length of Stay (ALOS) in Healthcare Facilities, Unpublished master's thesis, Department of Architecture, Texas A&M University. College Station, TX.* [4] **Preziosi P., S. Czerniichow, P. Gehanno, and S. Hercberg** *(2004) Workplace air-conditioning and health services attendance among French middle-aged women: a prospective cohort study. International Journal of Epidemiology.* [5] **Ulrich, R.** *(1984) View Through a Window May Influence Recovery From Surgery. Science, 224(4647)*

"Asset sales price for green buildings was 16% higher than that for non-green buildings."

ASSET VALUE

The impact of green buildings on asset performance has been the topic of much recent research and investigation. Two key reports which provide data from the American and Australian markets are:

- *Doing Well by Doing Good* **(2009) a paper by the Royal Institute of Chareted Surveyors (RICS), authored by Piet Eichholtz and Nils Kok of Maastricht University and John Quigley of Berkeley University.**
- *Building Better Returns* **(2011) an industry paper by the Australian Property Institute (API).**

THE CRITICAL FINDINGS OF THESE PAPERS, RELATING TO ASSET VALUE, RENTAL PREMIUMS AND VACANCY RATES ARE:

Valuations in Australia

- Operational energy ratings (NABERS) resulted in value premiums for office buildings. A 5 star NABERS energy rating delivered a 9% premium and a 3 – 4.5 star NABERS energy ratings delivered a 2 – 3% premium.
- Green premiums are market dependent, ranging from 8% in the Sydney suburban office to 21% in the government-tenant dominated Canberra office market for buildings with a 5 star NABERS rating.
- Asset value discounts were also evident for poorly performing buildings (less than 3 star NABERS ratings) for the Sydney CBD (10% discount in value) and Canberra (13% discount in value).
- The Green Star rating showed a green premium in asset value of 12%.

Rental premiums - Australia:

- Green rental premiums of 5% were yielded for the Green Star rating.
- Rental discounts were evident in the poor NABERS energy ratings in Sydney CBD (9% discount in rents) and Canberra (6% discount in rents).
- 5 star NABERS energy rating in the Sydney CBD office market showed green rental premiums of 3% and discounts in rents of 9% in the lowest NABERS energy rating.

Rental Premiums and Asset Value - USA:

- Rental premiums of 3% were seen for Energy Star certified buildings.
- Rental premiums adjusted for increased occupancy of 6% were seen for Energy Star certified buildings.
- Asset sales price for green buildings was 16% higher than that for non-green buildings.

THESE FACTORS INDICATE A CLEAR FINANCIAL BENEFIT FOR INVESTING IN GREEN BUILDINGS THAT HAVE EXCELLENT OPERATIONAL ENERGY PERFORMANCE.

OPERATIONAL COSTS

Reduced operational costs have a material impact on the bottom line of tenants and landlords (depending on the lease structure). Given the Eskom energy price increases approved by NERSA, this is set to become an increasingly important factor in South Africa. Combined with Eskom's Demand-Side Management (DSM) programme, the drive to become resource-efficient is becoming more financially viable.

The beneficiary of the operational cost savings will depend on whether the parties are working under a net or gross lease. But regardless of the leasing structure, the market is likely to respond more favourably to buildings that mitigate the operational costs for both tenants and landlords.

In cases where the landlord has provided efficiency systems but, tenants fail to use the building efficiently, the operational costs are likely to be high and will thus be to the tenant's financial detriment. It is therefore important for the landlord to put good operational systems in place and for the tenant to fully understand how to use these systems.

Green buildings are also more resilient in the face of degraded infrastructure. Buildings that use resources efficiently can run for longer on back-up systems in the event of power or water failures; something that is not uncommon in South Africa.

> "IT IS THEREFORE IMPORTANT FOR THE LANDLORD TO PUT GOOD OPERATIONAL SYSTEMS IN PLACE AND FOR THE TENANT TO FULLY UNDERSTAND HOW TO USE THESE SYSTEMS."

REDUCED EXPOSURE TO REGULATORY CHANGES

In South Africa, the Treasury have indicated their preference for a carbon tax and the new building regulations include energy efficiency requirements.

Some international precedents for this include:

- **Energy Performance Certificates in the UK**
- **Mandatory disclosure in Australia**
- **Carbon taxation in Australia**

As basic resources become increasingly scarce, it is not difficult to imagine a world where access to water is also regulated along with other environmental impacts.

Occupying and/or owning green buildings provide a buffer against these potential future regulatory changes.

“As basic resources become increasingly scarce, it is not difficult to imagine a world where access to water is also regulated...”

MEETING CORPORATE REPORTING REQUIREMENTS

Another benefit of owning or occupying green buildings for listed companies is the role they play in meeting the reporting requirements for the JSE Socially Responsible Investment (SRI) Index and the King III Corporate Governance Guidelines for integrated reporting.

The JSE SRI was introduced to identify listed companies that embrace the triple bottom line and allows for a broad assessment of company policies and practices against local and global standards.

2.3
TYPES OF GREEN LEASES

This Toolkit uses four levels of intensity for green leases. These provide an introduction to green leasing for tenants or landlords who are relatively new to sustainability and for those in current leasing agreements. It also aims to provide a framework for leasing in a regulatory environment that mandates building performance (such as the Australian federal government's requirement for NABERS ratings).

The content of the varying green leasing types relate to the broad categories of sustainability, but the lease requirements and penalties will vary with each successive level.

1 MEMORANDUM OF AGREEMENT

The memorandum of agreement (MOA) is the first level of formalising the move towards green buildings. With an existing lease, where it is not appropriate to renegotiate all the material terms, an MOA is the simplest way to bring sustainability into the contractual discussion.

The elements of an MOA should include:

- **Commitment from both parties to improved environmental performance**
- **Agreement on the parameters against which environmental performance will be measured**
- **Undertaking to monitor environmental performance against existing benchmarks**
- **Undertaking to develop management plans for energy, water and waste**

A contractually-binding MOA appended to an existing lease could include the provision of new sustainability clauses upon renewal of the lease. The MOA should include a timeframe for moving towards a formal green leasing agreement.

The content of the MOA and the content of the already existing lease agreement should not be in conflict.

A sample MOA is provided on page 51 of this document.

2 MUTUAL DISCLOSURE

The most accessible formal green leasing schedule is a mutual disclosure of environmental performance between the tenant and the landlord. This should build on the contents of the MOA but also require the tenants and landlord to participate in the monitoring and reporting of environmental initiatives.

3 MUTUAL PERFORMANCE

Where improvements in operational performance are of specific importance to either party, the mutual disclosure lease can be augmented with targets for improvement for both the tenants and the landlord. It sets standards to which each party must perform.

Targets should be set using the baseline established through the monitoring and reporting of building performance. Where no building performance information exists, targets should be framed using specific improvement benchmarks.

4 MUTUAL PERFORMANCE WITH PENALTIES ('HARD' GREEN LEASE)

When there are external regulatory pressures, penalties may be applied in the event of failing to meet targets. One example of this, is the requirement for Australian Commonwealth tenants to occupy buildings with a 4.5 star NABERS rating. Failure to maintain the NABERS rating can result in significant penalties for both landlords and tenants.

Under these circumstances, both parties must understand the details of the framework for assessment and their respective responsibilities in achieving the desired level of performance. It is critical for the auditing process to be agreed in detail before finalising a 'hard' green lease.

Caution should be exercised when introducing penalty provisions into either the MOA or lease agreement as such penalty provisions will be tested against prevailing South African legislation such as the Conventional Penalties Act 15 of 1962.

2.4 AUDITING HARD LEASES

At this stage, there is no external framework against which to assess 'hard' green leases. However, in the event of 'hard' leases being implemented, the following factors must be resolved:

- **The details and choice of regulatory framework under which performance must be achieved**
- **Third party auditors, arbitrators or attorneys who can settle disputes**
- **Forums for disclosure to maintain confidentiality**
- **Dispute resolution and mediation**
- **Relevant and enforceable penalties, which relate to the impacts of non-compliance against the external framework**

SUMMARY

The primary principle in moving toward a green lease is the negotiation of the shared benefit of owning and occupying operationally green buildings.

Three key elements must be understood by both the landlord and the tenant in negotiating shared benefits:

- **There are benefits to the landlord in owning green buildings, but these benefits are linked to the behaviour of tenants**
- **There are benefits to the tenant in occupying a green building, but these benefits rely on systems provided by the landlord**
- **Neither the landlord nor the tenant will realise the benefits from either owning or occupying a green building if they do not understand, and act for, the shared benefit**

The benefits that may accrue from the implementation of a green lease are categorised under the following:

- **Reputation**
- **Staff retention and productivity**
- **Asset value**
- **Operational cost savings**
- **Reduced exposure to regulatory changes**
- **Meeting corporate reporting requirements**

The four levels of green lease, identified by this Green Lease Toolkit, are:

- **Memorandum of Agreement (MOA) for existing leases**
- **Mutual Disclosure Green Lease**
- **Mutual Performance Green Lease**
- **Mutual Performance Green Lease with Penalties**

As the South African leasing environment matures, the uptake of more stringent green lease types will increase. However, no external framework against which to assess 'hard' green leases (Mutual Performance Green Leases – with or without penalties) currently exists. This will prevail as the principle of green leasing spreads and the demand is established.

3

IMPLEMENTATION

“A common goal is needed as a starting place for the journey.”

While the issues around environmentally friendly buildings may appear to be new, these issues are no different from any other aspect of building specification.

For example, a SAPOA C grade building, a SAPOA A grade building and a custom-built corporate head office each serves the same basic purpose – it provides a place for people to work. However, in each case the basic specification and the price of occupation are significantly different. There is also a marked difference in the proportionate cost-sharing between tenant and landlord. There is a tendency for the tenant to put more of their own capital into the project as the specification requirements become more sophisticated.

Just as the provisions of the currently standard lease have evolved over time, to take account of experience and to incorporate lessons learnt, it seems inevitable that the same process will apply to green lease provisions and these too will become integral to the standard lease.

A common goal is needed as a starting place for the journey.

3.1
EXPLICIT CONSENSUS

For any move toward formally recognising green issues in a lease there needs to be consensus between the parties on the minimum joint expectations and of the performance of the building. For a successful transaction, there must be an explicit agreement between the contracting parties as to the minimum requirements they will accept for green issues.

Explicit consensus is necessary to avoid a situation where one or other party does not commit to the minimums expected by the other party, resulting in the building performance not meeting mutual expectations. This could potentially have significant reputational consequences if the failure was to become public knowledge.

The green lease provisions should be a framework for achieving mutual goals, not a barrier to agreement.

The framework should spell out the expectations of the parties if the landlord aspires to a 6 star rating and the tenant is content with a 3 star performance the relationship is doomed. If the landlord is content to limit energy consumption and measure just this, but the tenant requires a formal rating there, again, is a material gap which will prevent any sensible agreement.

If there is common ground on what is to be achieved, how it is to be measured and on the broad affordability, then it would be appropriate to move to a formal contract. But landlords and tenants need to recognise that some opportunities should not be pursued if there is a disconnection in aspirations with regard to green issues.

3.2
NEW LEASES

There are two main scenarios where a new lease would be required:

1. **A new tenant to an existing building – a standard lease.**
2. **For a building to be developed for the needs of a specific tenant (including a redevelopment, relocation or an upgrade) – a tenant specific development lease. This could include re-development of existing premises such as expansions and/or reconfigurations.**

IMPLEMENTING DEVELOPMENT LEASES

While a standard lease can be revamped by adding clauses and annexures to deal with the green parameters, where the parties are contracting from the outset, it is sensible to develop an integrated contract document. But even in this case, as the subject is new, it is prudent to have a number of supplementary annexures that provide guidance on matters such as:

1. **A declaration of the intention of the parties and the agreed goals for the activities which fall under the umbrella of 'green'**
2. **How to conduct a tenant fit-out in a manner that complements green objectives**
3. **Methodologies and mechanisms for tracking sustainability metrics over time**
4. **Dispute resolution protocols**
5. **Remedies for non-compliance – in a 'hard' green lease these would be punitive in nature and would include the right to cancel for non-performance**

"Green issues are, in principle, no different to the multitude of other parameters and specifications debated and agreed on in leases."

The negotiation should define how much capital the landlord is willing to commit to the green infrastructure and indicate the additional rental required for the capital cost incurred. It should also specify how any budget overruns would be dealt with.

An unambiguous agreement is needed, that stipulates which party is responsible for maintenance, repair and replacement (both the cost of the activity and doing the physical work). Green issues are, in principle, no different to the multitude of other parameters and specifications debated and agreed on in leases. Certain elements would be in the base build and included in the base rental, other elements may be regarded as tenant requirements and the funding and repayment would be negotiated between the parties.

In instances where a tenant allowance is not adequate to meet their requirements, they are required to partially fund their own installations. Similarly, the tenant's green aspirations may exceed the landlord's willingness to fund these. If this happens, the tenant can elect to pay for the additional features. How this is dealt with at lease termination, needs to be clearly specified, and is no different to any other leasehold improvement. It is standard practice in South African leases that the tenant can leave the improvements behind without recompense or else remove and make good.

IMPLEMENTING STANDARD LEASES

All of the considerations for a development lease apply to a lease for a new tenant in an existing space, except that there will not be a design specification annexure with tenant input.

Accordingly, it is particularly important to establish that the building fabric is capable of providing the degree of 'greenness' required by the tenant or that it can be refurbished at an acceptable cost.

3.3 EXISTING LEASES

While either party can initiate discussions around how to 'go green', it seems likely that the landlord will use a Memorandum of Agreement (MOA) to begin the process of educating tenants (particularly smaller companies).

In essence, the MOA provides for a statement of intentions. It will not create legally binding obligations although it will create a moral obligation for compliance.

The MOA confirms that there is a common objective to collaborate to improve the internal and external environmental performance of the building. It requires the parties to share information relating to the building and premises.

As well as committing to share information, the MOA could set undertakings in the major areas of:

- **Energy**
- **Waste**
- **Water**
- **Plant and equipment replacement**
- **Alterations to premises**
- **Cleaning and hygiene**

What other issues can the MOA address?

The MOA may contain explicit green provisions, that on renewal, may be incorporated into a new lease.

The MOA creates a gateway for landlords and tenants to come to grips with what it practically means to provide and operate an environmentally friendly set of premises.

The lease that incorporates the green provisions from the MOA should be used as the new standard lease for future tenants.

4

BEST PRACTICE CHECKLIST

These checklists are a quick reference of what to look for in a green building if you're a tenant, or what to require of a tenant if you're a landlord.

Broadly speaking, the following factors are covered under the clauses in a green lease:

- **Resource efficiency (energy, water and waste)**
- **Indoor environmental quality (thermal comfort, natural light and air quality)**
- **Monitoring and disclosure of performance**
- **Building certifications**

What factors are covered under the clauses of a green lease?

The obligations on the landlord typically cover the building attributes and contracting of facilities management. From an operational perspective, landlords often need to respond to common areas and the metering, monitoring and disclosure of building energy, water and waste performance.

The obligations on the tenant typically apply to fit-out design and to occupant's behaviour. Tenant behaviour that impacts on building performance includes internal thermal loads and occupancy densities, occupancy times and the metering, monitoring and disclosure of energy, water and waste from each tenancy.

4.1
LANDLORD'S COMMITMENTS

BUILDING CERTIFICATION

Green Star SA:

- Green Star SA Design Rating ☐
- Green Star SA As-Built Rating ☐
- Green Star SA Performance Rating or equivalent (currently under GBCSA scoping) ☐

COMFORTABLE INDOOR ENVIRONMENT THAT PROMOTES HEALTH AND PRODUCTIVITY

Heating, Ventilation and Air Conditioning (HVAC) System:

- Fresh air provision ☐
- CO_2 monitoring ☐
- Radiant heating or cooling capability ☐
- Regular indoor air quality testing ☐
- Individual comfort control ☐
- Tenant exhaust riser for photocopying rooms ☐

Facilities Management (FM) and maintenance contracts:

- Noting acceptable paints, adhesives, sealants and carpets for use in the building ☐
- Demonstrating HVAC filter maintenance and cleaning ☐
- Live monitoring of space conditions with FM response requirements ☐

LIGHTING

- Demonstrated lighting levels below 400 lux ☐
- Access to external views and daylight with glare control ☐
- Natural lighting levels across the floor plate when conditions are appropriate ☐

- High frequency ballasts ☐
- Motion and daylight sensors ☐
- Energy efficient fixtures ☐

ENERGY USE

- Energy management guarantee from the building owner and manager ☐
- External operational commitment (future operational tool) ☐
- Metering, monitoring and reporting of tenant energy use ☐
- Metering, monitoring and reporting of base building energy use ☐
- Establishment of performance targets for both tenancy and base building ☐
- Real-time disclosure of performance against targets ☐
- Contracts and reporting mechanisms for regular maintenance and tuning of building systems ☐

TRANSPORT OPTIONS

- Access to public transport ☐
- Secure bicycle storage ☐
- Shower, changing and locker facilities ☐
- Preferential parking for electric or hybrid vehicles and motorbikes ☐

POTABLE WATER

- Water management guarantee from the building owner and manager ☐
- External operational commitment (future benchmarking tool) ☐
- Rain water harvesting and grey water re-use ☐
- Metering, monitoring and reporting of tenant water use ☐
- Metering, monitoring and reporting of base building water use ☐
- Establishment of performance targets for both tenancy and base building ☐
- Real-time disclosure of performance against targets ☐
- Contracts and reporting mechanisms for leak detection with regular maintenance and tuning of building systems ☐

RECYCLING FACILITIES

- Recycling storage facilities for paper, glass, metal and plastic ☐
- Systems for recycling e-waste (fluorescent lights, toner cartridges, batteries, mobile phones) ☐
- Monitoring and reporting of waste volumes by type ☐
- Energy recovery from waste systems ☐
- Waste management plan for the building ☐

CLEANING SERVICES

Cleaning service contracts which:

- Require the use of solvent and hydrocarbon-free cleaning products ☐
- Specify compliance with waste management and energy efficiency policies ☐

BUILDING MANAGEMENT

- Provision of a building users' guide to tenants ☐
- Environmental management plan for the building ☐

4.2
TENANT'S COMMITMENTS: FIT-OUT DESIGN

CERTIFICATIONS

- Green Star SA Interiors tool (currently under GBCSA scoping) ☐
- GBCSA Energy & Water Benchmarking tool ☐

ENERGY USE

- Lighting system type:
  - Energy efficient fluorescent with electronic ballasts ☐
  - Direct-indirect lighting ☐
  - Task lighting ☐
- Special purpose lighting (CFL and LED) ☐
- Lighting controls:
  - Zoning ☐
  - Daylight linking ☐
  - Occupancy sensing ☐
- A guarantee to not exceed a reasonable or mutually-agreed upon amount of peak energy or maximum monthly energy use ☐

FLOORS, WALLS, CEILINGS, WORKSTATIONS, FURNITURE AND JOINERY

- Retain existing finishes, minimise new fit-out items ☐
- Use recycled materials, FSC certified timber and modular systems ☐
- Select environmentally responsible materials ☐
- Use composite timber products with low formaldehyde content ☐
- Use low Volatile Organic Compound (VOC)-emission adhesives, sealants, paints and carpets ☐

APPLIANCES, FITTINGS AND FIXTURES

- Use energy- and water-efficient appliances ☐
- Water-efficient fittings and fixtures (on taps, toilets, urinals and showers) ☐
- Use appliances with automatic turn-off switches ☐

SUPPLEMENTARY AIR-CONDITIONING

- Avoid supplementary air-conditioning where possible ☐
- Where in use, supplementary air-conditioning is designed for optimal thermal comfort, air quality and energy efficiency ☐

INDOOR PLANTS

- Indoor plants for each work setting ☐
- Indoor plants with low/no water requirements ☐

WASTE MANAGEMENT

- Office waste separation (paper, glass, metal, plastic, food and general) ☐
- Fit-out construction waste: demolition waste (at an agreed percentage) to be diverted from landfill ☐
- Contractors and sub-contractors to adhere to a waste management plan ☐

4.3
TENANT'S COMMITMENTS: SPACE MANAGEMENT

POLICIES AND PROCEDURES

- Sustainability policy including:
  - Targets for energy, water and waste performance ☐
  - Indoor environmental quality requirements ☐
  - Mechanisms for building awareness, accountability and participation ☐
  - Education and training strategy for building users ☐
- Environmental management plan - describing the environmental procedures for the space ☐
- Waste management plan - describing the waste management commitments and strategies ☐
- Procurement plan - describing the purchasing requirements ☐

PROCUREMENT AND EQUIPMENT SELECTIONS

- Equipment with energy certification (Energy Star or equivalent) for:
  - Computers, laptops and monitors ☐
  - Copiers ☐
  - Scanners ☐
  - Servers ☐
  - Audio-visual equipment ☐
- Video-conferencing facilities ☐
- Paperless faxing
- Office paper to have high recycled content ☐
- Refilled or recycled toner cartridges for printers and copiers ☐

TENANT EDUCATION

- A simple building users' guide provided by the design team will help tenants use the environmental features installed in the building, showing them how they can contribute towards environmental sustainability in their decisions such as car-pooling to work, recycling their waste products and efficiently using dual-flush toilets ☐

SERVICES MANAGEMENT

- Regular checks of lighting and HVAC controls ☐
- Regular cleaning to avoid dust build-up on lights and AC systems ☐
- Seasonal AC settings for energy efficiency and comfort ☐
- Occupancy and temperature controls on supplementary AC systems ☐

WASTE MANAGEMENT

- Waste reduction strategies:
  - Double-sided printing default ☐
  - Paper re-use ☐
  - Purchasing procedures ☐
- Secure document destruction processes linked to recycling efforts, not landfill ☐
- Recyclables separated in accordance with the building waste management plan ☐
- Management tools in place to engage staff with recycling and waste minimisation ☐

TRANSPORT

- Reduction in parking provision / demand ☐
- Management tools to reduce travel:
  - Flexible work arrangements ☐
  - Video-conferencing ☐
  - Office pool cars ☐
  - Taxi agreements for staff meeting attendance ☐
- Public transport facilitation (via guides or provision of shuttle services) ☐

CLEANING AND MAINTENANCE

- Cleaning contracts require the use of solvent- and hydrocarbon-free cleaning products ☐
- Cleaning contracts require compliance with the building sustainability policy and waste, energy and environmental management plans ☐
- Cleaning contracts note any specific sustainable products or initiatives and relevant maintenance procedures ☐
- Office plants are kept free of herbicides, fungicides, insecticides or pesticides ☐
- VOC-based cleaning products must contain low concentrations of VOCs (volatile organic compounds) of less than 10% benzene, toluene, xylene and / or trichloroethane ☐

MEMORANDUM OF AGREEMENT

1. MEMORANDUM OF AGREEMENT ("MOA")

1.1 The Landlord currently owns the Building [to be defined] or sectional titled portion thereof and the Tenant currently occupies the Premises [to be defined] under the Lease.

1.2 The Parties agree to work together collaboratively to reduce the adverse environmental impact of the Building, the Premises and any services thereof.

1.3 The purpose of this MOA is to provide an agreed framework for the pursuit of this common goal. For ease of reference, this common goal is referred to as "improving the environmental performance".

1.4 The Parties agree to consider each of the possible interventions and actions set out below and in Schedules 1, 2 and 3. Using the Building Management Committee (described below) they will develop agreed objectives and will implement measures to achieve these objectives in an agreed time frame.

1.5 The Landlord will encourage any other occupiers in the Building to enter an MOA in the same terms as this MOA in order to improve the overall environmental performance of the Building.

1.6 This MOA is not legally binding (save where expressly stated to be so). However, the Parties agree to work together in good faith (but without legal obligation) for the lease term and from the date of this MOA to implement measures to achieve the aims and objectives which are set out in Schedules 1, 2 and 3.

2. DATA SHARING

2.1 Being able to measure performance is an important part of understanding what can be improved and ensuring that progress is being made toward improving environmental performance. Accordingly, the Parties agree to share with each other all data and relevant information they have in relation to the Building and the Premises (in as much detail as is available to them) in respect of:

- **Electricity consumption**
- **Water consumption**
- **Waste generation, management and recycling**
- **Maintenance of plant and equipment used in connection with the above**

2.2 Such data and relevant information will be provided [quarterly] [monthly] as a minimum in a form or methodology which the Parties agree upon as being appropriate for the purpose.

2.3 All such information will be provided in a form which allows meaningful and useful analysis.

2.4 An industry accepted methodology, agreed by the Parties, will be used to ensure consistency of data, such methodologies include but are not limited to:

- **IPD Environment Code**
- **Global Reporting Initiative**
- **GBCSA Operational Performance Tools**

3. BUILDING MANAGEMENT COMMITTEE

3.1 The Parties will set up a Building Management Committee which will meet [annually] [quarterly] [on an ad hoc basis].

3.2 The Building Management Committee will comprise representatives of the Landlord, the Tenant, any managing agent employed by the Landlord or Tenant and other persons involved from time to time in the operation or management of the Building and the Premises as the Parties deem appropriate.

3.3 The Building Management Committee will:

a. **Review:**

+ The data and other information shared by the Parties under paragraphs 2.1-2.4
+ The environmental performance of the Building generally
+ Any changes to the Building, the Premises or its operation which may affect the environmental performance of the Building or the Premises in the future
+ Any forthcoming changes in law or practice which may be relevant to the environmental performance of the Building and the Premises.

b. **Seek to agree an environmental management plan for the [Building] [Premises] or [review the Landlord's environmental management plan for the Building] and agree upon annual targets for:**

+ The reduction of energy consumption, carbon emissions, water use and waste at the Building and the Premises
+ The increase, where possible, in the use of plant and equipment, servicing the Building and the Premises, which is based on renewable technologies, renewable energy, recycling of waste, recycled water and captured rainwater
+ Other measures that are practical to adopt in order to improve the environmental performance of the Building and the Premises and the operation thereof.

c. **Produce an annual statement, which:**

- Contains a summary of the energy and water use and the waste generated by the Building and the Premises
- Sets out the targets agreed pursuant to (b) above
- Sets out progress towards achieving the targets agreed for previous years and identifies any other achievements (for example, reductions in fossil fuel consumption).

3.4 The Parties will provide each other with the names of the person(s) within their organisations and in any managing agents' organisations who should be contacted on issues relating to the environmental performance of the Building, Premises or Operation.

4. AGREEMENT UPON BUDGETS

4.1 Improving the environmental performance of the Building / Premises will require initial expenditure. Part of the deliberations of the Management Committee will be to set budgets against each of the agreed actions and interventions. It will also give consideration to any measurable life cycle cost savings which will accrue. It will consider to which party the benefits accrue.

4.2 The parties will agree a budget allocation.

5. CO-OPERATION ON SCHEDULE 1 MEASURES

5.1 The Parties will work together to consider and seek to implement, if appropriate, measures to implement the aims and objectives which the Management Committee has agreed to pursue (those of the aims and objectives, set out in Schedule 1, against which a tick has been placed).

5.2 The Parties will co-operate with each other in complying with the requirements of any Carbon Reduction Commitment scheme to which either of them may be subject and which affects the Building and/or the Premises.

6. MANAGING AGENTS

6.1 The Parties will require their respective managing agents or facilities manager, if appointed, to implement the principles and objectives set out in this MOA.

7. NEW OWNERS AND OCCUPIERS

7.1 If the Landlord disposes of its interest in the Building, the Landlord will encourage the new owner to enter into a similar MOA with the Tenant and with other occupiers of the Building.

7.2 If the Tenant cancels the lease or sublets the Premises, the Tenant will encourage any new occupier of the Premises to enter into a similar MOA with the Landlord.

8. RENEWAL OF THE LEASE

8.1 At the end of the the lease and concurrent MOA (referred to in paragraph 1.6), the Parties will review the progress which has been made in improving the environmental performance of the Building and the Premises and, unless there is good reason to the contrary, the Parties will renew this MOA for a further period of [twelve] months or such other period as is agreed between them at the time, understanding that the aforementioned period will run concurrently with the lease period stated in the Lease as referred to in 1.1 above.

8.2 Should the lease be due for renewal or re-negotiation, the Parties agree to incorporate the MOA conditions into the lease, formalising a binding undertaking to improve the environmental performance as part of the Lease agreement.

9. GENERAL

9.1 It is acknowledged that this MOA is not supplemental or collateral to the lease and is not to be taken into account when construing the provisions of the Lease and that the provisions of the Lease shall prevail over anything in this MOA.

9.2 Each Party agrees that information provided to the other pursuant to paragraph 2 of this MOA shall be used only for the purposes of implementing this MOA and for no other purpose whatsoever and that they shall keep all such information confidential and will not disclose it to any other person (save their agents, consultants or contractors who need to have such information for the purposes of this MOA other than if required to do so by law or with the written consent of the other Party.)

SCHEDULE 1:
BUILDING PERFORMANCE COMMITMENTS

1. BUDGET AGREEMENT

1.1 In accordance with paragraph 4.2 of the MOA, all funding and repayment agreements for the following initiatives to be agreed as part of the deliberations of the Management Committee.

2. BUILDING CERTIFICATION AND AUDITING

2.1 Where practical and commercially possible, the base building refurbishment is to achieve a Green Star SA Design rating.

2.2 Where eligible, the tenancy is to achieve a Green Star SA Interiors rating (not yet under development, but equivalent tool in Australia).

2.3 Where practical and commercially possible, the whole building will seek to achieve an appropriate Green Star Operation rating (under development).

2.4 Under the mandate of the building management committee (paragraph 3 above), [the Landlord] agrees to appoint a suitably qualified person to undertake an audit or assessment of the environmental performance of the Building and the Premises and to advise upon a strategy for implementing the aims and objectives set out in this MOA.

3. COMFORTABLE INDOOR ENVIRONMENT THAT PROMOTES HEALTH AND PRODUCTIVITY

3.1 Where existing equipment has capacity, fresh air provision is to be increased to occupied areas.

3.2 Where existing equipment has capacity, CO_2 monitoring is to be installed in high density areas to maintain air quality.

3.3 Where compatible with existing equipment, radiant heating or cooling capability is to be provided to occupied areas.

3.4 Regular indoor air quality testing is to be undertaken by the building owner for review by the tenant.

3.5 Where compatible with existing equipment, individual comfort control is to be provided to building users.

3.6 Dedicated exhaust is to be provided for copy rooms.

3.7 FM and Maintenance contracts to be amended to include:

- **Requirement for replacement paints, adhesives, sealants and carpets for use in the building to be low VOC.**
- **Requirement for regular HVAC filter maintenance and cleaning is to be included in FM contracts (if absent).**
- **Live monitoring of space conditions to be installed via the BMS (if present) with alarms for poor thermal comfort to trigger FM action.**

3.8 Landlord to provide artificial lighting review and refurbishment to:

- **Deliver lighting levels below 400 lux**
- **Provide high frequency ballasts.**

3.9 Tenant to provide:

- **Where possible, occupant access to external views and daylight to be optimised.**
- **Glare control blinds to be fitted to facades adjacent to occupied areas.**

4. ENERGY USE

4.1 Each of the Parties agrees to energy consumption targets and the real-time disclosure of performance against the targets.

4.2 Each of the Parties agrees to achieve certification under an appropriate Green Star SA operational rating tool.

4.3 Separate metering facilities for individual utilities for the Premises and the common parts and for other occupiers and special uses.

4.4 Each of the Parties agrees to disclosure of energy performance and targets in real-time where such capacity exists.

4.5 Where appropriate, the use of smart or automatic metering technology in the Building and/or the Premises.

4.6 Where appropriate participate in local and/or communal schemes for energy generation or provision.

5. TRANSPORT OPTIONS

5.1 Agreement to develop a green travel plan: taking into account public transport, lift sharing, alternative fuel vehicles and cycling.

5.2 Landlord is to provide secure bicycle storage of building for both tenants and visitors.

5.3 Landlord is to provide showers, changing rooms and locker facilities.

5.4 Both Parties to agree preferential parking for electric vehicles and motorbikes.

5.5 The Parties to co-operate in the establishment of shuttle links, where practicable, to any local transportation hubs.

6. POTABLE WATER

6.1 Each of the Parties agrees to water consumption targets and the real-time disclosure of performance against the targets.

6.2 Each of the Parties agrees to co-operate to obtain certification under a future Green Star SA operational rating tool.

6.3 The Landlord shall install high efficiency fixtures, fittings, appliances and control technologies in the Building and the Premises.

6.4 The Landlord undertakes to enter into contracts for leak detection with regular maintenance and tuning of building systems.

6.5 Each of the Parties agrees to support, where possible, the use of treated and recycled water, captured rain water and grey water, where potable water is not a necessity.

7. RECYCLING FACILITIES

7.1 Under the mandate of the building management committee (paragraph 3 above), both parties are to develop a waste management plan for the building, including implementation responsibilities.

7.2 The Landlord agrees to set aside adequate space and facilities for the storage of recycling (paper, glass, metal and plastic).

7.3 Systems for recycling e-waste are to be provided by the Landlord (fluorescent lights, toner cartridges, batteries, mobile phones)

7.4 Both parties agree to the monitoring and reporting of waste volumes by type.

7.5 Each Party agrees that on refurbishment and fit-out it shall require contractors to work to an environmental management plan and recycle 80% of construction waste.

8. CLEANING SERVICES

8.1 The parties agree to require cleaning service contracts to comply with the Environmental Management, Waste Management and Procurement Plans for the Building or Premises.

8.2 The parties agree to require cleaning service contracts to make use of solvent-free, low TVOC and hydrocarbon-free cleaning products.

8.3 The parties agree to require cleaning service contracts to note any specific 'green' products or initiatives and relevant maintenance procedures

8.4 Each Party is to require that indoor plants are kept free of herbicides, fungicides, insecticides or pesticides.

9. BUILDING MANAGEMENT

9.1 The Management Committee shall, as part of its mandate, procure the provision of the following documentation:

- **Provision of a building users' guide to tenants**
- **Environmental management plan for the building**
- **Waste management plan for the building**

SCHEDULE 2:
TENANT GUIDELINE: FIT-OUT DESIGN

1. BUDGET AGREEMENT

1.1 In accordance with paragraph 4.2 of the MOA, all funding and repayment agreements for the following initiatives to be agreed as part of the deliberations of the Management Committee.

2. LIGHTING

2.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Lighting system type:**
  - Efficient fluorescent with electronic ballasts
  - Direct-indirect lighting
  - Task lighting
  - Special purpose lighting (CFL and LED)
- **Lighting controls:**
  - Zoning
  - Daylight linking
  - Occupancy sensing

3. FLOORS, WALLS, CEILINGS, WORKSTATIONS, FURNITURE AND JOINERY

3.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Retain existing finishes, minimise new fit-out items**
- **Use recycled materials, FSC certified timber and modular systems**
- **Select ''eco-preferred'' materials (e.g. linoleum instead of vinyl)**
- **Use composite timber products with low formaldehyde content**
- **Use low-emission adhesives, sealants, paints and carpets**

4. APPLIANCES, FITTINGS AND FIXTURES

4.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Use energy and water efficient appliances**
- **Water efficient fittings and fixtures (taps, toilets, urinals, showers)**
- **Avoid hot water boilers (use kettles with automatic-off switches)**

5. SUPPLEMENTARY AIR CONDITIONING (AC)

5.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Avoid supplementary AC where possible**
- **Where not possible, supplementary AC design for optimal thermal comfort, air quality and energy efficiency**

6. INDOOR PLANTS

6.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Indoor plants for each work setting**
- **Indoor plants with low water requirements**

7. WASTE MANAGEMENT

7.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Office waste separation (paper, glass, metal, plastic, food and general)**

SCHEDULE 3:
TENANT GUIDELINE – MANAGEMENT

1. POLICIES AND PROCEDURES

1.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Sustainability policy including:**
  - Targets for energy, waste and waste performance
  - Indoor environmental quality requirements
  - Mechanisms for building awareness, accountability and participation
- **Environmental management plan - describing the environmental procedures for the office**
- **Waste management plan - describing the waste management commitments and strategies**
- **Procurement plan - describing the purchasing procedures**

2. PROCUREMENT AND EQUIPMENT SELECTIONS

2.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Equipment with energy certification (Energy Star or equivalent) for:**
  - Computers, laptops and monitors
  - Copiers
  - Scanners
  - Servers
  - Audio-visual equipment
- **Video-conferencing facilities**
- **Paperless faxing**
- **Office paper to have high recycled content (>60%)**
- **Refilled or recycled toner cartridges for printers and copiers**

3. SERVICES MANAGEMENT

3.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Regular checks of lighting and HVAC controls**
- **Regular cleaning to avoid dust build-up on lights and air conditioning (AC) systems**
- **Seasonal AC settings for energy efficiency and comfort**
- **Occupancy and temperature controls on supplementary AC systems**

4. WASTE MANAGEMENT

4.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions on the premises:

- **Waste reduction strategies:**
  - Double-sided printing default
  - Paper re-use
  - Purchasing procedures
- **Secure document destruction processes linked to recycling efforts, not landfill**
- **Recyclables separated in accordance with the building Waste Management Plan**
- **Management tools in place to engage staff with recycling and waste minimisation**

5. TRANSPORT

5.1 The Tenant undertakes that it shall comply with the following specifications in respect of any work it commissions:

- **Reduction in parking requirements**
- **Management tools to reduce travel:**
  - Flexible work arrangements
  - Video-conferencing
  - Office pool cars
  - Taxi agreements for staff meeting attendance
- **Public transport facilitation (guides or shuttle services)**

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INT-Man-8 Learning Resources

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise sustainability initiatives implemented in the fitout as learning resources for fitout users and visitors.

CREDIT CRITERIA

One point is awarded where:

• Within the fitout, the following 'Learning Resources' are provided for fitout occupants and visitors:

- A minimum of one sustainability initiative related to a Green Star SA Interiors Energy Credit is described and displayed, and the resulting energy use and greenhouse gas emissions are continuously presented;

AND

- A minimum of one sustainability initiative related to a Green Star SA Interiors Water Credit is described and displayed, and the resulting potable water savings are continuously presented;

AND

- A minimum of one sustainability initiative related to a Green Star SA Interiors Credit and not related to energy and water is described and displayed, and the resulting benefit(s) are presented.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. As Built drawings or Photographs

GBCSA's Submission Template prepared by a relevant project team member that describes how the Credit Criteria have been met by:
• Summarising each initiative, including;

- Stating which Green Star SA – Interiors v1 credit it relates to;
- Describing how data for water and energy initiatives are collected and continuously displayed;

As Built drawings or photographs showing the location of all initiatives and associated displays.

INT-Man-8 Learning Resources

POINTS AVAILABLE 1

ADDITIONAL GUIDANCE

Sustainability initiative

For the purpose of this credit, a sustainability initiative refers to any design attribute, structural or landscape component, system, service, equipment or strategy rewarded under a Green Star SA credit, and incorporated in the project's Green Star SA submission.

To be eligible to receive the point in this credit, at least one point in each of the Green Star SA – Interiors credits addressing all three sustainability initiatives described above must be achieved.

Description and display of learning resources

Sustainability initiatives must be described and displayed as follows:

• Description:

- A description of a sustainability initiative refers to a clear explanation of what the initiative is, how it works, and what is the expected sustainability benefit resulting from its inclusion in the project scope.

• Display:

- Display of descriptions of sustainability initiatives to fitout users includes but is not limited to the use of educational display boards, exhibits, screens, cutaway sections of the building fabric, audio, printed information, etc.

Energy and water savings are to be continuously presented as follows:

–The display provided must make provision for water and energy savings to be presented and regularly updated (period between updates not longer than daily) i.e. screens, signs or educational display boards used should have the functionality for energy and water savings to be displayed and updated on a regular basis.

Location of learning resources

Learning resources, including the display of real-time data (for energy and water) must be permanently located in an area where all fitout occupants and visitors will be exposed to them. Examples of such areas include, but are not limited to:

• Front desks and receptions;

• Waiting areas;

• Atria;

• Entrances; and

• Exhibition areas.

Learning resources can also be located next to the sustainability initiative (e.g. outside the building next to rainwater collection tanks, photovoltaic panels, co-generation or water treatment plants). When this is the case, signage directing building users to these areas must be provided in locations where all of the building occupants and visitors can see them. Where the initiative is not accessible to building occupants and visitors (e.g. located in the plant room), then the learning resources / information should be located in a central and accessible location such as reception or lobby area.

INT-Man-8 Learning Resources

POINTS AVAILABLE 1

BACKGROUND

The Learning Resources credit aims to educate fitout occupants on how the sustainability initiatives that have been implemented in the fitout work, and the associated environmental benefits of these initiatives.

Making sustainable initiatives and features visible and interactive can provide a valuable education and learning opportunity for fitout users to develop awareness about the fitout's impacts on the natural environment and resources. By incorporating important concepts such as energy, water and material efficiency, fitouts can become interactive learning tools.

REFERENCES & FURTHER INFORMATION

BREEAM Schools
http://www.breeam.org/page.jsp?id=20

Innovative Design, Sustainable school guidelines – Buildings that teach sustainability,
http://www.innovativedesign.net/pdf/03bldgteach.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-IEQ-1 Quality of Internal Air

POINTS AVAILABLE 4

AIM OF CREDIT

To encourage and recognise projects that provide high quality air to occupants.

CREDIT CRITERIA

Entry of outdoor pollutants

Half a point is available where:

- It is demonstrated that a contract exists requiring the regular replacement of air filters and maintenance of the fresh air ducting. For compliance with the credit criteria, annual changing of filters and cleaning of fresh air ducting must be conducted.

Provision of outside air

Up to two points are awarded as follows:

Naturally ventilated spaces

Up to two points are awarded where:

- It is demonstrated that 95% of the Nominated Area is naturally ventilated in accordance with SANS 10400-O:2011

Mechanically ventilated spaces

Up to two points are awarded where:

- It is demonstrated that for 95% of the Nominated Area, outside air is provided at rates greater than the l/s per person requirements of SANS 10400-O:2011, awarded as follows:

– 33% improvement for one point; or
– 66% improvement for two points

Mixed-mode ventilated spaces

Up to two points are awarded where:

- Both modes of operation individually satisfy the relevant criteria for naturally ventilated spaces and mechanically ventilated spaces. Points awarded are limited to the maximum points awarded under the mechanically ventilated space criteria.

Underfloor displacement ventilated spaces

Up to two points are awarded where:

- It is demonstrated that for 95% of the Nominated Area, outside air is provided at rates greater than the requirements of SANS 10400-O:2011, awarded as follows:

- 10% improvement for one point;
- 40% improvement for two points;

Note that displacement ventilation systems are those that provide 100% of all air into the space from low level and are designed to provide stratified air conditions within the space. Underfloor air distribution, which makes use of swirl diffusers to mix air within the space do not meet the credit criteria.

Use of CO_2 control

Up to one point is awarded where:

- It is demonstrated that CO_2 is monitored and outside air rates are controlled such that CO_2 levels are kept at:
  - 700ppm for half a point;
  - 600ppm for 1 point.

Exhaust of pollutants

Half a point is awarded where:

- It is demonstrated that a dedicated room is provided to house photocopy and print equipment, and that this room is connected to a dedicated exhaust riser or a ducted exhaust system.

OR

All printing or photocopy equipment located throughout the project is certified as having low emissions in accordance with the methodologies in the Additional Guidance.

OR

- No photocopy or print equipment is used in the space

For the purposes of this credit, the **'Nominated Area'** is **Occupied Space.**

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
For Entry of outdoor pollutants: 1. Extract(s) from Contract OR Statement of confirmation from the Landlord

INT-IEQ-1 Quality of Internal Air

POINTS AVAILABLE 4

For Provision of outside air:

2. GBCSA's Submission Template
3. As Built drawing(s)

Additionally for mechanically ventilated spaces:

4. Extract(s) from Commissioning Report(s)

For Use of CO_2 control:

5. As Built drawing(s)

For Exhaust of pollutants:

6. As Built drawing(s); OR
7. Test certificate OR Manufacturer datasheet(s) OR Signed correspondence from Tenant

GBCSA's Submission Template prepared by a suitably qualified professional demonstrating how the Credit Criteria have been met by:

- Providing a tabulated summary of all occupied spaces within the building, for each indicating their ventilation mode(s) and areas as indicated on the As-Built drawings;

Additionally for naturally ventilated spaces:

- Providing a tabulated summary of each occupied space, listing its floor area and the area of external openings in that occupied space expressed as a percentage of the occupied space floor area, demonstrating compliance with the 5% minimum requirement in SANS 10400-O:2011; and,
- Providing a tabulated summary of all occupied spaces, indicating the provision of CO_2 monitors and confirming that monitoring is provided for every room or 100m2; and,
- Confirming that the system provides an alarm if CO_2 levels rise above 600ppm, with reference to supporting documentation;

Additionally for mechanically ventilated spaces:

- Providing a tabulated summary of each occupied space, listing the AHU(s) or fan(s) that serve each space and the minimum outside air rate supplied, clearly demonstrating compliance with the credit criteria; and.
- Confirmation that the ventilation system(s) have been commissioned and operate as intended by the design.
- Confirming the provision of CO_2 sensors to each zone or 100m2, to no less than 95% of the Nominated Area, and that the system facilitates the continuous monitoring and adjustment of outside air rates;

Additionally for underfloor displacement ventilated spaces:

- Provide a description of how the system is designed to work and confirm how it qualifies as a displacement ventilation system per the Additional Guidance.

As Built drawing(s) clearly marked up to show:

- For naturally ventilated spaces: Architectural floor plans and elevations showing the locations of ventilation openings.
- For mechanically ventilated spaces: Mechanical services drawings, indicating the space served and nominating the outside-air supply rates.
- For CO_2 Sensors: The location of CO_2 sensors to each zone.

Where the point for Exhaust of pollutants is claimed:

- The location of the dedicated exhaust riser and/or exhaust louvre system(s) provided to each printing/copy room.

Extract(s) from Commissioning Report(s) demonstrating that the ventilation system(s) have been commissioned and operate as intended by the design, and indicating the minimum outside-air rates supplied by each AHU.

Extract(s) from Contract OR Statement of Confirmation from the Landlord confirming the requirements for regular maintenance of fresh air ducting in accordance with the Credit Criteria.

Test certificate OR **Manufacturer datasheet(s)** clearly stating the emission limits and the test methodology.

Signed correspondence from Tenant confirming there are no photocopying or printing equipment used in the space.

ADDITIONAL GUIDANCE

The systems claimed for this credit must be documented consistently throughout the submission, especially within related credits (IEQ-2: Thermal Comfort or Ene-1: Greenhouse Gas Emissions).

Supplementary outside air systems

Supplementary outside air systems can be incorporated. However, note the following:

- The project must operate and deliver the air to the occupied space whenever the air conditioning system is in operation (as per the Credit Criteria provided). Enabling users to connect to the system will not suffice; and
- The supplementary system must be installed and operated (including energy and maintenance provision) by the base building.

Mechanically ventilated spaces

Projects are required to use the design occupancy, not default occupancy from relevant standards, for all credits that address mechanical ventilation systems.

It must be clearly demonstrated that:

- The documentation shows the minimum outside air rates for each separately served space in the building;
- The HVAC system has been clearly sized to accommodate the increased outside air rates;
- The design ventilation rates represent the required increase on SANS 10400-O:2011 and that these minimum outside air rates are clearly documented in the project design; and
- The minimum outside air rate required by the standard is quoted. This will demonstrate to the assessor the percentage improvement for each mechanically ventilated space in the building.

Mixed-mode ventilated spaces

A space or building cannot be considered mixed-mode ventilated unless it independently satisfies the criteria for both naturally ventilated and mechanically ventilated spaces, regardless of the proportion of time the space operates in either mode.

Underfloor displacement ventilated spaces

For an underfloor air distribution system to qualify as a displacement ventilation system, the air velocity at the diffuser **may not exceed 0.2m/s** (*Displacement Ventilation* ASHRAE Journal, September 2004) and return air must be at ceiling level. Supply air must always be provided at a temperature below room air temperature. Note that floor supply of warm air with a ceiling return has a low air change effectiveness (± 0.7). As such, for a system to qualify as displacement ventilation, if heating is provided, it may not be provided at floor level with ceiling return.

The ASHRAE article *LEED and Standard 62.1* from the ASHRAE Journal, (Vol. 47, No. 9, September 2005 notes that "virtually every laboratory and field study has shown that air change effectiveness is always greater than 0.9 when supply air is cooler than room temperature regardless of diffuser location or design."

Table 6.2 of ASHRAE Standard 62.1 specifies that a system supplying cool air at ceiling level has an air distribution effectiveness of 1.0. Comparatively, a floor supply of cool air and ceiling return, characterised by low velocity displacement ventilation achieving thermal stratification has a typical air distribution effectiveness of 1.2. (Reference: ANSI/ASHRAE Standard 62-2001)

Thus lower flow rates are permitted for displacement ventilation systems, and are taken to achieve the equivalent air distribution effectiveness with lower resultant flow rates, scaled by a ratio of approximately 0.2.

Exhaust of pollutants

For compliance, an enclosed room for printing and photocopying with a dedicated exhaust facility must be provided. Exhaust air must not be recirculated to other enclosures. This can be achieved by connecting to the base building's dedicated exhaust riser (if applicable) or via an exhaust louvre with an extract fan. The method of exhaust must not also serve the kitchenette, tearooms or any other spaces with occupants.

If providing an exhaust louvre, it must be of a size equivalent to 1.75cm^2/m^2 of Occupied Area with the exhaust point at least 7m away from any openable window or air intake.

Photocopy and printing equipment

All photocopy and printing equipment to be certified in accordance with one of the following test methodologies: ECMA-328, RAL-UZ 122 or GGPS.003. The test certificate must state the emission limits detailed in the standard have been met.

Test certificate for printing equipment is the means to evidence compliance, certificates must be issued by a NATA or ISO 17025 accredited laboratories. Relevant limits are as follows:

Substance	Emission rate (mg/h)
TVOC	18
Benzene	0.05
Styrene	1.8
Ozone	3.0
Dust	4.0

BACKGROUND

SANS 10400-O:2011 sets minimum permissible ventilation rates, giving consideration to health and ventilation amenity. It does not cover other requirements associated with comfort such as temperature, humidity, air movement or noise. The minimum ventilation rates specified are intended to maintain general contaminants (e.g. body odours, volatile organic compounds, etc.) at concentrations below exposures that have potential to cause adverse health effects to a substantial majority of occupants.

The World Health Organisation estimates that up to 30% of new and remodelled buildings worldwide may be subject to excessive complaints related to indoor air quality. Employers, building owners, product manufacturers, engineers, architects and builders are all at risk of litigation arising from claims based on indoor air pollution and poor indoor environment quality.

Clearly there is a balance to be struck between providing adequate outside air in recirculation systems to dilute contaminants and the loss/gain of heat with the resulting increased energy consumption needed to maintain comfort levels.

REFERENCES & FURTHER INFORMATION

American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S (ASHRAE)
ASHRAE Fundamentals Handbook 1997.
ASHRAE 62.1-2007 Ventilation for Acceptable Air Quality
http://www.ashrae.org

Chartered Institute of Building Services Engineers, U.K. (CIBSE)
CIBSE Guide A: Environmental Design (2006)
http://www.cibse.org

South African Bureau of Standards (SABS)
SANS 10400-O:2011
http://www.sabs.co.za

The Environmental Protection Agency (EPA), U.S.
An Office Building Occupant's Guide to Indoor Air Quality
http://www.epa.gov/iaq/pubs/occupgd.html

Energy Cost and IAQ Performance of Ventilation Systems and Controls Study
http://www.epa.gov/iaq/largebldgs/energy_cost_and_iaq/

Indoor Air Quality and Energy Efficiency
http://www.epa.gov/iaq/largebldgs/i-beam/text/energy_efficiency.html

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-IEQ-2 Thermal Comfort

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise fitouts that achieve a high level of thermal comfort.

CREDIT CRITERIA

Up to two points are available for this credit. Projects are required to select Compliance Route 1 OR Compliance Route 2. Projects are NOT required to demonstrate compliance to all routes.

Compliance Route 1 - Modelling

Up to two points are awarded where a high level of thermal comfort is achieved for the occupied area on an area-weighted basis:

Mechanically Ventilated Spaces, Mixed Mode and Naturally Ventilated Spaces

Up to two points are awarded where:

- The Predicted Mean Vote (PMV) levels, calculated in accordance with ISO7730 using standard clothing and metabolic rate values, are within the following limits for at least 98% of occupied hours:

– One point for PMV levels between -1 and +1 (inclusive);
OR
– Two points for PMV levels between -0.5 and +0.5 (inclusive).

Naturally Ventilated Spaces

An alternate method to show compliance is available in naturally ventilated spaces.

Up to two points are awarded where:

- Internal operative temperatures are within the *ASHRAE Standard 55-2004 Acceptability Limits* for at least 98% of occupied hours, awarded as follows:

– One point for meeting the 80% *Acceptability Limits*;
OR
– Two points for meeting the 90% *Acceptability Limits*.

Compliance Route 2 - Deemed-to-Satisfy (DTS) Criteria

Up to two points are available for this credit. Each credit is independent of each other.

Seating

One point is awarded where:

- No long-term seating is provided within 1.5 metres of the external façade

Localised control

One point is awarded where:

- 90% of occupants have localised control of either air velocity or temperature. For naturally ventilated spaces, this can be in the form of openable windows. Compliance via operable windows is only available for occupants within 5m of an operable window.

AND OR

- All shared multi-occupant spaces are provided with comfort system controls to enable adjustments that meet group needs and preferences. Where desks are provided in clusters, one comfort system control per cluster is required.

For the purpose of this credit **'Nominated Area'** is defined as **Occupied Space.**

DOCUMENT REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Thermal comfort report 2. As Built drawing(s)

Thermal comfort report prepared by a suitably qualified professional that describes how the credit criteria have been met by:

- Describing the HVAC system (where applicable) and passive design strategies used to achieve thermal comfort;

For Compliance Route 1 - Modelling

- Confirming which thermal comfort methodology has been used (i.e. ASHRAE 55-2004 Acceptability Limits or ISO7730 PMV values), with justification for the selection based on the Credit Criteria;
- Describing the software package used for determining thermal comfort levels;
- Describing the weather data used and its source, demonstrating that it complies with the weather data requirements of the Additional Guidance;
- Providing marked-up plan drawings clearly showing the zones modeled for thermal comfort and that no perimeter zone exceeds 4m in depth;
- Providing a tabulated summary of all zones modelled, indicating the area of each and confirming all of the UA has been included in the analysis;
- Confirming the occupancy schedule and total number of hours assessed for thermal comfort;
- Confirming that all modelling inputs are in exact accordance with the modelling presented in Ene-1 Greenhouse Gas Emissions;

Additionally where ASHRAE 55-2004 Acceptability Limits methodology used:

- Confirming all spaces assessed are provided with openable windows, and not provided with mechanical cooling systems;
- Providing a table of the mean monthly outdoor air temperatures and resulting acceptability range;
- Providing a summary table of all zones assessed for thermal comfort and the hours below, within and above the Acceptability Limits of operative temperatures, clearly demonstrating compliance with the Credit Criteria.

Additionally where PMV ISO7730 methodology used:

- Confirming that the CLO and MET values used are in accordance with the Additional Guidance;
- Demonstrating that the air velocity value selected is justified for the actual system design.
- Providing a summary table of all zones assessed for thermal comfort and the hours

below, within and above the stipulated PMV levels, clearly demonstrating compliance with the Credit Criteria.

For Compliance Route 2 – Deemed-to-Satisfy

- Describing how occupants have localized control of either air velocity or temperature.

As Built drawings marked-up to clearly demonstrate

- Façade, roof and, wherever relevant, section drawings showing the materials in the design; and
- For naturally ventilated spaces, indicating and dimensioning all ventilation openings, inlets and outlets.

Additionally for Compliance Route 1 - Modelling

- Plans marked up to indicate all zones assessed for thermal comfort;

Additionally for Compliance Route 2 – Deemed-to-Satisfy

- Furniture layout plan
- Locations of occupant controls for air velocity or temperature

ADDITIONAL GUIDANCE

All inputs into the modelling or calculations (e.g. building form, materials and air conditioning system(s) etc.) must be referenced consistently throughout the rest of the submission (i.e. in related credits such as Ene-1: Greenhouse Gas Emissions or IEQ-1: Quality of Internal Air) and be clearly justified by the documented evidence.

On-site thermal comfort measurement is not an acceptable way to demonstrate compliance with the Credit Criteria.

ASHRAE 55-2004 Adaptive Comfort Temperatures

The ASHRAE guide defines a range of temperatures which are deemed comfortable for a naturally ventilated space, where occupants have control over openings. These depend on the mean monthly outside air temperature, based on the fact that people living in warmer areas can tolerate higher internal temperatures than those living in cold areas. An approximate summary of the data is as follows:

Mean monthly outdoor temp °C	Min internal temp (80% acceptability) °C	Min internal temp (90% acceptability) °C	Max internal temp (90% acceptability) °C	Max internal temp (80% acceptability) °C
10	17.5	18.5	23.5	24.5
15	19	20	25	26
20	20.5	21.5	26.5	27.5
25	22	23	28	29
30	23.5	24.5	29.5	30.5

Table IEQ-2.1: *Adaptive Comfort Temperatures as defined in ASHRAE 55-2004*

These internal temperatures are 'operative' internal temperatures, defined in ASHRAE Fundamentals 2001. For occupants not sitting in direct sunlight, this can be approximated as the mean of the air temperature and the mean radiant temperature.

ISO7730

The purpose of the ISO7730 is to present a method for predicting the thermal sensation and the degree of discomfort (thermal dissatisfaction) of people exposed to moderate thermal environments and to specify acceptable environmental conditions for comfort. It applies to healthy men and women and was originally based on studies of North American and European subjects but agrees also well with recent studies of Japanese subjects and is expected to apply with good approximation in most parts of the world. It applies to people exposed to indoor environments where the aim is to attain thermal comfort, or indoor environments where moderate deviations from comfort occur.

The Predicted Mean Vote (PMV) is an index that predicts the mean value of the votes of a large group of persons on the following 7-point thermal scale:

PMV (Predicted Mean Vote)	PPD (Predicted Percentage Dissatisfied)	Thermal Scale
+3		hot
+2	70%	warm
+1	25%	slightly warm
0	5%	neutral
- 1	25%	slightly cool
- 2	70%	cool
- 3		cold

Table IEQ-2.2: *PMV index*

The PMV index can be determined when the activity (metabolic rate) and the clothing (thermal resistance) are estimated, and the following environmental parameters are measured:

- Air temperature;
- Mean radiant temperature;
- Relative air velocity; and
- Humidity.

A PMV of between –1 and +1 corresponds to a Predicted Percent Dissatisfied (PPD) of no more than 25% (i.e. 25% of people are dissatisfied or uncomfortable). A PMV of between –0.5 and +0.5 corresponds to a PPD of no more than 10%. Note that when the PMV is zero, there are still 5% of occupants dissatisfied or uncomfortable, which illustrates the point that it is impossible to have 'perfect' comfort conditions since different people have different preferences.

Occupied space

The area used in the simulation must be defined as the area occupied and used for the primary purpose of the space type and as defined in the Glossary. This defined space must be used consistently throughout all relevant credits.

Building properties

Building properties shall be assigned in the model as defined in the Green Star SA – Interiors Energy Calculator.

Model zoning

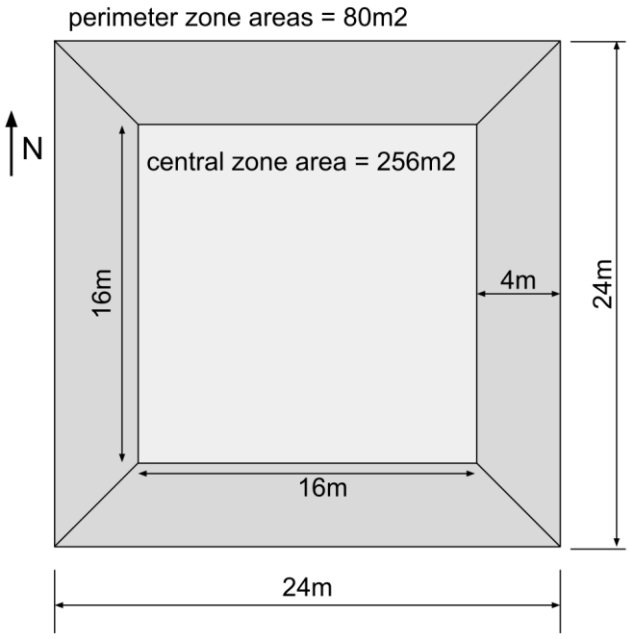
Perimeter zones of less than four meters from the façade shall be modelled independently to prevent averaging of heat fluxes and temperatures from invalidating the results. No perimeter zone may be larger than 100m^2.

Operating schedules

Should operating schedules of HVAC equipment be used as part of the energy performance or thermal comfort strategy (e.g. night flushing of the building), the actual HVAC plant operating schedules for the related equipment as supported by As Built documentation or commissioning data may be used for the thermal comfort model. Please note that if any overrides over timer-based controls are included in the system (e.g. CO2 or temperature overrides) these should be accounted for accurately or assumptions conservatively justified – alternatively the HVAC plant operating schedules in the Energy Modeling Protocol should be used.

Area weighting

Area weighting is to be done as a post process whereby resultant compliant and non-compliant hour totals for each zone are to be weighted based on their floor area. An example of this is included, based on the single-floor building shown below:



Below is an example of a building that meets the credit criteria for this credit:

Zone	Area	Hours below PMV = -0.5 (using CLO= 0.95)	Hours within PMV -0.5 to 0.5	Hours above PMV = 0.5 (using CLO= 0.6)	Percentage hours within PMV thresholds	Area weighted hours within PMV thresholds
Central zone	256	7	3180	13	99.4%	1 413
North perimeter	80	24	3161	15	98.8%	439
South perimeter	80	87	3113	0	97.3%	432
East perimeter	80	9	3158	33	98.7%	439
West perimeter	80	13	3132	55	97.9%	435
TOTAL	**576**					**3 158**

			TOTAL WEIGHTED RESULT	**98.7%**
Total hours in schedule	3200		**Compliant with credit criteria?**	**Yes**

Below is an example of a building that does not meet the credit criteria for this credit:

Zone	Area (m^2)	Hours below PMV = -0.5 (using CLO 0.95)	Hours within PMV -0.5 to 0.5	Hours above PMV = 0.5 (using CLO 0.6)	Percentage hours within PMV -0.5 to 0.5 (%)	Area weighted hours within PMV limits
Central zone	256	17	3143	40	98.22%	1 397
North perimeter	80	106	3007	87	93.97%	418
South perimeter	80	139	3044	17	95.13%	423
East perimeter	80	42	2997	161	93.66%	416
West perimeter	80	31	2982	187	93.19%	414
TOTAL	**576**					**3 068**
			TOTAL WEIGHTED RESULT			**95.87%**
Total hours in schedule	3200		**Compliant with credit criteria?**			**No**

Weather data

A Test Reference Year's (TRY) worth of weather data must be used to calculate hourly thermal comfort values for each location where one is available. Where no TRY is available, the applicant will be expected to demonstrate that the weather data is typical of that locality.

Standard variables

Standard Hours of Occupancy are defined in the Green Star SA – Interiors Energy Calculator.

When using the Predicted Mean Vote thermal comfort model:

Variable	Value	Notes
Warm condition CLO	0.6	For determining frequency of PMV > 0.5 or PMV > 1
Cold condition CLO	0.95	For determining frequency of PMV < -0.5 or PMV < 1
Met	1.2	1 Met = 58.2W/m^2 [ISO 7730, p. 3]
Air velocity	0.14 m/s	Typical value representative of an artificially ventilated space. [ASHRAE-55 p.8]

Using alternative air velocities

If a non-standard air velocity is used (such as in the case of natural ventilation or the implementation of ceiling fans), the chosen air velocity should be justified by the design team.

Localised occupant controls

Many conventional buildings are built as sealed spaces in which the occupants have no control over thermal conditions. A better approach would give individuals the freedom to adjust the thermal conditions for a more comfortable environment. An individual's thermal comfort can depend on air velocity, the direction and temperature of indoor air, and moisture content.

Mechanical systems that allow for individual control of comfort can be integrated into the overall systems design by enabling individual adjustment of selected comfort parameters,

such as individual thermostats, individual diffusers located on the floor, desk or overhead, and individual radiant panels. Occupancy sensors can also be integrated into the design to automatically turn down the thermostat and reduce airflow when occupants are away, which helps reduce energy use.

If windows are operable, the facility managers should educate tenants on the security and HVAC consequences of leaving windows open when the building is not occupied; explain how this affects the HVAC systems and ultimately comfort.

Shared multi-occupant spaces

For conference rooms and lecture halls, confirm that there is at least 1 accessible means of control over thermal comfort. For meeting spaces that can be subdivided, such as a convention hall with a movable wall, occupants in each area have control of their individual area.

BACKGROUND

The Thermal Comfort credit seeks to ensure that fitout occupants are provided with a thermal environment that can be maintained at a comfortable level, and that users can control thermal comfort levels within their immediate environment.

Most buildings are designed using air-temperature design conditions. Whilst this metric is the most easy to measure for the determination of comfort, it is often a poor indicator of how comfortable spaces actually are. This is because the sensation of comfort is based on a wide range of parameters which include air temperature, mean radiant temperature, humidity, air movement, clothing and metabolic rates. In practice, a high level of thermal comfort is considered to occur when a high proportion of fitout occupants are predicted to be satisfied with thermal conditions, based on consideration of the above factors.

This credit aims to encourage projects to design for comfort, rather than temperature. To assist, the credit reference relevant standards for thermal comfort that were developed to measure thermal comfort, rather than temperature, to assess the comfort of building occupants.

Operable windows are often one of the occupants' most desired building features. Other means of providing thermal comfort involve planning and design considerations. When the control method is chosen and the space occupied, project teams should take time to educate occupants on the individual controls of their office space, as well as facility managers on maintaining the HVAC equipment and recalibrating controls as recommended by the manufacturers.

REFERENCES & FURTHER INFORMATION

American Society of Heating, Refrigerating and Air-Conditioning Engineers,(ASHRAE)
ASHRAE 55-2004 – Thermal Environmental Conditions for Human Occupancy
and *ASHRAE Fundamentals Handbook 1997*
http://www.ashrae.org/publications

Chartered Institution of Building Services Engineers (CIBSE), U.K. *Standard 55-1992 - Thermal environmental conditions*
http://www.cibse.org

International Organisation for Standardisation (ISO). *ISO7730: Moderate thermal environments – Determination of the PMV and PDD indices and specification of the*

conditions for thermal comfort
http://www.iso.org/iso/en/ISOOnline.frontpage

University of California, Berkeley, *A Field Study of Personal Environmental Module Performance in Bank of America's San Francisco Office Buildings*, (1998) (This study provides information about underfloor air distribution technologies.)
http://www.cbe.berkeley.edu/research/pdf_files/bauman1998_bofa.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-IEQ-3 Lighting comfort

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage, recognise and reward well-lit spaces that provide appropriate levels of lighting comfort to occupants from artificial light sources.

CREDIT CRITERIA

Minimum compliance

- It is a condition of this credit that all lights, where relevant, contain high frequency ballasts, and that the lights accurately address the perception of colour in the space.

Light levels

One point is awarded for:

- Lighting levels provided in the nominated area are appropriate to the tasks performed in each space type.

Projects are only eligible to achieve points for this credit where the minimum compliance requirement described above is met first.

Nominated area
For purposes of this credit criterion, the nominated area includes all primary and secondary spaces. A space can be excluded if the use of the space (for example, a cinema) justifies different appropriate lighting levels.

Individual Control

One point is awarded where:

- Each occupant in the nominated area has the ability to control the lighting levels in their immediate environment.

A work setting where occupants are expected to remain for less than one continuous hour per day can be excluded. Where at least 90% of the work settings in the fitout can be excluded, the Individual Control point of the credit is deemed Not Applicable.

Nominated Area
For purposes of this credit criterion, the nominated area includes all primary spaces. A space can be excluded if the use of the space (for example, a cinema) justifies the exclusion of individual control.

Glare

One point is awarded where:

- Glare from bare lamps in all working spaces is eliminated either through baffles, louvres and diffusers or trough not exceeding the relevant maximum Unified Glare Rating (UGR)

Nominated area

For purposes of this credit criterion, the nominated area includes all primary spaces. A space can be excluded if the use of the space (for example, a cinema) is unlikely to lead to glare discomfort.

INT-IEQ-3 Lighting comfort

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Short Report 2. As built documentation And for projects claiming the 'individual control' credit component as 'Not Applicable' 3. Work Setting Schedule

Short report prepared by a suitably qualified professional demonstrating how the Credit Criteria has been met by:

- Providing a summary table that identifies the space serviced by the lighting layout, the location of the area, the maximum maintained illuminance levels as required by the Credit Criteria, the area of the space, the area that is compliant in both square meters and percentage compliance, and identifies the lighting layout and description and whether such layout is typical. The summary table must also demonstrate that the total compliant area is more than what is required by the Credit Criteria; and
- Describing the modelling or measurement methodology and all inputs used.
- If the glare point is claimed, describing the method of glare control, and any modelling or calculations as required.
- . A summary of relevant modelling results must be included in the report and referenced to the appropriate Credit Criteria - drawings of the full modelling results are not required.

As-Built Documentation such as reflected ceiling plan (RCP) drawings or manufacturer's datasheets showing for each lighting layout:

- The size of the area served by each lighting layout and the relevant lighting identifier;
- The location of all luminaires;
- The lamp type for each luminaire;
- The ballast type for each luminaire; and
- The glare diffusing aspects of fittings (if applicable).

Work Setting Schedule that provides a schedule of work settings in the fitout including relevant percentages and justification, establishing that Not Applicable can be claimed.

ADDITIONAL GUIDANCE

This credit addresses the lighting in the finished space. It makes no distinction between lights provided by the base building, or lights provided by the tenant.

Minimum compliance

For the purpose of this credit, lighting with high frequency ballasts refers to luminaires that have either:

- A minimum Class A1 ballast;
- High frequency ballasts for all fluorescent lamps, or
- Electronic ballasts in High Intensity Discharge (HID) lighting.

INT-IEQ-3 Lighting comfort

POINTS AVAILABLE 3

To address the perception of colour, all lamps must have a minimum Colour Rendering Index (CRI) of 80, unless the project team can demonstrate that, in a particular area, the activity is not impeded by a lower CRI. The project team shall support their justification by ensuring their selection complies with the guidance provided Table IEQ-3.1 (taken from) SANS:10114 below:

Table 3 — Lamp colour-rendering groups

1	2	3	4	5
Colour-rendering group	**Colour-rendering index range**	**Colour appearance**	**Examples of use**	
			Preferred	**Acceptable**
1A	$R_a \geq 90$	Warm Intermediate Cold	Colour matching Clinical examinations Picture galleries	—
1B	$90 > R_a \geq 80$	Warm Intermediate	Houses, hostels, restaurants, shops, offices, schools, hospitals	
		Intermediate Cold	Printing, paint and textile industries, demanding industrial work	
2	$80 > R_a \geq 60$	Warm Intermediate Cold	Industrial work	Offices, schools
3	$60 > R_a \geq 40$	Cold	Rough industries	Industrial work
4	$40 > R_a \geq 20$	Warm	—	Rough industries, industrial work with low-order colour - rendering requirements
NOTE If so desired, colour-rendering group 2 can be subdivided into groups 2A and 2B in a way that corresponds to the subdivision of group 1.				

Table IEQ-3.1: Lamp colour rendering groups

General Illuminance

The appropriate lighting levels for each task within each space type is defined as lighting with a maintained illuminance that meets the levels recommended in the relevant standard. The relevant table in the standard for the different space types and activity types are listed in table IEQ-3.2 adapted from SANS 10114-1:2005.

Type of area, task or activity	Illuminance range (Lux)	Space Type (added by GBCSA)
Outdoor circulation and work areas	20 -50	Any
Circulation areas, simple orientation or short temporary visits	50 -150	Any
Rooms not used continuously for working purposes	100 - 200	For example, store rooms
Tasks with simple visual requirements	200 - 500	To be motivated by projects
Tasks with medium visual requirements	300 -750	Office, retail, light industrial
Tasks with demanding visual requirements	500 -1000	heavy industrial
Tasks with difficult visual requirements	750 - 1000	Healthcare
Tasks with special visual requirements	1000 - 2000	To be motivated by projects
Performance of very exacting visual tasks	>2000	To be motivated by projects

Table IEQ-3.2: Typical illuminance ranges for different areas, activities and tasks

The maintained illuminance should be calculated on an area-weighted average for each distinct space or area. A space may contain areas with illuminance levels above what is required in the standard as long as it is balanced to achieve an average of less than the credit requirement over the whole space. The maintained Illuminance values must achieve a uniformity of no less than what is specified in Table IEQ-3.2 with an assumed standard maintenance factor of 0.8. Where maintained illuminance values for a particular space are not specified, the values to be used must relate to the closest type of task as defined in Table IEQ-3.2. These values must be justified in the short report. If a different maintenance factor is used, please submit a CIR prior to the submission for approval.

Demonstrating compliance
Compliance with this credit can be demonstrated through modelling of the whole fitout or just a representative floor or section. The modelled area must be representative of the typical lighting layouts found throughout the entire design. Fitout items that would impact results (such as partitions, equipment, and furniture) must be included in the modelling. Where the model has been simplified, the reason for the simplifications must be justified.

Individual Control

Demonstrating compliance
For this criterion to be satisfied, the individual must have control over the light levels in their work settings. This includes turning the lights on and off and adjusting their light levels. The relevant light is the light shone in the work setting.

One light can be controlled by one or more individual, however, the project team must justify why and how, this is conducive to individual control. For example, in an open plan office a single light can be controlled by two adjacent tables. However, in a hospital, a single light is unlikely to provide satisfactory results when controlled by two individuals. This would also be the case in a classroom, where a single control panel for the entire space is not acceptable, even if the space is zoned.

This criterion can be met by providing a two component lighting system, individual desk lamps, furniture with task lighting, or a more sophisticated digital dimmable lighting control system, provided that the user has control over their environment through a manual dimming switch or a computer interface linked to a digital lighting control system.

Two component lighting system
Two component lighting system is defined as a system where a lower lux level is provided to the general space, with additional task lighting provided to suit individual tasks.

Glare

Options for demonstrating compliance
To consider this credit criterion met, glare from lamps must be eliminated from the nominated area. There are three methods for achieving this - two prescriptive methods, and a performance method.

> Option A (Prescriptive method)
> All bare lamps directing light onto workstations have been fitted with baffles, louvers, translucent diffusers, or other means that directly obscure the lamp from all viewing angles by staff, including looking directly upwards.
>
> Option B (Prescriptive method)
> The Unified Glare Rating (UGR) calculated for the lighting of work spaces on a representative floor does not exceed the maximum values listed in Table 1 - Minimum maintained illuminance values of SANS 10114-1:2005. This is achieved by using luminaires with the same UGR value in the nominated area as listed in the manufacturer's datasheet, and would simply require a schedule of luminaires indicating the acceptable UGR.

Option C (Performance method)
The Unified Glare Rating (UGR) calculated for the lighting of work spaces on a representative floor does not exceed the maximum values listed in Table 1 - Minimum maintained illuminance values of SANS 10114-1:2005.This applies to where the project's design results in UGR values that are different to manufacture datasheets, in which instance the project is required in each instance required to motivate that the design UGR is at an acceptable limit for the specific work setting.

The UGR rating must be calculated in accordance with the procedure outlined in Section 15.3.3 of SANS 10114-1:2005. Either the CIE (International Commission on Illumination) unified glare rating (UGR) system or the British (UK) Glare Index (GI) system can be used to demonstrate compliance with this option.

Glare control by shielding
Opaque material can be used to intercept the light emitted by a lamp in the direction of an occupant's eyes. The lamp luminance will then be shielded from the occupant and cannot cause any glare. The principle of luminance control by shielding is applied in the form of louvres, baffles, reflectors, spillrings, etc., which might be elements of the building structure or within the fitting itself.

Glare control by deflection
An appropriate optical device interposed between the lamp and the occupant's eyes can be used to deflect the light emitted by the lamp away from his eyes into other directions. Optical devices that are frequently used for this purpose are refracting systems (for example, prismatic panels), mirrors (flat or curved types), and reflectors (diffusing or specular).

Glare control by translucence
Translucent material is characterized by its ability to diffuse light while transmitting it. When translucent material is placed between a lamp and the occupant's eyes, this material replaces the lamp as the potential glare source, but is of greater area and lower luminance. Therefore, whereas shielding and deflection hide or redirect the light from the lamp, translucence reduces the luminances without necessarily reducing significantly the intensity of the bare lamps in the relevant directions.

Glare control by indirect lighting
Luminance control by indirect lighting consists in concealing the lamps from view and directing the light of the lamps to elements of the building structure (usually the ceiling and the frieze), which then become a secondary light source of low luminance

UGR rating
Acceptable freedom from glare discomfort is achieved by ensuring that the computed UGR for the installation does not exceed the values recommended for the particular interior space; values which are related to the conditions of the different activities. They are tolerance limits, not absolute values, and are based on good current practice. The UGR recommendations are limited to those locations where the rating can be derived from the tabulated data, i.e. to general systems of artificial lighting.

Two main methods are used to establish the degree of glare in an area:

- The British (UK) Glare Index (GI) system

$$Gl = 10\log_{10} 0{,}45\sum \frac{(L_S)^{1,6}(\omega_S)^{0,8}}{L_b P^{1,6}}$$

- The CIE Unified Glare Rating (UGR) system, described in CIE 117.

$$UGR = 8\log_{10}\frac{0.25}{L_b}\sum\frac{L_S^2\omega_S}{P^2}$$

In both cases,
L_s is the luminance of each individual glare source, in candelas per square metre;
ω_s is the solid angle subtended at the eye by each individual glare source, in steradians;
L_b is the background luminance, in candelas per square metre;
P is the position index for each individual glare source.

The numerical values obtained by both methods are very similar, therefore the same maximum values in the Table apply.

Demonstrating compliance
Compliance with this credit can be demonstrated through modelling of the whole fitout or just a representative floor or section. The modelled area must be representative of the typical lighting layouts found throughout the entire design. Fitout items (e.g. partitions, equipment, and furniture) must be included in the modelling. Where the model has been simplified, the reason for the simplifications must be justified.

BACKGROUND

The Lighting Comfort credit addresses the quality of lighting within a fitout space. The credit addresses five particular aspects of lighting that directly correspond to the most common complaints of building users relating to lighting.

The first key issue addressed is that of the potential health impacts that can result from flickering and the negative impacts on comfort that can result from poor colour temperature and reproduction.

Flickering lights can lead to headaches, eye strain and general eye discomfort. Flickering can be addressed by replacing magnetic ballasts with electronic, or by installing solid state lights. Poor colour rendering is another negative impact resulting from badly lit spaces. Poor colour rendering strains the eyes, and can cause significant discomfort for building occupants. Utilisation of lighting with appropriate colour rendering relative to space-use results in higher levels of lighting comfort.

The second key issue is that of the amount of general lighting levels within a space (general illumination). Different spaces and different activities require different amounts of light. Fitout spaces often encounter problems of too little or too much light. Projects must therefore consider a space's intended use, and consult the Australian Standard for Lighting when developing a fitout's lighting design.

The remaining two impact issues, occupant control and glare discomfort, relate to lighting in spaces where occupants spend significant amounts of time. Office spaces, patient areas and classrooms, are all examples of spaces where lighting issues can significantly impact learning, health or productivity outcomes.

Studies have shown occupants do use the individual lighting controls to adjust the illuminance for different tasks, and that there are wide differences between the preference of individuals. The ability to dim the lighting was considered highly desirable and made the task seem less difficult. Additionally, use of the lighting controls saved energy.

Personal control lets users set light levels to their personal preference and, as a result, gain more control over lighting conditions. Personal-control strategies include switching and dimming and can involve multiple layers of lighting, such as task lighting.

Glare affects visual performance negatively. It can be described as "light out of place" and can be caused by any source of excessive luminance in the visual field. The source of glare could be the sky viewed through windows in walls and roofs, or the luminaires in the room, and might be seen either direct or by reflection from polished surfaces. Glare is not always immediately apparent; its deleterious effects sometimes become evident only after long periods of sustained and exacting work.

Under the high levels of illuminance characteristic of modern installations, little or no direct disability to vision may occur, but there could well be serious discomfort caused by the complex interplay of the luminances, sizes and positions of the light sources as seen against the luminance of the general surroundings.

REFERENCES & FURTHER INFORMATION

The Illuminating Engineering Society of North America (IESNA) (2000), The IESNA Lighting Handbook, 10th ed., Publication Department IESNA, New York, USA.
http://www.ies.org/handbook/

New York City Department of Design and Construction (2006) Manual for Quality, Energy Efficient Lighting.
http://www.nyc.gov/html/ddc/downloads/pdf/lightman.pdf

“Indoor Office Lighting-Lighting Design”, Knisley, Joe, ECM Magazine,
http://ecmweb.com/mag/electric_practical_guide_indoor/

“Lighting Controls: Personal Switching, Dimming”, DiLouie, Craig, Facilitiesnet magazine,
http://www.facilitiesnet.com/lighting/article/Lighting-Controls-Personal-Switching-Dimming--9153#

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-IEQ-4 Visual Comfort

POINTS AVAILABLE **3**

AIM OF CREDIT

To encourage and recognise the delivery of well daylit spaces that provide high levels of visual comfort and views to occupants.

CREDIT CRITERIA

Up to three points are awarded independently as follows:

Daylight
One point is awarded where:

- A minimum of 30% percentage of the nominated area meets a Daylight Factor (DF) of at least 2.0%

OR

- A minimum of 30% of the nominated area meets a Daylight Illuminance (DI) of at least 250 lux, as measured at finished floor level (FFL) under a Uniform Design Sky

OR

- A minimum of 30% of the nominated area meets a Daylight Illuminance of at least 300 lux based on an annual dynamic simulation model, for 50% of the standard occupied hours (Daylight Autonomy (DA) incremental method).

Daylight Glare Control
One point is awarded where:

- In the nominated area, the glare from daylight through all viewing façades is reduced through any combination of: blinds (to have a visual light transmittance (VLT) of ≤ 10%), screens, fixed shading devices, or other means.

Views
One point is awarded where:

- A minimum percentage of 60% of the nominated area has a direct line of sight to a high quality internal or external view.

For purposes of this credit, **Nominated area** is defined as **Occupied Space**.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. As built drawings *Where the point for daylight is claimed:* 3. Daylight modelling report *Where the point for glare control is being claimed:* 4. Manufacturer data sheet(s)

INT-IEQ-4 Visual Comfort

POINTS AVAILABLE 3

GBCSA's Submission Template prepared by a suitably qualified professional that describes how the Credit Criteria for Daylight have been met by:

Where the point for glare control is being claimed:

- Identifying all spaces within the Nominated Area where glazing elements are provided and glare is to be controlled; and
- Nominating the solution(s) used to minimise glare in each space;

Additionally where internal blinds/screens are used:

- Confirming that the blinds/screens provided have compliant VLT and that occupants can control the operation of the blinds/screens.

Where the point for views is being claimed:

- Providing calculations of the total Nominated Area within eight metres of vision glazing and compliant day lit atrium; and
- Providing a summary table demonstrating that compliant nominated area jointly accounts for the stipulated percentage of the nominated area.
- The amount of compliant area;
- The lines of sight showing that no obstructions exist;
- Any internal features, if claimed, or, showing that no obstructions exist externally.

Please note that a summary table & calculations must be submitted as supporting documentation to the submission template

Daylight modelling report showing the daylight factor or daylight illuminance for the claimed spaces and

- Providing a summary table showing each space or floor, their nominated area, and the compliant area in both square meters and as a percentage basis; and
- Providing the daylight model showing the amount of floor area that is compliant, and the daylight values.

Where the point for daylight is claimed, and manual calculations are used to demonstrate compliance, the drawings must show:

- The height and length of windows and any area of any skylights;
- The window properties;
- The amount of floor area that is compliant.

As-built drawings marked up and showing the following:

- Location of all blinds / shutters, or any glare control devices
- Floor plans marked up to show the location of vision glazing and all Nominated Area within eight metres of vision glazing or daylight atrium and indicating sight lines where relevant;
- Elevations showing the location and dimensions of vision glazing.

Manufacturer product datasheet(s) or equivalent indicating the type and visual light transmittance of the blinds/screens

ADDITIONAL GUIDANCE

As glare can be experienced from any orientation, all facades must meet the credit criteria regardless of the façade / atrium orientation.

The following definitions and exclusions apply:

Exclusions
For the purposes of this credit, spaces that for functional reasons do not allow daylight in the space are excluded. This includes, but is not limited to theatres, cinemas, performance areas (stages), art galleries, and archives.

User
The user, for purposes of this credit, is defined as the user / employee who will be using a single piece of furniture or equipment non-continuously for at least two hours during a given day or in the case of education and healthcare facilities the users include students and patients.
For example:

- In an office, the project user's day to day activities in a primary space occur in workstation. Therefore at least 30% of the workstations must have access to sufficient daylight.
- In a retail environment, the project users are considered to be the retail staff. Therefore, they must have access to daylight to perform the day to day activities. In most retail environments, these are the cashiers' tills, and the staff rooms.

Overcast sky
Overcast sky is a defined as a sky with a completely closed cloud cover (100 %). This is the sky condition applied in daylight factor calculations (ISO 15469:2004 or CIE S 011:2003).

Uniform sky
Uniform sky represents a sky with a constant value of luminance. Thus, no matter where in the sky you look, the model has the same value (ISO 15469:2004 or CIE S 011:2003).

CIE Design Sky
Figure IEQ-XX illustrates the various CIE design skies that are used for daylight modelling. For the purposes of Green Star SA, the Daylight Factor method must be used with either the Overcast Sky or Uniform Sky, however for the Daylight Illuminance method, a Clear Sky must be used.

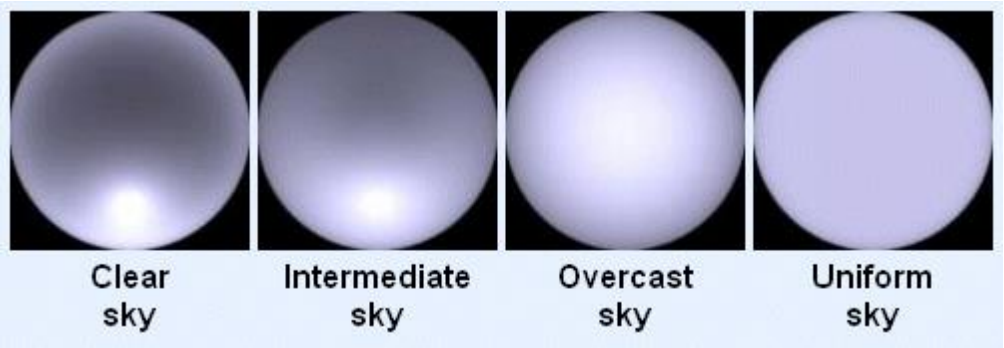


Figure 1: Illustration of the different CIE design skies.

Viewing Façades
Viewing façades, for purposes of this credit, are defined as any part of the building's façade through which occupants can view the external environment. In walls, glazing and perforated façades are considered viewing façades. In the roof, transparent skylights are considered viewing façades. Translucent sheeting in the roof and walls is excluded from the credit.

Nominated Plane
This nominated plane must be justified based on the type of activity held in each space, e.g. for offices the nominated plane is 720mm AFFL. Where a space is purpose built for a specific activity, the nominated plane and standard occupancy hours can be selected by project teams provided justification is given.

Nominated Hours
The business day of 8am to 6pm is to be used as a standard day for calculating 80% of the

nominated hours. If the space is purpose built for a specific activity, nominated hours can be selected by project teams. These must be justified based on the type of activity held in each space.

Daylight Glare Control
A combination of the methods outlined below, can be used to achieve this credit.

Option A
Fixed devices must be shown to shade the nominated plane, 1.5 meters in from the centre of the viewing façade. The nominated plane must be shown to be shaded from direct sun for 80% of the nominated hours for each day of the winter and spring equinox as well as the summer and winter solstices.

Option B
Blinds/Screens must be either manual or automated. Internal, in-glazing, or external blinds may also be used.
Where automated blinds are used, these can be controlled either by a management system or by a manually activated switch. All automated blinds and screens must be equipped with a manual override function accessible by occupants for each individual space.

All blinds must meet the following criteria:

- The blinds must eliminate 95% of all direct sunlight penetration;
- Blinds must be controlled by all affected occupants within each space within each individual space; and
- Blinds must have a visual light transmittance (VLT) of ≤ 10%.

Option C
A combination of tinted glazing and fixed shading devices can be used to meet the credit criteria, provided that it will result in a reduction of glare to the user equivalent to that which is stated in the credit criteria. The following must be provided:

- A description of the methodology used to create the daylight glare model and the software used;
- A description of how the selected points for modelling represent the areas that would be effected by glare;
- All terms clearly defined;
- All names, types, glazing properties, and location of glazing; and
- Justification of how the results in the model are equivalent to that of the credit criteria.

Daylight - Sufficient daylight relevant to their activities
The users must have good access to daylight in order to perform their activities. There are three methods for achieving this criterion, one is a prescriptive method, and the other two are performance methods. A combination of methods is acceptable for demonstrating compliance.

Option A - Compliance using Daylight Factor

The Daylight Factor describes the proportion of internal illuminance over external illuminance, expressed as a percentage.

Daylight Factor = Internal Illuminance (Lux) / External Horizontal Illuminance (Lux) x 100%

(Where the External Horizontal Illuminance is from a point with an unobstructed hemispherical view of the sky).
The Daylight Factor is a useful method for benchmarking the effectiveness of a design, because it measures the proportion of daylight entering a building and is not climate specific. A typical external horizontal illuminance might be 10,000 Lux for many parts of South Africa. A space achieving a

daylight factor of 2.0% means that internal light levels average 200 Lux at this particular outside lighting level.

Daylight Factor (DF) is most commonly calculated using CIE (Commission International de l'Eclairage) overcast sky. However Green Star recommends the use of a uniform sky as it allows easier comparison with the Daylight Illuminance method. Calculation using CIE overcast sky is acceptable, but this method will usually give lower results than that calculated using a uniform sky.
Note that is the software does not have a preset option for a uniform design sky; it can often be set up manually as follows:

Design sky values should be derived from a statistal analysis of outdoor illuminance levels for the particular project location, representing a horizontal illuminance level that is exceeded 85% for the time between the hours 8am and 6pm through the working year. Thus they also represent a worst-case scenario that a building can be designed to and ensure it will meet the desired light levels at least 85% of the time.

With a uniform sky, no matter where in the sky you look, the sky has the same illuminance value. The shading effect of the immediate surrounding building and any obstructions still have to be taken into account.

Option B - Compliance using Daylight Autonomy

The Daylight Autonomy (DA) at a point of interest in a building is defined as the fraction of the occupied times per year, when the required minimum illuminance level at the point can be maintained by daylight alone. The percentage of the nominated area has a Daylight Illuminance (DI) of at least 300 Lux based on an annual dynamic simulation model, for 50% of the standard occupied hours.

The daylight autonomy (DA) model can be done assuming that all shading devices are static, including all blinds. Blinds can be assumed to be open. The climate data, and standard hours of occupancy used must be the same as that used in the 'Greenhouse Gas Emissions' credit. Time intervals must be set at intervals of no more than one hour.

There are a number of dynamic simulation software programs that can be used to show compliance with the credit criteria. Daysim, ESP-r, Lightswitch Wizard, and SPOT (>ver 4.0) can be used. Where other programs are used, the project team must demonstrate that it is based on the radiance simulation engine, and that it uses the statistical sky, the daylight coefficients & Perez, or the annual CIE sky simulation algorithms.

Option C - Compliance using Daylight Illuminance
As an alternative method of compliance, light levels inside the building should be simulated at 12 noon on the equinox (21st March/September). A clear sky should be assumed. The simulation should be carried out on a 1m calculation grid and areas where the light level calculated at 720mm AFFL is above 250 Lux can count towards the credit.

Option D - Deemed to Satisfy

It is acceptable to calculate the daylight access using manual calculations for simple designs. To use manual calculations, there must be negligible overshadowing of glazed areas and separate calculations must be provided for each space.
A line designating the compliant floor area is to be drawn at a distance of 1.5 times the height of the windows from the wall. Any area within this distance is considered compliant.
The following are conditions and assumptions to be considered:

- The line of compliant floor area may not be drawn past solid or glazed partitions.
- Any partition or furniture over 1.5m in height must be included and treated as a partition.
- External shading must not impinge a direct 45 degree line from the window. This must include surrounding buildings. Glazed areas where this condition applies should be considered solid for this manual calculation.

Note that this method is likely to yield more conservative results i.e. less daylight coverage. A full computer model may reveal more accurate figures and indicate greater daylight penetration than the manual method.

Manual Calculation for Daylight Factor:
While daylight modelling is encouraged because it gives much better information on the spread of daylight within the space, the manual calculation method described in BS 8206 Part 2 is accepted as an alternative. To use this method, there must be limited overshadowing of glazed areas and separate calculations must be provided for every occupied space.

Where two or more windows in a room face in different directions or have different obstructions, the daylight factor for each window must be calculated individually and the results summed.

Hand calculations must be provided for all rooms and must be summarised in a list clearly demonstrating that a daylight factor of 2% is achieved for the relevant percentage of nominated area claimed.

The daylight factor D is estimated using the following equation:

$$D = \frac{T\ Aw\ \theta}{A\ (1-R^2)}$$

Where:

T = the diffuse light transmittance of the glazing, including a correction factor for the effect of dirt (see below);

Aw = the glazed area of the window in m², including a correction factor for the effect of the frame (see below);

θ = the angle subtended by the visible sky (degrees). It is measured in a vertical plane normal to the glass, from the window reference point which is at the centre of the window as illustrated below

A = the total area of the ceiling, floor and walls, including windows, in m²; and

R = the area-weighted average reflectance of the interior surfaces (A). In initial calculations for rooms with white ceilings and mid-reflectance walls, this may be taken as 0.5.

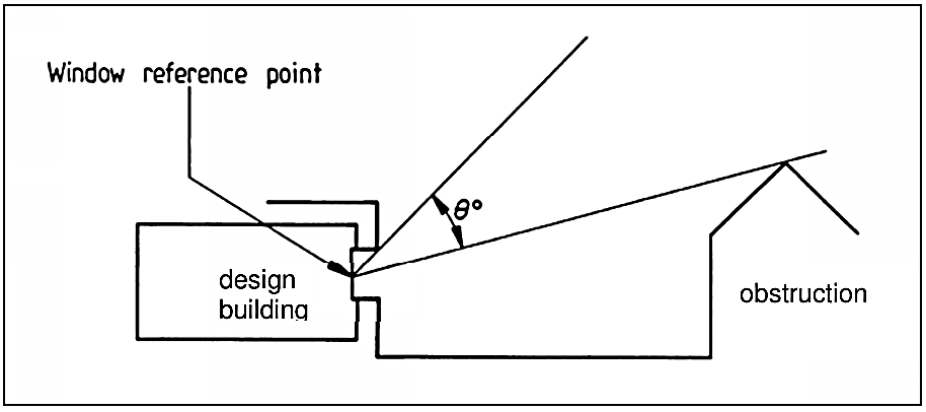


Figure 2: Diagram illustrating angle to be used in hand calculation of daylight factor

Modelling guidance

Permanent partitions must be included within the modelling of this credit. Temporary partitions can be excluded only if they are shown to not be in place for most of the occupied hours in the building (for instance, auditorium partitions). All fitout partitions must be included. Large fitout items, including workstations must be included. Movable items can be disregarded.

Calculation Grid
All software calculates Daylight Factor at points on a plan. Some systems calculate the Daylight Factor for an almost infinite number of points, providing very accurate results. Other modelling programs request the user to identify the points matrix on the floor plan. If using computer modelling to calculate the Daylight Factor, it must be calculated for at least 1 point per each square metre of floor area.
A maximum $1m^2$ grid must be overlaid over the floor plan to determine these points and at all perimeters, each $1m^2$ must begin at the façade. Daylight factor is then calculated in the centre point of each box in the grid.

Reflectance Values
The following reference reflectance values are to be used whenever actual reflectance values are not known. If the actual values substantially differ from these reference values, these must be justified. Inputs used for this credit must be consistently referenced throughout the submission.

- 0.2 for floor (assumes a light-coloured flooring);
- 0.5 for walls (assumes walls are painted white); and
- 0.7 for ceilings (assumes ceilings are painted white).
- 0.3 for internal partitions
- 0.2 for ground

Overshadowing
Overshadowing must be taken into account in the calculations. Projects must include shading from any shutters or overhangs.

- A nearby building or feature (such as a cliff face) must be accounted for in overshadowing where the building height is at least a third of the height of the proposed building design; and
- where the angle between the nearest point at the top of that building and the nearest point base of the proposed building is greater than the 21 June (winter) midday altitude of the sun.

Demonstrating Compliance
Compliance for this credit cannot be demonstrated by measurement of actual daylight levels in the building. Compliance with this credit can be demonstrated through modelling of a representative floor. The modelled floor must be representative of the typical daylight access found throughout the entire project, and account for overshadowing by adjacent buildings. Where the model has been simplified, the reason for the simplifications must be justified. The engineer responsible for modelling must then justify how the floor is representative of the design, and certify that all other floors comply with this criterion.

Views

The sight line is to be measured by extending a perpendicular line from the atrium or window; a line at 45 degrees can be used at the corners of atria or windows, as per Diagram IEQ-4.2. Sight lines must take into account thickness of external walls (there must be a clear line of sight to the outside). The area behind any solid portion of the perimeter of the external wall or atrium must be excluded from the calculations.
Windows below 720mm or above 2400mm AFFL, including skylights should not be included in the calculation. Spaces where daylight is not allowed for functional reasons (see definition above) are also excluded.

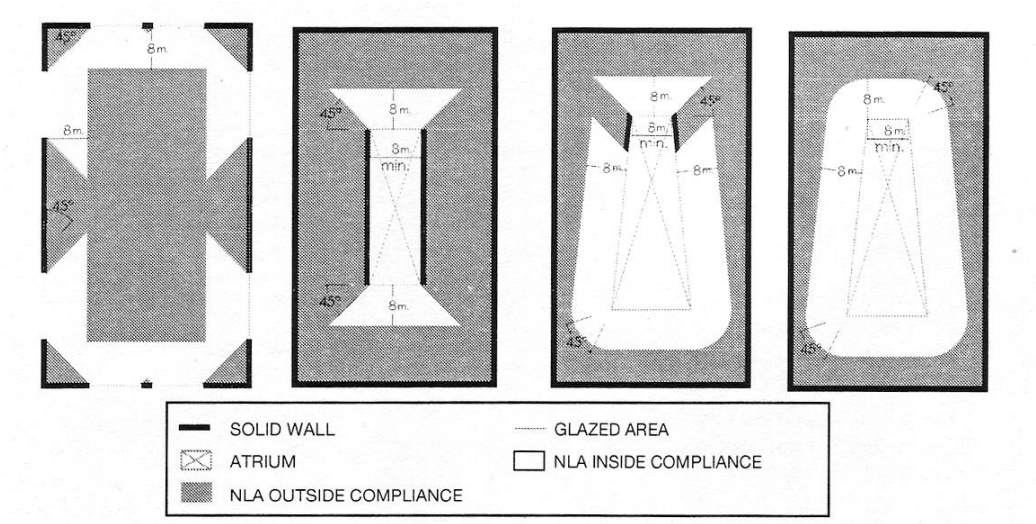


Figure 3: Diagrams illustrating areas that comply with the Credit Criteria given various atria shapes

External views

Where compliance is achieved through external views, the view must extend from the user to the outside and be unblocked by any permanent solid structure or high partition (i.e. there must not be another building within eight metres).

Day-lit Atrium

Where compliance is achieved through a day-lit atrium, the following must be achieved:

- The atrium must be at least 8 metres wide at any point to which the line of sight is demonstrated;
- The daylight levels within the atrium must be in accordance with the compliance thresholds of the IEQ-4 Daylight credit. See overleaf for details on how to address scenarios where less than 100% of the atrium space is compliant with the IEQ-4 Daylight thresholds.
- If the nominated space opens directly onto the atrium, calculation must be made from the vision glazing or from the internal perimeter of the atrium if no internal glazing is installed;
- The area behind any solid portion of the atrium perimeter must be excluded from the calculations;
- The base of the internal atrium is considered to be at the lowest level of the occupied space (even if the actual base of atrium is several floors lower)

Proportioning of Atrium daylight compliance

Project Teams may apply a 'proportional-based' method to determining compliant views claimed from an appropriately sized day-lit atrium. This method correlates the daylight compliant percentage of the horizontal plan area (at the level/floor analysed) of the atrium (at a particular level) with the compliant views claimed.
Where X% of the adequately sized day-lit atrium horizontal plan area is adequately day lit in accordance with the compliance thresholds from the IEQ-4 Daylight credit, then only X% (i.e. the same percentage) of the maximum compliant UA external view for that floor (determined from the atrium perimeter), may be claimed.

For example, a building has three identical floors (680m² nominated area each) with an adequately sized atrium. An analysis of the maximum external view nominated area claimed due to the atria (only) on each floor indicates compliant nominated area of 100m² on each floor. Daylight modelling indicates that on the top level, 94% of the horizontal plan area of the atria achieves the compliance

thresholds from the IEQ-4 Daylight credit, and on the middle level this reduces to 68% and on the lower level this reduces to 51%. Using the proportional based method, the external view nominated area which may be claimed for the top floor is 100 x 94% = 94m², the middle floor 100 x 68% = 68m² and the lower floor 100 x 51% = 51m².

BACKGROUND

This credit addresses factors that influence user satisfaction, comfort and wellbeing within a fitout including glare, access to daylight and external views.

This credit encourages the provision of natural light, as daylight can positively influence the health of the user, improve efficiency and productivity. International research has found that students studying in environments with natural light have better attention rates, are less prone to being distracted or disruptive and have a better health than fellow students in artificially lit rooms.

The impact of circadian rhythms on our productivity and health is well documented. These rhythms are based on the body's understanding of the time and day, which is driven by access to daylight. The natural changes in the light that occur over the course of the day drive the circadian rhythms and remind the body that it is not evening.
Natural light can also reduce the need for artificial lighting and thus energy saving. However direct sunlight or patches of sunlight on internal surfaces, including reflections of windows on computer screens, can also cause problems with glare.

Research proves that conventional internal blinds are marginally effective, so this credit requires that as a condition that this is addressed by fixed shading, screens, daylight control, tinted glass or blinds, but still allowing for natural daylight penetration to the fitout.

Daylight Autonomy has been included as an indicator as it provides a more accurate representation of the availability of daylight in a space throughout the year and recent advances in software development is making the extensive simulations required to determine the DA more accessible to projects. In combination with ray tracing software, light bouncing interventions (complex or simple) can now be reflected in a design to a level of accuracy compared to other indicators. This is particularly relevant in predominantly sunny climates like South Africa where energy and indoor environmental quality performance can benefit significantly through optimisation of daylight within buildings.

This credit also encourages external views and recent studies have linked access to views to the relief of boredom, anxiety, stress as well as to greater productivity.
Windows not only allow daylight to penetrate the interior space, but provide occupants with a greater sense of time, weather and access to contextual focal points in the distance. Access to views can be provided internally, through the provision of line of sight to a courtyard or atrium, or externally.

REFERENCES & FURTHER INFORMATION

Haworth (Why Daylight and Views Matter pdf)
http://www.haworth.com/home/resources/research/white-papers

CCSE (Daylight for Energy Savings and Psycho-Physiological Well-Being in Sustainable Built Environments) November 2008
www.ccsenet.org/journal/index.php/jsd/article/download/1198/1160

Daylight Modeling
http://www.daylightmodeling.com/faq.htm

CIBSE (The Chartered Institution of Building Services Engineers, UK) (1999) Daylighting and Window **Design**
http://www.cibse.org/

IESNA (Illuminating Engineering Society of North America), Lighting Handbook, 10th edition
www.iesna.org/

British Standard BS 8206: Part 2: 1992, Lighting for Buildings: Code of Practise for Daylighting
http://www.bsi-global.com

Public Interest Energy Research (Pier) Program for the California Energy Commission – Daylight Metrics: PIER Daylighting Plus Research Program – February 2012
http://www.h-m-g.com/DaylightPlus/Daylight_Metrics.htm

Massachusetts Institute of Technology (MIT) (2006), 'Daylight Savings: Building with Natural Light', ScienceDaily, 15 November 2006
www.sciencedaily.com/releases/2006/11/061114194440.htm

Standards Australia (2006), AS/NZS 1680.1-2006: Interior and workplace lighting – General principles and recommendations
www.standards.org.au

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-IEQ-5 Acoustic quality

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise fitouts that are designed to provide appropriate acoustic qualities to enable the functionality of the space.

CREDIT CRITERIA

Two points are available in this credit. Each criterion is independent from the other. Each criterion is only awarded if it is applicable and the relevant credit criteria are met.

Internal noise levels

One point is awarded where:

- Internal sound levels in the nominated areas are appropriate and relevant to the activity type in each room in accordance with SANS 10103:2008. This includes the influence of all sound generated by the building systems and the outside constant noise sources such as external mechanical plants that may be controlled or implemented by the tenant or the building owner (if the building owner is the applicant and also occupies more than 75% of the building). Where a sound masking system is installed, the SANS 10103:2008 reference is not applicable. A maximum noise level of 48 dBA is allowed (with maximum +-2 dB variance throughout the installed area) in this case.

Reverberation

Half a point is awarded where:

- The nominated areas have been built to provide appropriate sound reverberation characteristics not to impact on the functionality of the spaces in accordance with AS/NZS 2107.

Interference

Half a point is awarded where:

- The interior of the building has been designed to minimize noise interference in public spaces or co-occupant spaces such as open plan offices or libraries; this may include design and/or management measures such as quiet spaces for private conversations (or telephone rooms), installation of multi-zonal intelligent sound masking systems, effective sound barriers between spaces or workstations and managing behaviour changes.

Speech privacy

An additional point is available under Inn-2 'Exceeding Green Star SA Benchmarks' related to this credit where:

- The enclosed spaces created provide appropriate speech privacy levels for their intended function, in accordance with the ‘Prescriptive’ or the ‘Performance’ method described below.

INT-IEQ-5 Acoustic quality

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance
1. Acoustic Report.

Acoustic report prepared by a Qualified Acoustic Consultant that describes how the Credit Criteria have been met by:

For the Interior Noise Levels criterion

- Providing a table summary of the applicable requirements of SANS 10103:2008 pertaining to equivalent continuous rating levels for all example areas;
- Describing all relevant internal noise sources and quantified levels from building services, or confirming lack thereof;
- Describing the supporting external noise level measurements and measurement methodology, or justification why external noise level measurements may not be required;
- Describing the noise control features required to achieve the Credit Criteria, in each Example Area with references to relevant supporting documentation;
- Providing a summary table of the Example Areas tested and the measured internal noise levels in each space, clearly indicating compliance with the credit criteria;
- Confirming the test methodology used, the conditions under which the testing was done, including the time of testing and confirming that the spaces tested are representative and 'worst case'
- Providing a conclusion that supports compliance with the Credit Criteria.
- If a sound masking system is installed, demonstrate that the measured sound spectrum curve has been calibrated to minimise annoyance while the masking level is set at maximum 48 dBA (with maximum +- 2dB variance) in the example areas defined.

For the Reverberation criterion

- Providing a table summary of the applicable requirements of AS/NZS 2107 for each of the Example Areas in the Area Categories
- Demonstrating through calculation that the reverberation time is in compliance with the Credit Criteria; OR
- Demonstrating through acoustic measurements that the reverberation time is in compliance with the Credit Criteria.

For the Interference criterion

- Describing the initiatives implemented to address Interference for each Example Area (see additional Guidance)
- If a sound masking system is installed, demonstrating that the measured sound spectrum curve has been calibrated to minimise annoyance while the masking level is set at a maximum of 48 dBA (with maximum +- 2dB variance) in the example areas defined.

For the Speech Privacy criterion

- Claim only if applicable.
- Nominating the 'acoustically sensitive areas' where speech privacy is important, e.g. Executive boardrooms, Client consulting rooms, Human resource interview rooms, Financial institution consulting rooms, Legal firm consulting rooms etc.
- Confirming that the nominated 'acoustically sensitive area' have been designed or implemented to meet the credit criteria under Method A: 'Prescriptive' or Method B: 'Performance' described under ADDITIONAL GUIDANCE below, with reference to supporting

documentations such as design drawings or measurements and calculations according to a 'Prescriptive' or 'Performance' method.

ADDITIONAL GUIDANCE

Area Categories and Example Areas in the nominated area

The qualified acoustic consultant is to provide a baseline document including a table that categorizes the nominated areas and the relevant acoustic properties associated with each area. This must be in accordance with the recommended values as listed in SANS10103:2008, SANS10218:2012 Part 1 and AS/NZS 2107. An Example Area is to be identified for each Area Category, with a short description justifying the choice, and used to demonstrate compliance. An Example Area must represent the worst case scenario in its Area Category.

The Qualified Acoustic Consultant is to audit whether the example chosen for each category does indeed meet the specific credit requirement. Only when all the Example Areas of all Area Categories meet the specific credit criteria, will the points be awarded.

Qualified Acoustic Consultant

'Acoustic Consultant' in South Africa is not a recognised professional qualification by relevant registration authorities for Engineering and the Built Environment. To ensure the Acoustic Consultants assisting on the rating process have the relevant experiences and minimum professional standings, the 'Qualified Acoustic Consultant' must have a thorough knowledge of the specific credit area(s) and must be a registered Professional Architect or Professional Engineer or Professional Technologist with relevant registration institutions, or have a relevant tertiary qualification from a publically recognized institution.

Interior Noise Levels

Noise sources to be included are building services equipment that may be controlled or implemented by the tenant or the building owner (if the building owner is the applicant and also occupies more than 75% of the building). Regardless of ventilation mode, occupational noise can be disregarded.

All calculations must be carried out with ventilation openings open and any extract fans running as required for normal operation of the building.

Example Areas	**Equivalent continuous rating level for ambient noise**		**Recommended reverberation time** [T]
Types of occupancy or activity	**Design** [dBa]	**Maximum** [dBa]	
Offices – general / open	40	45	0.4 to 0.6
Offices – private	35	40	0.6 to 0.8
Conference room	30	35	0.6 to 0.8
Corridors / Lobby / Reception	40	50	0.4 to 0.6
Cafeterias / Restaurant	45	55	Note A
Classroom	35	40	0.7 to 1 (Note B)
Lecture or assembly hall <250 seats	30	35	0.7 to 1 (Note B)
Lecture or assembly hall >250 seats	25	30	0.6 to 0.8
Healthcare consulting room	40	45	0.4 to 0.6
Healthcare ward space	30	40	0.4 to 0.7
Retail – small	45	50	Note A
Retail – Department store / Supermarket	50	55	Note A

Table 1: Design and Maximum Rating Levels for Ambient Noise and Reverberation Time for Different Areas of Occupancy or Activity Indoors

NOTE A: Requires that reverberation times be minimised as far as practicable.

NOTE B: For other occupancy spaces, see SANS 10103:2008, Table 1 and AS/NZS 2107:2000 for applicable values.

External noise level measurements

The GBCSA does not explicitly require that external noise level measurement surveys be conducted. It is at the discretion of the Qualified Acoustic Consultant if external noise level surveys are required to appropriately inform the acoustic design response. Where not deemed necessary, the Qualified Acoustic Consultant must justify within the documentation as to why external noise level measurement surveys are not required

Where deemed necessary and conducted, external noise level surveys must be conducted on the actual project site and not on a neighbouring site, in order to accurately reflect true conditions. The period of measurement is also at the discretion of the Qualified Acoustic Consultant, however it must be selected such that all potential sources of noise (of concern) are measured

To consider this credit criterion met, the internal sound levels in the Example Areas are to be no more than 3 dB above the "Maximum equivalent continuous rating level" allowed.

Equivalent continuous rating level ($L_{Req,T}$)

Typically, Sound energy fluctuates continuously in nature. An Equivalent Continuous Rating Level is a single number representation of the fluctuating sound energy over a period of time.

Reverberation

Reverberation time (R_{T60}) of an enclosure, for a sound of a given frequency or frequency band, is the time that would be required for the reverberantly decaying sound pressure level in the enclosure to decrease by 60 decibels.

To consider this credit criterion met, the reverberation time in the Example Areas must be below the maximum stated in the "Recommended Reverberation Time" provided in Table 1

Note: although a 0.6 to 0.8 sec range is recommended in AS/NZS 2107:2000 for rooms with teleconferencing applications, a reverberation time range of maximum 0.6 sec should be achieved.

Where **"Note A"** applies, which requires that reverberation times be minimised as far as practicable, acoustic solutions should be installed to meet the relevant reverberation time proposed by the Qualified Acoustic Consultant.

Interference

To consider this credit criterion met, it must be shown that the interior environment includes design features that minimise the noise interference (people talking, equipment noise, telephonic conversations, etc.) to the primary activities of the space, as well as describe how they effectively improve acoustics. Example solutions include, but are not limited to: sound screens with adequate height (typically 1500mm off the floor); Class A (or Noise Reduction Coefficient (NRC >0.9) acoustic ceiling; a well-designed and calibrated multi-zone intelligent sound masking system; the provision of "quiet rooms" or "telephone rooms".

Speech Privacy (innovation point)

To consider this credit criterion met, the project must address speech privacy and noise transmission between spaces. This criterion applies to acoustically sensitive spaces. Where no acoustically sensitive spaces exist; such as in the case of a small retail shop; the point is "not applicable" and is not available as an innovation point..

There are two methods for demonstrating compliance with this criterion: a prescriptive method and a performance method.

Method A (Prescriptive)

The partition between acoustically sensitive room and the surrounding spaces should be constructed to achieve a weighted sound reduction index (R_W) that complies with SANS 10218:2012 Part 1.

Method B (Performance)

The sound insulation between acoustically sensitive rooms and other occupied spaces complies with $D_W + LA_{eq},T > 75$

This is defined as:

- D_W is the weighted sound level difference between the two spaces
- LA_{eq},T is the A-weighted design (or measured) indoor ambient noise level in the space adjacent to the acoustically sensitive example room.

The sound test from which D_W is derived must be measured in accordance with SANS 140-4:1998. Measurement must be based on finished rooms, accounting for any carpets and acoustically absorbent ceilings specified. The measurement can be conducted in either furnished or unfurnished spaces.

Noise reduction materials

Reverberation time requirements can generally be met through the use of sound absorptive materials and other surfaces. The performance of a sound absorptive material is quantified by means of a Noise Reduction Coefficient (NRC). The most common application of sound absorptive materials is suspended ceiling tiles (Typically with a rating of NRC=0.7), but other sound absorptive panels may be used elsewhere in the room to meet the area requirements. The most basic form of absorptive material is glass wool (a 40mm thick, 47.5kg/m^3 glass wool batt may provide NRC>0.9)

Note: the mechanism of sound absorption is completely independent of the mechanism of sound insulation.

BACKGROUND

The Acoustic Comfort credit seeks to achieve an acoustically functional environment through design that is sensitive to a fitout's intended use. The credit also seeks to minimise sound reverberation and achieve optimal privacy in rooms where it is required, such as in the case of meeting rooms.

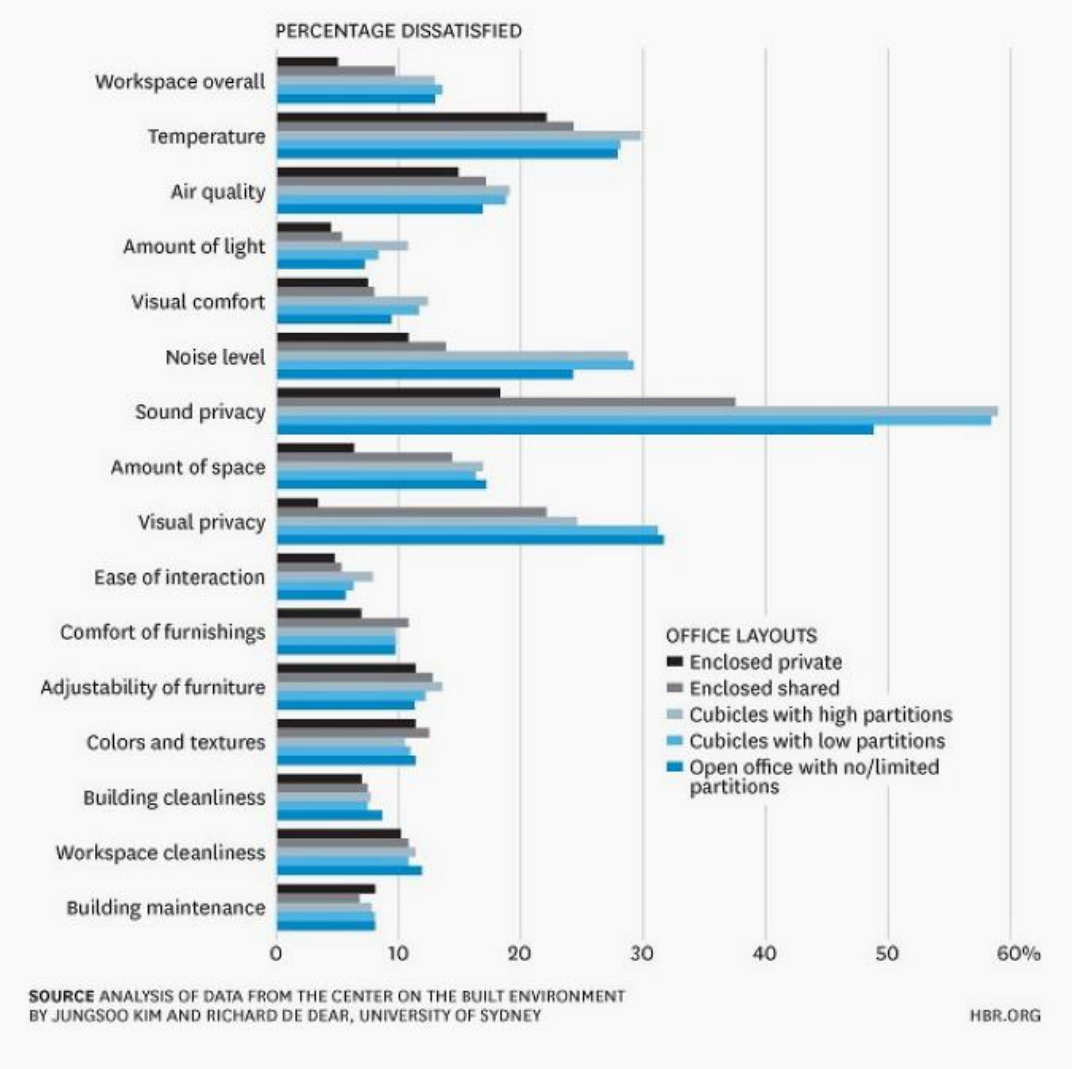
Internal ambient noise is a significant factor in terms of occupant satisfaction and wellbeing. It can have a major influence on productivity in the workplace and is recognised as a health hazard by the World Health Organisation.

Ambient noise level is a measure of ‘background sound’, usually of low intensity and present for the majority of the time. In a building, ambient noise refers to the noises caused by things such as HVAC operations, equipment, lighting systems, computers and general activity sounds, however it excludes specific 'one-off' sources, such as a person talking in an adjacent space (occupational noise). Excessive levels of ambient sound can cause stress and impede an individual’s productivity or comfort.

Sound is measured in terms of pressure levels to which the human ear is extremely sensitive. The measure used is the decibel (dB). On this scale 0dB corresponds to the lowest possible audible sound and 140dB to the level at which pain will occur. The scale is not linear and an increase of 3dB corresponds to a doubling of the sound intensity whilst an increase of 10dB is perceived as an approximate doubling of the loudness of the sound.

The level of ambient sound may affect speech communication or, in extreme conditions, the effectiveness of a public address system. Control of the ambient sound level and limiting reverberation times are required to achieve good communications. On the other hand, spaces such as offices and restaurants may benefit from some continuous ambient sound, which may assist in

providing privacy between adjacent groups of people or in reducing distraction where people are concentrating on some particular task.



Work Space Satisfaction Study

A round table discussion called “Enhancing the Workplace with Activity Based Acoustic Design” was held at the European facility management conference in Prague on May 23rd 2013. Topics discussed were the need to see acoustic design as an enhancer of the activity provided by the workplace; standards available, such as the ISO3382-3; R&D; on the impact of acoustics on people. Finally, the benefit on the business, thanks to less time lost via unnecessary acoustic interruptions was highlighted and discussed.

According to delegates at the recent European Facilities Management Conference (EFMC 2013) held in Prague, around 24 days of working time per employee per year are lost due to unnecessary interruptions caused by unwanted noise. Noise that could have been avoided with the proper acoustic treatment. They also estimated that at an average cost of 1.36 Euros per minute per worker, lost time due to poor acoustics could be costing businesses around 15,000 Euros per worker per year.

REFERENCES & FURTHER INFORMATION

SANS 10103:2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication

SANS10218:2012 Part 1 - Acoustical properties of buildings Part 1: Grading criteria for the airborne sound insulation properties of buildings

AS/NZS 2107:2000 The measurement and rating of environmental noise with respect to annoyance and to speech communication

Workspace satisfaction: The privacy-communication trade-off in open-plan offices - Jungsoo Kim and Richard de Dear – Faculty of Architecture, design and Planning, The University of Sydney, Australia, Journal of environmental Psychology 36 (2013), p18-26

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-IEQ-6 Reduced Exposure to Pollutants

POINTS AVAILABLE **5**

AIM OF CREDIT

To encourage and recognise projects that safeguard occupant health through the reduction of internal air pollutant levels.

CREDIT CRITERIA

Up to five points are available independently as follows:

Paints

One point is awarded where:

- At least 95 % of all internally applied paints in the nominated area meet the Total VOC limits stipulated in Table 1 below
  OR
- No paint is applied in the nominated area

Adhesives and sealants

One point is awarded where:

- At least 95% of all internally applied adhesives and sealants in the nominated area are less than the Total VOC limits stipulated in Table 2 below

OR

- No adhesives and sealants are applied in the nominated area

Carpets and flooring

One point is awarded where:

- At least 95% of all carpets and flooring in the nominated area meet the Total VOC limits stipulated in Table 3 below

OR

- No new carpets or flooring installed in the nominated area

Engineered wood products

Two point is awarded where:

- All engineered wood products are less than the formaldehyde limits stipulated in Table 4 below

OR

- No new engineered wood products are used in the project.

For the purposes of this credit, **nominated area** includes all internal habitable areas.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. Manufacturer datasheets

INT-IEQ-6 Reduced Exposure to Pollutants

POINTS AVAILABLE 5

GBCSA's Submission Template prepared by a suitably qualified professional that describes how the applicable Credit Criteria have been met by:

- Listing all the applications in the fitout that are relevant under this credit ;
- Listing the compliant low-VOC products used by describing the type and supplier of the paint, adhesive and sealants, carpets and flooring and engineered wood products used in the project.

Where projects have non-compliant applications:

- Providing calculations to demonstrate compliancy with the Credit Criteria thresholds.

Where projects are claiming the lack of using a material category:

- Describing the alternative finish or justifying how the project does not use the material (e.g. no carpet installed).

Manufacturer product datasheet(s) or test certificates, be provided for each compliant product, that:

- Clearly indicates the compliant TVOC level as referenced in the short report;
- States the calculation method used to determine the TVOC level; and
- For paint finishes only; states that the paint product does not contain added lead.

ADDITIONAL GUIDANCE

For the purpose of this credit, nominated area includes all internal habitable areas. Non-habitable rooms that open directly to outside or into internal car parking areas, such as store rooms and plant rooms, may be excluded. However, non-habitable rooms that open directly into internal spaces other than internal car parking areas must be included in the scope of the credit. Rooms such as security offices, workshops and rooms dedicated for manual waste sorting are however considered habitable and must be included under the credit criteria.

It must be clear that all finishes of a product category and product applications (both exposed and concealed) within the external vapour barrier, have been addressed by the documentation. If points are claimed for avoiding the use of a product type, it must be clearly stated within the documentation.

The specifications given to contractors must explicitly list all the appropriate low-VOC content or emissions (depending on the product category) next to each product type used. A general clause that stipulates that compliance is required with Green Star SA – Interiors V1 Technical Manual, is not acceptable for the documentation requirements.

Volatile organic compounds (VOCs) are organic chemicals that have a high vapor pressure at ordinary room temperature. This causes large numbers of molecules to evaporate from the liquid or solid form of the compound, and enter the surrounding air. VOCs are found in a wide variety of products. They include both human-made and naturally occurring chemical compounds. Most scents or odors that we come across contain VOCs, for example the smell of paint or new upholstery. Some

INT-IEQ-6 Reduced Exposure to Pollutants

POINTS AVAILABLE 5

VOCs are dangerous to human health or cause harm to the environment, especially indoors where concentrations are the highest. Harmful VOCs are typically not acutely toxic, but have compounding long-term health effects and can cause headaches and other irritation.

Formaldehyde - Formaldehyde is a widely used industrial chemical (generally as a solution in water) and is a gas at room temperature. Formaldehyde resins are used to bond the constituent parts together in particleboards, fibreboards, plywood, veneer, MDF and decorative overlaid wood panels. Many building materials such as paints, adhesives, wall boards, and ceiling tiles slowly emit formaldehyde, which irritates the mucous membranes and can make a person irritated and uncomfortable. In 2011, the US National Toxicology Program described formaldehyde as "known to be a human carcinogen."

Manufacturer product datasheets

For the purposes of the Reduced Exposure to Pollutants credit, a 'Manufacturer product datasheet' is defined as:

- Compliance certificate or report– Where products have been certified by a third party certification that complies with the same testing methodology and TVOC content limits required by the IEQ-6 credit. Certificates and/or reports must be provided from the third party certification scheme which confirms the certification of the specific product specified in the project. If not stated on the certificate or report, supporting documents must also be submitted that state the testing method and demonstrate that the TVOC content limits required by the certification body are in line with those set out in the Additional Guidance.
- For carpets, the testing method and TVOC limits referenced in this credit have been based on the Carpet and Rug Institute's Green Label. For products that are Green Label or Green Label Plus certified, only the compliance certificate need be provided as the testing method and TVOC limits are known to be in conformance.

OR

- Laboratory test reports or test certificates – Product TVOC test reports/certificates must be issued by an ISO/IEC 17025 certified testing laboratory and must state the product name, TVOC result and the testing method used.

OR

- Material Safety Data Sheets (MSDS) – Where a product MSDS includes TVOC information, it must include the numerical result expressed in g/litre of product and the test method used to obtain the results.

OR

- Manufacturer product data sheet(s) – Official manufacturer datasheets must be provided for each compliant product and must clearly indicate the compliant TVOC levels and state the calculation method used to determine the TVOC levels. The product data sheets must demonstrate that TVOC is based on theoretical calculations of the subtotal of the known VOC values of the product's raw material components.

  Where the TVOC content of individual components is not known, it must be determined experimentally by one of the appropriate test methods listed below. The manufacturer prepared VOC datasheets must contain the following:
  - Numerical TVOC results expressed in g/litre of product (the total VOC content or sum, not the itemized calculation);
  - Manufacturer's statement that the results have been obtained based on the subtotal of the known VOC values of the product's raw material components.

  OR

- Alternatively, project teams must submit a signed letter from the manufacturer containing the above requirements. Screen captures of website information is not an acceptable form of to demonstrate a product's compliance with the Credit Criteria.

Measurement by content
Where TVOC content for individual items is not known, a theoretical calculation based on the subtotal of the known VOC values of the products raw material components is acceptable. This is not relevant to carpets and engineered wood products.

Paints

Paints are defined as any liquid applied to surface finishes, including varnishes protective coatings. This criterion addresses internal applications of all types of paint, adhesives and sealants applied on exposed and concealed applications.

The following items are excluded from this credit:

- Glazing film, tapes, and plumbing pipe cements;
- Paints, adhesives and sealants used off-site. For example, paint applied to furniture or joinery items in an off-site manufacturing facility and later installed in the fitout;
- Adhesives and mastics that are used for temporary formwork and other temporary installations.

Total VOC (TVOC) values should reflect the final product ready to use, inclusive of paint tints and irrespective of the number of coatings or amount used. TVOC content results must be made in grams of VOC per litre (g/L) of ready to use product.

Where the TVOC content of individual components is not known, it must be determined empirically by one of the following testing methods as appreciate:

- ISO Method 17895 (2005), for a material with a presumed VOC content < 1%,
- ISO Method 17890-2 (2006), for a material with a presumed VOC content < 15%,
- ISO Method 11890-1 (2007), for a material with a presumed VOC content > 15%;

OR

- ASTM D3960, which is comprised of four individual testing procedures that measures TVOC (D2369) as well as density (D1475), water content (D4017), but not excluding exempt compounds (D4457).

The product(s) must comply with the following table:

Product Category	**Max TVOC in grams per litre (g/L) of ready to use product**
Walls and ceilings – flat washable, low sheen, semi-gloss	16
Walls and ceilings – interior gloss	75
Ceilings – interior flat	14
Trim – gloss, semi-gloss, stain, varnishes and wood stains	75
Timber and binding primers	30
Latex primer for galvanized iron and zincalume	60
Interior latex undercoat	65
Interior sealer and general wall & ceiling primer	65
One and two pack performance coatings for floors	140

Any solvent based coatings whose purpose is not covered in table	200

Table 1: Maximum TVOC Content limits for Paints, Varnishes and Protective Coatings

Note: For the purposes of this credit, epoxy wall and/or floor coverings, are considered paints, not sealants, and must not exceed 200g/L TVOC content as per the sub-category 'solvent-based coatings'. General primers are included in the 'Interior Sealer' category. Binding primers are included in the 'Timber and binding primers' category.

Adhesives and Sealants

An adhesive is a material that joins two surfaces together by bonding them. It is usually applied as a thin layer between the two surfaces. Sealant is a material designed either to fill up a space, or applied to a surface for waterproofing or stopping leaks. The spaces can be joints, gaps or cavities between two surfaces.

This criterion addresses internal applications for adhesives and sealants, including both exposed and concealed applications. Common applications include: floor coverings (e.g. carpet and tile adhesives); wall coverings (e.g. wallpaper and tile adhesives); ceiling and soffit coverings (e.g. ceiling tiles or bonded insulation); and skirting applications. This also includes exterior-grade and solvent based sealants and adhesives, should they be employed in internal applications. All VOCs are to be in conformance with the grams per litre (g/L) content limits set out in Table 2.

Where the TVOC content of individual components is not known, it must be determined empirically by ASTM D3960, which is comprised of 4 individual testing procedures that measures TVOC (D2369) as well as density (D1475), water content (D4017) but not excluding exempt compounds (D4457).

The product(s) must comply with the maximum TVOC limits in the following table:

Product Category	**Max TVOC in grams per litre (g/L) of ready to use product**
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and laminate adhesive	100
Resilient flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base and skirting adhesive	50
Dry wall and panel adhesive	50
Multipurpose construction adhesive*	70
Structural glazing adhesive	100
Architectural sealants, acoustic sealants, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Clear wood finishes – varnish, lacquers, sealers	250
Stains	100

Concrete and masonry sealers	100

Table 2: Maximum TVOC Content limits for Adhesives and Sealants

*Multipurpose construction adhesives includes, but not limited to, mastics, glues, epoxies, neoprene-based, acrylic, vinyl-emulsions, vinyl acetate, and any solvent-based adhesives. Architectural sealant includes, but not limited to, caulks and gap fillers, silicone, acrylic, polyurethane, latex, hybrids and any solvent-based sealants.

Carpets and Flooring

This criterion addresses all new carpets and flooring, or installed as part of a provision to 'make good'. In addition to broadloom carpet, examples of flooring include, but not limited to, vinyl sheet, vinyl composite tiles (VCT), rubber, linoleum, cork, carpet tiles. Reused carpets and flooring or those already installed in the fit out space are excluded.

Timber flooring and hard surfaces (e.g. exposed concrete floor, stone, ceramic and concrete tile, etc.) are excluded from this aspect of the credit, however the sealers or protective coatings applied to such products must comply with the criteria for 'Interior sealer' in Table 1. If the flooring is a composite wood product it must meet the "engineered wood products" criteria.

The TVOC levels of at least 95 % of carpets and flooring used must be in conformance with the TVOC emissions limits set out in the table below. If carpet has an underlay or carpet pad, the underlay or pad must also meet the criteria for this credit.

There are two testing methods accepted for demonstrating carpets and flooring compliance:

ASTM D5116 (Carpets and other flooring products):	
Total VOC limit	0.5 mg/m^2 per hour
4-PC (4-Phenylcyclohexene) limit	0.05mg/m^2 per hour
ISO 16000 (Flooring products other than carpet):	
TVOC at 3 days	5mg/m²/h
TVOC at 28 days	0.5mg/m²/h

Table 3: Maximum TVOC Content limits for Carpets and Flooring

For carpets, the testing method and TVOC limits referenced in this credit have been based on the Carpet and Rug Institute's Green Label. For products that are Green Label or Green Label Plus certified, only the compliance certificate need be provided as the testing method and TVOC limits are known to be in conformance.

Engineered Wood Products

Engineered wood products is a range of wood products which are manufactured by binding the strands, particles, fibres, or veneers of wood, together with adhesives, to form composite materials.

This criterion addresses all engineered wood products which include: particleboard, plywood, medium density fibreboard (MDF), oriented strand board (OSB), laminated veneer lumber (LVL), high pressure laminate (HPL), compact laminate, phenolic-core laminate and decorative overlaid wood panels.

This includes engineered wood products for items that may be addressed in other credits in the materials category, such as Assemblies, Furniture, Flooring and Wall Coverings. A timber veneer is not an engineered wood product, however in most cases a veneer would be adhered to an engineered wood product.

The emission levels must be established by a NATA or an ISO/IEC17025 registered laboratory as per the testing methodologies provided in table below:

Test Protocol	Emission limit/ Unit of measurements
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤ 1.0 mg/L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1.0 mg/L
AS/NZS 4357.4 – Laminated Veneer Lumber (LVL) Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) – LVL	≤ 1.0 mg/L ≤ 1.0 mg/L
JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	≤ 1.0 mg/L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	≤ 1.0 mg/L
JIS A1901 (not applicable to Plywood) ≤ 1.0 mg/L ASTM D5116	≤ 0.1 (+/- 0.0005) mg/m²hr*
ISO 16000 part 9, 10 and 11 (also known as EN 13419)	≤ 0.1 (+/- 0.0005) mg/m²hr (at 3 days)
ASTM D6007	≤ 0.1 (+/- 0.0005) mg/m²hr (at 3 days)
ASTM E1333	≤ 0.12mg/m³**
EN 717-1 (also known as DIN EN 717-1)	≤ 0.12 mg/m³***
EN 717-2 (also known as DIN EN 717-2)	≤ 3.5mg/m^2hr*
JAS 233 for Plywood	≤ 0.12mg/L
EN 120 for Particle Board and MDF	≤ 9mg/(100g)
EN 120 for Plywood	≤ 6mg/(100g)

Table 4: Formaldehyde Emission Limit Values for Different Testing Methods

* mg/m^2hr may also be represented as mg/m2/hr.
** The test report must confirm that the conditions of the above Table 4 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.
*** The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.

Note: Test methods and limits applicable to glulam timber, HPL and compact laminates are JIS A 1901, ASTM D5116 and ISO16000 part 9, 10 and 11. EN717-1 and EN717-2 are also applicable to glulam timber.

BACKGROUND

Volatile Organic Compounds (VOCs) are concentrations of organic chemicals (e.g. formaldehyde) that have a high vapour pressure at original room temperature conditions. This causes large molecules to evaporate and enter the surrounding air. High concentrations of VOCs in internal air have been shown to result in a number of negative health impacts. VOCs are a leading contributor to building related illness (previously known as "sick building syndrome") and key symptoms associated with exposure to VOCs are eye, nose and throat irritation, headaches, dizziness, loss of coordination, nausea, damage to the liver, kidneys and central nervous system. Some organic compounds are suspected to cause cancer in humans.

The Reduced Exposure to Pollutants credit rewards projects that minimise these negative impacts by selecting paints, adhesives, sealants, carpets and engineered wood products that are low VOC emitting. The introduction of plants into a fitout is also rewarded in the Indoor Plants credit, as this can further enhance indoor air quality and reduce pollutant levels.

REFERENCES & FURTHER INFORMATION

United States Environmental Protection Agency
http://www.epa.gov/iaq/voc.html

UIS SEDIBA Laboratory
http://www.uissl.co.za/index.php/green-building-materials-testing

South African National Accreditation System
http://www.sanas.co.za/

South African National Occupational Health and Safety Act, 1993: various chapters
http://www.acts.co.za/occupational-health-and-safety-act-1993/index.html

South Coast Air Quality Management District (US), Rules and regulations
http://www.aqmd.gov/rules/rulesreg.html

Carpet and Rug Institute, Green Label Testing Program
http://carpet-rug.com

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-IEQ-7 Mould Prevention

POINTS AVAILABLE **0.5**

AIM OF CREDIT

To encourage and recognise the design of services that reduces the risk of mould growth and its associated detrimental impact on occupant health.

CREDIT CRITERIA

Half a point is awarded where it is demonstrated that for 95% of the nominated area:

- The mechanically air-conditioned ventilation system maintains humidity levels at no more than 60% relative humidity in the space and no more than 80% relative humidity in the supply ductwork;

  AND

- For fit outs in which existing HVAC supply ducting and equipment is being re-used, a visual inspection for mould is to be carried out and, if any mould is found, it must be appropriately cleaned.

OR

- The fitout is naturally ventilated.

If the air conditioning system is of such a design that it has no supply air ducting then the credit is 'Not Applicable'

If the air conditioning air handling plant does not service the fit out exclusively then the credit is 'Not Applicable'. As an example, if the fit-out encompasses only a few floors in a building with a central HVAC system for the whole of the building, or a similar type of arrangement then the credit will be 'Not Applicable' as the benefits from duct cleaning are only achieved if the whole system is cleaned; if the whole system is not cleaned, the non-cleaned elements will re-contaminate the cleaned elements as the air flows through the system.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated spaces: 1. Opening area schedule 2. As Built Drawings *For mechanically ventilated spaces:* 1. GBCSA's Submission Template 2. As Built Drawings *Additionally, if existing HVAC equipment is being reused* 1. Confirmation from a suitably qualified professional *Where the credit is claimed as not applicable*

1. Extracts from the lease or letter from the landlord confirming that the tenant is not servicing the HVAC

For naturally ventilated spaces:

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O:2011. The position and arrangement of opening areas must be in accordance with SANS 10400- O:2011 clause 004.

As Built drawing(s) for naturally ventilated spaces showing openings and ventilation inlets and outlets.

For mechanically ventilated spaces:

Short report prepared by a suitably qualified mechanical engineer that describes how the Credit Criteria have been met. Humidity levels can be maintained by sensors and associated controls. Humidity levels in ductwork that have a constant supply air temperature can also be maintained by undercooling air and then reheating it without the need of controls. In such a case, a psychometric chart showing how 80% humidity is maintained, is to be provided in the short report.

As Built drawing(s) showing humidity sensors installed in the ductwork and confirming that they are connected to an automated HVAC control system.

Confirmation from a suitably qualified professional, if the existing supply ductwork or equipment is used, that confirms:

1. The ductwork and equipment has been visually inspected for mould. The mould inspection must be done by inspecting duct pieces that were taken down or opening up two to three sections for inspection. Where mould is found, it must be clear that the inside of air handling units, cooling coils and filters have been appropriately inspected.
2. Where mould is found, confirmation that all duct work and plant was cleaned before being made operational again.

Extract(s) from the Commissioning Record(s) showing the humidity levels in the ducts and in the occupied space for all modes of operation**.**

ADDITIONAL GUIDANCE

ASHRAE Standard 62-2001 recommends maintaining indoor relative humidity levels between 30% and 60%. Humidity levels less than 30% trigger respiratory discomfort in some people while humidity levels over 70% near surfaces for extended periods of time promote the growth of some forms of mould and fungi.

The U.S. Department of Labour Occupational Safety and Health Administration OSHA 3304-04N 2006 states that indoor relative humidity should be maintained below 70% (25-60%, if possible).

Systems that rely on humidity monitoring only or humidity control by coil selection only do not satisfy the Credit Criteria.

Naturally ventilated spaces

The areas nominated as naturally ventilated must be designed to meet the requirements of

SANS10400-O:2011.

For purposes of this credit, where the building is claiming IEQ-1 'Ventilation' by meeting the requirements for 'Naturally Ventilated Spaces' this credit is automatically achieved and no additional documentation is required. Where the project does not achieve full points for IEQ-1 'Ventilation', the point will not be awarded for this credit through this deemed-to-satisfy route.

Mechanically air-conditioned spaces
Humidity sensors must be provided in the ductwork and linked to automated HVAC control system to ensure that humidity control can be maintained both during and after commissioning. It must be clear from the documentation that an active humidity control system has been incorporated in the project. Extracts from the Commissioning Records will be needed, showing measured humidity levels in the ductwork and in the occupied space for all modes of operation.

Mixed-mode ventilated space
Mixed-mode ventilated spaces must comply with the criteria for mechanically air conditioned spaces.

BACKGROUND

Mould is a type of fungus. There are numerous naturally occurring species present outdoors and inside buildings. Typically, they pose no hazard to people but problems may arise when quantities of mould grow beyond usual limits or when particular species are introduced into a building.

The health effects of concern from exposure to mould contamination in an indoor environment can be common allergy building-related illnesses such as allergic rhinitis, allergic asthma, and hypersensitivity pneumonitis (also called extrinsic allergic alveolitis) as well as infections such as histoplasmosis and ryptococcosis. Mycotoxins can also produce toxin-mediated adverse health effects.

Ultra-violet systems located in the ductwork, just after cooling coils, can reduce the risk of mould growth but do not eliminate the risk.

Excessive moisture in various building materials and systems can provide a conducive environment for mould growth. Controlling humidity and moisture is the primary way to prevent unhealthy mould growth and build up. This must be combined with an effective maintenance programme.

If mould is found in duct work or HVAC components it should be cleaned. All components of the system must be cleaned. Failure to clean a component of a contaminated system can result in re-contamination of the entire system. Water-damaged or contaminated porous materials in the ductwork or other air handling system components should be removed and replaced. Ventilation system filters should be checked regularly to ensure that they are seated properly. Filters should be replaced on a routine schedule.

REFERENCES & FURTHER INFORMATION

Preventing Mould-Related Problems in the Indoor Workplace a Guide for Building Owners, Managers and Occupants: U.S. Department of Labour Occupational Safety and Health Administration OSHA 3304-04N 2006
https://www.osha.gov/Publications/preventing_mold.pdf

ASHRAE – Minimizing Indoor Mould Problems through Management of Moisture in Building Systems
http://www.mass.gov/anf/docs/dcam/mafma/manuals/minimizing-indoor-mold-problems-thru-moisture-mgmt.pdf

ASHRAE - The ASHRAE Guide for Buildings in Hot and Humid Climates 2008
http://www.ashrae.org/File%20Library/docLib/Public/20081111_cztables.pdf

Ska rating Good practice measures for offices Version 1.1 Clean existing air supply ductwork
http://www.officedesign.co.uk/downloads/pdf/ska-datasheets.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-IEQ-8 Ergonomics

POINTS AVAILABLE **2**

AIM OF CREDIT

To recognise and reward the choice of ergonomic equipment and design of space that promotes wellbeing, efficiency and effectiveness.

CREDIT CRITERIA

Up to two points are available for this credit where each point may be obtained independently of each other.

The first point is available as follows:

Furniture and Design Assessment:

For Office Projects:
One point is awarded where:

- Office furniture (new or reused) for workstations (new or reused) in the nominated area is compliant with the ergonomic requirements that are set out in the Additional Guidance and that are analysed and reported on by a suitably trained professional that has followed the workstation principles that are outlined in ISO 9241-11 and ISO 9241-5, in particular Chapter 4 & Chapter 5.

The nominated area, for the purposes of this credit, includes all primary workspaces. The nominated areas are workspaces that are in use for more than two hours per day by the same individual. Examples include but are not limited to the desk, workstation, retail counter, teller counter, reception counter, a laboratory, a library bench or similar furniture designed for a specific task.

OR

Non-Office projects:
One point is awarded where:

- The project team undertakes an Ergonomics Design Assessment (per Additional Guidance) where the furniture (new or reused) and layout in the nominated area is evaluated by a suitably qualified professional according to ISO 11226 and EN 1005-4 (international standards on working postures and movement),

Note that a non-office project includes all other workstations other than office type workstations.

The nominated area, for the purposes of this credit, includes all primary workspaces. The nominated areas are workspaces that are in use for more than two hours per day by the same individual. Examples include but are not limited to the desk, workstation, retail counter, teller counter, reception counter, a laboratory, a library bench or similar furniture designed for a specific task.

The second point is available as follows:

Workstation Assessment

INT-IEQ-8 Ergonomics

POINTS AVAILABLE **2**

One point is awarded where:

- An Ergonomics assessment is conducted for each user by a suitably qualified professional where the user that interacts with a workspace in the nominated area. For each user, the main risks should be identified, evaluated and prioritised and suitable recommendations should be made.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
Furniture and Design Assessment For Office Projects: 1. Short Report For Non-Office Projects: 2. Ergonomics Design Assessment Report **Workspace Assessment** 3. Ergonomics Workstation Assessment Report

Short Report prepared by a team member who is a suitably trained professional that demonstrates how the credit criteria have been met. The report must contain, at minimum, the following topics:

- Description of assessment procedure and chosen evaluation criteria in the nominated area and references to norms/guidelines and best practices that ensure validation of these criteria.
- An analysis regarding the existing and/or intended furniture, equipment or and/or lay-out of the fitout in relation to the interaction requirements of the intended user population. It should give information about the different tasks and sub-tasks' which are performed by the intended user population and about the use of related furniture or equipment. It should also identify the relative priority given to different information sources within the intended user population's tasks with respect or the placement of tools, equipment locations, job aids and furniture. The task analysis should include consideration of:
    - Versatility-flexibility
    - Fit
    - Postural change
    - User information
    - Mental demands
    - Maintainability-adaptability.
    - Physical environment (i.e. the impact of the physical environment components on the ability of the people to perform their tasks)
- Recommendations
- Completed scorecard (as per example given in Table 1)

Ergonomics Design Assessment Report prepared by a suitably qualified professional. The Report must at a minimum contain the following topics:

- Description of assessment procedure and chosen evaluation criteria in the nominated area and references to norms/guidelines and best practices that ensure validation of these criteria.

- An analysis regarding the existing and/or intended furniture, equipment or and/or lay-out of the fitout in relation to the interaction requirements of the intended user population. It should give information about the different tasks and sub-tasks' which are performed by the intended user population and about the use of related furniture or equipment. It should also identify the relative priority given to different information sources within the intended user population's tasks with respect to the placement of tools, equipment locations, job aids and furniture. The task analysis should include consideration of
    - Versatility-flexibility
    - Fit
    - Postural change
    - User information
    - Mental demands
    - Maintainability-adaptability.
    - Physical environment (i.e. the impact of the physical environment components on the ability of the people to perform their tasks)
- Recommendations
- Completed scorecard (as per example given in Table 1)

- **Ergonomics Workstation Assessment Report** prepared by a suitably qualified professional. The Report must at a minimum contain the following topics for each individual workstation

    - Posture analysis
    - Physical and muscular work demands (WRULDs)
    - Equipment and workplace design
    - Environmental factors (light, noise and temperature) and the impact of the physical environment components on the ability of the people to perform their tasks)
    - Risk identification, evaluation and recommendations
    - Score Card of used criteria [i.e. a cash register will have different requirements (score elements) than a reception]
    - Sources & references

ADDITIONAL GUIDANCE

The following definitions and exclusions apply:

Ergonomics
Ergonomics refers to "Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance." Physical ergonomics is that component of ergonomics that considers the physical capabilities and limits of the worker as he or she interacts with tools, equipment, work methods, tasks and the working environment.

Furniture
Furniture, for the purpose of this credit, include, but are not limited to desks, workstations, work benches, surfaces, teller counters, chairs, VDU's, laptops, keyboards, mouse, pen & paper.

User

The user, for purposes of this credit, is defined as the person/staff member who will be using a primary workspace in the nominated area for at least two hours (continuously or non-continuously) during a given day.

Workstation
A workstation includes a desk, retail counter, teller counter, reception counter, a laboratory, a library bench or similar furniture designed for a specific task. A workstation includes an office, a teller counter in a bank, a bench in a retail store, laboratory, and a hospital operating theatre, or similar. The design or selection of a workstation must be shown to address the ergonomic needs of a specific user..

Suitably trained professional
For the purposes of this credit, a suitably qualified person is defined as someone with an Honour's degree in Ergonomics/Human Factors (or equivalent), a Certified Ergonomics Assistant, or as defined by the Professional Affairs Board of the Ergonomics Society of South Africa

Suitably qualified professional
For purposes of this credit, a suitably qualified person is defined as someone with a Master's degree in Ergonomics/Human Factors, a Certified Professional Ergonomist, or as defined by the Professional Affairs Board of the Ergonomics Society of South Africa

Furniture or Design Assessment:
This assessment is an evaluation that shows how human factors integrates into the design of the workspace (furniture, equipment, tools and lay-outs) so as to match human abilities and limitations for the intended user population. For purposes of this credit, the emphasis is on the interaction between the physical capacities of the intended user population and their intended interaction with their equipment in relation to the tasks that need to be performed in order to maximise efficiency and minimise discomfort.

Additional Guidance for: Furniture and Design Assessment

<u>For Office Projects</u>
The project team must demonstrate that the office furniture (new or reused) for workstations (new or reused) is compliant with the workstation principles that are outlined in ISO 9241-11, ISO 9241-5, in particular Chapter 4 & Chapter 5. Note that a task analysis needs to precede the workplace design and must give information about the different tasks and sub-tasks' performed and the use of related furniture and equipment. The analysis must identify the relative priority given to different information sources within the user's task with respect to the placement of displays, equipment location and job aids.

The task analysis should include considerations of:

a. **Primary tasks:** tasks most important to performance and/or tasks that are performed most frequently
b. **The position and use of the hands:** implications for posture, reach and device manipulation by the relative positioning of VDT equipment (e.g. monitors or other visual displays, input devices such as a keyboard, mouse, scanners, etc., and other supportive equipment such as chairs, stools, notes, books, etc.), and task materials, frequency, duration and complexity of movements.

Note that the design and selection of workspaces for VDT office tasks must take into consideration the following interrelated principles:

- Versatility-flexibility, fit, postural change, user information and maintainability-adaptability. Other major factors that facilitate comfortable and efficient operations that should be included are seat & work surface, line-of sight angle, work surface and keyboard height, knee clearance, forearm inclination, and elbow height.

The actual dimensions that are set out in the guidance will be based on a combination of EN:1335-1:2000, BifmaG1:(2013) and SANS 1528-1: 2013.

An example scorecard is as follows (Table 1):

Seat	**Dimension**
Seat height	
Seat depth	
Seat width	
Inclination of seat surface (degrees)	
Waterfall or Rounded downward slope	
Back rest	
Back pad or Lumbar support height	
Lumbar support height	
Height of the back pad	
Height of the upper edge of the back rest above the seat surface	
Back rest width	
Back rest inclination	
Synchronised mechanism	
Adjustable backrest tension	
Shape bottom backrest/separate backrest	
Arm Rest	
Length	
Width of arm rest pad or cap	
Height adjustability	
Inside armrest width adjustable?	
Width between armrests	
Underframe	
Maximum off set of the underframe	
Stability dimension	
5 castor wheels	
Swivel	

For Non-Office Projects

The project team must demonstrate that the furniture (new or reused) for workstations (new or reused) is compliant with the workstation principles for office projects (where applicable) as well as ISO 11226 and EN 1005-4. Similarly, a task analysis should be conducted that includes considerations of:

a. **Primary tasks:** tasks most important to performance and/or tasks that are performed most frequently
b. **The position and use of the hands:** implications for posture, reach and device manipulation by the relative positioning of primary equipment, and task materials, frequency, duration and complexity of movements.

Additional Guidance for: Workstation assessment

The project team is required to engage a suitably qualified professional to provide advice and recommendations to the project as relevant to the needs of each user, aimed at maximizing ergonomic comfort and efficiency in the fitout. The furniture and equipment must address, amongst other things, adjustability, size, and comfort. Equipment placed near or on workstations, including specialised equipment and furniture, must also be taken into account. Common equipment includes computers, cashiers, medical equipment, tables, counters, stools and chairs. (tools, scanners, payment devices, tablets, supportive documents, etc.)

INT-IEQ-8 Ergonomics

POINTS AVAILABLE **2**

A workstation assessment, for the purposes of this credit, refers to an analysis or risk assessment of each user's workstation for the nominated area/s. These requirements should be incorporated into the risk assessment form as a checklist so that this indicates compliance or non-compliance for each user. All human characteristics, primary task, and environmental requirements of the workstation that emerge from the risk assessment need to be included in the report as a comprehensive ergonomic check list/scorecard that provides a clear indication of compliance or non-compliance for the user.

BACKGROUND

Since Ergonomics in South Africa is a relatively new discipline, there is both a lack of understanding of and awareness of Ergonomics within the South African environment.

Ergonomics is a tool that can be considered to help mitigate injuries in the workplace as it reduces the risk of injury by adapting the work to fit the person instead of forcing the person to adapt to the work.

This credit considers human beings' comfort as an essential part of every business process and critical to delivering quality products and services. It also recognises the lack of productivity that can result from a badly designed work environment. Work-related musculoskeletal disorders may not immediately be obvious, but tend to develop over a long period of time.

"Work-related musculoskeletal disorders are disorders of the muscles, skeleton and related tissues that have been empirically shown or are suspected to have been caused by a workplace activity", one example is Carpal Tunnel Syndrome. Employees reporting symptoms and receiving treatment early greatly improves the likelihood of preventing a serious injury.

In addition to injury prevention, Ergonomics is also concerned with enhancing work performance, by removing the barriers that exist in many work places that prevent employees from performing to the best of their abilities. Therefore, another benefit of applying ergonomics to office work is that it helps people work more effectively, efficiently, and productively.

REFERENCES & FURTHER INFORMATION

EN:1335-1:2000, BifmaG1:(2013) and SANS 1528-1: 2013.

Cornell University Ergonomics (Performance Oriented Ergonomic Checklist For Computer (VDT) Workstations)
http://ergo.human.cornell.edu/cuvdtchecklist.html

Office Ergonomics (Practical Solutions for a Safer Workplace)
http://www.lni.wa.gov/IPUB/417-133-000.pdf

System Concepts
http://www.system-concepts.com/ergonomics/ergonomics-standards.html

NHS Health Scotland (Display Screen Equipment Workstation Assessment) (DSE Form)
http://www.healthyworkinglives.com/document?ItemID=55122

Rossiter and Co (VDU Health and Safety Risk Assessment)
http://www.vduhealthandsafety.org/

The Ergonomics Society of South Africa (ESSA)
www.ergonomicssa.com/

European Agency for Safety and Health at Work (Work-related musculoskeletal disorders: Back to work report)
https://osha.europa.eu/en/publications/reports/7807300

ANSI/HFES 100-2007 Human Factors Engineering of Computer Workstations

CSAZ412-00 (R2011) - Guideline on Office Ergonomics

ISO 9241-11 1998 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 11: Guidance on usability

ISO 9241, 1999: Ergonomic requirements for office work with visual display terminals (VDT's)

ISO 11226, 2000: Ergonomics — Evaluation of static working postures

EN 1005-4:2003+A1:2008: Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and components parts of machinery

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata that have been issued for this credit.

INT-IEQ-9 Indoor Plants

POINTS AVAILABLE **1.5**

AIM OF CREDIT

To encourage and recognise the installation of indoor plants that both improves the indoor environment quality and also provides occupants with a connection to nature.

CREDIT CRITERIA

One point is awarded where:

- Provide one Plant Unit for every 50m^2 of regularly occupied space in the project or a number of plants equalling 0.5 Plant Units per Full Time Equivalent occupant, whichever is greater;

  AND;

- At least 70% of the plants incorporated into the fitout are suited to the indoor environments~~;~~

  AND

- An Indoor Horticultural Maintenance Plan and maintenance contract with an Interior Landscape Contractor must be in place for a minimum of two (2) years to ensure that the health and number of plants in the space is maintained.

An additional half point is awarded where:

- The point above is achieved;

  AND

- One Plant Unit is provided for every 25m^2 of regularly occupied space in the project or a number of plants equalling 0.5 Plant Units per Full Time Equivalent occupant, whichever is greater

Note that the table below provides the Plant Units for typical planting applications:

10-15cm Grow Pot	0.33 Units
20cm Grow Pot	0.5 Units
25-32cm Grow Pot	1 Unit
40cm Grow Pot	2 Units
55cm Grow Pot	4 Units
70cm Grow Pot	8 Units
Bed & Vertical Planting	Determine number of equivalent grow pots and divide by this to provide plant units

INT-IEQ-9 Indoor Plants

POINTS AVAILABLE **1.5**

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Statement of confirmation 2. Horticultural Maintenance Plan 3. As-built Floor Plan OR Photographs 4. Extract from maintenance contract

Statement of confirmation from the plant supplier of the quantity and species of the plants supplied and that the plants were selected for their suitability to indoor environments;

Horticultural Maintenance Plan must, as a minimum, include/address the following:

- The location and density of plants;
- Service intervals;
- Policy regarding the maintenance of soil moisture, pH and nutrients;
- Watering and cleaning requirements;

As-built floor plan OR **Photographs** indicating the location and size of the plants/planters

Extract from maintenance contract that demonstrates at least a two year commitment to the Horticultural Maintenance Plan;

ADDITIONAL GUIDANCE

Suitability to indoor environments

For additional guidance in selecting plants that are suited to the indoor environments and have been scientifically demonstrated to produce substantial benefits to indoor air quality, please refer to the "Approved Plantings for Biofiltration for Indoor Air" from Green Plants for Green Buildings (see References)

Interior landscape contractor

An interior landscape contractor is defined as a specialist contractor or company that do the maintenance of indoor plants.

Decorative Soil Coverings

Research conducted by Wolverton Environmental Services Inc. revealed that 50-65% of VOC removal can be attributed to root and soil microbes. With the roots being one of the primary sources of air filtration light weight soil and decorative soil coverings need to be used to avoid compaction of soil e.g.13mm bark soil mix is recommended as the basis for the potting soil. Decorative soil coverings could include bark chip or "Eco-Bark "which is made from recycled material.

Decorative Pot Selection

Pots made from bio-degradable, environmentally friendly / recyclable products should be considered where ever possible.

BACKGROUND

Research has found that indoor plants contribute to the health and wellbeing of building occupants. The introduction of plants into a fitout is rewarded under this credit, as this can further enhance indoor air quality and reduce pollutant levels.

The potted-plant microcosm has been shown to reduce air-borne concentrations of Volatile Organic Compounds (VOCs). Research findings demonstrate that the ability of plants to metabolise VOCs increases with extended exposure to VOCs, provided the potted-plant system is kept in optimum condition.

According to many research studies, people and nature are intertwined, with people's need for a connection to nature having a strong link to their psychological and bodily well-being.

Studies have also shown that indoor plants can also

- reduce dust levels;
- stabilise humidity and temperature;
- baffle noise;
- reduce CO_2 levels; and
- reduce levels of Volatile Organic Compounds.

The presence of indoor plants has also been shown to decrease complaints of symptoms associated with respiratory illness and poor indoor air quality. Several studies have also shown lower workplace stress, a decrease in fatigue and enhanced productivity.

REFERENCES & FURTHER INFORMATION

Burchett, M. Torpy, F. Tarran, J. (2008), *Interior Plants for Sustainable Facility Ecology and Workplace Productivity*, Faculty of Science, University of Technology, Sydney, **http://www.interiorplantscape.asn.au/Downloads/M_B_Papers/BurchettM3_UTS_Ideaction_08_PAPER_W.pdf**

Ibid., Potted Plants Can Significantly Reduce Urban/Indoor Air Pollution **http://greenplantsforgreenbuildings.org/news/potted-plants-can-significantly-reduce-urbanindoor-air-pollution/**

Ibid., *Plants in the Classroom Can Improve Student Performance* **http://www.interiorplantscape.asn.au/wp-content/uploads/2012/05/Research-Report-Effects-of-indoor-plants-on-school-performance-2010-V1.pdf**

Green Plants for Green Buildings, *Approved Plantings for Biofiltration for Indoor Air*
http://greenplantsforgreenbuildings.org/wp-content/uploads/2014/01/These-Plants-Clean-Your-Air.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Ene-1 Greenhouse Gas Emissions

POINTS AVAILABLE **12**

AIM OF CREDIT

To encourage and recognise projects that minimise the greenhouse gas emissions associated with operational energy consumption, and maximise potential operational energy efficiency of a tenant fitout.

CREDIT CRITERIA

Up to twelve points are awarded where it is demonstrated that the tenant fitout's predicted greenhouse gas emissions have been reduced according to the various criteria set out in this credit.

Up to 12 points are available for this credit as follows (broken into parts A to G):

Part A - Artificial lighting

Up to two points are awarded where:

- The effective installed lighting power density for at least 95% of the tenancy area is less than the values prescribed in the below table (adapted from SANS 10400 2011 and ASHRAE 90.1 2007):

Building Code Classification	Occupancy	For 1 point (W/m^2)	For 2 points (W/m^2)
A1	Entertainment and public assembly	7	5
A2	Theatrical and indoor sport	7	5
A3	Places of instruction	7	5
A4	Worship	7	5
B1	High risk commercial service	16.8	12
B2	Moderate risk commercial service	14	10
B3	Low risk commercial service	10.5	7.5
C1	Exhibition hall	10.5	7.5
C2	Museum	3.5	2.5
D1	High risk industrial	14	10
D2	Moderate risk industrial	14	10
D3	Low risk industrial	14	10
D4	Plant room	3.5	2.5
E2	Hospital	7	5
E3	Other institutional (residential)	7	5
E4	Health care	7	5
F1	Large shop	10.5	7.5
F2	Small shop	10.5	7.5

F3	Wholesalers' store	10.5	7.5
G1	Offices	7.7	5.5
H1	Hotel	7	5
H2	Dormitory	3.5	2.5
H3	Domestic residence	3.5	2.5
H4	Dwelling house	3.5	2.5
H5	Hospitality	7	5

Part B – Lighting controls

Up to two points are awarded independently as follows:

Half a point is awarded where:

- Occupancy sensors that control lighting are installed for at least 75% of the tenancy's nominated area, where the nominated area is the net lettable are excluding open plan desk areas/work settings.

Half a point is awarded where:

- Open plan desk areas/work settings have zoned lighting control, where not more than 4 work settings are switched or dimmed automatically or manually, or both, from one control switch

One point is awarded where:

- Daylight sensors that control lighting are installed for at least 25% of the tenancy's net lettable area. Where projects have less than 25% of their nett lettable area adjacent to an external façade, this point is not applicable. For the purpose of calculating the percentage of nett lettable area adjacent to the façade, a maximum distance of 5m is to be used.

Part C – Energy efficient equipment

Up to three points are awarded as follows:

One point is awarded where:

- 60% of appliances and equipment by rated power installed in the fitout are energy efficient*.

Two points are awarded where:

- 70% of appliances and equipment by rated power installed in the fitout are energy efficient*.

Three points are awarded where

- 80% of appliances and equipment by rated power installed in the fitout are energy efficient*.

*An energy efficient appliance is defined to be one which has achieved either a minimum B rating of the European Union Energy Labelling system or has an ENERGY STAR® rating. For the purpose of these calculations, where a fitout makes use of laptops instead of desktops, desktops with a rated power of 350W must be used as a reference case. Laptops do not require an energy rating, as they are inherently more energy efficient than desktop computers.

Note: This requirement applies to appliances, office equipment, electronics, and commercial food service equipment. Excluded are HVAC, lighting, and building envelope products.

Part D - Plug load and equipment control

One point is awarded where:

- Plug load controls are used for 50% of appliances by rated power. These may be either motion sensors or timer based.

OR

One point is awarded where:

- A tenancy has replaced desktops with laptops and where the desktops would have been more than 50% of the total installed equipment load for the fitout. For the purpose of this calculation, 350W is to be used for the rated power of a desktop as the reference case.

Equipment includes but is not limited to desktop computers, laptops, computer monitors, washing machines; televisions and AV equipment, printing and photocopy equipment. Plug load control can be at the distribution board or built into the equipment itself.

Part E – HVAC

There are two compliance paths available for points related to HVAC systems installed by the tenant (i.e. E.1 Deemed to Satisfy OR E.2 Energy Modelling)

Part E.1 – HVAC Deemed to Satisfy

There are two compliance options are available under E.1:

Compliance route E1.1

Four points are awarded where:

- The fitout is naturally ventilated

A naturally ventilated tenancy must ensure that the design complies with minimum comfort levels through either of the two methods below:

Internal operative temperatures are within the 80% Acceptability Limits given in ASHRAE Standard 55-2004 for 90% of occupied hours in the year;

OR

PMV (Predicted Mean Vote) levels are within -1.0 and +1.0 for 90% of occupied hours in the year.

Compliance route E1.2

Four points are awarded as follows:

E1.2.1

Up to three points are awarded where the project exceeds the SANS 204 2011 Minimum COP performance criteria for all HVAC equipment installed by the tenant as per below

- One point for a 15% improvement
- Two points for a 25% improvement
- Three points for a 35% improvement

The table below shows a minimum efficiency for HVAC equipment.as per SANS 204 2011.

Equipment	**Capacity Range kW**	**Minimum COP**
Unitary console and split type*	<7	2.5
Packaged and Split Air Conditioning (Including VRF and air cooled chiller)**	7<9	2.6
	10 < 40	2.96
	40 < 70	2.72
	>70	2.64
Water cooled chiller**	> 70	3.2

* COP includes indoor fan unit at 35°C outdoor temperature.
** COP is for outdoor unit/chiller only at 35°C outdoor temperature

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E1.2.2

One point is awarded where:

- Occupancy sensors are installed to control HVAC equipment in all cellular offices and meeting rooms.

AND

- Open plan spaces have a minimum of timer based control for the HVAC serving them.

Part E.2 – Energy Modelling (HVAC only)

As an alternative to Part E.1, the tenancy HVAC system can be modelled using the GBCSA energy modelling protocol, and the predicted carbon emissions compared with a baseline tenancy in the same location constructed to the requirements of the SANS 10400 Part XA 'deemed to satisfy' clauses. Points are then awarded on a linear scale with 0 points for the baseline building and 4 points for a 40% improvement over the baseline buildings HVAC systems.

The points are determined by the Green Star SA – Interiors Energy Calculator.

% Improvement in Carbon Emissions over SANS 204 Notional Tenancy	*Number of Points Obtained*

< 10% (less than 10% improvement)	0
greater or equal to 10%	1
greater or equal to 20%	2
greater or equal to 30%	3
greater or equal to 40%	4

An additional 5 points can be targeted as innovation points under the Innovation Category

Domestic Hot Water*
Half a point is awarded where:

- 75% or more of domestic hot water heating is provided by non-electric resistance means.

One point is awarded where:

- 100% of domestic hot water heating is provided by non-electric resistance means.

*These points do not form part of the energy category score.

Tenant Vertical Transport*
Up to two points are awarded as follows:

One and a half points are available where:

- All tenant escalators are fitted with occupancy sensors that start and stop the escalator depending on the proximity of a user.

Half a point is available where:

- The tenant elevators are equipped with regenerative braking systems.

*These points do not form part of the energy category score.

Renewable energy, off-sets and carbon credits

Where the project produces its own energy on site, this production can be used to claim innovation points depending on the percentage of the total installed load that is represented by the renewable energy. The guidance below can be used when submitting for innovation points

- 1 point for 20% of total installed load
- 2 points for 30% of total installed load
- 3 points for 40% of total installed load

Carbon credits, off-sets and commitments to purchase renewable or ‘green’ power from an electricity supplier are an operational matter, rather than an inherent building attribute; as a result ‘green’ power generated off-site cannot be included in energy modelling.

DOCUMENTATION REQUIREMENTS

INT-Ene-1 Greenhouse Gas Emissions

POINTS AVAILABLE **12**

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. Contractual documentation *Additionally for modelled HVAC compliance path:* 3. Energy modelling report 4. Completed Green Star SA – Interiors Energy Calculator *Additionally for naturally ventilated spaces (3 & 4 not applicable):* 5. Natural ventilation report

GBCSA's Submission Template prepared by a suitably qualified professional clearly outlining:

- The compliance route and credits chosen;
- Providing a summary of how the various criteria are met; and
- Referencing supporting documentation where applicable.

Contractual documentation in the form of As-built drawings or a signed confirmation from the tenant stating all relevant equipment installed for the tenancy. All simulation inputs used for the energy modelling report must be referenced in this documentation.

Energy modelling report in accordance with the Green Star SA – Interiors Energy Calculator & Modelling Protocol Guide:

- Following the structure defined in the Green Star SA – Interiors Energy Calculator & Modelling Protocol Guide;
- Clearly identifying all assumptions made for tenant and other loads (e.g. occupant density);
- Clearly identifying all of the design-driven inputs and referencing drawings; and-Clearly corresponding to the design
- Whenever assumptions are used, they must be justified and conservative fitout.

Completed Green Star SA – Interiors Energy Calculator to show what energy values have been entered for the actual and benchmark fitout

Natural Ventilation Report prepared by a suitably qualified person (i.e. mechanical engineer, architect or AP) that describes how the fitout has been designed to be naturally ventilated and confirms that an analysis has been carried out to check that internal conditions will be acceptable to the occupants. This is to avoid rewarding fitouts which will overheat or be uncomfortable and require air conditioning to be retrofitted.

The report should include:

a) Opening Area Schedule of openings room by room, showing that each naturally ventilated space has an opening of area at least 5% of floor area (as required by SANS 10400-O

b) Thermal Analysis of all typical spaces in the fitout, using hourly weather data to show that

internal comfort conditions are met

The report must clearly show the geometry and materials of the model, and list all assumptions made such as clothing levels, etc. Occupancy times, equipment and lighting heat gains should be modelled using the same assumptions as the Green Star SA – Interiors Energy Calculator & Modelling Protocol Guide. The report should include a summary of the mean radiant temperatures and air temperature results from the simulation and details of the weather data used. Refer to credit IEQ-2 for more details of calculation method. Note that if a naturally ventilated building fails to achieve the above criteria, it can still be submitted for Green Star SA – Interiors assessment, but the energy modelling must include a notional air conditioning system in the actual fitout. With such a building there is a significant risk that future occupants will retrofit air conditioning systems. Refer to Green Star SA – Interiors Energy Calculator & Modelling Protocol Guide for more details

ADDITIONAL GUIDANCE

Modelling and supporting documentation

Refer to the Green Star SA – Interiors Energy Calculator & Modelling Protocol Guide for details of how to carry out the modelling.

BACKGROUND

The Greenhouse Gas Emissions credit is a conditional requirement of the Green Star SA- Interiors rating tool, meaning minimum credit requirements must be met in order for a Green Star SA – Interiors certified rating to be achieved.

Through the Greenhouse Gas Emissions credit, predicted greenhouse gas emissions are calculated to determine improvement over that of a comparable 'benchmark fitout' as determined by the Greenhouse Gas Emissions Calculator.

REFERENCES & FURTHER INFORMATION

ANSI-ASHRAE 104:2004 *Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs*
https://ashrae.org/

CIBSE TM33:2006 *Tests for Software Accreditation and Verification*
http://www.cibse.org/

Department of Minerals and Energy, *Energy Efficiency Strategy of the Republic of South Africa* – March 2005
http://www.energy.gov.za/files/esources/electricity/ee_strategy_05.pdf

ASHRAE 90.1-2004 *Energy Standard for Buildings Except Low-Rise Residential Buildings*
http://www.ashrae.org

SANS 204:2008 *Energy Efficiency in Buildings*
http://www.sabs.co.za

SANS 10400 Part XA: 2011 *Energy Efficiency in Buildings*
http://www.sabs.co.za

International Energy Conservation Code, 2006 edition
http://www.iccsafe.org

New Buildings Institute, *Advanced Lighting Guidelines*
http://algonline.org

Energy Star
www.energystar.gov

European Union Energy Label
www.newenergylabel.com/uk/purpose

ENERGY MODELLING PROTOCOL

Refer to the appended energy modelling protocol overleaf.

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical clarifications or Errata that have been issued for this credit.

Green Star SA – Interiors v1

ENERGY CALCULATOR & MODELLING PROTOCOL GUIDE

Last update: November 2014

1 Executive Summary

The Green Star SA – Interiors rating tool has been developed to evaluate the predicted performance of the Heating Ventilation and Air Conditioning (HVAC) in fitouts. The Energy Calculator within this tool compares the predicted HVAC energy consumption of a facility to a benchmark based on a notional building complying with SANS 204:2011 of the same size as the actual building and in the same location. The carbon emissions associated with the HVAC energy consumption are determined by the calculator, and points are awarded to any facility which improves on the benchmark.

To use the calculator, the predicted HVAC energy consumption of both the actual facility and the notional building must be calculated. This guide specifies standard inputs to be used when modelling the heating, ventilation and cooling (HVAC) systems of the facility. The standard inputs include operational profiles and internal heat loads which facilitate comparison between different facilities.

The predicted ancillary load energy consumption, such as that from lighting and appliances, are calculated in a deemed to satisfy manner as outlined in the Technical Manual. They do not form part of this modelling guide.

Finally, this guide includes information on how to enter the simulation outputs into the Green Star SA – Interiors rating tool Energy Calculator. The calculator converts the energy use into carbon emissions and indicates the percentage improvement of the actual tenancy compared to the notional tenancy. Points are awarded based on 0 points for no improvement; up to a maximum of 4 points for a building with a 40% HVAC energy saving over the reference building.

2 Acknowledgements

The Green Building Council of South Africa (GBCSA) would like to acknowledge all the parties who have worked on and supported the development of the Green Star SA – Interiors rating tool.

SPONSORSHIP
Green Star SA – Interiors tool sponsors, Standard Bank and Saint Gobain provided much-needed financial support to develop the rating tool.

SUPPORT
The Green Building Council of South Africa acknowledges the support of the Green Building Council of Australia in providing their Green Star intellectual property and assisting the GBCSA in adapting it for the South African market.

ADDITIONAL EXPERTISE
The Green Building Council of South Africa acknowledges the work of technical consultant Solid Green in adapting developing the Energy Calculator Guide for the Green Star SA – Interiors rating tool.

3 Introduction

The Green Building Council of South Africa (GBCSA) is developing a suite of rating tools to assess the environmental performance of buildings in South Africa. As part of this package, the Green Star SA – Interiors rating tool assesses the environmental performance of tenant fitouts by measuring their environmental impact. Part of this assessment includes determining the predicted energy consumption of the HVAC systems in a tenant fitout.

The tenancy must be simulated using computer modelling software in order to determine the predicted energy consumption of its Heating, Ventilation and Cooling (HVAC) system. Thermal modelling must be done using software that complies with the requirements in this guide. Systems modelling may be done in a spreadsheet program or by hand, provided full details are submitted.

This report has been written as a guide to these calculations and to how the data must be entered into the Energy Calculator to produce a score.

Please note that the GBCSA does not keep a list of currently acceptable software packages and does not endorse any particular package or company. Any software program meeting the requirements in this guide is acceptable.

All energy modelling undertaken for Green Star SA certification purposes applies the principal of comparative modelled performance rather than actual predicted performance. Comparative performance compares the modelled performance of the building as designed (with a number of design assumptions) to a notional benchmark building which meets minimum energy performance regulation criteria. This enables us to recognise the design aspects that assist in improving the potential of the building to reduce its environmental impact. It is important to note however that this modelling exercise applies assumptions for factors such as occupant density, tenant equipment, tenant behavioral patterns, local climate conditions etc. These assumptions are made as it is impossible to completely predict or control such factors accurately. I.e. tenant occupancy patterns, equipment, actual weather conditions etc. may vary significantly from the assumptions made at design stage, resulting in actual energy performance which varies from the modelled performance. While the GBCSA encourages predictive modelling and coordination of that with the Green Star SA submission process, it should be noted that the Green Star SA modelling results are unlikely to be an actual prediction of energy consumption due to the variances discussed above. Although building energy modelling may thus not result in exact predictions of actual building energy consumption, it is still recognised as a critically important tool in evaluating and informing design decisions as well as allowing for comparative performance measurement. The importance of actual performance however is still recognised by the GBCSA through the Green Star SA - Existing Building Performance Tool.

4 General Methodology

Where this document refers to 'building' it refers to the building in which the tenancy is located, and in particular the tenancy itself. Projects are not required to model other areas outside of the relevant tenancy, such as the neighbouring tenant's air conditioning system or systems located in common areas. Energy consumption is only required to be modelled for the relevant tenant/fitout area, and not for the entire building unless it is a single tenanted building.

4.1 Model Notional SANS204 Tenancy

A building in which the tenancy finds itself in is in the same location and with the same geometry as the actual tenancy / building is modelled, with defined areas of glazing and fixed fabric performance and M&E systems performance. The tenancy / building is generally as defined by the SANS 204-3:2011 *(Energy efficiency in buildings Part 3: The application of the energy efficiency requirements for buildings with artificial environmental control)* deemed to comply clauses.

4.2 Model Actual Tenancy

The actual tenancy within the building is modelled in the context of the base building, using exactly the same simulation software, weather data and tenant assumptions as the model of the notional tenancy, but with the actual tenancy fabric and HVAC systems.

4.3 Enter energy use into Green Star SA – Interiors energy calculator

The HVAC energy uses predicted by the models above for the notional tenancy and the actual tenancy are entered into the calculator. The calculator produces an estimate of the carbon emissions/m²/year for both the notional tenancy and the actual tenancy.

The final Ene-1 point score is awarded based on the percentage improvement of the actual tenancy compared to the notional tenancy in terms of carbon emissions, on a linear scale with 0 points representing no improvement and 1 point for every 10% improvement over the reference building up to a maximum of 4 points.

5 General Modelling Parameters

This section pertains to both the notional and actual buildings/tenancies.

Table 1: General modelling parameters

Modelling Parameter	Requirements	Documentation
Simulation Package	Passed the BESTEST simulation software validation test	Declaration in modelling report
Weather Data	A Test Reference Year (TRY) if the building location is within 50km of a TRY location; or In the absence of local TRY weather data, an actual year of recorded weather data from a location within 50km of the building location; or In the absence of TRY or actual weather data within 50km, interpolated data based upon 3 points within 250km of the building location. Weather data can be obtained using sources such as Meteonorm or Weather analytics provided that the files are specifically formatted for energy simulation and are based on at least 5 years of measured data.	Statement in modelling report. Where weather file sources as per the list below are used, no description of the weather files is required; the modelling report should merely state the origin of the files. • IWEC (International Weather for Energy Calculations) • Meteonorm • Weather Analytics These sources have previously been approved via TC's in other tools and have therefore been deemed appropriate for this tool.

Overshadowing	Overshadowing from adjacent buildings is to be taken into account for both notional and actual buildings. Criteria as set out in The Green Star Office credit IEQ-04 can be used to determine the buildings that must be included for overshadowing.	Provided all relevant information is shown, this does not need to be on a tender or as built drawings. Supporting documentation can be via a site survey, photographic evidence etc.
Space Type Breakdown	All relevant space types and areas as per the building input sheet must be accounted for in the energy calculations. A maximum 10% difference between modeled area and architectural area is permitted.	Marked up drawing showing typical areas included in analysis. Marking up can be done on architectural drawings by the building simulation professionals.

6 Building Envelope

6.1 Building Fabric – Opaque Elements

All building fabric elements to reflect deemed to satisfy requirements as per SANS 204:2011

Table 2 Opaque building fabric elements

	Notional Building	Proposed
Geometry	As per proposed building. Graphic from the simulation program showing notional and actual buildings produced is to be provided	As per building design. All elements of the proposed building shall be modeled as per design documents. Where assumptions are made they must be shown to be conservative. Where this information is not readily available from the landlord the architect or interior architect or mechanical engineer may provide a letter confirming what they are able to determine from a site inspection, and therefore what conservative values are appropriate to be assumed.
Internal floors*	10mm Ceiling tile, 300mm air gap, 100mm concrete slab, 150mm air gap,10mm wooden floor	
Ground floor/adjacent to basement parking	Standard EPS*,150mm concrete slab,100mm air gap,10mm wooden floor. with carpet, insulation to meet R-value as required for climate zone Climate zone 1 and 2 – R=1.5 (35mm EPS) Climate Zone – 3,4 and 6 – R=1.0 (15mm EPS) Climate zone 5 – No insulation	
Exterior Wall Construction	Brick work wall with insulated air gap between skins. Cavity insulation R values to match required CR levels as stipulated in SANS 204:2011 Tables 3 and 4. For building types where no requirement is stipulated, a 50mm air cavity will be used. CR -60 (50mm air cavity) CR-80 (10mm Standard EPS) CR-100 (20mm Standard EPS)	

	CR-120 (30mm Standard EPS)	
Roof	Roof screed, concrete roof, insulation, air gap, ceiling tile. Insulation to achieve total R-value as per climate requirement	
Insulation	Properties of standard expanded polystyrene to be used are as per below; Conductivity (W/m-k) – 0.04 Specific Heat Capacity (J/kg-K) – 1400 Density (kg/m²) – 15.0	
Orientation	Model as per actual orientation	

*Note the inclusion of ceiling tiles and wooden floors for the notional building is to encourage projects to make use of the buildings thermal mass for annual energy savings.

**EPS – Expanded Polystyrene Insulation

6.2 Building Fabric – Glazing

<table>
<tr><th></th><th>Notional Building</th><th>Proposed</th></tr>
<tr><td>Vertical glazing window to wall ratio*</td><td>The reference building glazing window to wall ratios shall be as per the SANS 204 2011 equation outlined in section 4.3.4.2.3 and provided below.
<table>
<tr><th>Climate Zone</th><th>N</th><th>NE</th><th>E</th><th>SE</th><th>S</th><th>SW</th><th>W</th><th>NW</th></tr>
<tr><td>1</td><td>34%</td><td>31%</td><td>37%</td><td>49%</td><td>64%</td><td>54%</td><td>47%</td><td>39%</td></tr>
<tr><td>2</td><td>35%</td><td>31%</td><td>38%</td><td>62%</td><td>99%</td><td>72%</td><td>44%</td><td>37%</td></tr>
<tr><td>3</td><td>35%</td><td>30%</td><td>33%</td><td>45%</td><td>78%</td><td>51%</td><td>35%</td><td>32%</td></tr>
<tr><td>4</td><td>34%</td><td>31%</td><td>37%</td><td>49%</td><td>64%</td><td>54%</td><td>47%</td><td>40%</td></tr>
<tr><td>5</td><td>32%</td><td>29%</td><td>29%</td><td>38%</td><td>49%</td><td>38%</td><td>30%</td><td>29%</td></tr>
<tr><td>6</td><td>35%</td><td>32%</td><td>35%</td><td>52%</td><td>71%</td><td>54%</td><td>44%</td><td>36%</td></tr>
</table></td><td rowspan="3">As per building design. All elements of the proposed building shall be modeled as per design documents. Where assumptions are made they must be shown to be conservative. Glazing inputs must take frames into account

Manual shading devices such as blinds are not to be included in the energy model.

Where this information is not readily available from the landlord the architect or interior architect or mechanical engineer may provide a letter confirming what they are able to determine from a site inspection, and therefore what conservative values are appropriate to be assumed.</td></tr>
<tr><td>Vertical glazing performance</td><td>Performance as per SANS 204-2011 Table 6 – Tinted double glazing in aluminum/steel frame.

U-Value: 4.23

SHGC: 0.59</td></tr>
<tr><td>Skylight glazing area</td><td>Skylight glazing area to match that of the proposed building up to a maximum of 10% of the total roof area. Where the proposed building has no skylights/roof lights none are to be modeled in the notional building.</td></tr>
</table>

Skylight glazing performance	Performance as per SANS 204-2011 Table 11. U-Value: 2.5 SHGC: 0.35	

6.3 Internal Loads

Table 3 Internal Loads

	Notional Building	Actual building
Summer Design Temperature	As per actual building	As per design
Winter Design Temperature	As per actual building	As per design
Occupancy	As per actual building	As per design
Internal Lighting	Table below	As per design
Tenant Equipment	As per actual building	As per design
Fresh Air rates	As per minimum code requirement for space type	As per design

Hourly profiles of these loads must be as per the schedules provided.

Table 4 Notional building lighting inputs (As per Green Star SA - PEB v1 Tool)

Building Code Classification	Occupancy	Notional Building Input (W/m²)
A1	Entertainment and public assembly	10
A2	Theatrical and indoor sport	10
A3	Places of instruction	10
A4	Worship	10
B1	High risk commercial service	24
B2	Moderate risk commercial service	20
B3	Low risk commercial service	15
C1	Exhibition hall	15
C2	Museum	5
D1	High risk industrial	20
D2	Moderate risk industrial	20
D3	Low risk industrial	20
D4	Plant room	5
E2	Hospital	10
E3	Other institutional (residential)	10
E4	Health care	10
F1	Large shop	15
F2	Small shop	15

F3	Wholesalers' store	15
G1	Offices	11
H1	Hotel	10
H2	Dormitory	5
H3	Domestic residence	5
H4	Dwelling house	5
H5	Hospitality	10
Common areas - reception, ablutions, circulation		6
Internal Covered Vehicle Parking Area (B1, ground and above ground) lighting		2
Sub-basement Vehicle Parking Area (B2 and below) lighting		2

6.4 Actual Tenancy – HVAC Systems

All components of the HVAC system that forms part of the tenant fitout are to be modeled as designed. Actual capacities of equipment as specified by the mechanical engineer are to be used in the simulation and documented in the report. The table below gives guidance on items that are to be included in the report where relevant. Where the tenancy is served by a central air-conditioning plant, the method of apportioning load and energy must be clearly described.

Modelling Parameter	*Requirements*	*Documentation*
HVAC System design	• Demonstrate that the HVAC system modelled represents the system design for each part of the building.	Verification Documents: • Design or as-installed (where appropriate) relevant pages from mechanical specification and mechanical drawings which accurately and thoroughly describe the basic HVAC system design. Energy Report: • Details of how the HVAC system has been represented in the model.
Zoning	• Demonstrate that all air conditioning zones represented in the thermal model accurately reflect the designed systems performance and zonal solar diversity.	Energy Report: • Details of how the air conditioning zones have been represented in the model, and how these zones accurately represent the mechanical design drawings and specification.

Chiller plant	• Demonstrate that the chiller plant size is accurately reflected in the model. • Demonstrate that the actual efficiency curves of the installed plant are used in the model. • Water cooled equipment: Demonstrate that chiller data is specified under conditions that reflect the intended condenser water temperature controls. • Air cooled equipment: Demonstrate that the air cooled chiller COP profiles have been accurately modelled with regard to loading and ambient conditions	Verification Documents: • Design or as-installed (where appropriate) relevant pages from the mechanical specification showing the chiller plant size and any condenser water operation. • Documentation from chiller supplier giving part load curves (and condenser water temperatures where applicable). Energy Report: • Details of how the chiller plant size has been represented in the model. • Details of how the actual efficiency curves have been used in the model. • Details of how the chiller data is relevant to the intended condenser water temperature controls.
Boiler plant	• Demonstrate that the boiler plant size, thermal efficiency and distribution efficiency are accurately reflected in the model.	Verification Documents: • Design or as-installed (where appropriate) relevant pages from the mechanical specification which show details of the boiler plant size, thermal efficiency and distribution efficiency. Energy Report: • Details of how the boiler has been modelled.
Supply Air and Exhaust Fans	• Demonstrate that fan performance curves are accurately represented in the model. .	Verification Documents: • Design or as-installed (where appropriate) pages from the mechanical specification showing fan performance curves and fan size. Energy Report: • Details of how these have been modelled. • Summary table showing all fan inputs entered into the model and how these correlate to the actual fan data provided.
Cooling Tower Fans	• Demonstrate that allowance for energy consumption from cooling tower fans has been made, based upon the annual cooling load of the tenancy and the supplementary cooling load for tenancy air conditioning.	Energy Report: • Details of how the cooling tower fans have been modelled.

Cooling Tower and Condenser Water Pumping	• Demonstrate that allowance for energy consumption from cooling tower and condenser water pumping has been made, based upon the annual cooling load of the tenancy.	Energy Report: • Details of how the cooling tower and condenser water pumping have been modelled.
Controls - Outside Air	• Demonstrate that outdoor air flows have been modelled as documented in the mechanical design drawings and specifications, and in compliance with the appropriate standards.	Verification Documents: • Design or as-installed (where appropriate) relevant pages from mechanical specification, giving details on the correct minimum outside air flow Energy Report: • Detail of how outside air flow has been represented in the system
Controls - Economy Cycle	• Demonstrate that economy cycles have been modelled to reflect system specification noting any enthalpy/temperature cut-off and control point.	Verification Documents: • Design or as-installed (where appropriate) relevant pages from mechanical specification giving details on the economy cycle of the system Energy Report: • Detail of how the economy cycle has been modelled
Controls - Primary duct temperature control	• Constant Volume Systems: Demonstrate that modelling has allowed supply air temperatures to vary to meet loads in the space • Variable Volume Systems: Demonstrate that modelling has allowed supply air volumes to vary to meet loads in the space • Demonstrate that setpoints have been rescheduled as specified. Note that simplifications may be made to consider average zone temperature in lieu of high/low select.	Verification Documents: • Design or as-installed (where appropriate) relevant pages from mechanical specification giving details of the design temperature and HVAC cooling and heating setpoints Energy Report: • Detail of how design temperatures and setpoints have been modelled

<table>
<tr>
<td>Controls - Airflow</td>
<td>

Demonstrate that control logic describing the operation of the dampers to control outside and re-circulated airflow is inherent in the model and accurately reflects the airflow characteristics of the system.
Where variable air volume fans are used in the proposed building, part load performance is to be modelled as per the table below (ASHRAE 90.1 part load power coefficients).

Table 5 VAV fan part-load power
<table>
<tr><th>Fraction of full load volume</th><th>Fraction of full load power</th></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>0.9</td><td>0.83</td></tr>
<tr><td>0.8</td><td>0.68</td></tr>
<tr><td>0.7</td><td>0.54</td></tr>
<tr><td>0.6</td><td>0.41</td></tr>
<tr><td>0.5</td><td>0.3</td></tr>
<tr><td>0.4</td><td>0.21</td></tr>
<tr><td>0.3</td><td>0.13</td></tr>
</table>
</td>
<td>
<u>Verification Documents:</u>

Design or as-installed (where appropriate) relevant pages from the mechanical specification giving details of the operation of the dampers to control outside and recirculated air

<u>Energy Report:</u>

Details of how these have been represented in the model

</td>
</tr>
<tr>
<td>Controls - Minimum turndown</td>
<td>

Demonstrate, where relevant, that the minimum turndown airflow of each air supply is accurately reflected in the model.

</td>
<td>
<u>Verification Documents:</u>

Design or as-installed (where appropriate) relevant pages from the mechanical specification giving details of the minimum turndown airflow of each air supply

<u>Energy Report:</u>

Details of how the minimum turndown is modelled for each air supply

</td>
</tr>
</table>

Chiller staging	• Demonstrate that for systems that employ multiple chillers with a chiller staging strategy, the correct controls are modelled to reflect the actual relationship between the chillers.	Verification Documents: • Design or as-installed (where appropriate) relevant pages from the mechanical specification giving details of the chiller staging strategy Energy Report: • Details of how chiller staging has been modelled
Temperature control bands	• Demonstrate that the temperature control bands of the system accurately reflect the thermal model.	Verification Documents: • Design or as-installed (where appropriate) relevant pages from the mechanical specification giving details of the design specification for the thermal model Energy Report: • Details of how the temperature control bands have been modelled

6.5 Notional Building - HVAC System 1

For non-residential tenancies that are greater than 3500m² a variable air volume fan served by an air-cooled chiller shall be modeled. Heating will be via electric reheat.

System Component	Performance Parameter
Chiller	As per Table 7.
Number of chillers	To be based on peak building load reported during the simulation. Chillers are to be simulated sequentially with no chiller staging performed. =< 500 kW 1 air cooled chiller 500kW<1000kW 2 air cooled chillers sized equally >1000kW minimum of two air cooled chillers with chillers added so that no chiller is larger than 650 kW, all sized equally
Chilled Water Temperatures	6°C supply water temperature
Chilled Water pump power	=<500kW Primary constant volume pump with specific fan power 349 W/l/s Where more than one chiller is required, a primary/secondary configuration will be simulated with the secondary pump riding the pump curve.
Heating	Electric resistance heating with a COP of 1
Supply Air Temperature	12 °C supply air temperature
Supply Air Fan Power	Variable air volume fan specific fan power at rated condition of 1.8 W/l/s with an overall fan efficiency of 70%. Part load power characteristics shall follow variable speed curve as per the table below. 1.8 W/l/s includes all fan energy use required for air conditioning, including fresh air and exhaust fans. One air handling unit per typical floor is to be modeled.

<table>
<tr><th>System Component</th><th>Performance Parameter</th></tr>
<tr><td></td><td>Table 6 VAV fan part load power
<table><tr><td>Fraction of full load volume</td><td>Fraction of full load power</td></tr><tr><td>1</td><td>1</td></tr><tr><td>0.9</td><td>0.83</td></tr><tr><td>0.8</td><td>0.68</td></tr><tr><td>0.7</td><td>0.54</td></tr><tr><td>0.6</td><td>0.41</td></tr><tr><td>0.5</td><td>0.3</td></tr><tr><td>0.4</td><td>0.21</td></tr><tr><td>0.3</td><td>0.13</td></tr></table></td></tr>
<tr><td>Zoning</td><td>Thermal zones as per proposed tenancy with one air handling unit object per floor.</td></tr>
</table>

Table 7 Notional building chiller part load performance

		Outdoor Temperature									
		20	22	24	26	28	30	32	34	35	
Part Load %	20%	4.3	4.0	3.8	3.6	3.4	3.3	3.2	3.0	2.9	COP
	30%	4.3	4.0	3.8	3.6	3.4	3.3	3.2	3.0	2.9	
	40%	4.4	4.1	3.9	3.7	3.5	3.4	3.2	3.1	3.0	
	50%	4.4	4.2	4.0	3.7	3.6	3.4	3.3	3.1	3.1	
	60%	4.3	4.1	3.8	3.6	3.4	3.3	3.2	3.0	3.0	
	70%	4.1	3.9	3.7	3.4	3.3	3.1	3.0	2.9	2.8	
	80%	3.9	3.7	3.5	3.3	3.2	3.0	2.9	2.8	2.7	
	90%	3.9	3.7	3.5	3.3	3.1	3.0	2.9	2.7	2.7	
	100%	3.8	3.6	3.4	3.2	3.1	2.9	2.8	2.7	2.6	

6.6 HVAC System 2

For residential and tenancies that are less than 3500m² a unitary heat pump system shall be modeled for the notional tenancy.

System Component	Performance Parameter
Unitary heat pump	Cooling COP of 3 and heating COP of 3.2.
Supply air temperature	12° C
Supply Air fan power	Constant volume fan with a specific fan power of 0.8 W/l/s and an overall fan efficiency of 70%.
Zoning	Thermal zones as per proposed building with one air unitary heat pump object per zone.

7. Example Report

The following template must be used as a basis for the report that is to be submitted to the GBCSA with the Round 1 or Round 2 submission.

Text in closed brackets and italics gives guidance on the information required and is not to be included in the final report. Note that examples of design/as-built documentation correlating the actual equipment in the example report have not been included – project teams are however expected to provide this information with their modeling report with all relevant information highlighted, as set out in the documentation requirements section of this document.

1 General Modelling Parameters

- Project *XYZ Office*
- Number of Stories *1*
- Location *Johannesburg*
- Simulation Software used *DesignBuilder v3.1*
- Weather Data Used *Meteonorm O.R.Tambo/Jan Smuts Airport 1996-2005*
- Space Breakdown:

Table 8. Space break down

Space	Type	Included in simulation	Area (m²)	Comments
Reception	*Office*	*yes*	*50*	
Office	*Office*	*yes*	*1674*	
Stairwell	*Office*	*yes*	*46*	
Ablutions	*Office*	*yes*	*80*	*Extract fan energy use excluded from calculations*
TOTAL			***2537***	

[Justification for any areas of the project excluded from the model]

Car park lighting, lifts and escalators and ventilation energy were excluded from the calculations. The tenant is fitting out an existing building and had no influence on the design of these areas.

[Details of any central plant which serves areas other than the modelled area, and how these have been dealt with]

No central plant serving other areas is included on this project

Naturally Ventilated Buildings

[Confirmation that the Natural ventilation comfort criteria has been met or not, and details of modelling to show compliance – either in the energy modelling report or as a separate Natural Ventilation Report – refer Green Star SA Technical Manual – credit Ene-1]

The project is an artificially air conditioned building.

2 Energy Efficiency Measures

[*Provide a brief description of the items that contributes to the energy efficiency results obtained]*

The building has been designed to reduce thermal loads on the HVAC system as much as possible. External shading has been provided on all facades except the south.

Energy efficient lighting that saves electrical energy and reduces the thermal load on the HVAC system is used on the project.

The building makes good use of thermal mass by exposing the ceilings and floor, this reduces energy consumption on the HVAC system and improves thermal comfort, particularly in perimeter zones.

The air conditioning system itself (VRF system) is energy efficient and can perform simultaneous heating and cooling. High part load COPs that exceed that of the reference building can be obtained.

3 Building Envelope

3.1 Geometry

The fitout consists of the entire 2nd floor of the recently completed XYZ building in Johannesburg.

[Isometrics of the simulation model for both the Actual and the Notional Building showing the building shape and window locations, etc, that allows easy comparison with architectural drawings]

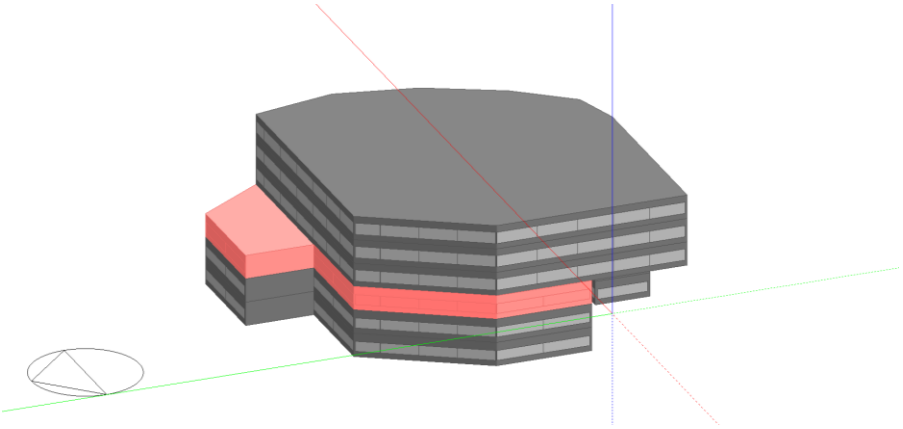

Figure 1 Notional building model

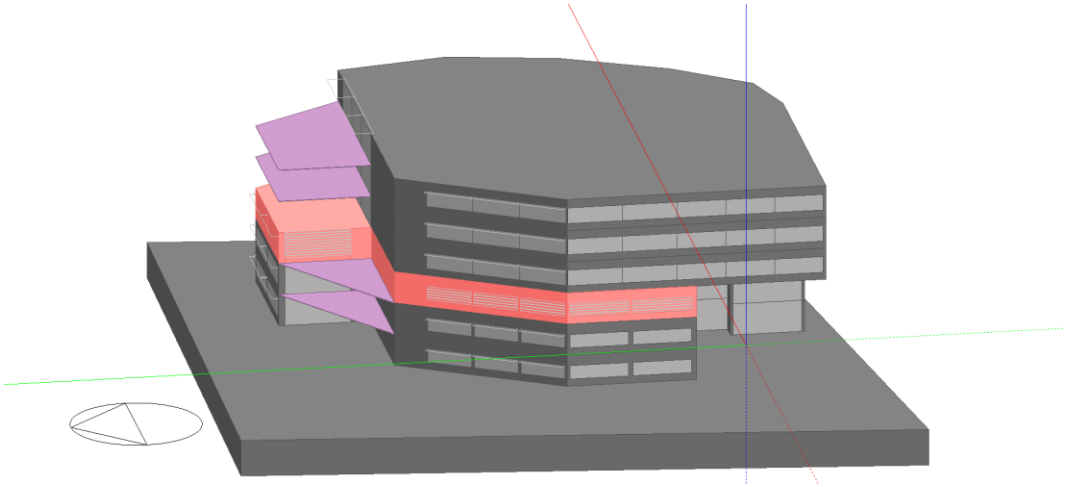

Figure 2 Actual building model

3.2 Fabric

3.2.1 Opaque building fabric

Table 9 Opaque fabric elements summary

	Notional Building	Actual Building
Exterior Wall Construction	110mm brick,15mm Standard EPS Insulation,110mm brick,10mm plaster Insulation R=0.891 CR = 80	110mm brick, 50mm air cavity,110mm brick R = 0.6
Roof	N/A	N/A
Internal Floor/Ceiling	10mm Wooden floor,150mm air gap,150mm concrete slab,500mm air gap,10mm ceiling tile R=1	200mm skimmed concrete slab R= 0.4

3.2.2 Glazing

Table 10 Vertical glazing summary

	Notional Building	Actual Building
Window Type	SANS 204 Double Glazed, Timber Frame, Solar Coating	Double Glazed Low-e
Average U value including frame	4.23	2.2*
SHGC	0.59	0.51

*Aluminium frames are drawn geometrically in the model as per glazing schedules, total U-value is calculated by the modeling software.

Table 11 Notional building glazing area calculation

Climate Zone	N	NE	E	SE	S	SW	W	NW
1	34%	31%	37%	49%	64%	54%	47%	39%
2	35%	31%	38%	62%	99%	72%	44%	37%
3	35%	30%	33%	45%	78%	51%	35%	32%
4	34%	31%	37%	49%	64%	54%	47%	40%
5	32%	29%	29%	38%	49%	38%	30%	29%
6	35%	32%	35%	52%	71%	54%	44%	36%

Glazing was as per the requirements for climate zone 1 in the table above.

3.2.3 Roof lights

Table 12 Rooflight summary

	Notional Building	Actual Building
Rooflight Type	SANS 204 minimum standard	N/A
Rooflight area (m²)	N/A	N/A
Average U value including frame	N/A	N/A
SHGC	N/A	N/A

3.2.4 Shading

[Details of internal and external shading included in simulation]

No shading was modeled for the notional building. All shading elements as per architects drawings were included in the actual building. These were as per the summary below and have been marked up on the architects drawings.

Table 13 Actual building shading summary

Location	Description
West facing glass	Horizontal louvres with a 300mm spacing, 300mm blade depth and angled at 30° to the horizontal
North facing glass	2m overhang placed 500mm above glazing.
East facing glass	Horizontal louvres with a 300mm spacing, 300mm blade depth and angled at 30° to the horizontal

3.3 Orientation

[Evidence that orientation of the building has been taken into account]

The building orientation was as per architects drawing. The correct orientation has been marked up on the architects drawings provided.

3.4 Infiltration

Infiltration for perimeter zones was set as below;

Table 14 Infiltration

	Notional Building	Actual Building
Infiltration rate	0.5ach	0.5ach

3.5 Internal Loads

	Notional Building	Actual Building
Summer Design temperature	23°C	23°C
Winter Design Temperature	21°C	21°C
Occupancy	9 m²/person	9 m²/person
Tenant lighting	11 W/m²	6 W/m²
Tenant equipment	11 W/m²	11 W/m²
Fresh air rate	7.5 litres/sec/person	10 litres/sec/person

3.6 HVAC Systems

3.6.1 Zoning

The same zoning was used for both the notional and actual building. This zoning was exactly as per the mechanical engineers design.

3.6.2 Notional building HVAC

HVAC system 2 was used for the notional building since the project consisted of a floor less than 3 500m². Notional building system inputs were as per the table below

System Component	Performance Parameter

Unitary heat pump	Cooling COP of 3 and heating COP of 3.2.
Supply air temperature	12° C
Supply Air fan power	Constant volume fan with a specific fan power of 0.8 W/l/s and an overall fan efficiency of 70%. This equates to a standard fan coil unit.
Zoning	Thermal zones as per proposed building with one air unitary heat pump object per zone.

[*details on sizing calculated by modelling software must be provided for all notional building hvac components*]

Table 15 Notional building HVAC system sizing

Zone	DX Cooling Coil Load (kW)	Fan Input Power (kW)
EAST3	6.4	0.7
EAST4	4.8	0.5
EAST5	3.6	0.2
SOUTH3	3.2	0.2
WEST4	6.4	0.6
INTERNAL	72.2	3.9
SOUTH2	6.4	0.2
EAST1	4.7	0.5
EAST2	6.9	0.7
WEST2	8.5	0.8
WEST3	7.0	0.9
WEST5	3.2	0.5
WEST1	4.8	0.2
NORTH1	7.1	0.3
SOUTH1	7.0	0.3

3.6.3 Actual Building

[Description of the HVAC system, including number and kW rating of chillers, plant efficiency (COP) etc, number and duty of air handling units/split units etc. Note the actual capacities of equipment are to be used in the model and reported]

3.6.3.1 Cooling and heat rejection

The actual building makes use of a VRF system for heating and cooling. VRF energy consumption was modeled using data from manufacturer's documentation for the specified equipment. A single outdoor unit as per the design was modeled. The table below shows a summary of the actual building energy inputs.

Table 16 VRF Outdoor Unit Modelled Capacity

System Component	Rated Capacity (kW)	Note
Outdoor unit - Cooling	100	The actual design capacity is used
Outdoor unit capacity- Heating	120	

Table 17 VRF outdoor unit performance data

		Outdoor Temperature					
		18°C	20°C	23°C	27°C	31°C	
% Part Load	50.00%	5.95	5.86	5.72	5.43	4.84	COP Cooling/Heating
	60.00%	6.02	5.93	5.76	5.35	4.75	
	70.00%	6.03	5.92	5.73	5.22	4.60	
	80.00%	5.96	5.87	5.70	5.02	4.43	
	90.00%	5.91	5.79	5.51	4.83	4.26	
	100.00%	5.84	5.74	5.31	4.66	4.09	

3.6.3.2 Supply Air Fans

Since the indoor units are constant volume fan coil units that also supply fresh air from a rear mounted plenum box into the space, supply air fan energy consumption was calculated by taking the total installed fan power and multiplying by the total number of HVAC hours. **F**an power as per the product data sheets provided for each specified fan are given below. Flow rate was entered as per the design flow rate indicated on the mechanical engineers drawings.

Table 18 Fan power of installed indoor units

Model Reference	Design Flow Rate (m^3/s)	Fan Power (w)
EAST3 SUPPLY FAN	0.25	130
EAST4 SUPPLY FAN	0.25	130
EAST5 SUPPLY FAN	0.15	80
SOUTH3 SUPPLY FAN	0.15	80
WEST4 SUPPLY FAN	0.4	200
INTERNAL SUPPLY FAN	3.5	1700
SOUTH2 SUPPLY FAN	0.25	130
EAST1 SUPPLY FAN	0.25	130

EAST2 SUPPLY FAN	0.25	130
WEST2 SUPPLY FAN	0.45	225
WEST3 SUPPLY FAN	0.4	200
WEST5 SUPPLY FAN	0.15	80
WEST1 SUPPLY FAN	0.4	200
NORTH1 SUPPLY FAN	0.25	130
SOUTH1 SUPPLY FAN	0.4	200
Fresh Air Fan	2	2000

Fresh air is delivered by a constant volume fresh air fan and is included in the table above.

4. Simulation Results

Results from the procedures outline above are presented below. Four points are claimed for ENE-1 section E1.2 based on the results below.

Table 19 Simulation Results

Building Component [kWh/annum]	Notional Building	Actual Building
Heating	1,368	2,251
Cooling and Heat Rejection	58,369	24,320
Fans	25,366	13,630
Total	85,103	40,201
Total Building kWh/m²/annum	46.81	22.11
Base Building (kgCO2m²/annum)	56.17	26.54
Percentage Saving Over Notional		53%
Green Star SA Points		4

Ene-2 Energy Sub-metering

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise the installation of energy sub-metering that facilitates on-going management of energy consumption.

CREDIT CRITERIA

Up to two points are awarded as follows:

Metering and monitoring

One point is awarded where:

- Electrical sub-metering is provided for all substantive electrical energy uses within the project

AND

- An effective monitoring system is installed to monitor all sub-meters, with data accessible to occupants, and a metering strategy is developed.

Sub-metering

An additional one point is awarded where:

- The above point is achieved;

AND

- Electrical sub-metering is provided separately for lighting and separately for power consumption. Where the tenancy is greater than one floor, this must be provided separately for each floor.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. As Built drawing(s) **or** Electrical system line drawing(s) 3. Metering strategy

GBCSA's Submission Template prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Providing a summary table of all separately sub-metered lighting and power groups for the fit out;
- Providing a summary table of all separately sub-metered spaces and substantive loads in the fitout, or justifying their exclusion through calculations;
- Describing how the energy is effectively monitored during the fitout's operation and how fitout occupants have access to their consumption data

As Built drawing(s) or Electrical system line drawing(s) marked-up to clearly show the location of all sub-meters and the loads of all substantive energy demands as referenced in the short report.

Metering strategy document that describes:

- The frequency of meter readings, data collection and storage, and reporting method; and,
- How metering errors are to be identified and provide guidance on future calibration or verification requirements (where applicable).

ADDITIONAL GUIDANCE

The documentation must account for all of the substantive electrical demands in the fitout, and clearly identify the location, number and respective loads of all sub-meters.

Effective monitoring system

There must be an 'effective' system for collecting, recording and monitoring data from all sub-meters. In most cases, the requirement for an effective system will lead to the inclusion of automated monitoring systems. Manual monitoring and data collection of sub-meters is also an acceptable way to meet the Credit Criteria.

Substantive electrical loads

Substantive electrical loads are those where electrical sub-metering is deemed sensible and beneficial for energy saving and monitoring by a suitable qualified professional. These are expected to include the following (where applicable):

- Centralised hot water, heating, cooling or ventilation systems (electric and gas metering as appropriate);
- Car park lighting & ventilation;
- Common area lighting and general power;
- External lighting;
- Lifts (if collectively over 20 kVA)
- Chillers;
- Hot water plants for space heating;
- Air handling units, fans, humidification;

- Lifts/escalators;
- Building-related process energy systems and equipment; and
- Any additional item that carries an energy use greater than 25kVA.

Metering strategy

The metering strategy must be based on what the actual methodology will be that the fitout will adopt for sub-metering. The strategy document need not be exhaustive and must be written in easy-to- read language for a non-technical reader.

BACKGROUND

The Energy Sub-Metering credit encourages the provision of energy use information to fitout users as a meaningful deterrent to wasteful behaviour and a powerful way to raise awareness of the financial benefits of reduced energy consumption.

Metering is an integral part of energy and resource conservation during a fitout's operational life. In successfully managing energy consumption it is important that sufficient data is available to the tenant to allow them to monitor consumption and compare historical records. Sub-metering allows the tenant of fitout managers to fine tune operational procedures to minimise consumption and to detect any operational problems early.

REFERENCES & FURTHER INFORMATION

CIBSE TM39:2006 Building Energy Metering – A Guide to Energy Sub-metering in Nondomestic Buildings
www.cibse.org.uk

International Performance Measurement & Verification Protocol
http://www.ipmvp.org

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Tra-1 Commuting Mass Transport

POINTS AVAILABLE **1**

AIM OF CREDIT

To encourage and recognise the selection of sites/premises that are near public transport and facilitate the use of public transport.

CREDIT CRITERIA

One point is available where:

- The project is located within 1000m walking distance of at least 2 different modes of public transport stops

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. Site plan extending to surrounding areas OR online map

GBCSA's Submission Template prepared by a suitable professional including a tabulated summary of the public transport stops surrounding the site in compliance with the distance requirement

Site plan or online map extending to surrounding areas showing the project site and surrounding area, marked up to show:

- The scale of image or plan;
- The major entrances to the building;
- The relevant mass transport stop(s); and
- The walking distance from the building entrance to the relevant transport stop(s).

ADDITIONAL GUIDANCE

Distance to site

INT-Tra-1 Commuting Mass Transport

POINTS AVAILABLE **1**

The distance to a public transport stop is to be measured as actual pedestrian walking distance - not bird's eye view or simple radius – from a major building entrance. It must be demonstrated that safe, dedicated pedestrian facilities are provided between the building and adjacent street network. The walking route may only cross streets at pedestrian traffic crossings or road intersections, not mid-block where there is no pedestrian crossing facility.

BACKGROUND

The Commuting Mass Transport credit addresses the importance of choosing appropriate sites as it relates to commuter transport access.

Access to quality public transport can have a significant impact on travel habits and result in better environmental outcomes across a variety of impact categories. When a development is poorly located in proximity to transport nodes (stops, stations and interchanges) and/or and the frequency of service is poor, then it is unlikely that fitout occupants will use mass transport to travel to work or complete other errands. Conversely, developments that are within close proximity of good transport nodes with frequent service can encourage fitout occupants to use mass transport.

REFERENCES & FURTHER INFORMATION

City of Cape Town's Integrated Transport Plan
http://www.capetown.gov.za/en/IDP/Statutory%20plans%202011%20%202012/AnnexureK_Integrated_Transport_Plan_Revised.pdf

Gautrain
http://join.gautrain.co.za/map.aspx

MyCiti
http://myciti.org.za/en/routes/interactive-routes/

Golden Arrow Bus Services
http://www.gabs.co.za/timetables-routes/

VicHealth (1999), Trends in Transportation in Moving to Healthier People and Healthier Places, Victorian Government, Melbourne, Australia.

http://www.vichealth.vic.gov.au/~/media/ProgramsandProjects/PlanningHealthyEnvironments/Attachments/vhtransch3.ashx

INT-Tra-1 Commuting Mass Transport

POINTS AVAILABLE 1

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Tra-2 Local Connectivity

POINTS AVAILABLE **1**

AIM OF CREDIT

To encourage and recognise tenants that choose to locate their premises within walking distance of high quality amenities such as shops and parks, thus reducing private vehicle use and the associated negative environmental impacts.

CREDIT CRITERIA

One point is awarded where:

- At least five amenities listed below are located, within 1000m unimpeded walking distance of the tenancy's building entrance, or are within the building itself.

Accepted amenities:

- Hardware store
- Public sports field
- Pharmacy
- Gym, pool or sports facility
- Library
- Bank or ATM
- Cinema or theatre
- Places of worship
- Officially designated 'Trading Area'
- Community centre
- Hospital, clinic or healthcare centre
- Registered childcare centre
- Post office
- Retail shop
- School, University or Technikon
- Beauty Salon or Spa
- Community food garden
- Supermarket or grocery store
- Dry cleaners or Laundromat
- Convenience store
- Restaurant or food outlet
- Recycling depot
- Garden nursery
- Farmers' or Craft market
- Playground

Projects within a retail centre or a mixed use development can use amenities within the development to demonstrate compliance with this credit.

INT-Tra-2 Local Connectivity

POINTS AVAILABLE **1**

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. Site Plan extending to surrounding areas OR online map 3. Evidence of location of amenities

GBCSA's Submission Template prepared by a suitable professional that includes a summary table for all amenities claimed, listing the type and the distance to the building, as well as evidence these amenities exist.

Site plan or online map extending to surrounding areas showing the project site and surrounding area, marked up to show:

- The scale of image or plan;
- The major entrances to the building;
- The relevant amenities and their walking distance from the building entrance(s)

Evidence of location of amenities such as phone book, yellow pages or equivalent listing showing the location and type of each local amenity including listing of addresses

ADDITIONAL GUIDANCE

Amenities claimed must be five unique types from the list. Multiples of any one type only count as one amenity for purposes of this credit. For example, three restaurants within the required distance would only count as one amenity for credit compliance.

Evidence of amenity existence

Documentation of existence for each amenity claimed can include but not limited to: phone book/yellow pages listing including address, website page including physical address, photograph of amenity, or confirmation of address on letterhead from the establishment.

Distance to site

INT-Tra-2 Local Connectivity

POINTS AVAILABLE 1

The distance to an amenity is to be measured as actual pedestrian walking distance - not bird's eye view or simple radius – from a major building entrance. It must be demonstrated that safe, dedicated pedestrian facilities are provided between the building and adjacent street network. The walking route may only cross streets at pedestrian traffic crossings or road intersections, not mid-block where there is no pedestrian crossing facility.

BACKGROUND

The Local Connectivity credit addresses the importance of selecting sites that are easily accessible and are located within walking distance of a variety of high quality amenities. Where amenities are located within close proximity, the likelihood increases of building occupants choosing to walk or cycle these short distances in lieu of personal car trips, and satisfaction increases due to increased convenience and reductions to travel time. Walking to nearby amenities to do errands increases physical movement, provides exercise and contributes towards a healthier lifestyle.

Sites that are located within walkable distance to other amenities and public transport facilities also result in significant environmental benefits such as reduced necessity for carbon-intensive private transport. Reduced private transport leads to subsequent decreases in the demand for car-parking facilities, thus making land available for more environmentally, socially, or economically beneficial uses.

REFERENCES & FURTHER INFORMATION

Department of Transport and Public Works (2009), Non-motorised Transport in the Western Cape Draft Strategy

City of Johannesburg, (2007) City of Johannesburg Planning Framework for NMT in JHB **http://www.joburg-archive.co.za/2009/pdfs/transport/nmt_framework09.pdf**

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Tra-3 Alternative transport

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise projects that promote and facilitate the use of alternative modes of transport in lieu of the use of private cars.

CREDIT CRITERIA

Two points are available for this credit. Each point is independent of each other.

Cyclist facilities

One point is awarded where:

- Cyclist facilities are provided for 3% of the on-site staff which include: secure bicycle storage, secure locker or personal storage space per bicycle, shower(s), and changing facilities.

Alternative Transportation Parking

Half a point is available where:

- 5% of the tenant parking spaces provided for occupants and visitors are designated for mopeds, scooters, motorbikes, carpooling and/or electric vehicles.

Reduced use of private fossil fuel vehicles

Half a point is available where the operational travel is further reduced by encouraging the reduction of private car use through any of these initiatives:

- No parking is provided for staff
- Provide electric vehicles and charging facilities and encourage the use of these vehicles by staff during work travel
- Provide access to a car sharing program for staff use
- Provide access to a bicycle share program for staff use
- Provide leased or purchased bicycles for staff use
- Provide video conferencing solution(s) to minimise air travel

DOCUMENTATION REQUIREMENTS

INT-Tra-3 Alternative transport

POINTS AVAILABLE **2**

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. As Built drawings 3. Evidence of alternative transport initiatives

GBCSA's Submission Template prepared by a suitable professional that describes the submission for this credit.

Where the point for 'Cyclist facilities' is claimed, the template must include descriptions of:

- How the credit criteria has been met including calculations of the number of staff accommodated;
- The location and provision of the cyclist facilities - including showers and lockers provided - and references to as built drawings or images;
- How access is convenient and security is provided;

Where the point for 'Alternative Transportation Parking' is claimed, the template must include descriptions of:

- How the credit criteria has been met including how parking spaces for alternative modes of transport are provided and designated.

Where the point for 'Reduced use of private fossil fuel vehicles' is claimed, the template must include descriptions of:

- The alternative transportation initiatives or service(s) available for use by staff referencing relevant policies, receipts, contracts or as-built drawings as documentation.

As-built drawings marked up to show relevant features relating to credit compliance:

- Location of showers, lockers, and bike parking/storage,
- Designated parking spaces for alternative transportation, vehicle charging facilities, or demonstration of no parking provided,
- Location, route and distance to alternative transport facilities, shared vehicle(s), or provided bicycles for staff' use.

Evidence of alternative transport initiatives in the form of policies, receipts or contracts for the purchase or lease of alternative modes of transport provided, as well as for car and bicycle sharing programs implemented.

INT-Tra-3 Alternative transport

POINTS AVAILABLE 2

ADDITIONAL GUIDANCE

Cyclist facilities

For this criterion to be met, staff must have access to a sufficient number of high quality cyclist facilities, which are defined as:

- Secure bicycle storage;
- Showers with appropriate space to change clothes; and
- Adjacent or nearby secure lockers or personal storage.

There are a number of methods to fulfil this requirement. Regardless of the method, it must be convenient for staff to arrive at the project, lock their bicycle to a rack or within a secure room, go to a location where they can securely store items in a locker or similar, take what is needed for a shower and change clothes. For example, a staff member must not need to store their belongings at their desk or have to walk through a large public area between the location of lockers and showers.

Sufficient number

Cyclist facilities must be provided for at least 3% of the fitout staff, which is defined as the maximum number of staff that will work within the project premises at the same time during a month of standard operation. The calculations should include all staff on site, not only staff employed by the main fitout user. This includes staff such as temporary exhibitors, event staff, security, staff in leased areas, maintenance and cleaning personnel. For each bicycle parking space, one locker must be provided. A shower must be provided for every 10 (or part thereof) bicycle parking spaces. For example, 12 bicycle spaces would require 12 lockers and 2 showers.

Bicycle storage

Secure bicycle storage for staff is to be protected from the elements and provided in close proximity to a main entrance area or other relevant entrance in a location that is highly visible, well lit, and with good passive surveillance.

Secure bicycle storage can be achieved by one of the following two methods:

- Racks/rails which are covered and protected from the elements, and designed to allow both a wheel and the frame to be locked securely to the structure;

OR

- A locked bicycle room or shed, with access for staff only. Sufficient space must be provided to store all bikes without having to move other bikes or rely on a bike's integral stand. Fixtures or racks to lock bikes in this case are not required.

Railings, lamp posts or other non-purposeful bike parking facilities do not comply.

Showers

Showers and changing facilities must be protected from the elements and available for both male and female users. These facilities can also be available for non-cycling users of the building. The total required number of showers and lockers do not have to be provided in one area. However, all cyclist facilities must be accessible to all staff.

Showers must either have a space for changing, or be located next to a changing amenity with temporary personal storage space or lockers. Both showers and changing areas must be able to be locked or otherwise provide full privacy to the user(s). The showers must also provide a space to hang or store dry towels and clothing items and change areas away from wet areas.

Regular toilets do not count as changing facilities unless they have been fitted out as changing rooms with sufficient private space and lockers. Separate toilets provided for persons with disabilities do not contribute towards changing facilities for this credit. Disabled showers may contribute towards the total number of showers provided when they are not stipulated in statutory requirements for the project.

To be deemed adjacent, changing facilities must be immediately adjacent to the showers or for refurbishments, be located on the same floor with direct access that avoids crossing of public spaces such as lift lobbies, reception areas or primary circulation space.

Lockers

Lockers or securable personal storage space must be provided within close proximity to the changing amenity and showers. Lockers cannot be located in another area of a building that a person is not likely to have access to.

Additional notes for this criteria

The total required number of showers and lockers does not have to be provided in one area. Showers and changing amenities can be available for users other than cyclists. Unisex facilities can meet the requirements for the credit criteria if a level of privacy is provided for showering and changing (i.e. opaque partitions and private changing amenities adjacent to or within the showers).

Provide electric vehicles for staff use

Demonstrate that electric vehicles and charging facilities are provided as part of the project. One electric vehicle and charging facility must be provided for every 100 staff or one vehicle and one charging facility must be provided if the total number of staff is less than 100. A

nominated member of staff must be trained in the use of the vehicle and will train all other staff members on the use of the vehicle as required.

Electric car charging facilities may be provided within car-parking facilities that are part of the project or in car-parking facilities which are leased for use by the project in the building, neighbouring buildings or car-parking facilities. The leased parking must be no further than 500 metres walking distance from an entry to the building where the project is located.

When documenting the provision of electric vehicles, provide receipts or contracts for the purchase or lease of a plug-in electric vehicle and the provision of appropriate car charging facilities. Where charging facilities are provided in neighbouring buildings or car parking facilities, provide drawings showing the route and distance taken from the car park to the closest entry to the building.

Provide access to car sharing programs

Demonstrate that fitout staff have access to a car sharing program with the parking location of these share cars available to them within 500 metres walking distance. One parking space must be available for every 100 staff.

When documenting the provision of car sharing program, provide receipts or contracts for the provision of a car purchase or lease. Provide marked-up drawings or scaled images showing the route and distance taken from the car parking location to the closest entry to the building.

Provide access to bicycle share programs

Demonstrate that fitout staff have access to a bicycle share program, as well as the cyclist facilities point of the credit has also been achieved. The number of bicycles provided must correlate with the number of bicycle parking facilities provided on the basis of the cyclist facilities criteria of this credit.

When documenting the provision of bicycle sharing program provide receipts or contracts for the provision of bicycles for the project. Provide marked-up drawings or scaled images showing the route and distance taken from the bicycle parking location to the closest entry to the building.

Design and implement a video conferencing solution to minimise air travel

Provide either a central video conferencing solution, or a video conferencing solution in each meeting room, with sufficient bandwidth to support multiple video and desktop sharing streams simultaneously. The video conferencing facility must be fully in place, not planned for future implementation.

Desktop video conferencing facilities can be used to demonstrate compliance with this criterion. However, each facility must be provided with a microphone or headset, as well as headphones. If this solution is used, it must be demonstrated that the office network and

internet connection have sufficient capacity to hold simultaneous video conferences for at least 10% of staff at any given time without impacting the rest of the network speed.

Note for retail spaces

It is acknowledged that in some retail spaces the 'reduced use of private fossil fuel vehicles' criteria may not be relevant. Projects are encouraged to submit CIRs to propose alternative criteria which will achieve the same aim and are relevant to the circumstances of the project.

BACKGROUND

The Alternative Transport credit addresses transport modes and technologies that are not addressed by other credits within the Green Star – SA Interiors Transport category. Alternative transport modes include cycling, electric vehicles, car-sharing and the provision of live conferencing technology in order to negate the necessity of travel altogether. The implementation or encouragement of alternative transport use can result in significant benefits to environmental, social and economic aspects of sustainability.

The use of all forms of alternative transport requires the provision or availability of at least some level of infrastructure within close proximity to a building. For example, if electric car use is to become a viable option for fitout users, access to car-charging facilities must be provided.

Tenants may choose to select sites where alternative transport infrastructure is already readily available, or to implement and spread such technologies or infrastructure in areas where they are not commonly available.

REFERENCES & FURTHER INFORMATION

Infrastructure policy, planning and design digest
http://www.ibike.org/engineering/infrastructure.htm

Framework for non-motorised transport, January 2009
http://www.joburg-archive.co.za/2009/pdfs/transport/nmt_framework09.pdf

City of Cape Town: NMT Policy and Strategy
http://www.cityenergy.org.za/transport/nmt

eThekwini bike share system raises cycling awareness in Durban

http://urbanearth.co.za/articles/ethekwini-bike-share-system-raises-cycling-awareness-durban

Liftshare.co.za

http://www.liftshare.com/za/

Carpoolmates

http://www.carpoolmates.co.za

LiftClubSA

http://www.liftclubsa.co.za

FindALift

http://www.findalift.co.za

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Wat-1 Potable Water

POINTS AVAILABLE **6**

AIM OF CREDIT

To encourage and recognise interior fitouts that minimise potable water consumption.

CREDIT CRITERIA

Up to 6 points are awarded where the potable water consumption of the fitout will be less than industry norms. Two compliance paths are available (simulation or deemed to satisfy), as set out below.

For tenancies with no existing or new water consumption, and with no landscaping or less than 0.5% of the nett lettable area being landscaped, this credit is not applicable and is excluded from the points available used to calculate the Water Category score.

Compliance Route 1 - Simulation method

Up to six points are awarded where the water efficiency performance of the fitout achieves a minimum percentage reduction in potable water consumption from a reference case using the Green Star SA – Interiors v1 Potable Water Calculator. Points are allocated as follows:

Reduction in Potable Water Consumption (%)	Wat-1 Points Awarded
0	0
15	1
30	2
45	3
60	4
75	5
95	6

Table 1: Points Allocation for the Green Star SA – Interiors v1 Potable Water credit

INT-Wat-1 Potable Water

POINTS AVAILABLE 6

Compliance Route 2 - Deemed to satisfy methodology

Up to six points are awarded through the Deemed-to-Satisfy methodology which stipulates minimum compliance criteria. Up to 6 points are available as follows under Parts A-D:

Part A - Fittings

Up to two points are awarded where:

- The project installs fixtures that comply with the maximum allowed flow rates stipulated below:

Fixture type	Maximum allowed flow rate
Bathroom taps	4 L/min
Kitchenette taps	6 L/min
Toilets	3.6 L/flush
Urinals	2 L/flush
Showers	9 L/min

Where the project is not installing fixtures, these points may be achieved if it can be demonstrated that the facilities used by the occupants have existing fixtures that comply with the maximum allowed flow rate. If the project has no fittings (new or existing), these points are 'Not Applicable' and are excluded from the points available used to calculate the Water Category score.

Part B - Laundry and Kitchens

One point is awarded where:

- laundry and kitchen appliances meet the following maximum allowed water consumption:

Fixture type	Maximum allowed flow rate
Laundry washing machines	• 7.2 litres per kg of clothing washed for machines up to 10 kg • 10 litres per kg of clothing washed for machines greater than 10kg capacity
Dishwashers	• 0.93 litres per place setting
Commercial pre-rinse spray valves (for food service applications)	• 6.5 L/min

If the project has no laundry or kitchen appliances installed in the project, this point is 'Not Applicable' and are excluded from the points available used to calculate the Water Category score.

Part C - Swimming Pools, Irrigation and heat rejection

One point is awarded where:

- At least 2 of the following interventions are included:

    1. For projects installing a swimming pool(s) or spas the following criteria are met:
        - All pools and spas must be fitted with a pool cover for use when the pool is not in use
        - The pool filtration system avoids the requirement for backwashing (i.e. not absorptive media or sand filter) or recycles all backwash water
    2. For projects where landscaping makes up more than 5% of the project site area, the potable water demand for irrigation is reduced by 90%
    3. For projects installing heat rejection, the potable water demand for heat rejection is reduced by at least 50% or the project uses no water for heat rejection.

If no heat rejection systems, swimming pools or spas are installed and or if there is no landscaping or the total landscaping represents less than 0.5% of the nett lettable area, these points are 'Not Applicable' and are excluded from the points available used to calculate the Water Category score.

Part D - Reclaimed or recycled water use

Up to 2 points are awarded where:

- Projects can demonstrate that reused or reclaimed water meets the annual demand of all water requirements for the tenancy as follows:
    - 50% of the total water demand for 1 point;
    - 75% of the total water demand for 2 points.

If the project has no existing or new water consumption, these points are 'Not Applicable' and are excluded from the points available used to calculate the Water Category score.

DOCUMENTATION REQUIREMENTS

Compliance Route 1 - Simulation method

Green Star SA – Interiors:
Submit all the evidence and ensure it readily confirms compliance to **Compliance Route 1 - Simulation method**
1. Short report 2. Statement of confirmation (1) 3. Completed Wat-1 Calculator 4. Statement of confirmation (2) 5. Manufacturer product datasheet(s) Or Letter from the supplier

6. As Built drawing(s)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Listing the key elements supporting the water efficiency strategy and key systems; and
- Providing a tabulated summary of fixtures and fittings included and nominating the water efficiency performance (i.e. L/min or L/flush) of each, with reference to supporting documentation.

Additionally where water based heat rejection is installed:

- Describing the heat rejection system installed for the project;
- Listing the heat rejection loads as determined by the Energy Modelling, or calculated by mechanical engineer if no modelling was done for Ene-01; and
- Justifying all entries to the Calculator relating to water consumption by the heat rejection system (drift co-efficient, condenser water dT, cycles of concentration) by referencing supporting documentation where relevant.

Additionally where efficient outdoor landscaping is installed:

- Listing the landscape areas, sizes and microclimate, with reference to supporting drawings;
- Listing the plant schedule and identifying the projected water demand for each defined landscape area, in line with Appendix B of the Potable Water Calculator Guide; and
- Explaining the irrigation system and their controls for each defined landscape area in line with the Potable Water Calculator Guide.

Additionally where swimming pool(s) are installed:

- Listing the swimming pool(s), filtration system and initiatives to reduce potable water consumption; and
- Justifying all inputs to the Calculator with reference to supporting documentation.

Additionally where laundry facilities are installed:

- Listing the laundry facilities, laundry load estimates and equipment proposed/installed; and
- Justifying all inputs to the Calculator with reference to supporting documentation.

Additionally where large kitchen(s) are installed:

- Listing the kitchen fittings and equipment proposed/installed; and
- Including calculations demonstrating the estimated number of meals served; water demand per meal in line with the guidance provided in the Potable Water Calculator Guide.

Additionally where other major water uses are installed:

- Listing the major water use and the water saving initiatives; and
- Including calculations justifying the inputs into the Potable Water Calculator.

Note: the project must clearly demonstrate the claimed water consumption through calculations and verification documentation.

Additionally where sustainable water supply is installed:

- Describing the type of sustainable water (recycled water, rainwater, other non-potable water supplies) initiatives and systems included in the project; and

Where grey/black water supply is recycled:

- Justifying all inputs into the Calculator with reference to supporting documentation, including but not limited to recycled water sources, non-potable water demands, and daily treatment, storage capacity and system operations.

Where rainwater is harvested and reused:

- Justifying all inputs into the Calculator with reference to supporting documentation, including but not limited to rainfall harvesting areas, non-potable water demand, and daily treatment, storage capacity and system operations.

Where other sustainable water supply is used:

- Justifying all inputs into the Calculator with reference to supporting documentation.

Additionally where off site reclaimed water is supplied to site:

- Describing the arrangement with the supply vendor; and
- Confirming the volumes supplied to the site.

Statement of Confirmation (1) from the Tenant confirming:

- Occupant inputs (occupant type, design number of occupants, occupancy profile, peak days per week, percentage of occupants who have access to shower);
- The number of staff that will work in the fitout simultaneously during standard operation; and
- The maximum number of visitors/students to the fitout simultaneously during standard operation.

Completed Wat-1 Calculator with all inputs correctly entered corresponding to all supporting documentation requirements provided.

Statement of confirmation (2) in the form of signed correspondence from the off-site reclaimed water supply vendor/designer confirming;

- The volume to be supplied (annually or otherwise); and
- The availability of the reclaimed water at the date of practical completion of the project.

Manufacturer product datasheet(s) OR Letter from the supplier clearly demonstrating:

- The water usage per flush or per minute of each fixture and fitting (WC's, urinals, WHB, and shower)

Additionally where water based heat rejection is installed:

- The operational parameters (drift co-efficient, condenser water dT, cycles of concentration) used for completion of the Potable Water Calculator

Additionally where efficient landscaping is installed:

- The relevant parameters of the irrigation controls used for completion of the Potable Water Calculator.

Additionally where swimming pool(s) are installed:

- The relevant parameters (pump flow rate, filtration system, filtration controls) of the filtration system and controls used for completion of the Potable Water Calculator.

Additionally where laundry facilities are installed:

- The water usage per kg of linen for each laundry machine.

Additionally where large kitchen(s) are installed:

- The water usage of each kitchen appliance or fitting

As Built drawing(s) marked-up to clearly demonstrate:

Where water based heat rejection is installed:

- Location and type of the water based heat rejection system.

Additionally where efficient outdoor landscaping is installed:

- The different landscaped areas, plant types, irrigation demands, external landscape area sizes, and microclimate necessary for completion of the Potable Water Calculator; and
- Where irrigation systems are installed: drawings showing irrigation system and irrigation system controls.

Additionally where swimming pool(s) are installed:

- The location, size and volume of the indoor/outdoor swimming pool, and
- Pool cover and pool filtration systems.

Additionally where sustainable water supply is installed:

- All applicable reclaimed/reuse water systems, storage capacity and the connections to end-uses (where applicable).

Additionally where off site reclaimed water is supplied to site:

- Showing the connection to off-site reclaimed water supply, and connection to water demands.

Compliance route 2 - Deemed to Satisfy methodology

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance to **Compliance route 2 - Deemed to Satisfy methodology**

INT-Wat-1 Potable Water

POINTS AVAILABLE **6**

1. Short report

Where points are targeted for fixtures and fittings:

2. As Built fittings schedule or drawing(s)
3. Datasheets for fixtures showing flow rates

Where points are targeted for laundry and kitchen appliances:

4. As Built appliance schedule or drawing(s)
5. Datasheets for appliances

Where points are targeted for swimming pools, irrigation and heat rejection provide the applicable documentation:

6. As Built drawing or detail showing pool cover and type of pool filtration system installed
7. Datasheet or manufacturer's confirmation for pool filtration system
8. Irrigation calculation report
9. Heat rejection calculation report or Statement from mechanical engineer

Where points are targeted for reclaimed or recycled water use:

10. Water balance calculation report
11. As Built drawing(s) and/or Datasheets
12. Statement of confirmation

Where points/parts of the credit are claimed as 'Not Applicable':

13. As built drawings indicating that there are no water consumption fittings/devices/elements

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Short report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Describing the methodology used and the number of points targeted
- Listing the key elements supporting the water efficiency strategy and key systems; and
- Providing a tabulated summary of fixtures and fittings included and nominating the water efficiency performance (i.e. L/min or L/flush) of each, with reference to supporting documentation.

Additionally where points are targeted for laundry and kitchen facilities:

- Listing the laundry facilities, laundry load estimates and equipment proposed/installed;
- Listing the kitchen appliances proposed/installed, including calculations demonstrating the estimated number of meals served;

Additionally where points are targeted for swimming pools, irrigation and heat rejection:

- Listing the swimming pool(s), pool cover and filtration system;
- Listing the landscape areas and planting types, with reference to supporting drawings;

- Describing the heat rejection system proposed for the project;

Additionally where points are targeted for reclaimed or recycled water use:

- Describing the type of sustainable water (recycled water, rainwater, other non-potable water supplies) initiatives and systems included in the project;

As Built fittings schedule or drawing(s) listing the applicable fixtures and fittings and their flow rates (i.e. L/min or L/flush)

Datasheets for fixtures showing flow rates (i.e. L/min or L/flush)

As Built appliance schedule or drawing(s) showing nominated appliances

Datasheets for appliances showing relevant water consumption data of nominated appliances.

As Built drawing or detail showing pool cover and type of pool filtration system installed.

Datasheet or manufacturer's confirmation describing the pool filtration system and that it avoids the requirement for backwashing (i.e. not sorptive media or sand filter)

Irrigation calculation report prepared by a suitably qualified professional (e.g. landscape architect or hydraulic engineer) that describes how the Credit Criteria have been met by:

- Showing calculations that demonstrate a 90% reduction in annual potable water demand for irrigation.
- Describe the reference case, the water saving interventions and clearly demonstrate through calculations that the required reduction is met.

Heat rejection calculation report prepared by a suitably qualified professional (e.g. mechanical engineer or hydraulic engineer) that describes how the Credit Criteria have been met by:

- Showing calculations that demonstrate a 50% reduction in potable water demand for heat rejection.
- Describe the reference case, the water saving interventions and clearly demonstrate through calculations, the required reduction.
- Where no water is used for heat rejection (e.g. air cooled chillers or natural ventilation) no calculations are required; instead a **Statement from the mechanical engineer** describing the heat rejection system is sufficient.

Water Balance calculation report prepared by suitably qualified professional (e.g. hydraulic engineer) that describes how the Credit Criteria have been met by:

- Showing calculations that demonstrate 50% (1 point) or 75% (2 points) of non-potable demand is met with reclaimed or recycled water.
- Describe the calculation inputs and assumptions to estimate the non-potable water demand and describe how this demand is offset with reclaimed or recycled water.
- Where onsite rainwater harvesting is used, ensure that an annual water balance is undertaken to demonstrate the required target is met.

- Include a description of the recycled or reclaimed water source and reference to supplementary documentation such as As Built drawings or contracts with water suppliers.

As Built drawing(s) and/or Datasheets providing supporting documentation to the Water Balance calculation report.

- This may include drawings or schematics showing the size of the rainwater system or capacity of the treatment systems.
- Alternatively datasheets may be used to demonstrate treatment system capacities

Statement of confirmation, where off-site reclaimed water is used, in the form of signed correspondence from the off-site reclaimed water supply vendor/designer confirming:

- The volume to be supplied (annually or otherwise); and
- The availability of the reclaimed water at the date of practical completion of the project.

ADDITIONAL GUIDANCE

The Potable Water Calculator is a benchmarking tool only and must not be used to design harvesting and recycling systems. As such, it does not undertake detailed calculations of water storage efficiency and it is the responsibility of the design team to ensure appropriate storage capacities given building demands and available harvested sources

Flow restrictors, aerators or other flow controlling devices which can only be removed from a fixture or fitting through the use of specialist equipment or tools commonly used by wet services sub-contractors or building maintenance staff, are considered an “intrinsic attribute” of the fixture or fitting. Similar devices which can be removed without the use of such tools (i.e. by hand) are not deemed intrinsic and cannot be used to claim water efficiency improvements within the Green Star SA Potable Water Calculator. For fixtures and fittings with such ‘intrinsic’ devices, product literature or manufacturer datasheets must clearly state the necessary water efficiency performance of the complete assembly with the flow-controlling device for inclusion in the Green Star SA Potable Water Calculator. Water efficiency data for a fixture or fitting without such a flow-controlling device that is nominally adjusted for the benefit of such flow limiting devices is not acceptable.

Other major water uses

Where a project team feels that there is another major water demand in which they have reduced potable water consumption, which is not covered in the tool, they can include this in the Potable Water Calculator. The project must clearly demonstrate the claimed water consumption through calculations and verification documentation, approved by the GBCSA through a CIR process

Sustainable Water

Sustainable Water is defined as water that is collected on site or recycled/recovered from a previous use such as blackwater or greywater. Previously unused water from high-value fresh water sources (e.g. lake, river or groundwater) cannot contribute to the amount of sustainable water used. In addition, extracting ground water from any neighbouring fresh-water sources impacts on the water

table level and merely localises a problem that otherwise would take place on the municipal or provincial level.

Off-Site Reclaimed Water

The use of reticulated off-site reclaimed water is an acceptable way to reduce potable water consumption within the Green Star SA rating system.

Ground Water

Previously unused groundwater seeping into building basements cannot be used in this credit as sustainable water for amenities (WC's, urinals, etc.), unless it is used and then recycled within the building. Groundwater seeping into building basements may be included as sustainable water for landscape irrigation. However, project teams must submit calculations of the quantity of groundwater available for use, clearly demonstrating reasonable assurance that the quantity calculated will be available in future. These calculations must be submitted for approval via CIR prior to project submission.

Rainwater, Greywater & Blackwater

Collecting rainwater from roofs and other impervious surfaces can add to the amount of sustainable water available for use in buildings. Retail centres with large roof areas are particularly well suited for rainwater collection.

Greywater can be recovered from sinks and showers, washing machines, cooling towers and other water sources that do not contain food or human waste. This water can be stored for irrigation and toilet flushing but needs to be used within a short period following collection to avoid having extensive treatment requirements.

In locations where on-site blackwater treatment is generally not permitted, projects should consider contacting local authorities to discuss the benefits of on-site water treatment for the project and local infrastructure.

Water Efficiency Labelling Scheme

The South African Government, through the Department of Water Affairs (DWA), is currently working with the South African National Standards to introduce the Water Efficiency Labelling and Standards (WELS) Scheme that involves the introduction of national mandatory water efficiency labelling and minimum performance standards for domestic water-using devices.

Landscaping Water Efficiency

Potable water demand can be reduced through the installation of water-efficient irrigation systems (such as sub-soil or drip irrigation) or through the use of sustainable water for landscape irrigation.

A 'xeriscape garden' is defined as a water-conserving garden, or garden requiring no additional watering beyond establishment. Where a xeriscape garden has been installed, provisions must be made to remove any irrigation system within twelve months of establishment and ensure that the landscape will not receive watering after that time. Evidence will include, but will not be limited to, a report from the landscape architect confirming why the design can be classified as xeriscape.

Heat Rejection

INT-Wat-1 Potable Water

POINTS AVAILABLE 6

The use of water based heat rejection systems that consume large quantities of water through cooling towers is wide spread because of the high energy efficiency of such systems. Minimising or eliminating the use of potable water in heat rejection systems or completely eliminating the need for mechanical cooling in buildings can achieve significant savings in both energy and water. The use of non-chemical dosing (such as ionisation, UV treatment, etc) can save water by avoiding more frequent flushing of cooling tower water systems.

Laundry Equipment

A typical commercial laundry utilises a washer technology called washer-extractors. This type of machine ranges in size from about 16 kg up to 1 766 kg in the largest laundries. The name washer-extractor is used because after each portion of the wash cycle (soak, suds, pre-wash, wash, rinse, or finish) an extraction imparting centrifugal force removes the water and detergent contents from the wash wheel to the drain.

Other equipment found in large industrial laundries are tunnel washers (or continuous batch washers), which is an industrial laundry machine designed for heavy loads. Tunnel washers are inherently water-efficient; water is used several times before being sent to the drain. Average water consumption of this type of equipment is 16 litres per kilogram of laundry, which is 2/3 of the typical washer extractor.

Water recycling in laundry processes can be done quite easily. The last rinse water used in an industrial washer can be reused as a pre-wash for the next wash cycle. Larger commercial and industrial laundries have been utilising this technology for decades. For smaller laundries it is not common practice due to the high upfront cost. However in recent years, washing machine manufacturers have been designing water reuse systems that are less expensive and require less space.

Most commercial washer-extractors can be retrofitted with a tank to save the final rinse water, which can then be reused as pre-wash in the next load. It is possible to cut the potable water consumption by 30% by reusing water from the final rinse cycle for the next load.

Large Kitchens

Inefficient use of water in kitchen operations is usually a result of equipment design and/or behavioural patterns. The main types of water using equipment found in kitchens are dishwashers, sinks, woks, steamers, pre-wash spray rinse units, ice-making machines and garbage disposal units.

Dishwashers

Substantial savings can be made with a new dishwasher as newer models use less water. Furthermore different types of dishwashers have different flow rates. Below are the most common dishwasher types with their average water consumption.

Type	Description	Litres per rack
Under counter	A machine with an overall height of 1 meter or less, in which a rack of dishes remains stationary within the machine while being subjected to sequential wash and rinse sprays, and is designed to be installed under food preparation workspaces.	13 ltr/rack
Single Tank Door	A machine in which a rack of dishes remains stationary within the machine while subjected to sequential wash and rinse sprays. This definition also applies to machines in which the rack revolves on an axis during the wash and rinse cycles.	8.4 ltr/rack
Tank conveyor	A washing machine that employs a conveyor or similar mechanism to carry dishes through a series of wash and rinse sprays within the machine. Specifically, a single tank conveyor machine has a tank for wash water followed by a final sanitizing rinse and does not have a pumped rinse tank.	6.0 ltr/rack
Multiple Tank conveyor	A conveyor type machine that has one or more tanks for wash water and one or more tanks for pumped rinse water, followed by a final sanitizing rinse.	4.1 ltr/rack

*Source:*http://www.energystar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers

***Table WAT-1**: Description of types of dishwashers.*

Commercial Car Wash Facility

Commercial Car Wash Facilities use large amounts of water. The amount of potable water to wash cars varies depending on the method used from bucket and hand wash to open hose spray and industrial high pressure conveyor carwash system.

One of the largest car rental companies of South Africa has invested in reducing and recycling the water used to wash the vehicles. They procured a conveyor bay wash system which washes a car within 45 seconds. It further included the construction of underground water filtration and recycling facilities that filters the waste water and reuses it in the wash cycle. Rainwater is also collected and used for car washing. Potable water is only used for the final rise, minimising potable water use. All interventions saved the company approximately 100 million litres of water annually.

Laboratories

In meeting their large cooling and process water demands, most laboratories use significantly more water per square metre than standard commercial buildings (US EPA, 2005). As an example, the Australian National University has estimated that 45% of the 750 million litres of water used annually is consumed in its laboratories, compared to 25% used in accommodation and 15% in irrigation (ANU, 2008). This demand arises from space cooling requirements, water used in the activity of the laboratory and equipment cooling (the focus of this credit).

Single-pass or once-through systems are commonly used to cool a broad range of scientific and medical equipment from CAT scanners to mass spectrometers. These systems circulate water,

typically directly from the public water supply, once through the piece of equipment and then discharges directly to the sewer. These systems are the most water intensive cooling methods used in laboratories; consuming approximately 40 times the water required by cooling towers to remove the same heat load (US EPA, 2005).

BACKGROUND

The Potable Water credit uses the Green Star SA – Interiors Potable Water Calculator to calculate a project's predicted potable water use in relation to a comparable 'benchmark project' as determined by the Calculator. The Potable Water Calculator must be used in accordance with the Potable Water Calculator Guide available from the GBCSA website **(http://www.gbcsa.org.za).**

The credit aims to encourage water-efficient fitout projects by rewarding the implementation of water-efficient systems and fixtures.

The Potable Water Calculator is a benchmarking tool only and must not be used to design harvesting and recycling systems. As such, it does not undertake detailed calculations of water storage efficiency and it is the responsibility of the design team to ensure appropriate storage capacities given building demands and available harvested sources

REFERENCES & FURTHER INFORMATION

South African Weather Service
http://www.weathersa.co.za

South Africa Rain Atlas
http://134.76.173.220/rainfall/index.html

South Africa Department of Water Affairs
http://www.dwa.gov.za

Water Efficiency South Africa
http://www.waterefficiencysa.co.za

SANS: 10252-1: 2004, Water Supply and Drainage for Buildings, Part 1 – Water Supply Installations for Buildings.

Landscape Irrigation Association of South Africa
http://www.liasa.co.za

Water Conservation & use in Agriculture.
http://www.wca-infonet.org

Water Conservation in the Professional Car Wash Industry (1999) International Car Wash Association
www.carwash.org

Alliance for Water Efficiency, Commercial Laundry Facilities
http://www.allianceforwaterefficiency.org/commercial_laundry.aspx

Best Practice Guidelines for Kitchen and Amenities, South East Water
http://www.sewl.com.au/SiteCollectionDocuments/Business/WaterMAP/1-SEW_IntroKitchensAmenities_WEB.pdf

Labs for the 21st century.
http://www.labs21century.gov/

Water Efficiency Guide for Laboratories; Best Practices
http://www.labs21century.gov/pdf/bp_water_508.pdf

WATER CALCULATOR GUIDE

The Water Calculator Guide is appended with this credit.

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

Green Star SA – Interiors v1

POTABLE WATER CALCULATOR GUIDE

Last update: November 2014

Table of Contents

1 Introduction

The Green Star SA water credits encourage and recognise reduction in potable water consumption through various water saving initiatives. The Potable Water Calculator has been developed in an effort to equitably relate potable water savings across all Fitout water uses to Green Star SA points awarded.

The potable water demand reduction is assessed by comparing the total estimated consumption of the project, as built (the *Actual Fitout*) to a standard practice reference fitout (the *Notional Fitout*). Green Star SA points are awarded based on the percentage demand reduction shown.

The calculator is divided into four sections – Fitout information inputs, Water demand, Sustainable Water and Water Usage Summary, as detailed in this document.

Under **Fitout Information Inputs**, the user enters details on how many people will occupy each major space type in the fitout, and how often, which directly impacts on the usage patterns of the fitout occupants. The user also records where the fitout is located, so that rainfall and irrigation schedules can be determined.

Under **Water Demand**, all the major water demands are estimated for the *Actual Fitout* and the *Notional Fitout*. At this stage, it is still assumed that the total water demand for the Actual and the Notional fitouts will be met by potable water. Water savings compared to the reference case up to this point is due to water efficiency alone.

In the next section of the calculator, **Sustainable Water**, the reduction of potable water consumption through the use of non-potable water is considered. Only the Actual fitout is assumed to use non-potable water.

Finally, the estimated potable water demand reduction is compared to the Notional fitout, and the amount of Green Star SA points claimed, is shown under **Water Usage Summary**.

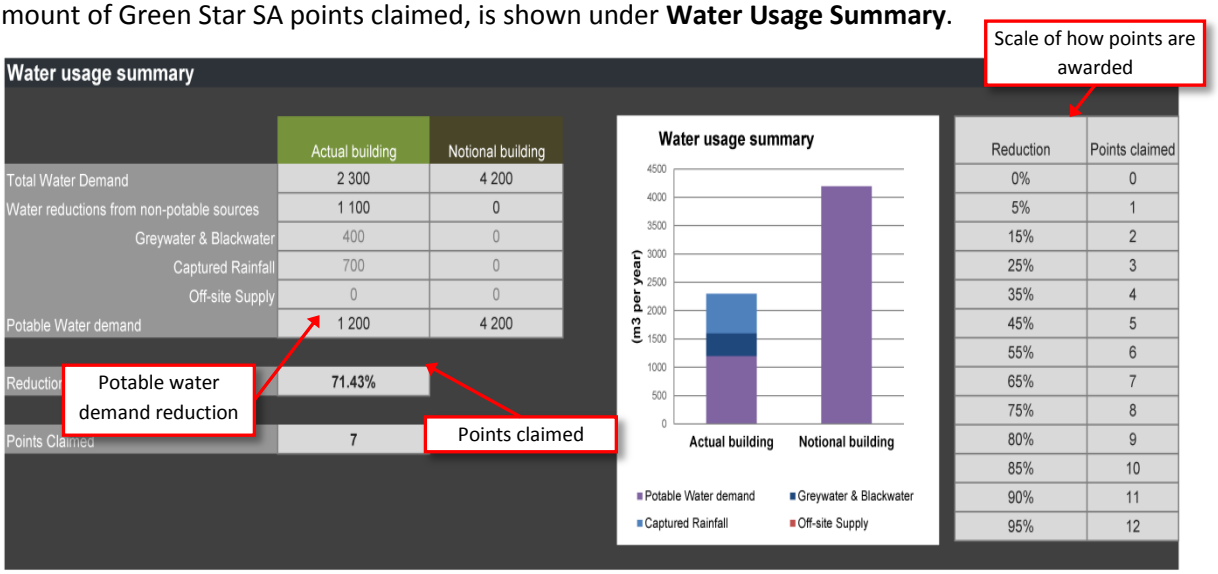

Figure 1 - Extracts from Potable Water Calculator showing summary of Water Usage

2 Fitout Information Input

In this section, information relating to Fitout occupancy and location is entered into the calculator. This information will be used for the Actual Fitout and the Notional Fitout calculations.

Occupant information is used to establish the total number of hours people will spend in the tenancy, which forms the basis of calculating Actual and Notional Fitout occupant amenity water consumption.

The fitout location information is used in landscape irrigation to determine seasonal irrigation schedules, and to determine monthly rainfall in rainwater balancing calculations.

2.1 Inputs

Users are required to enter the following information:

1. Occupant type	2. Design number of occupants	3. Occupancy profile	4. Peak days per week	5. Percentage of occupants with access to showers
Office workers	25	Office	5 day week	100%
Lecturers	30	A3 Tertiary Education	5 day week	100%
Students	400	A3 Tertiary Education	5 day week	0%
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Figure 2 – Occupant information input into the calculator

1. Occupant type

Descriptive name for each type of occupant, with distinct occupancy patterns

2. Design number of occupants

The number of each type of occupant the Fitout is designed for. If the design number of occupants for an area is unknown, it can be calculated using the area of the occupied space, divided by a default design occupant density, as per Table 1.

Table 1 – Default design occupant densities

Occupant Densities	
	m2 per person
Office	15
A1 Community / day centre	5
A1 Restaurant / Public House	5
A2 Sports Centre / Leisure centre	5
A2 Theatres / Cinemas / Music Halls	5
A3 Tertiary Education	5
A3 Primary and Secondary Schools	5
A4 Places of Worship	5
Airport / Public Transport terminal buildings	10
C1 Convention Centre / Exhibition hall	10
C2 Libraries / Museums / Galleries	20
Courts	15
Gym	5

3. Occupancy profile

The occupancy schedule occupants will follow in the space. This determines how many of the occupants are present in the space at different times in the day. The schedule selected should define the main function of the space, for example 'Office' includes all areas which serve an office area – office space, toilets, tea kitchens, etc. The occupancy profile can either be selected from the list of defaults provided in the dropdown, or be manually entered in the space provided (cells ES&ET:15-38). If manually entered, 'User Defined' should be selected from the 'Occupancy Profile' dropdown list. Manually entered occupancy profiles must be based on the profiles contained in the Energy Modelling Activity Schedules available for download from the GBCSA website.

For gym areas, one of the 'GYM' occupancy profiles has to be selected, as shower usage patterns in gyms are different to those in other areas.

Details on these profiles and information on manually entering an alternative occupancy profile are given in Appendix A.

4. Peak days per week

Number of days per week occupants will occupy the space according to the 'Peak' profile (as in Appendix A). Remaining week days are considered to be 'Off-peak'.

5. Percentage of occupants who have access to shower

This input is used to differentiate occupant shower patterns between staff, visitors and gym members.

To make provision for public spaces (such as libraries) where staff showers are provided, but the majority of the occupants will not be staff, users are asked to specify what percentage of the occupants in the space will have access to shower facilities.

Example: In a museum designed for 100 people, of whom 10 are staff members, 10% of the occupants will have access to shower facilities. In office areas where cyclist facilities are provided, 100% of the occupants have access to showers, as in gyms. In education buildings, where only staff have access to showers, only the staff component of the occupants should be input as having access to showers.

6. Fitout location

Select the city or town that your site is located in or closest to, to determine rainfall data for the site and the SANS 204 climatic region the Fitout is in. This is used in calculations for irrigation, swimming pool water consumption and rainwater harvesting calculations.

2.2 Calculation methodology

The occupant information provided under 'Fitout Information' is used to determine the total number of occupants in the fitout how much time they will spend there and how many times they will use amenities like toilets and urinals.

3 Water demand

All major potable water demands within the project including external uses such as irrigation are taken into account in this section. The actual Fitout design consumption is compared against a Notional Fitout of the same size with default consumption figures to determine potable water savings. The water consumption is calculated in the following sections:

3.1 Occupant Amenity water - internal plumbing fixtures

3.2 Heat Rejection water demand – water consumed by cooling towers and other evaporative cooling systems

3.3 Irrigation water demand

3.4 Swimming pools

3.5 Laundry Facilities

3.6 Commercial kitchens

3.7 Other water uses

3.1 Occupant Amenity Water

Installing water efficient fixtures and fittings is the first step in reducing potable water demand. This section focuses on the major domestic fixtures and fittings. Projects will be credited for installing water fixtures with flow rates lower than those assumed for the Notional Fitout (assumed Notional Fitout consumption is shown under 'Summary of Inputs and Notional Fitout assumptions' at the end of this section).

Further occupant amenity water demand reduction is possible by using non-potable water for some of these demands. This is calculated under the 'Sustainable water' section of the tool.

3.1.1 Inputs

Users are required to enter information regarding all the toilets, urinals, indoor taps and showers installed in the fitout. Users enter fitting description, flow rate and the percentage of the installed fittings that accounts for each different type of fitting.

Toilets

Enter the toilet type, the flow rate (litres/flush) for each type and the percentage of each type based on total toilets installed.

- For single flush toilets, input the rate per flush (L/flush)
- For dual flush toilets – enter toilet consumption calculated as per AS/NZS6400 – the average of one full flush and four half flushes: (Full flush x 1) + (Half flush x 4) / 5. E.g. if the toilet is a 3 litre/6litre dual flush system, the flush rate entered would be: ((6 litres X 1) + (3 litres X 4)) /5 = 3.6 litres

Urinals

Users specify whether urinals are installed in the Fitout or not. With urinals, installed occupants are assumed to use the toilet less often which is reflected in the calculations.

Types of urinals are divided into manually flushed or Passive Infra-Red (PIR) controlled urinals (urinals flushed after each use) and urinals on auto-timer. Input the urinal type, the flow rate (litres/flush) for each type and the percentage of each type based on total urinals installed.

For manually flushed or PIR controlled urinals, input the rate per flush (L/flush)

For urinals on auto-timers, consumption is calculated based on the number of flushes per day and litres per flush provided by the user, for 365 days of the year.

Where urinal troughs on an auto-timer are installed, each 600mm of trough (or part thereof) should be counted as one urinal in order to enter the percentage of urinal troughs compared to the total number of urinals in the project

The notional fitout's consumption is calculated assuming manually flushed urinals are installed.

Indoor Taps

Input types of taps, the flow rate (litres/min) and percentage of each type installed. Options for different types of controls are provided; this affects the duration taps are used. The control options are:

- Manual WHB/Sink Tap – 9 seconds per use
- Timed WHB/Sink Tap – 7 seconds per use
- PIR WHB/Sink Tap – 6 seconds per use

Indoor taps accounted for in this section include those in tea kitchen facilities. Taps used in kitchens for large-scale meal preparation are included under Section 2.6 Large Kitchens. Any kitchen taps not accounted for in Section 2.6 must be accounted for here under Indoor Taps.

Showers

The user is asked to specify anticipated shower usage, based on facilities provided and the number of staff expected to use showers. Please ensure consistency with the percentage claimed for cyclist facilities in the Alternative Transport credit.

As stated under 'Fitout Information Inputs', users must select the gym occupancy profiles for gym areas. It is assumed that more occupants in gym areas will use the showers.

The table overleaf shows the number of staff expected to use the shower based on user input provided.

Table 2 - Occupant shower usage

Percentage of occupants who use shower	
No showers installed	0%
No significant gym or cyclist facilities	3%
Provision of cyclist facilities for 3% of staff	3%
Provision of cyclist facilities for 6% of staff	6%
Gym area	80%

Shower head types, percentages and flow rates (litres/min) are entered.

3.1.2 Calculation methodology

Occupant information entered under 'Fitout Information' is used to determine the total number of hours occupants will spend in the fitout, and therefore how many times they are likely to use toilets, urinals, indoor taps and showers, based on occupant usage patterns shown in Table 4.

The total actual fitout water consumption is then calculated using fitting information entered by the user. For the comparative notional fitout, fitting flow rates are assumed to be of average water efficiency, as under 'Summary of Inputs & Notional Fitout Assumptions' below.

Table 3 - Assumed uses per day

Uses per day (based on 9.5hr workday)		REFERENCE
Toilet - no urinal (l/flush)	2.3 uses per day	Water Centre at the Building Research Establishment, UK
Toilet with urinal (l/flush)	1.3 uses per day	
Urinal (l/flush)	1 use per day	
Taps (l/min)	2.5 uses per day	
Manual WHB/Sink tap	9 sec per use	
Timed WHB/Sink tap	7 seconds per use	
PIR WHB / Sink tap	6 seconds per use	
Shower (l/min)	1 use per day, 5 min per use	

3.2 Heat rejection water demand

Heat rejection water consumption can be one of the major water consuming aspects of a fitout, but is largely undetected since it is out of sight from most fitout occupants.

The aim of this section is to encourage and recognise the reduction of potable water used for heat rejection in large fitouts.

Cooling towers (water based heat rejection) are assumed for the Notional Fitout reference case for Fitouts with a Nominated Area (HVAC)* of greater than 2000m^2. Reduction in potable water usage for heat rejection can then be achieved through

- Using air based heat rejection

Or, if water-based heat rejection is used, through

- Passive and low energy building design, to reduce the heat rejection load
- Using non-potable water for heat rejection
- Efficient cooling tower design

Notional fitout heat rejection loads for tenancies with Nominated Area (HVAC) < 2000m^2

Air based heat rejection is assumed for the Notional Fitout reference case for tenancies with a Nominated Area (HVAC)* of less than 2000m^2. For projects smaller than this size, using water based heat rejection will therefore in effect be penalised if they use any potable water for heat rejection.

*For the purpose of this credit *Nominated Area (HVAC)* must be entered, consistent with the inputs provided in ENE-1. A definition of Nominated Area (HVAC) can be found in the Energy Calculator and Modelling Protocol guide.

Notional fitout heat rejection loads for tenancies with Nominated Area (HVAC) > 2000m^2

The reference case against which these improvements are measured is based on the Notional Fitout modelling results from the ENE-1 Credit. However as ENE-1 assumes the base case to be air cooled a COP conversion factor is used within the tool. For the conversion factor, it is assumed that the notional air-cooled chiller has an average COP of approximately 3, and the notional water-cooled chiller a COP of 5. Therefore, a conversion factor of -10% is applied.

Please note: This conversion factor is applied automatically and users need not perform any additional calculations on the Notional Fitout energy modelling results. The statement above is for information only.

3.2.1 Inputs

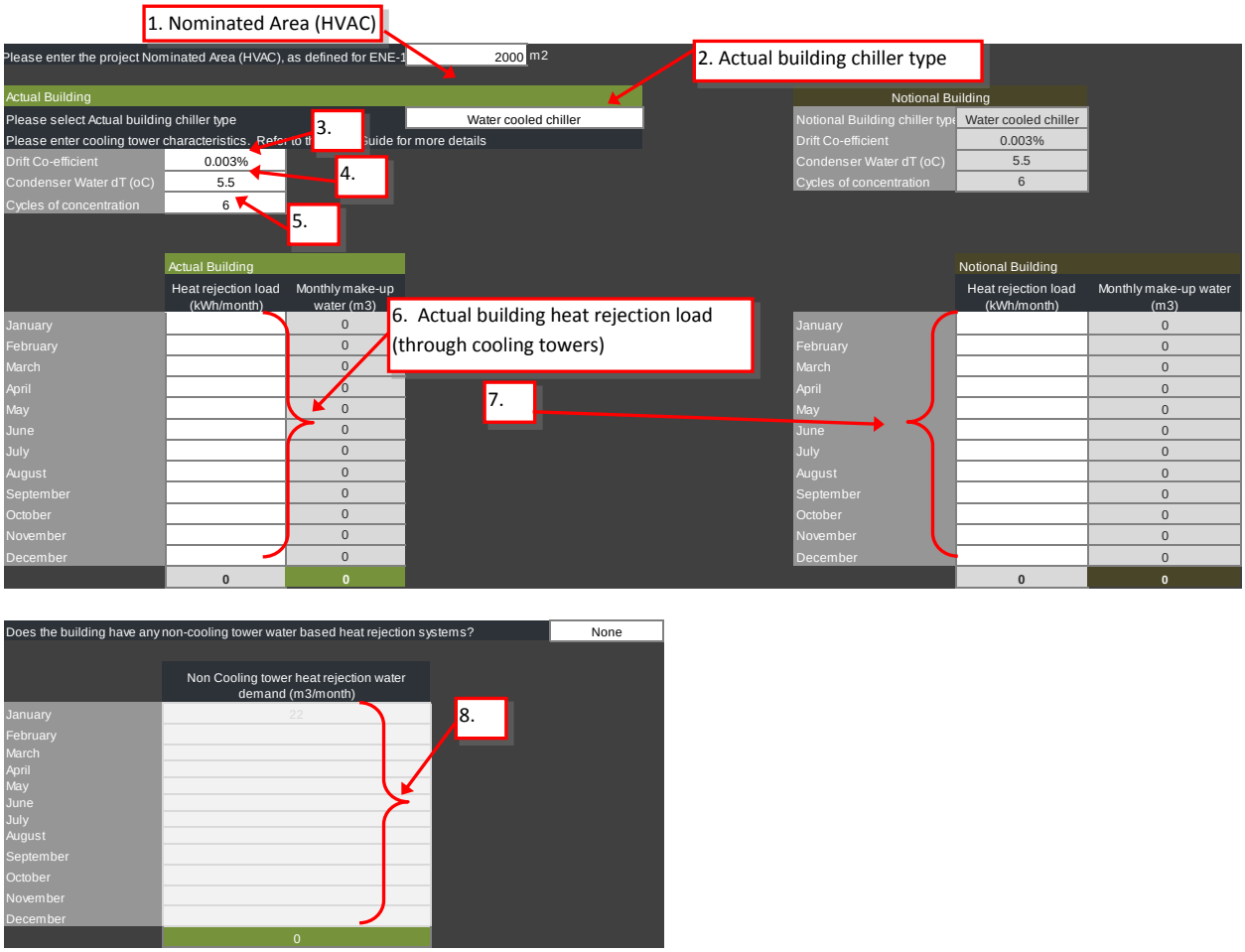


Figure 3 – Heat Rejection water demand inputs required

1. Nominated Area (HVAC)

For the purpose of this credit *Nominated Area (HVAC)* must be entered, consistent with the inputs provided in ENE-1. A definition of Nominated Area (HVAC) can be found in the Energy Calculator and Modelling Protocol guide.

2. Actual Fitout chiller type

The user must select whether the actual fitout has an air-cooled or water-cooled chiller.

3. Drift co-efficient

This is only applicable if the actual fitout has water cooled chillers, and does not need to be filled in for fitouts with air-cooled chillers.

This quantifies the percentage of condenser water lost due to droplets of water escaping the cooling tower, through wind or other environmental factors. For the actual fitout, a default value of 0.003% can be used; alternatively users can input their own value, with justification. Notional fitout drift co-efficient is assumed to be 0.003%, if the notional fitout chiller is assumed to be water-cooled.

4. Condenser Water dT

This is only applicable if the actual Fitout has water cooled chillers, and does not need to be filled in for Fitouts with air-cooled chillers.

This is the temperature difference between condenser water flowing into and out of the cooling tower. For the actual fitout, a default value of 5.5°C can be used; alternatively users can input their own value, with justification. Notional fitout condenser water dT is assumed to be 5.5°C, if the notional fitout chiller is assumed to be water-cooled.

5. Cycles of concentration

This is only applicable if the actual fitout has water cooled chillers, and does not need to be filled in for Fitouts with air-cooled chillers.

This quantifies how much water is lost to bleed-off for each condenser water cycle. For a cycle of concentration of 'X', each unit of water can circulate 'X' times through the cooling tower, before too much water has been evaporated from it and it the concentration of impurities in the water becomes too high. To keep water quality at an acceptable level, 1/Xth of the condenser water is bled off after each cycle, and replaced with 'new' water.

For the actual fitout, a default of 6 cycles of concentrations can be used assuming that municipal potable quality water is used (). Using recycled water will typically result in a reduced number of cycles of concentration (due to recycled water containing a higher concentration of impurities), leading to more water (but less potable water) being used. If non-municipal water is used please justify the cycle of concentration assumed.

For the Notional fitout, 6 cycles of concentration is assumed, if the notional fitout chiller is assumed to be water-cooled.

6. Actual Fitout heat rejection load

This is only applicable if the actual fitout has water cooled chillers, and does not need to be filled in for Fitouts with air-cooled chillers.

This is the heat load rejected through the cooling towers, including the refrigeration effect and the work done by the chiller. The user is required to enter the monthly heat rejection load into the calculator, consistent with the Actual Fitout results obtained from the detailed energy modelling done for ENE-1.

For fitouts where there is both water-based and air-based based heat rejection, only the heat load that is rejected via the cooling towers is to be entered into the water calculator for the actual fitout. This must be justified and be consistent with ENE-1 inputs and calculations.

If the method of compliance for ENE-1 is not through energy modelling and no model was constructed, the monthly cooling loads can be calculated by the mechanical engineer.

7. Notional Fitout heat rejection load

This is only applicable if the notional fitout is assumed to have water cooled chillers, and does not need to be filled in for notional fitouts with air-cooled chillers.

This is the heat load rejected through the cooling towers, including the chiller load. The user is required to enter the monthly heat rejection load into the calculator, consistent with the Notional Fitout results obtained from the detailed energy modelling done for ENE-1.

As described previously, a conversion factor will be applied to the Notional Fitout heat rejection loads, to account for the Notional Fitout being modelled with an air-cooled chiller.

8. Non Cooling tower heat rejection water demand

If the fitout has a non-cooling tower water-based heat rejection system such as direct evaporative cooling, the user is required to enter the system's monthly water demand, calculated manually, in m3 per month. Should a fitout have cooling tower and non-cooling tower water-based heat rejection, the heat load rejected through cooling towers and water consumed through non-cooling tower heat rejection should be apportioned accordingly.

The Notional fitout is assumed to have no non-cooling tower water based heat rejection systems.

3.2.2 Calculation Methodology

The total heat rejection make-up water demand is calculated taking into account:

- Evaporation – the water evaporating into the atmosphere because it's absorbing heat from the Fitout. The amount lost is directly related to the fitout heat load, and calculated using water characteristics as shown in the table in figure 6.
- Drift – the percentage of the condenser water lost as it flows through the cooling tower, due to environmental factors like wind. This is influenced by the cooling tower design (how sheltered it is) and by the amount of water flowing through the tower.
- Bleed – the amount of water that has to be removed from the system and replaced after each cycle, to keep the concentration of dissolved solids in the water at an acceptable level. This is influenced by the purity of the condenser water.

Table 4 - Assumed constants for calculating heat rejection water demands

List of constants	
Latent heat of vaporisation (kJ/kg)	2256
Density of water (kg/L)	1
Specific heat of water (kJ/LoC)	4.18

3.3 Irrigation water demand

Landscape irrigation can often form the largest portion of the water demand. This water does not need to be treated to levels suitable for drinking, however in most cases, potable mains water is used for irrigation purposes.

This section rewards landscape irrigation design efficiency - the use of appropriate plant choices with low water demands and irrigation systems which are effective at providing water without environmental losses due to wind drift etc. It also aims to encourage projects to have irrigation controls which scheduled irrigation supply according to seasonal demand or rainfall.

While some irrigation designs still assume a set weekly irrigation rate throughout the year, best practice is to define different rates for different rainfall seasons; Green Star SA therefore assumes that this water saving practice is used in the Notional Fitout.

For the purposes of the Potable Water Calculator, default seasonal irrigation schedules are determined based on rainfall in that region. The Notional Fitout makes use of this default schedule whereas the Actual Fitout must specify if any, and which irrigation controls, are installed. The irrigation schedule ranges from 100% (none of the irrigation demand is met by rain) to 50% (50% of the irrigation requirement is met by rain).

Further landscape irrigation demand reduction by using non-potable water is calculated under 'Sustainable Water'.

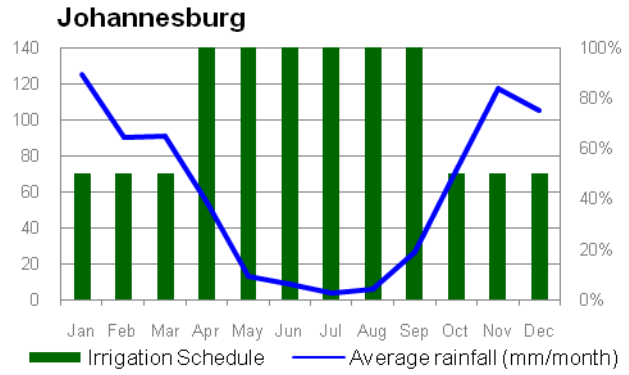


Figure 4 – Example seasonal irrigation schedule: Johannesburg.

3.3.1 Inputs

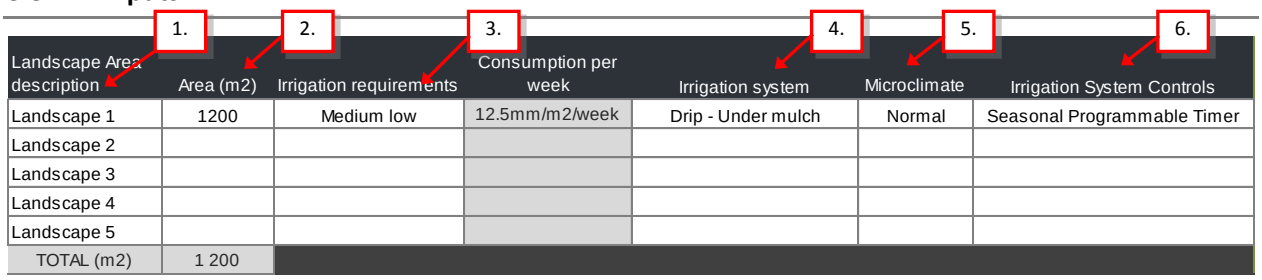


Figure 5 – Landscape irrigation input table

1. Landscape area description

A descriptive name for each landscape area

2. Area

Enter the area in m^2 for each landscaped area.

3. Irrigation requirements

Choose high, medium, low or xeriscape irrigation requirement based on the planting types and the irrigation requirements as prescribed by the landscape designer. This default peak established demands (in mm/m^2/week) can be compared against the plant listing table in Appendix B that itemizes a number of commonly used landscape plants and their respective irrigation demands.

Table 5 - Assumed water consumption for different irrigation requirements

Irrigation requirement	Peak established demand
Xeriscaping	0mm/m2/week
Low	7.5mm/m2/week
Medium low	12.5mm/m2/week
Medium	20mm/m2/week
Medium high	30mm/m2/week
High	40mm/m2/week

4. Irrigation system

Select the irrigation system installed for each landscaped area. Different irrigation systems have varying degrees of efficiency when it comes to delivering the required amount of water to landscaped areas, and factors such as wind, runoff and uniformity impact on how much water reaches, and can be absorbed, by plants. This is taken into account by the user selecting an irrigation method, with associated application efficiency. In this way, projects are rewarded for installing irrigation systems which are efficient. Select the irrigation efficiency according to the type of irrigation and when the irrigation is applied. The Notional fitout assumes 75% efficiency (Sprinklers applied at night). Due to surface run-off, rainfall is assumed to be 60% effective.

Table 6 - Assumed irrigation application efficiency for different irrigation methods

Average irrigation application efficiency	
Rainfall	60%
Sprinklers - Day	65%
Sprinklers - Night	75%
Sprays - Day	65%
Sprays - Night	70%
Micro sprays - Day	60%
Micro sprays - Night	65%
Drip - Bare soil	80%
Drip - Under mulch	85%
Subsurface drip (SDI)	90%
Hand watering (by hose)	50%

5. Microclimate

The level of exposure is selected based on the location of the landscaped area in relation to other features that may protect it, to account for landscaped areas which would require more or less irrigation due to being sheltered or exposed. The 'Normal' micro-climate is used for the Notional fitout.

Table 7 - Assumed microclimate factors

Microclimate factor	
Exposed - no shade during the day, high temperatures, full wind exposure on all sides	1.3
Normal	1
Protected - full shade, no direct sun during the day. High wind protection, shelter on 3 or 4 sides	0.7

6. Irrigation System Controls

For the Actual Fitout, select which of the following controls are installed:

1. **No controls** - landscape is irrigated at the same peak requirement throughout the year
2. **Seasonal Programmable Timer** - irrigation schedule as per Notional fitout – irrigation is set to 100% during dry seasons and 50% during rainy seasons.
3. **Precipitation sensing** – Takes rainfall into account to reduce irrigation requirements.

The Notional fitout is assumed to have the default seasonal schedule.

SANS 204 region and rainfall data (entered under Fitout Information)

This input has already been entered under 'Fitout information'. The SANS 204 climatic region corresponding to the fitout location is determined when the project location is selected under 'Fitout

Inputs'. This is used to determine the default seasonal schedule which is used by the Notional fitout and is an option for the Actual fitout. It assumes that irrigation is reduced during the rainy season. Graphs for each of the climatic zones are provided in Appendix C.

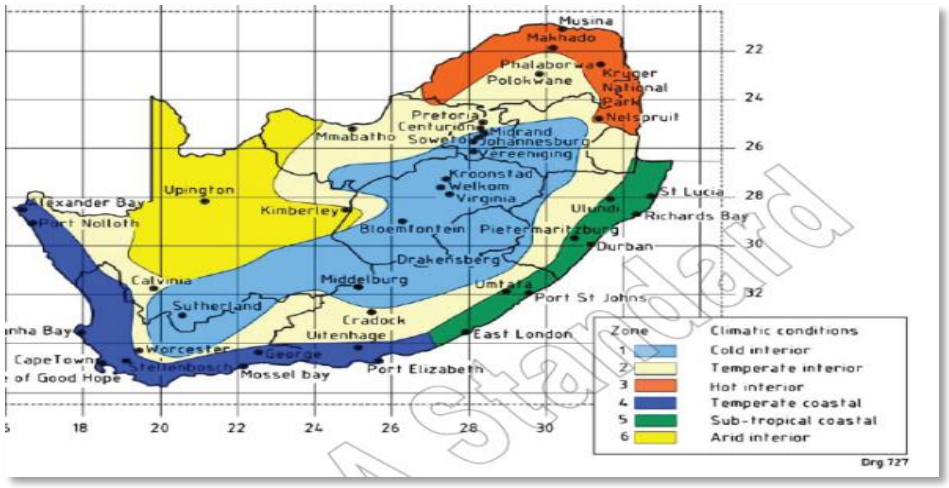


Figure 6 – SANS 204 Climatic regions

3.3.2 Calculation Methodology

The volume of water required for irrigation is calculated using the irrigated areas at the rates provided. The irrigation efficiency and microclimate are factors applied to the required irrigation rate to determine the volume of water that must be provided.

Depending on the irrigation controls specified, the following irrigation schedules are used

- If there are no irrigation controls, no schedule is applied to plant water demand and irrigation requirement is simply the monthly plant water demand
- With a seasonal programmable timer, it is assumed that the irrigation schedule will be a default seasonal schedule based on the SANS 204 climatic region
- If there is precipitation sensing, the rainfall data is correlated with the irrigation requirement to determine how much of the requirement is met by rainfall.

3.4 Swimming pools

Reduction in potable water usage for swimming pools can be achieved through any combination of the following:

- Efficient pool filtration systems
- The use of a pool cover
- Using non-heated pools
- Sheltering the pool from environmental conditions (indoor pool)
- Reuse of backwash water, which is included under the 'Sustainable Water' section of the calculator

Two water demands from swimming pools are taken into account in the calculator – backwash for cleaning the filters, and evaporation. Several factors influence the water consumption of swimming pools. Backwash is influenced by the type of filtration system and the type of filtration system controls. Evaporation is influenced by whether it is an indoor or outdoor swimming pool, whether it is heated and if a pool cover is installed.

3.4.1 Inputs

SANS 204 climatic region & Rainfall region

Selections from the Irrigation section carry over for use in this section. If no regions are selected an error is indicated.

Pool volume [m^3]

The volume of the pool is input into the calculator to determine the notional Fitout pump size. The same pool volume is assumed for the Notional and Actual Fitouts. For the notional fitout, it is assumed that the pump is sized to have the capacity to cycle the whole volume of the pool within 5 hours. The pump size is used to calculate backwash water consumption. For the Actual Fitout the actual pump size is used.

Pool surface area [m^2]

The surface area of the pool is input into the calculator for calculating the evaporation off the pool water surface. The same surface area is assumed for the Notional and Actual Fitouts.

Pool filtration system

For the Actual fitout, users can select between a sand / sorptive media filter, a cartridge filter or natural filtration, depending on the system installed in the actual fitout.

- Sand/Sorptive Media filters require backwashing, which consumes water. If Sand/sorptive Media filter is selected, the user is required to enter the pool pump flow rate (in litres per minute), which is used to determine backwash water requirements. It is assumed that filters are backwashed once for every 70 hours of pump operation (based on one cycle every two weeks at 5 hours per day – recommended spring/autumn schedule). Water used for backwashing is

eligible for recycling, and can be indicated as such under the 'Sustainable Water' section of the calculator.

- Cartridge filters require manual cleaning (hosing down the filters). If cartridge filtration is selected, the user has to enter the number of cartridges installed in the pool which is used to determine filter cleaning water requirements. As with backwashing, cartridges are assumed to be cleaned once every 70 hours of pump operation, and to use 100 litres per cartridge per cleaning cycle. This is more water efficient than backwashing, but more difficult to recapture the cleaning water for reuse. If the user claims that cleaning water is recycled, it must be demonstrated that the system is designed for this.
- Natural filtration requires no backwash/cleaning water

The Notional fitout assumes a standard sand filter.

Pool filtration controls

If Sand / Sorptive media or cartridge filters are selected, the user selects whether filtration systems have basic or advanced controls. Basic controls have standard hours of pumping per day for all seasons of the year. Advanced controls include automated control systems that allow for seasonal pool routine (i.e. multiple timer settings), automatic pressure sensors with automatic backwashing (reducing backwash cycles per year) and controlled backwash periods. Advanced controls have a backwash period of 1.5mins instead of 2.5mins for Basic controls.

Pool filtration controls influence the frequency of backwashing and cartridge filter cleaning, and the duration of backwashing, as shown in the tables below.

Table 8 - Backwash / Cartridge filter cleaning schedules for different controls

Backwash schedule	(Assuming one backwash for every 70hrs of pool operation)			
Basic controls				
	Pump hrs/day	Days/year	Pump operation Hrs/year	Backwash/Cartridge cycles per year
Summer	7	90	630	9.0
Spring/Autumn	7	183	1281	18.3
Winter	7	92	644	9.2
TOTALS		365	2555	36.5
Advanced Controls				
	Pump hrs/day	Days/year	Hrs/year	Backwash/Cartridge cycles per year
Summer	7	90	630	9.0
Spring/Autumn	5	183	915	13.1
Winter	2.5	92	230	3.3
TOTALS		365	1775	25.4

Indoor or outdoor

It is assumed that an indoor pool will have only 40% of the evaporation of an equivalent outdoor pool. This assumes that the pool hall is kept at a balanced temperature and humidity to reduce the temperature and humidity differences between the pool water and surrounding air. The Notional Fitout will be the same as the actual Fitout.

Heated or non-heated

Heated pools lose significantly more water than non-heated pools. It is assumed heated pools will lose 40% more water than non-heated pools. The Notional Fitout pool is assumed to be non-heated.

Pool cover

Input whether the Actual Fitout has a pool cover or not. The Notional Fitout assumes no cover. Please note that the pool cover must be an evaporation barrier – safety nets are not considered pool covers. It is assumed that the pool is covered at night during the swimming season. Furthermore it is assumed that most rainwater falling on the pool is able to enter the swimming pool even when the cover is in place. A pool cover is assumed to reduce evaporation loss by 90% (Daisy Pool Covers, *Fact sheet 1: Evaporation*, 2005).

The table below shows the various different assumed pool evaporation coefficients.

Table 9 - Pool evaporation co-efficient

Evaporation coefficients	
Indoor	40%
Outdoor	100%
Non-heated	100%
Heated	140%
Pool Cover	10%

Filtration pool area

If a user selects 'Natural Filtration' under filtration systems, the filtration pool area, and whether the filtration pool is indoor or outdoor, is requested. This is only required if a dedicated and physically distinct filtration pool area, which will not be used for swimming, is installed. If the filtration pool area forms part of the main pool, its area can be included under 'Pool surface area' and 'Filtration pool area' can be set to 0.

3.4.2 Calculation methodology

Water consumption by swimming pools is calculated for the entire year – It is assumed that the pool will be operational throughout the year.

The water consumption is calculated as the sum of the evaporation off the swimming pool surface and the water loss due to backwashing.

Evaporation

Evaporation is calculated by multiplying the pool surface area with an average monthly evaporation rate for the climatic region. ETO evaporation data from Agromet Weather Stations for each of the six SANS 204 climatic zones were used to determine the monthly average evaporation rate.

The evaporation rates are adjusted with the evaporation co-efficient, based on whether the pool is indoor/outdoor, heated/non-heated or has a pool cover, as described earlier.

Monthly evaporation is offset by monthly rainfall data to calculate the net evaporation loss (Evaporation loss – rainfall gain). This method does not account for pool overflow, which is conservative and will slightly benefit the design team. Indoor pools do not receive any rainfall top-up.

Backwash / filter cleaning water loss

Dependant on the filtration system selected, the water loss for filter maintenance is determined as follows

- Sand/Sorptive media filters – The pump flow rate (in litres per minute) is multiplied by either 1.5min or 2.5min (according to which filtration controls were selected) and by the number of times per month the filters are backwashed (according to which filtration controls were selected). This gives monthly backwashing water requirements. This water can be claimed for reuse under the 'Sustainable water' section of the calculator.
- Cartridge filters – the number of filters installed, as specified by the user, is multiplied by the number of times the filters are cleaned per year (according to which filtration controls were selected). As stated, each filter cleaning is assumed to consume 100 litres of water. This cleaning water can be reused under the 'Sustainable water' section of the calculator but must be justified through design demonstration as it is not intrinsic to the filtration system.

3.5 Laundry Facilities

Where laundry facilities are provided as part of the fitout (i.e. laundry supports or is ancillary to the primary function of the fitout), projects need to enter the estimated laundry load per month (in kg). Note that this does not apply for commercial laundries acting as retail tenants within a Fitout as these are susceptible to churn. If the Notional Fitout consumption for laundry accounts for more than 3% of the total typical Fitout water consumption (occupant amenities, heat rejection and irrigation), the project needs to account for laundry facilities in the calculator. At less than 3% of total (a very small laundry facility), projects can choose whether to include laundry facilities in the calculator or not. The Notional Fitout reference case assumes 26 litres of water per kilogram of laundry.

Reduction in potable water usage can be achieved through more efficient wash extractors or through the use of non-potable water for laundry. In this section, only the efficiency of the equipment is considered to establish the total Actual Fitout consumption. Where projects make use of rainwater harvesting and/or treated grey/blackwater water to reduce the potable water usage, it is entered under the 'Sustainable Water' section of the calculator.

3.5.1 Inputs

Estimated laundry load per month

The user is required to enter the estimated laundry load per month. This can be based on the estimated load per day, multiplied by the number of days per month. Due to the varying nature of laundry loads projects are asked to input their own estimates, with justification (a conference centre might only do laundry 5 days a week, opposed to a hotel where laundry is done daily). Monthly input is required to facilitate later non-potable water demand reduction calculations.

The same laundry loads are assumed for the Actual and Notional Fitouts.

In the example shown below, the laundry load for a conference centre with 500kg (500 sets of linen) is shown. If they wash every third day, the laundry load for January is calculated as 500kg x 10 days =5000kg, and so forth for the other months.

	Estimated Laundry Load (kg)
January	5 000
February	5 000
March	5 000
April	5 000
May	5 000
June	5 000
July	5 000
August	5 000
September	5 000
October	5 000
November	5 000
December	5 000
	60 000

Figure 6 – Example input of estimated laundry loads per month

Efficiency of equipment

This input is optional if Notional Fitout Laundry consumption accounts for less than 3% of total Notional Fitout water consumption.

The user is required to enter the water efficiency of the laundry equipment in litre per kilogram. Water efficiency of the equipment needs to be justified with a manufacturer's data sheet confirming the litres of water used per kilogram of linen.

3.5.2 Calculation Methodology

The equipment efficiency entered by the user is multiplied by the monthly load to determine the monthly water consumption by the laundry facility.

Potable water savings due to the use of recycled or rainwater is taken into account under the 'Sustainable Water' section of the calculator.

3.6 Large Kitchens

Large kitchens are defined as kitchens where meals are served to Fitout users, and do not include tea kitchens or kitchens for personal food preparation. Note that this does not include restaurant tenancies within the Fitout as these would be susceptible to churn, but does include kitchens in restaurant buildings and base-building kitchens for cafeteria's, conference centres, etc. Where large kitchens are provided as part of the base building, projects need to enter the estimated number of meals served per month, and indicate which of the following kitchen items are installed in the project, for use in preparing meals:

- Dishwashers
- Pre rinse valves
- Basin / Sink Taps
- Steam cookers

The Notional Fitout consumption is calculated based on which of the above is installed, using the reference values in Table 10. If the Notional Fitout consumption accounts for more than 3% of the total typical Fitout water consumption (occupant amenities, heat rejection and irrigation), the project needs to account for Large Kitchens in the calculator. At less than 3% of total, projects can choose whether to include Large Kitchens in the calculator or not.

Reduction in potable water usage can be achieved through more efficient kitchen appliances or through the use of non-potable water for dishwashers. Where projects make use of rainwater harvesting and/or treated grey/blackwater water to reduce the potable water usage, it is entered under the 'Sustainable Water' section of the calculator.

Table 10 – Notional Fitout Large Kitchen usage assumptions

Kitchen Item	Reference case usage	Usage
Dishwasher* - under counter	13 ltr/rack	1 rack per 10 meals
Pre rinse valves	20 ltr/min	1 minute per 5 meals
Basin / Sink Taps	12 ltr/min	1 minute per 5 meals
Steam Cookers	57 ltr/hour	1 hour per 25 meals

* Based on Energy Star Specifications

3.6.1 Inputs

Estimated meals served per month

The user is required to enter the estimated number of meals served per month. This can be based on the estimated meals per day, multiplied by the number of days per month. Due to the varying nature of meals served projects are asked to input their own estimates, with justification (an office might serve meals only 5 days a week, opposed to a hotel where meals are served 7 days a week). Monthly input is required to facilitate later non-potable water demand reduction calculations.

In the example shown below, the number of meals served in a conference facility where lunch is provided for 500 visitors, 10 times a month, is shown. The number of meals served in January is calculated as 500 x 10 =5000, and so forth for the other months.

	Estimated number of meals served
January	5 000
February	5 000
March	5 000
April	5 000
May	5 000
June	5 000
July	5 000
August	5 000
September	5 000
October	5 000
November	5 000
December	5 000
	60 000

Figure 7 – Example input of estimated meals served per month

Kitchen items installed

For each kitchen item, the user is asked to indicate whether or not the item is to be used in during meal preparation in the project.

Actual Fitout kitchen water demand per meal

This input is optional if Notional Fitout Kitchen consumption accounts for less than 3% of total Notional Fitout water consumption.

The user is required to enter the calculated kitchen water demand per meal. For details on how these calculations are done, please refer to Appendix D.

3.6.2 Calculation Methodology

The water demand per meal is multiplied by the monthly number of meals served to determine the monthly water consumption of the kitchen facility.

Potable water savings due to the use of recycled or rainwater is taken into account under the 'Sustainable Water' section of the calculator.

3.7 Other major water demands

Where a project team feels that there is another base-building major water demand in which they have reduced potable water consumption, which is not covered in the tool, they can enter the monthly water demand in the space provided under 'Other major water demands', for both the Actual and the Notional Fitouts. Space is provided for up to three other demands, and each demand will only be eligible if the reference case (Notional Fitout) demand exceeds 3% of the total Notional Fitout demand for occupant amenities, heat rejection and irrigation. This 'Other major water demand' will become available as a source of recycled water under 'Sustainable water'. The project must clearly demonstrate the claimed water consumption through calculations and verification documentation, approved by the GBCSA through a CIR process.

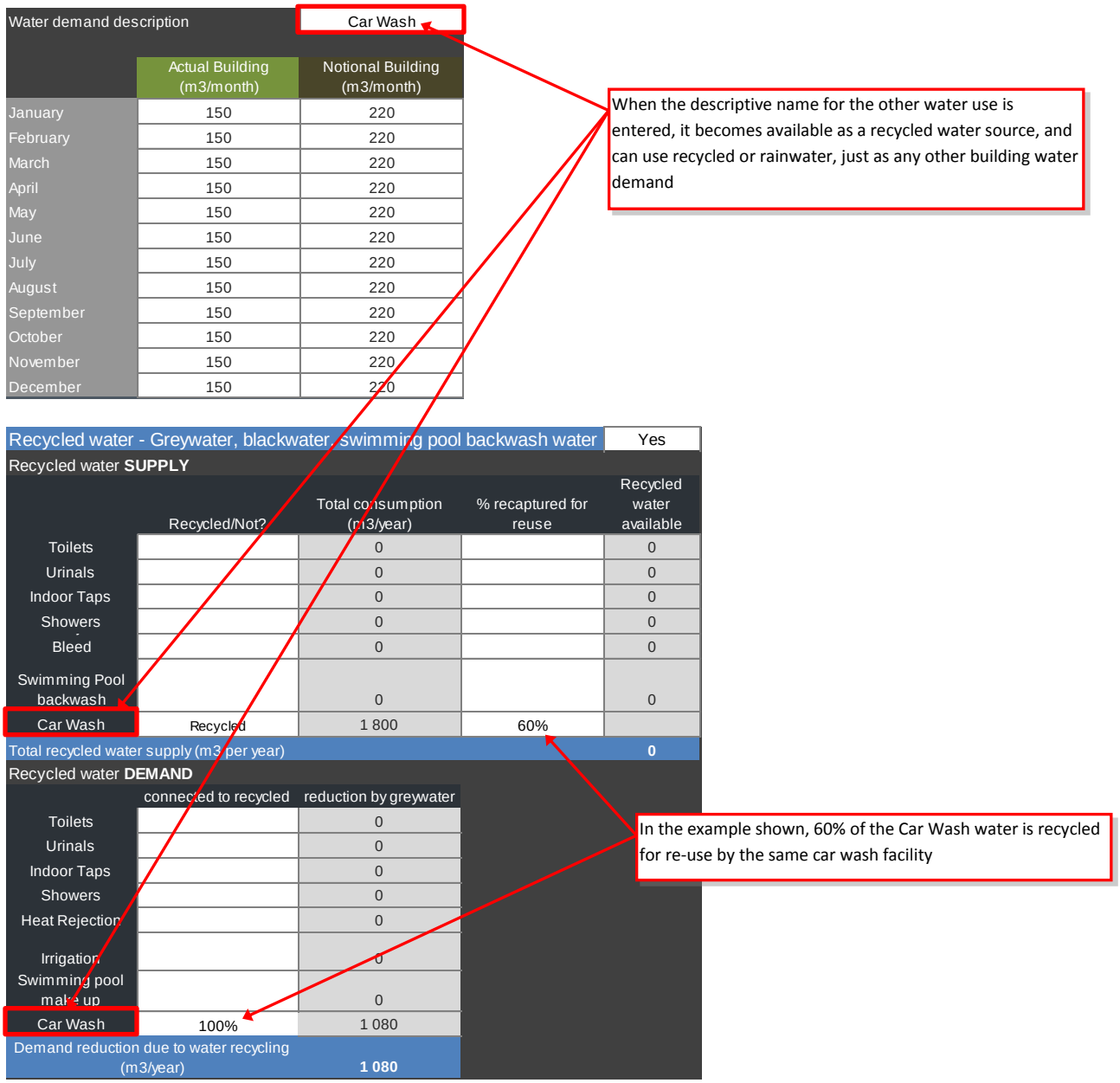


Figure 8 – Example input showing how 'Other major water demands' is reflected under the 'Sustainable Water' section of the calculator

4 Sustainable water

Once the water consumption is calculated, alternative water supplies are considered to determine how much of the water demand can be offset using non-potable water sources.

Sustainable Water is defined as water that is collected on site or recycled/recovered from a previous use such as black water or grey water. Previously unused water from high-value fresh water sources (e.g. lake, river or groundwater) cannot contribute to the amount of sustainable water used. In addition, extracting ground water from any neighbouring fresh-water sources impacts on the water table level and merely localises a problem what otherwise would take place on the municipal or provincial level

The following sources of sustainable water are taken into account:

- **Recycled water** – greywater from indoor taps and showers; blackwater from toilets and urinals; recaptured heat rejection bleed and swimming pool backwash
- **Rainwater** harvested from flat building surfaces
- **Other non-potable water supplies**, specified by the user

It is possible that one water demand can be met by multiple sustainable water sources – for example landscape irrigation which is fed by both recycled greywater and rainwater. For such cases, the calculation is done in a way to prioritise greywater and blackwater recycling (which benefits the projects in EMI-6 Discharge to Sewer) and accurately model demands that are met by more than one non-potable source.

4.1 Recycled water

For calculation purposes, greywater, blackwater and swimming pool backwash are treated as a single source. The treatment required is the responsibility of the design team and does not affect the Potable Water Calculator. The total water recycled from these sources is summed and it is assumed the system capacities are sized to handle the load. Where a Fitout includes a recycling system which is too small to deal with the full water supply, the percentage input as recaptured should be adjusted to account for this.

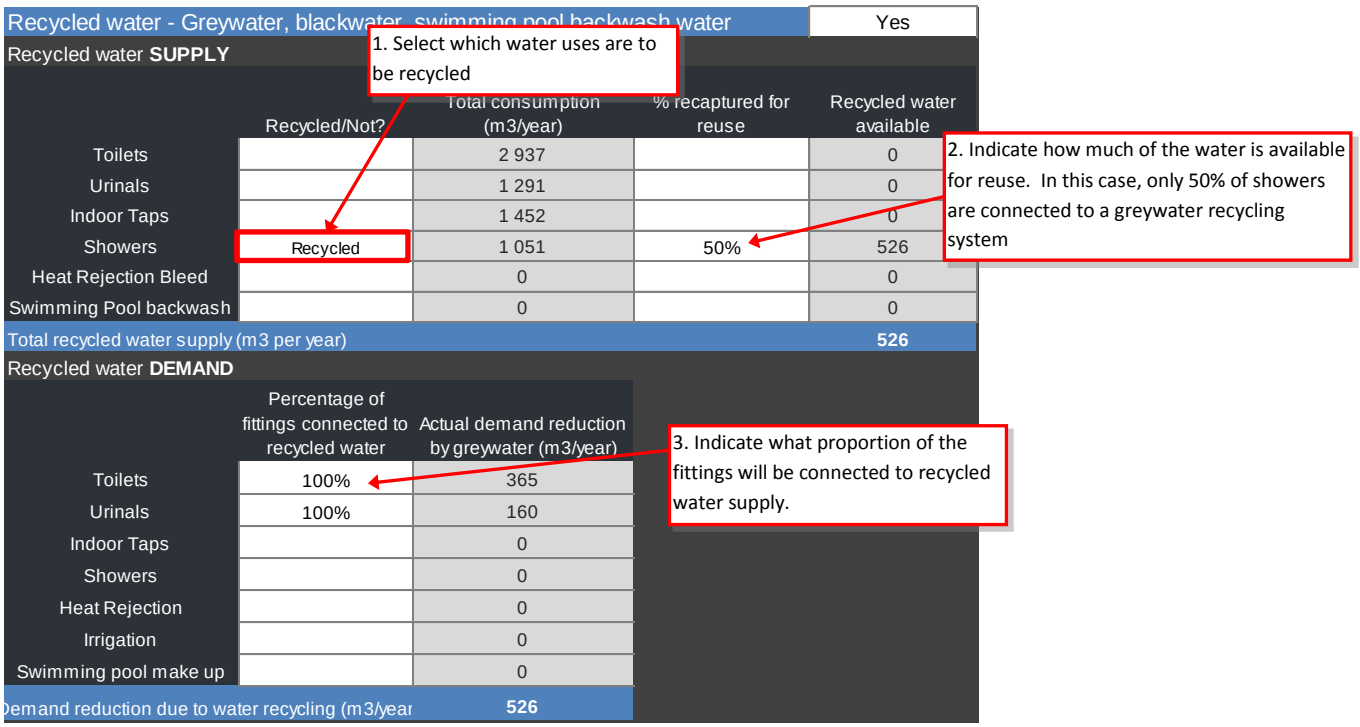


Figure 9 – SANS 204 Climatic regions

4.1.1 Inputs

Recycled water supply

The user specifies which Fitout water uses will be recycled, and how much of the water will be recaptured for reuse. From this is calculated the total recycled water supply available.

Recycled water demand

For each Fitout water demand, the user specifies which percentage of the demand is connected to recycled water (for example 100% if all toilets are connected to non-potable supply, 33% if only one of three toilet blocks are connected).

4.1.2 Calculation Methodology

Monthly recycled water supply is calculated based on the fittings that feed the recycled supply. No storage is taken into account for recycled water, as it assumed that the systems designed include sufficient storage and treatment capacity to process the amount specified as recaptured, and most recycled water is used as it becomes available.

All the recycled water supply is lumped together, as is the demand, and monthly balancing calculations determine the amount of potable water saved.

4.2 Rainwater harvesting

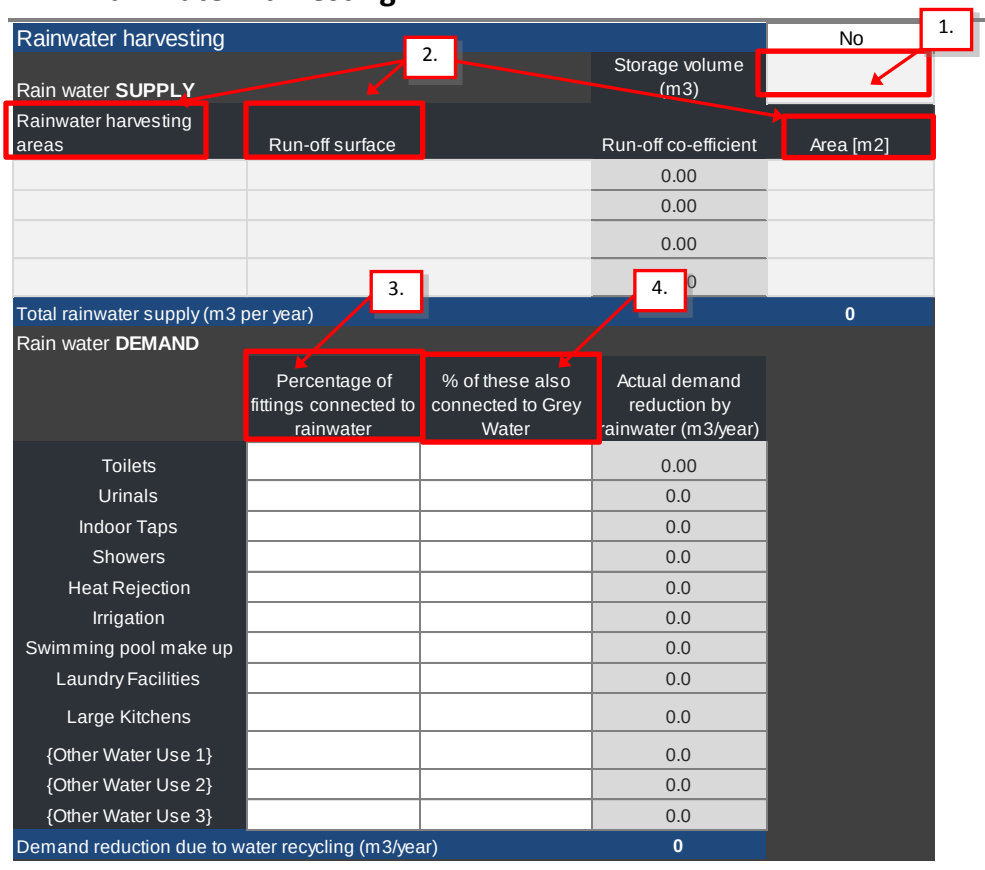


Figure 10 –Rainwater harvesting inputs

4.2.1 Inputs

1. Storage volume

The size, in m3, of the rainwater storage provided.

2. Rainwater harvesting areas

The user selects a descriptive name for each rainwater catchment area, its area (in m2) and the catchment surface which determines the run-off co-efficient for that area.

3. Rainwater demand

For each Fitout water demand, the user specifies which percentage of the demand is connected to rainwater supply.

4. Percentage of fittings also connected to grey water

The user must also enter what percentage of fittings connected to rainwater, are *also* connected to greywater. This will determine how much of the demand, if any, is partly met by greywater.

For example – consider a Fitout with two toilet cores:

Scenario 1 - Both toilet cores are connected to grey water and rainwater. Thus 100% of the toilets are connected to rainwater, and *of that 100%, 100% is connected to greywater as well.*

	Percentage of fittings connected to rainwater	% of these also connected to Grey Water
Toilets	100%	100%

Scenario 2: One toilet core is connected to both rain and greywater. Thus 50% of the toilets are connected to rainwater, and *of that 50% 100% is connected to greywater as well.*

	Percentage of fittings connected to rainwater	% of these also connected to Grey Water
Toilets	50%	100%

Scenario 3: One toilet core is connected to rainwater only, the other is connected to greywater only. Thus, 50% of the toilets are connected to rainwater, and *of that 50%, none are connected to greywater as well.*

	Percentage of fittings connected to rainwater	% of these also connected to Grey Water
Toilets	50%	0%

This is in order to not incorrectly attribute rainwater and greywater where single demands are met by multiple sustainable water sources.

4.2.2 Calculation Methodology

Daily inflow / outflow calculations are used to determine potable water reduction due to rainwater harvesting. A design rainfall year is calculated using monthly weather data from the Fitout location. For each rainy day

- The gross run-off generated from flat surfaces (in m3) is calculated from surface areas and descriptions entered into the calculator by users
- A volume of water must be diverted from the water storage to prevent storage from being contaminated with pollutants. This volume is referred to as the first flush, and assumed to be 0.5L/m2. The first flush volume lost (calculated at 0.5L/m2) in each rainfall event is subtracted from the gross run-off available, to determine the harvested rainwater available

Calculating rainwater demand per day

- The water demand, as determined from user input, is used to determine the demand for rainwater per day. Reduction in daily demand due to recycled water usage is taken into account.

Daily water balancing calculations

- Daily rainwater supply and demand is used to determine reduction in potable water consumption, with excess supply stored for use the next day

The table below shows the assumptions used in rainwater harvesting calculations.

Table 11 - Assumed constants for rainwater harvesting calculations

Rainwater collection	
First flush volume	0.5L/m2
Rain day minimimum	1mm
Run-off co-efficients	
Steel roof >30o Pitch	0.9
Non-absorbent roof>30o Pitch	0.9
lat non-absorbent roof < 30o Pitch	0.8
Flat gravel or turf roof < 30o pitch	0.65

4.3 Other non-potable water supply

"Other sustainable water supply" is any non-potable water that is being used in the Fitout that is not already addressed in the calculator, such as treated effluent from a waste water treatment plant or condensate from the chillers.

Previously un-used water from high-value fresh water sources (e.g. lake, river or ground water) cannot contribute to the amount of non-potable water used. In addition to the surface water table dropping, there is a global deficit of groundwater, and extracting water from any neighbourhood fresh water sources merely localises what otherwise would take place on the municipal or state level.

4.3.1 Inputs

Other sustainable water supply

The calculator allows for up to three supplies to be considered. A description of each supply and the monthly water available is input by the user. The design team must justify the assumptions and calculations in supporting documentation.

Other sustainable water demand

For each Fitout water demand, the user specifies which percentage of the demand is connected to other sustainable water supply.

4.3.2 Calculation Methodology

Monthly supply of each other sustainable water supply is entered by the user, however in the calculations all entered supply sources are treated as a single supply. No storage is taken into account. Potable water reduction is calculated by subtracting monthly demands from the monthly supply that serves the demands.

5 Water usage summary

The water usage summary shows the water demand for the Actual and Notional Fitouts, and the reduction in water demand for the Actual Fitout because of non-potable water sources. The percentage reduction in potable water consumption of the actual Fitout compared to the notional Fitout, and the associated number of points claimed, is determined from this.

Appendix A: Occupancy Profiles

Standard occupancy profiles are based on the UK Dept. of Communities and Local Government's National Methodology (NCM) Activity Databases. These profiles are available in the general section of the certification engine. Instructions on how to enter user defined occupancy profiles are shown below. User defined schedules must be based on one of the Occupancy Profiles contained in the Energy Modelling Activity Schedules available for download from the certification engine.

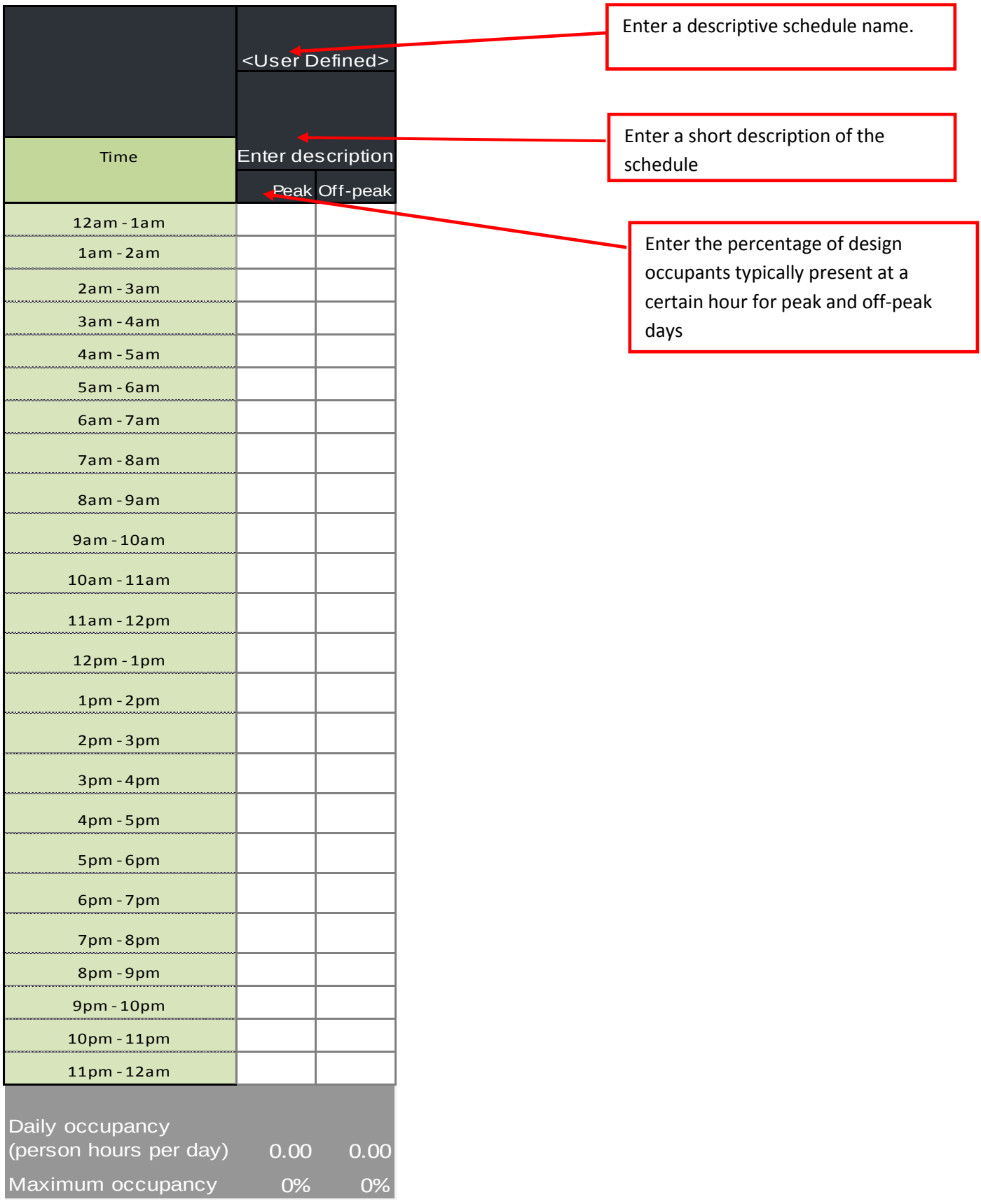


Figure 4 - User defined schedules

Appendix B: Watering Requirements for Typical Plants

List of Plants commonly used in the South Africa and their water usage

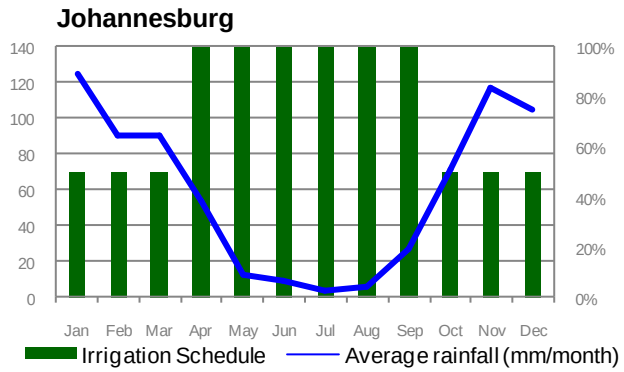
	mm/week
1. High Water demand plants	**40mm**
Cyperus textilis	
Kniphofia uvaria	
Wachendorfia spp.	
Zantedeschia aethiopica	
2. Medium high water demand plants	**30mm**
Elegia capensis	
Juncus krausii	
Melianthus major	
Plectranthus ciliatus	
Stenotaphrum secundatum (Buffalo Lawn)	
Sutera cordata	
Tulbaghia violacea	
3. Medium water demand plants	**20mm**
Asparagus densiflorus	
Barleria repens	
Buddleja salvifolia	
Carissa macrocarpa	
Cynodon dactylon (Kweek Lawn)	
Dietes grandiflora	
Dymondia margaretae	
Leonotis leonorus	
Pennisetum clandestinum (Kikuyu Lawn)	
Rhus crenata	
Scabiosa incisa	
4. Medium low water demand plants	**12.5mm**
Agapanthus praecox	
Agathosma spp.	
Arctotis acaulis	
Asystasia gangetica	
Bulbine frutescens	
Chrysanthemoides monilifera	
Crassula multicava	
Eriocephalus africanus	
Euryops pectinatus	
Felicia spp.	
Gazania spp.	
Hypoestes aristata	
Osteospermum jucundum	
Pelargonium capitatum	
Plectranthus neochilus	
Plumbago auriculata	
Salvia spp.	
Strelitzia reginae	
Tecoma capensis	
5. Low water demand plants	**7.5mm**
Aloe spp	
Aptenia codifolia	
Carpobrotus edulis	
Cotyledon orbiculata	
Euphorbia spp.	
Helichrysum petiolare	
Lampranthus spp.	
Portulacaria affra	
Ruschia macowanii	
Sanseveria spp.	

Please note: The above list is a selection of plant material that is typically used in the landscape industry. This is not intended to be a fully comprehensive list, but aims to guide the user as to types of plants and their water consumption. The amount of irrigation applied to these types of plants is intended to achieve a minimum acceptable level of landscape, ie: many of these plants can do with less water, but would not appear healthy and viable.

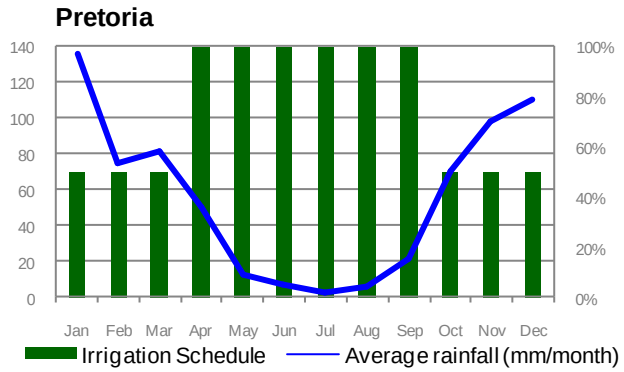
Appendix C: SANS 204 Climate Zones and Irrigation Schedules

Examples of irrigation schedules and annual average rainfall for SANS 204 climatic zones

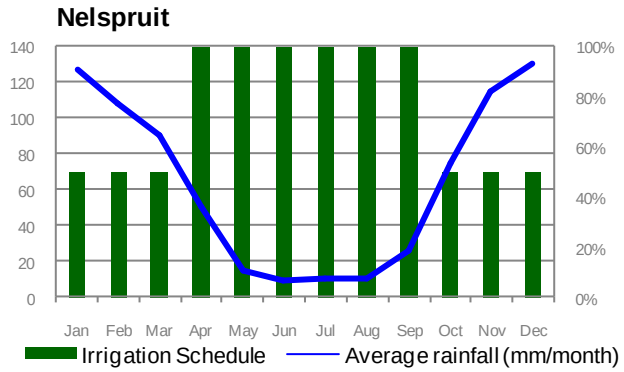
ZONE 1 – Cold Interior



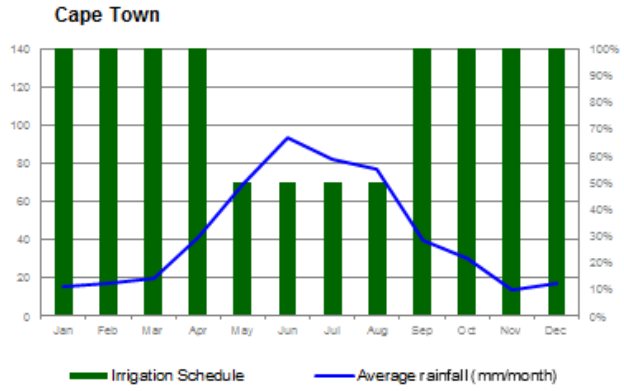
ZONE 2 – Temperate Interior



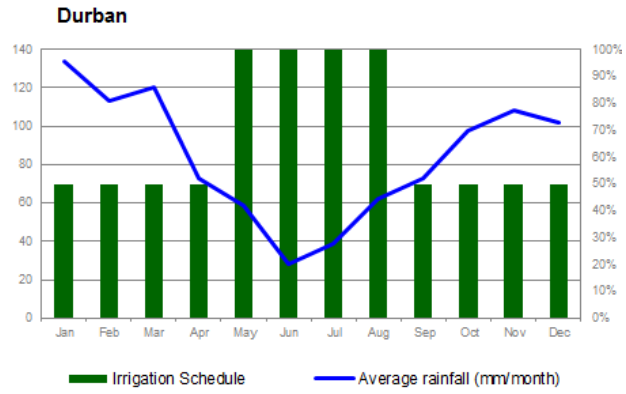
ZONE 3 – Hot Interior



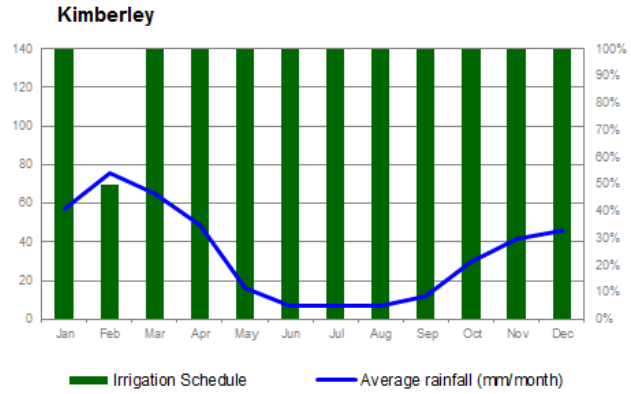
ZONE 4 – Temperate Coastal



ZONE 5 – Sub-tropical Coastal



ZONE 6 – Arid Interior



Appendix D: Establishing Large Kitchen Water Demand

The project must determine the water consumption per meal (in litres per meal) served in the kitchen, based on equipment installed. The reference case is established as per the table below. Follow the same procedure for the actual Fitout. Water efficiency of equipment must be demonstrated and justified through manufacturer's datasheets.

Kitchen item	Reference case water usage	Usage	Reference Case (example based on a kitchen producing 600 meals per day)
Dishwasher[4]			
Under counter	13 ltr/rack	1 rack per 10 meals	1.3 litres per meal
Single Tank Door	8.4 ltr/rack	1 rack per 10 meals	0.84 litres per meal
Tank Conveyor	6 ltr/rack	1 rack per 10 meals	0.6 litres per meal
Multiple Tank Conveyor	4.1 ltr/rack	1 rack per 10 meals	0.41 litres per meal
Pre rinse valves	20ltr/min	1 minute per 5 meals	4 litres per meal
Basin / Sink taps	12ltr/min	1 minute per 5 meals	2.4 litres per meal
Steam Cookers	57 ltr/hour	1 hour per 25 meals	2.28 litres per meal

[4]Based on Energy Star Specifications

For a kitchen where Under Counter dishwashers are installed, along with pre rinse valves, basins and steam cookers, the consumption per meal would be 1.3 + 4 + 2.4 + 2.28 = 9.98 litres per meal.

INT-Wat-2 Water Sub-Metering

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise the design of systems that both monitor and manage water consumption.

CREDIT CRITERIA

Up to two points are awarded as follows:

Metering

One point is awarded where:

- Water meters are installed for all major water uses in the tenancy

Metering Strategy

An additional one point is awarded where:

- The above is achieved;
- A metering and verification strategy is developed for the project;
  AND
- Occupants are provided with a dedicated visual display of the water consumption data, as provided by their sub-metering system

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA Submission Template 2. As Built drawing(s) Or contract document 3. Metering and verification strategy 4. Manufacturer product datasheet(s) Or Letter from supplier

GBCSA Submission Template prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Providing a summary table of all major water uses in the fitout and the water sub-metering requirements.

Where additional point claimed:

- Describing how the water consumption data will be effectively monitored during then fitout's operation and how fitout occupants have access to their consumption data, demonstrating compliance with the Credit Criteria;
- Describing the functionality of the visual display provided

As Built drawing(s) Or Contract document marked-up to clearly demonstrate the inclusion of all sub-meters demonstrating that they are in an accessible location for occupants, as referenced in the short report

Metering and verification strategy describing in not more than one A4 page a summary of the overall metering and verification strategy for the project

Manufacturer product datasheet(s) Or Letter from supplier for the visual display system, clearly demonstrating the systems' functionality

ADDITIONAL GUIDANCE

Major water uses are defined as items or spaces that individually account for at least 10% of the fitout's total water use. Examples of major water uses include, but are not limited to: bathrooms; evaporative heat rejection systems; irrigation systems; car wash facilities; food preparation facilities; laundry; wash-down systems; recycled/rainwater supply and humidifiers.

It may be necessary to provide separate sub-metering on other water uses within the fitout if they are deemed equally substantial and the assessors reserve the right to request this after the round 1 submission.

Water meter requirements

One water meter for all bathrooms is sufficient for meeting the Credit Criteria regardless of the size of the building, as long it covers both hot and cold water. Kitchenette and custodian sinks (regardless of number) do not require a separate meter. However, their water use must be monitored by being on one of the sub-metered lines, such as the bathroom line.

If the water consumption of one of the major uses can be determined by a simple (and in most cases automatic) subtraction of all the other metered uses from the building's total water consumption, it does not have to be separately sub-metered. For example, if all water going into the building and all water going out (e.g. for cooling towers) is sub-metered and if the difference equates to bathroom water consumption, it is not necessary to have a separate bathroom meter.

Metering and verification strategy

The metering and verification strategy must be based on what the actual methodology will be that the fitout will adopt for the sub-meters. It must highlight the frequency and methodology of meter reading, data collection and storage, verification and reporting. The frequency of readings must be a minimum of once a month. The strategy document need not be exhaustive and must be written in easy-to- read language for a non-technical reader.

Visual display and analysis systems

The intent of the visual display is to enable quick, simple and effective communication of a fitout's water consumption to the occupants. The visual display can either be a visual display infrastructure provided within the fitout, installed in an easily accessible and visible location for use by the occupants or an online external website or intranet accessible system with access permissible by personal computer, interactive multimedia or cell phone.

BACKGROUND

Water is an economic and natural resource which traditionally has not been extensively sub-metered in the built environment. In many cities throughout the world, water metering when installed, has been limited to a building scale only, with a single meter provided to a single building with multiple tenants.

Sub-metering is now gaining popularity as an effective strategy for water resource management, as it permits the signalling of the marginal cost and increasing scarcity of water to consumers. These signals can assist in reducing per capita consumption within a distribution network.

The Water Sub-Metering credit encourages the provision of water use information to fitout users as a meaningful deterrent to wasteful behaviour and a powerful way to raise awareness of the financial benefits of reduced water consumption.

The implementation of appropriate metering and monitoring strategies allows project teams to conduct water audits to manage consumption. Effective monitoring practices also offer an effective method for detecting leaks within water systems and for fine tuning operational procedures.

REFERENCES & FURTHER INFORMATION

Waterwise (2007),'International experiences of sub-metering: An analysis of four case cities to inform planning for domestic metering in the Greater London Area', Commissioned by the Greater London Authority, Waterwise.
http://www.waterwise.org.uk/data/2007_Waterwise_submetering.pdf

City of Richmond (Canada) Water Meter Program
http://www.watermeter.ca/english/about.html

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Mat-1 Operational Waste Management

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise developments which provide a spatial allocation for recycling and an operational waste management plan to facilitate the recovery of resources used within the tenancy to reduce waste going to disposal.

CREDIT CRITERIA

Up to two points are available for this credit. The points are awarded independently of each other:

Recycling Waste Storage

Where waste storage is provided for within the tenancy:

One point is awarded where:

- A dedicated storage area for the separation and collection of recyclables is provided with the tenants area and is sufficiently sized, to handle the collection and sorting of all waste streams identified as a minimum.

OR

Where waste storage is provided for outside of the tenancy (either due to multi tenancy or tenancy waste sharing schemes)

One point is awarded where:

- The storage area for the separation and collection of recyclables provided for all tenants is sufficiently sized to deal with all waste streams, based on the projected waste profile of the fitout tenant and the collection frequency, for all following waste streams identified as a minimum.

AND

- Waste and recyclable collection point(s) are provided within the tenancy.

Operational Waste & Recycling Management Plan

One point is awarded where:

- A comprehensive and project specific Operational Waste & Recycling Management Plan is developed for the tenant to reduce operational waste and increase recycling.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
For recycling waste storage 1. GBCSA Submission Template 2. As Built Drawings 3. Supporting Evidence

INT-Mat-1 Operational Waste Management

POINTS AVAILABLE **2**

For Operational Waste and Recycling Management:

4. Operational Waste & Recycling Management Plan

GBCSA Submission Template that clearly identifies:

- The relevant waste streams for the tenancy
- The spatial allocation of the recycling storage area by providing calculations that demonstrate that the area provided is adequately sized to handle the recyclable waste streams, based on:
  - A profile of projected waste generation for the tenancy
  - Collection frequency of each waste stream
- Reasonable and accessible walking distances between the waste storage area and waste removal points

As Built drawing(s) or Photograph(s) marked up to show:

- Location of the recycling storage area(s) with dimensions indicated;
- Location of waste collection areas for the tenants and/or visitors and transfer routes through the tenancy to the recycling storage areas;
- Signage communicating the recycling initiatives to tenants

Supporting Evidence that confirms any waste collection frequency claims as referenced in the short report, in the form of either:

- A letter of confirmation from the tenant or building owner confirming the municipal collection frequency
- A contract between the tenant/building owner and waste services provider or landlord recycling scheme confirming collection frequency

Operational Waste & Recycling Management Plan outlining the plan for reduction of the overall operational waste. The plan must meet the requirements set out in the Additional Guidance. The submitted plan must be signed by the tenant representative.

ADDITIONAL GUIDANCE

Waste streams

The waste streams to be collected and sorted, at minimum, include:

- Cardboard;
- Paper Products;
- Glass;
- Plastics; and
- Metals

Additional waste streams to be collected and managed could also include:

- Compostable organic material (food or garden waste);
- Cooking oil;
- E-waste (electronic equipment and peripherals);
- Light bulbs (CFLs and fluorescent tubes);
- Printer and toner cartridges;
- Batteries; and
- Motor oil

INT-Mat-1 Operational Waste Management

POINTS AVAILABLE 2

The type of waste management plan implemented within a fitout must take into account the size, function, number of occupants and collection frequency of recyclable material for the project. Effective waste management plans assist project occupants and external waste management service providers to segregate, store and collect recyclable materials, and helps to minimise the amount of recyclable material that ends up in landfill.

Recycling storage space

The recycling waste storage must effectively serve all building uses and occupants and be sufficiently sized to accommodate the storage of the minimum waste streams. Where kitchens are present, storage for grease/cooking oil, and organic compost material must also be provided. Where there are large areas of landscaping it is also recommended to address disposal/composting of garden waste.

Access and signage requirements

For recycling waste storage facilities and waste collection points demonstrate:

- The storage area is appropriately signposted
- The storage waste bins must be labelled per waste stream
- The waste disposal points for tenants and/or visitors are conveniently located and within reasonable walking distances from the waste storage area (if located within a tenancy) or waste collection points (if storage exists external to the tenancy)
- There is adequate signage explaining the recycling initiative to tenants within the tenancy
- The transfer routes between the waste disposal points, storage area, and collection point for removal must allow the smooth transport of waste (i.e., the surface treatment must demonstrate easy access)
- Reasonable and accessible walking distances between the waste storage area and waste removal points

External recycling waste storage

As Green Star SA assesses permanent attributes of buildings, external amenities can only be rewarded if they are provided for the life of the building to the same degree of service and certainty as internal facilities. As a result, the following applies to amenities (such as recycling waste storage) that are located on separate premises and not within the assessed building:

- The scope of assessment is not extended beyond the assessed building, i.e. the building within which the amenities are housed does not need to meet the Credit Criteria of any claimed credits; only the amenities assessed against the Credit Criteria of the credit towards which they contribute;
- The assessed building and the amenities are under the same ownership and cannot change ownership separately (i.e. they are on the same title or equivalent);
- The assessed building and the amenities are under the same management and cannot change management separately (e.g. the same facility management to ensure recycling waste storage is processed as designed);
- The recycling waste storage facilities are in close proximity to the assessed building and the access route is clearly marked and sign-posted, convenient, guaranteed, secure and without a step change;
- The amenities are completed by the date of practical completion of the assessed building; and;
- The amenities fully meet the Credit Criteria and are documented in strict accordance with the Technical Manual, including weather protection.

Waste collection areas for the tenants and/or visitors

Waste collection areas for recyclables must be provided within the interiors fitout design. The number of bins must correlate with the stated recyclable waste streams identified in the short report. These

areas must include appropriate signage, either on the bins or on the walls, to clearly communicate which recyclable waste each bin accommodates.

Operational Waste and Recycling Management Plan

The Operational Waste and Recycling Management Plan must address all waste (recyclable and non-recyclable) generated in the building from occupants, common areas, and visitors. As a minimum, it should describe:

- The common waste streams (e.g. paper, various plastics, and glass) and the additional waste streams specific to the fitout;
- An estimation of waste generation and frequency of collection to justify of the size of the recycling waste storage area and waste collection areas for the tenants and/or visitors;
- Waste collection areas for the tenants and/or visitors;
- The waste storage areas, in terms of location, size, accessibility, easy access for manoeuvring bins and cleaning storage areas;
- The allocated waste collection areas for the tenants and/or visitors including a description of the bins that are provided and how these are distributed throughout the tenancy to allow for recyclable waste streams;
- The procedure and frequency of emptying bins and how this works together with the waste recycling storage area location and size;
- Transfer of waste bins to storage areas; in terms of surface (free of steps, kerbs), distances, grades;
- Signage and educational initiatives geared towards building occupants and customers;
- Monitoring and reporting requirements, (minimum quarterly);
- On-going management and proposed roles and responsibilities of the involved parties;
- Explicit annual operational waste reduction targets, for reduction in the amount (by weight or volume) of the building's overall operational waste or provide a plan to audit the operational waste stream for setting such targets; and
- The strategy to deal with electronic waste (electronic equipment and light bulbs) and how this is communicated to the staff responsible for replacing/disposing of these items.

BACKGROUND

While the Green Star SA- Interiors rating tool mainly addresses the sustainable aspects of fitout construction, the Operational Waste Management credit is included to address the impacts associated with the fitout operation post-construction. Compliance with the Operational Waste Management credit requires project teams to institute a management plan for recycling waste such as paper, plastics and glass.

The intention is to provide convenient and accessible recycling bins to promote higher recycling rates. Recycling operational waste diverts waste to landfill and contributes to job creation in South Africa.

REFERENCES & FURTHER INFORMATION

South African Waste Information Centre (SAWIC), National Waste Management Strategy Implementation Project, (2005). *Waste Stream Analysis and Prioritisation for Recycling*
http://www.sawic.org.za/documents/234.pdf

Paper Recycling Association of South Africa
http://www.prasa.co.za

Institute of Waste Management of Southern Africa
http://www.iwmsa.co.za/

City of Cape Town (2005) Smart Living Handbook, Cape Town, South Africa.
http://www.capetown.gov.za/en/EnvironmentalResourceManagement/Pages/SmartLivingHandbook.aspx

Polokwane Declaration
http://www.environment.gov.za/ProjProg/WasteMgmt/Polokwane_declare.htm

Financial and Fiscal Commission Policy Brief: Making Solid Waste Management in South Africa Sustainable 6 / 2012, Plastics South Africa
http://www.plasticsinfo.co.za/

E - Waste Association of South Africa (EWASA)
http://www.ewasa.org/

My Waste website
http://www.mywaste.co.za/

GWIS - Gauteng Waste Information System
www.gwis.gpg.gov.za/

WRAP *Guidance on operational waste management: Waste management in office Buildings* (2009)
http://www2.wrap.org.uk/downloads/Operational_Waste_Guidance.e6518603.8080.pdf

New South Wales *Better Practice Guidelines for Waste Management and Recycling in Commercial and Industrial Facilities*
http://www.epa.nsw.gov.au/resources/warr/120960wastecif.pdf

CIPS *How to develop a waste management and disposal strategy*
http://www.cips.org/Documents/About%20CIPS/Develop%20Waste%20v3%20-%2020.11.07.pdf

Better Buildings Partnership *Guidelines for Operational Waste: procurement, management and reporting*
http://www.sydneybetterbuildings.com.au/assets/2014/08/20140710-BBP-Operational-Waste-Guidelines-final-draft-for-consultation.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Mat-2 Furniture

POINTS AVAILABLE **8**

AIM OF CREDIT

To recognise the selection of furniture that has a reduced environmental impact compared to available alternatives.

CREDIT CRITERIA

Up to eight points are awarded where the furniture used has a reduced environmental impact as determined by the Furniture Calculator against the following criteria:

- Certified product
  - 80% of an item's total mass is certified by a recognised 3rd party certification scheme
- Reused:
  - 80% by area, length, volume or mass of the furniture item must be retained or reused
- Product stewardship
  - Furniture item must have an end-of-life purpose in the form of either:
    - A formalised take back scheme, OR
    - Item has been designed for disassembly, OR
    - Item features long-term durability and has a manufacturer's or supplier's warranty
- Re-used, recycled or certified content
  - 40% of the item's mass is reused, recycled, or certified content or a combination
- Manufacturer ISO 14001 certification
  - 80% of the item's mass must be sourced from manufacturing facilities that are certified to ISO 14001

If the material cost of furniture represents less than 1% of the project's total contract value, this credit is 'Not Applicable' and is excluded from the Points Available used to calculate the Materials Category score.

Please refer to the Calculator guide section below for detailed descriptions and additional information relating to the Furniture Calculator.

INT-Mat-2 Furniture

POINTS AVAILABLE **8**

Calculator credit criterion	Calculator input options available	Criterion score (%)	Comment
Compliance route 1			
Certified product	Level A	100	Selecting Option 1 as the compliance route will grey out all criteria under Option 2, as a final product score will be calculated based on the Option 1 compliance level.
	Level B	85	
	Level C	75	
Compliance route 2			
Reuse	Yes	100	If compliance is achieved for this criterion, no further entries are required as this is the maximum product score available.
	No	0	
Product Stewardship	Take back- lease	30	For compliance under any of these criteria, the scores applied to each criteria are added together to give the final product score.
	Take back- purchase	25	
	Designed for disassembly or re-use	30	
	Durability – A	30	
	Durability – B	25	
	Durability – C	15	
Reused, recycled or certified content	Yes	20	
	No	0	
ISO 14001 manufacturers	Yes	20	
	No	0	

Table 1: Score contributions for responses to the Criteria

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Completed furniture calculator 2. Short report 3. Project-specific schedule of all items 4. Written confirmation from Contractor 5. Supporting Evidence

Completed furniture calculator with all inputs correctly entered corresponding to all supporting documentation requirements provided.

Short report by a suitably qualified professional that describes how the Credit Criteria have been met and:

For certified products:

- Providing a summary of all certified products in the project, their certification ranking, and relevant certifying scheme

For reused products:

- Providing calculations and a summary table confirming the stipulated proportion of re-used furniture in the project

For design for disassembly and/or reuse:

- Identifying the furniture elements designed for disassembly and/or reuse
- Describing the process involved for reclaiming each element
- Identifying potential reuse options for each of those items
- Providing calculations and a summary table confirming that the stipulated proportion of the relevant furniture is designed for disassembly and reuse

For items with re-used, recycled, or certified content:

- Providing calculations showing how the proportion of re-used, recycled, or certified content was derived. The results must be tabulated to clearly demonstrate:
  - All components in the item
  - Mass of each component
  - Mass of re-used, recycled, or certified content in each component
  - Percentage of re-used, recycled, or certified content for an item

For items from ISO 14001 certified manufacturing facilities:

- Providing a summary of all qualifying products in the project and their manufacturers
- If not 100% from same manufacturer, tabulating the mass of each compliant furniture component and total weight proportion
- ISO 14001 certification number for each product and component claimed.

Where the credit is claimed as 'Not Applicable'

- Providing calculations showing the percentage of the total cost of furniture specified of the total cost of the project.

Project-specific schedule of all items prepared by the relevant project team member listing all the products relevant to the credit, stating the type and quantity of these items

Written confirmation from the tenant that the products listed in the project specific schedule have been installed in the project

Supporting evidence

For certified products:

- **Copy of the certification licence(s)** or certificate for each material or item. The certification must be current at the time of installation and the certification scheme must be recognised by the GBCSA at level A, B or C.
- In the case of timber and bamboo products, a copy of the FSC or PEFC chain of custody certificates (CoC) must be submitted.

For reused products or content:

If purchased from a second-hand retailer, such as an auction house

- Purchase receipts/delivery receipts

If materials were used on the current site by a previous occupant or installed by a building owner as part of make good processes prior to fitout works by the tenant:

- Confirmation from the tenant that the items were in use onsite prior to the project works and that they have now been re-installed onsite

If materials were relocated to the site from the new tenant's, or occupants', previous fitout or building:

- Mover's inventory from the previous location.

  OR

- Inventory/schedule or images from the previous fitout showing clearly the items that have been re-used in the new fitout

For Recycled content:

- Statement of confirmation from manufacturer confirming all recycled claims as referenced in the short report

For the take back schemes:

- **Copy of the signed contract** between the tenant and the manufacturer clearly:
  - stipulating the terms and conditions of the take back scheme, confirming the commitment to take back the quantity of the product or material supplied to the project
  - nominating the intended reuse of the product/materials
  - listing the manufacturer's details (i.e. registered name, address, email address, telephone number and website as applicable)

For design for disassembly:

- **Drawing(s)** marked-up to show detail drawings of connections demonstrating that the relevant furniture elements can be disassembled without cutting, material damage, or hindrance from adjacent materials;
- **Comprehensive Disassembly Plan** that:
  - Identifies which materials are designed to be recovered during furniture disassembly;
  - Details how (in terms of technique, expertise and technology required) the identified materials and products should be recovered, indicating the order of disassembly to enable them to be extracted without material damage or interference from other furniture materials/elements.

For durability:

- **Copy of the warranty contract/offer** demonstrating that the items have been purchased with an offer that includes a defined warranty period for the number of years as claimed

For items from ISO 14001 certified manufacturing facilities:

- **Copy of ISO 14001 certification** that is valid from each manufacturer
- **Manufacturer's confirmation** confirming the weight of all components (if applicable)

ADDITIONAL GUIDANCE

The GBCSA Interiors tool has 4 calculators, one of which is the Furniture Calculator. Each of these calculators is evaluated against specific credit criteria, the results of which are captured in the calculator input excel sheets. The credit criteria evaluate to what extent interior finishes are reused, contain certified content, have incorporated product stewardship in the consideration of the product/material, and have been manufactured in an environmentally responsible way.

The information provided in the credit criteria and Additional Guidance merely summarises the key considerations. Project teams must consult the Furniture Calculator Guide (below) for detailed information regarding criteria definitions, how the calculators operate and how to input into the excel sheets correctly.

BACKGROUND

Environmentally responsible furniture design and manufacturing addresses the impact of furniture products on the environment by considering all aspects of the design and manufacturing process.

There are a number of ways for the specified furniture to reduce its impact on the environment, and many of these are rewarded within this credit. These include using recycled materials in the manufacturing process, using products that can be disassembled and recycled after their useful life and using products that have durability/ longevity. The aspiration is for a closed-loop cycle in which materials and products are perpetually recycled to avoid disposal in landfills. This credit also rewards re-used furniture or furniture that has been certified according to independent 3rd party product certification schemes.

INT-Mat-2 Furniture

POINTS AVAILABLE **8**

Rewarding responsible choices for furniture encourages designers, manufacturers, suppliers and users to have environmental considerations for the products' life cycles such as designing for disassembly where parts can be separated for re-use, recycling or re-processing. One of the easiest ways to extend the life of furniture is to replace worn-out elements instead of the whole item. This credit rewards having a manufacturer's or supplier's warranty of the product and encourages warranties over 10 years. Furniture should offer an extended life and easier serviceability.

ISO 14001 Standard

ISO 14001 is an internationally recognized standard that sets out the criteria for an Environmental Management System (EMS). It does not state requirements for environmental performance, but maps out a framework that a company or organization can follow to set up an effective EMS. It can be used by any organization that wants to improve resource efficiency, reduce waste, and drive down costs. Meeting this standard can provide assurance to company management and employees as well as external stakeholders (customers and shareholders) that environmental impacts are being measured and improved.

ISO 14001, as with other ISO 14000 standards, is voluntary with its main aim to assist companies in continually improving their environmental performance. Organizations are responsible for setting their own targets and performance measures, with the standard serving to assist them in the subsequent monitoring and measurement of these.

While being ISO 14001 certified does not guarantee high environmental performance of a product, it assists companies to better manage the goal of reducing their environmental impacts which could include a reduction in waste, consumption of resources and operating costs.

REFERENCES & FURTHER INFORMATION

Sustainable furniture guidelines article
http://www.buildings.com/article-details/articleid/14002/title/sustainable-furniture-specification-guide.aspx

ISO 14001 website
http://www.iso.org/iso/home/standards/management-standards/iso14000.htm

Cement and Concrete Institute of South Africa (CNCI):
http://www.cnci.org.za

South African Institute of Steel Construction:
http://www.saisc.co.za

Steel Recycling Institute (US):
http://www.recycle-steel.org

Forest Stewardship Council (FSC)
http://www.fsc.org/

Programme for Endorsement of Certified Wood (PEFC)
http://www.pefc.org/

Rainforest Alliance, Sustainable Forestry (formerly SmartWood)

http://www.rainforest-alliance.org/forestry.cfm?id=certification

Australian Government Product Stewardship website
http://www.environment.gov.au/settlements/waste/product-stewardship/index.html

Environmental Protection Agency (EPA) Product Stewardship website
http://www.epa.gov/epawaste/conserve/tools/stewardship/index.htm

FURNITURE CALCULATOR GUIDE

Scope and definitions
The scope of the Furniture Calculator is as follows:

Furniture items in the calculator must include all freestanding seating, surfaces, work settings, beds, and storage units used within project floor areas that are permanently covered and protected from the elements.

The following inclusions, exclusions and definitions apply:

Furniture
Furniture includes, but is not limited to seating's, surfaces, work settings, beds and storage units.

Seating's
Seating's includes, but is not limited to benches, chairs, stools, couches, ottomans and recliners. Chairs that are joined together, such as theatre or auditorium seating should be counted as one chair for every seat.

Surfaces
Surfaces include, but are not limited to, all tables, desks and work settings.

Work settings
Work settings includes, but is not limited to desks, workstations, work benches, surfaces or teller counters. A work setting includes both the work surface and the structure supporting the work surface. Elements that are attached to the work settings should be treated as part of the work settings, e.g. off desk screening, shelving, storage and monitor arms.

A work setting that is designed to accommodate multiple users, but only one at a time (e.g. hot desks) to be counted as one work setting per user.

Storage units
Storage units include, but are not limited to, filing or stationery cupboards, cabinets, shelving units, moveable compact filing units, lockers, wardrobes, dressers, chests, bookcases and pantries. Storage units are units which are intended to be used as storage, which is not custom made. These include items which are "off the shelf" whether they are assembled offsite or onsite.

Exclusions
Any built in, custom made furniture, custom made storage units and demountable partitions are assessed as joinery under the Assemblies Calculator.

Entering information into the Furniture Calculator

The steps outlined below must be followed when completing the calculator

Step 1: Total quantity of items

Enter the total number of furniture items in the project.

'Total number of furniture items in the project' is displayed at the top centre of the Furniture Calculator.

Step 2: Name of supplier and brief description

Enter the name of supplier, the product's brand name and type, in the column called 'Name of Supplier and Brief Description of Item'. One entry may represent a single furniture item or a group of similar furniture items. Each entry must represent furniture that is sourced from the same supplier.

For reused items, enter "re-used tables" or "re-used chairs" etc.

Enter the supplier's name and the product name followed by a brief description of the item.

If various components of an item are sourced from different suppliers, the item entry must include all suppliers' names, followed by a brief description of the item. Below is an example of how the 'Name of Supplier and Brief Description of Item' column may look when completed for three furniture items. Note that information is only required in the white cells.

Refer to the Fitout Calculator Guide for detailed instructions

#	Name of Supplier and Brief Description of Item	Total Number of Items
1	Lucy task chairs (Chair Company)	5
2	Sarah task chairs (Chairs R Us)	5
3	Jessica task chairs (Comfort Chairs)	5
4	Re-used workstations (5th Avenue Auctioneers)	5
5	Live workstations (Furniture Downtown)	5
6	Cupboards (Uptown Furniture)	3
7	Tables (Furniture Office)	2
8		
9		

Example: Name of supplier and brief description of item

Step 3: Total number of each item

Enter information in the column called 'Total Number of Items'. A total must be entered for each item listed in a Furniture Calculator. See inclusions and exclusions as stated in the scope and definitions section above.

Step 4: response to the criteria

Enter information about an item type under one or more of the criteria columns.

Calculator criteria

There are two compliance options available to project teams and these are discussed below. For each line item in each one of the calculators, project teams must pursue either Option 1 or Option 2. Both options cannot be pursued for individual products or materials although each of the calculators can have a mix of Option 1 and 2, depending on the mix of products and materials that are selected. For each line item entered in the respective calculators, an item score is calculated. This represents the points awarded out of 100 points available for a specific environmental criterion. The maximum item score therefore for a product is 100%. The item score is subsequently multiplied with the number of items of that product, to achieve the weighted score, which informs the final score. The item scoring associated with each of these options is described in more detail below.

Option 1: GBCSA-approved 3rd party certification scheme

This option rewards team that procure products and materials that have been assessed by a 3rd party certification scheme. These are initiatives that independently assess the environmental performance of products and materials. There are many Ecolabels available on the market.

The GBCSA has approved a list of 3rd party certification schemes (i.e. Ecolabels) based on an assessment framework that evaluates the Ecolabel according to several environmental, social and legal criteria. Depending on the outcomes of the GBCSA assessment, the Ecolabel is certified according to level A, B or C, indicating the level of environmental performance.

The GBCSA has approved a list of 3rd party certification schemes (i.e. Ecolabels) and these are provided in the General section and on the GBCSA website (https://www.gbcsa.org.za/rating-tools/products-materials/).

In the calculator, select the level (A, B or C) for each item that is certified by a 3rd party product certification scheme or select no (or leave blank) for all other items that are not certified. The selected level will give a corresponding item score.

Option 2: Deemed to satisfy criteria

Products and materials that have not been assessed by a GBCSA approved 3rd party certification scheme can still have positive environmental features and are subsequently awarded in the deemed to satisfy option. The deemed to satisfy option has four criteria in each calculator, each with associated options and items scores. The four criteria are:

- DTS Criteria 1: Dematerialization
- DTS Criteria 2: Product Stewardship
- DTS Criteria 3: Certified, Recycled or Reused content
- DTS Criteria 4: Responsible Manufacturing

DTS Criteria 1: Dematerialization is whether or not the product is reused or, alternatively, if no product has been used at all, via an exposed substrate (the exposed substrate option is not applicable to furniture). If the product is reused or no product is used (and the substrate is exposed), it is awarded an item score of 100% for the product and all other criteria thereafter are not applicable.

Reused products:

For a product to be defined as reused, at least 80% by area, length, volume or mass of the item must be retained (the metric chosen must be justified) via one of the following ways:

- purchased from a second-hand retailer, such as an auction house;
- items that were used on the current site by a previous occupant or installed by a building owner as part of 'making good' prior to fitout works by the tenant;
- relocated to the site from the new tenant's, or occupant's, previous fitout or building

To enter an item as 'dematerialised', select 'Yes - reused for items that are re-used' and select 'No' (or leave blank) for all other items.

DTS Criteria 2: Product Stewardship:

Product stewardship is an environmental management approach that calls for increased responsibility by manufacturers, designers and consumers to consider the end of life impact of materials and products. This approach acknowledges a shared responsibility in how we dispose of products and consider how the end of a product's life will impact on the environment and human health. This concept is alternatively referred to as extended product responsibility (EPR).

Product stewardship can be achieved in the following ways in the calculators:

- Committing to a take back scheme
- Demonstrating that the product/material has been designed for disassembly
- Procuring products and materials that have long term durability (this only applies to the furniture calculator)

Take back scheme:

A take back scheme is a contract between a client and manufacturer, committing the manufacturer to taking back the material or product at its end of life, for the purpose of reusing or recycling the product as an input to a new value chain of goods. Take back schemes can either be part of formal programmes offered by manufacturers or suppliers, or they can be project specific arrangements. However, the nominated reuse of the product/material must be identified and clearly explained. The take back scheme needs to be a signed contract between both parties and cannot include exemptions related to limitations of timing of product return, or minimum quantity of product to be accepted.

Design for disassembly

Design for disassembly-requires products to be readily disassembled with the use of non-specialist tools where parts can be separated into elemental components for re-use, recycling or re-processing.

An item is considered to be designed for reuse when at least 50% of the item (by mass) can be readily disassembled and has a clear recyclable value.

The aim of this credit encourages designers to think of how products are assembled at the onset of the design stage, and effectively inform the process so that the product reuse is ensured after

disassembly. Design for disassembly develops products that can be readily and easily disassembled and parts can be separated into components for re-use, recycling or re-processing.

Durability (this is only applicable to the furniture calculator):

Durability is defined as the number of years covered by a manufacturer's or supplier's warranty and is intended to reward project teams that procure products designed for quality and for long term use. It is calculated according to the length of the manufacturer's or supplier's warranty of the product. There are three categories:

- Level C: 5 - 7 years
- Level B: Between 7 and 10 years
- Level A: More than 10 years

To enter product stewardship, select 'Yes' for the relevant option (i.e. leased item, purchased with a product stewardship contract, warranty contract or designed for disassembly) and select 'No' (or leave blank) for all other items.

DTS Criteria 3: Certified, Recycled or Reused content:

This criterion rewards products that contain a proportion of materials that deliver environmental benefits. In order to qualify, at least 40% of the item's mass consists of any combination of the following:

Re-used material: An item qualifying as reused must be retained or be reused from a previous installation

Recycled content: Post-consumer material that has been diverted from landfill. Pre-consumer materials such as rework, regrind, or scrap, generated in a manufacturing process and capable of being reclaimed within the same process that generated it, are not considered recycled. This credit rewards post-consumer recycled content only and not post-industrial recycled content.

Certified Content: item contains material or components that are certified by a GBCSA-recognised product certification scheme or certified by a forest certification scheme, namely Forestry Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC).

To enter re-used, recycled or certified content, select 'Yes' for items where at least 40% of the item's mass consists of any combination of the following:

- Re-used components;
- Independently verified recycled content;
- Components certified by a product certification standard recognised by the GBCSA
- Timber and bamboo components that are certified by a recognised forest certification scheme, namely FSC (Forestry Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification).

Calculating re-used, recycled, and certified content

The example bellows shows how to calculate the proportion of re-used, recycled and certified content for a workstation made from several components.

Each 'Live' workstation from Furniture Downtown is made up of the following four components:

1. Worktop made from timber that has a chain of custody certification from a forest certification scheme, namely FSC.

   100% of the worktop's mass is counted towards re-used, recycled, or certified content calculations.

2. New aluminium frame with no recognised documentation to show that it contains re-used, recycled or certified content.

   0% of the frame's mass is counted towards re-used, recycled or certified content calculations.

3. Polymer screens supplied as part of each workstation, containing 20% independently verified recycled content.

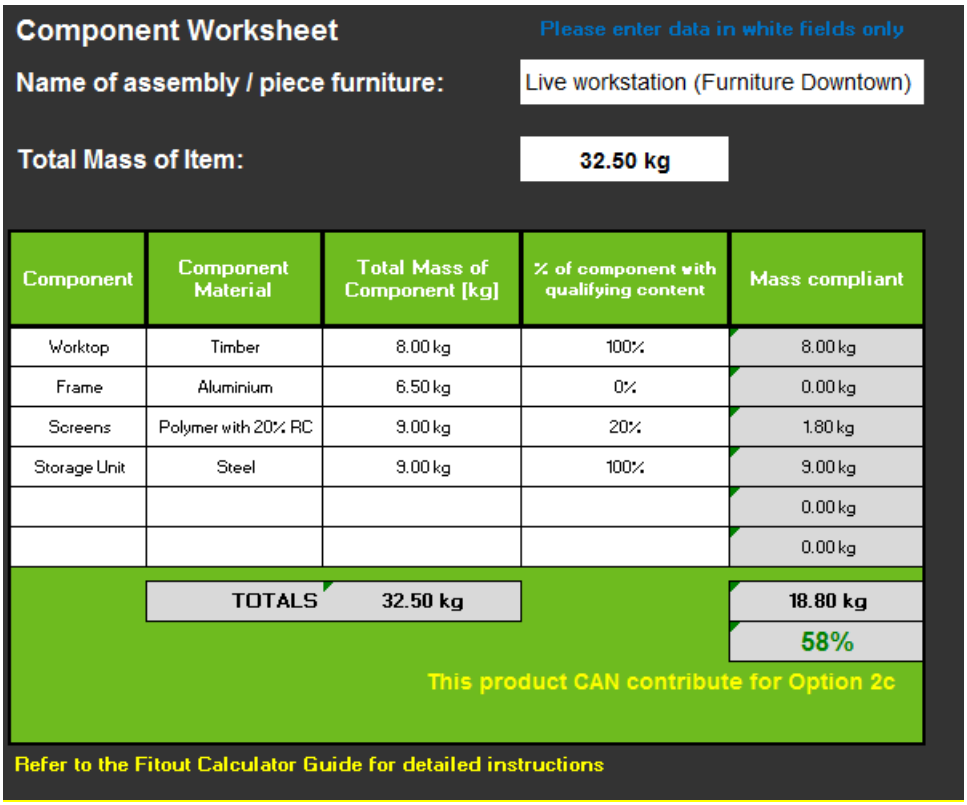
   20% of the screen mass is counted towards re-used, recycled or certified content calculations.

4. Storage unit as part of each workstation, certified by a GBCA-recognised product certification scheme.

   100% of the storage component's mass is counted towards re-used, recycled or certified content calculations.

The tool includes a Component Calculator to assist teams in demonstrating how a product may comply to obtain a score under this criterion. A screenshot of this calculator is provided below.

Project teams must provide 'screenshots' of this calculator for each applicable product with their submission documentation to demonstrate how compliance is achieved.



Component Worksheet

Please enter data in white fields only

Name of assembly / piece furniture: Live workstation (Furniture Downtown)

Total Mass of Item: 32.50 kg

Component	Component Material	Total Mass of Component [kg]	% of component with qualifying content	Mass compliant
Worktop	Timber	8.00 kg	100%	8.00 kg
Frame	Aluminium	6.50 kg	0%	0.00 kg
Screens	Polymer with 20% RC	9.00 kg	20%	1.80 kg
Storage Unit	Steel	9.00 kg	100%	9.00 kg
				0.00 kg
				0.00 kg
	TOTALS	32.50 kg		18.80 kg
				58%

This product CAN contribute for Option 2c

Refer to the Fitout Calculator Guide for detailed instructions

In the example above, 58% of the 'Live' workstation mass qualifies for compliance through being re-used, recycled, or having certified content. This exceeds the requirement of minimum 40% mass. Therefore, Furniture Downtown's 'Live' workstation qualifies as a compliant product with re-used, recycled, or certified content.

DTS Criteria 4: Responsible Manufacturing:

This criterion rewards products that have been manufactured in an ISO 14001 certified facility. In order to comply, 80% of the mass of the product or materials must be sourced from manufacturing facilities that are certified to ISO 14001.

An ISO 14001 certification is a management system tool designed to help an organisation administer and control its Environmental impact and compliance with regulations. ISO 14001 does this by guiding the development and implementation of policies, objectives and processes. ISO 14001 certifications are authorised by independent external auditors and need to be reviewed annually for compliance and to maintain their validity. ISO 14001 certified facilities will have certificates that demonstrate their certification, stipulating the period of validity and the external auditing party who verified the certification.

ISO 14001certified Environmental Management System (EMS) ensures that organisations:

- Commit to environmental objectives and targets
- Identify key environmental impacts and aspects associated with their business operations as well as mitigation measures, if necessary

- Develop systems and procedures for documentation, reporting and auditing the key environmental considerations and impacts
- Track and monitor their water and energy usage, as well as their waste generation and materials utilizations, with the aim of continually improving environmental performance over time.

Manufacturer

For the purposes of the Materials Calculators, this is the maker who delivers a finished product. If there are several key manufacturers for a given product, ISO 14001 certification will be required from each manufacturer. This does not include parties who process or extract raw materials e.g. foresters, miners, etc.

Manufacturing facility

For the purposes of this criterion, a 'manufacturing facility' is where product components are manufactured from raw materials, whilst the final product may be assembled in this facility, a manufacturing facility is not the same as the warehousing or assembly only facility.

To enter an item with Manufacturer ISO 14001 Certification, select 'Yes' for items that have at least 80% of the mass of their total content sourced from manufacturing facilities that are certified to ISO 14001 and select 'No' for all other items.

Point calculation

To calculate the number of Green Star SA credit points generated in the Materials Calculators, the following processes described below are followed:

- Calculating the 'item score'
- Calculating the 'weighted item score'
- Calculating the 'overall score'
- Calculating the 'points generated'.

a) Item score

The item score is the criterion score that is allocated for the different responses to the criteria. The maximum score that an item can achieve is 100%.

b) Weighted item score

A weighted score is calculated for each item by multiplying the item score with the quantity of that item. Below is an example that demonstrates how 'Jessica' chairs from Comfort Chairs which are certified by a Level B GBCSA-approved scheme generates an item score of 85%.

The total number of items for this product is 5.This gives a weighted item score of:

= (85% x 5)

= 4.25 weighted item score

Loose Furniture — Please enter data in white fields only — Points Available: 7

Total Number of Furniture Items in the Project: 30 — Points Generated: 4.7 — Overall Score: 61 % — Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

#	Name of Supplier and Brief Description of Item	Total Number of Items	Option 1: Certified Product	Option 2: Re-used	Option 2: Product Stewardship	Option 2: Re-used, Recycled or Certified Content	Option 2: Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

The overall score is calculated by adding all the weighted item scores in the calculator and dividing them by the total quantity of relevant items included in the calculator. The overall score is calculated as follows:

$$\textbf{Overall score} = \frac{\text{Total of all weighted item score}}{\text{Total quantity of relevant items in the project}}$$

d) Credit Points generated

The number of 'Points Generated' is calculated based on the overall score. This number is displayed in the 'Points Generated' field at the top of the calculator. The number of points available varies for each Materials Calculator and is defined in the 'Credit Criteria' for the relevant Green Star SA credit.

If a project team achieves and overall score of 90% or more, the full credit score will be awarded. Where the overall score is lower than 90%, points are awarded as a percentage of the points available. The final score is rounded to include one decimal point. Where more than 1 point is available the overall score determines the points generated as follows:

$$\textbf{Points generated} = \frac{\text{Overall Score}}{90} \times \text{Number of points available}$$

An example of the point calculation is shown below:

Example of point calculation

Step 1: Calculating the item score

- Item 1: 'Lucy' task chairs = Item score 30%
- Item 2: 'Sarah' task chairs = Item score 100%
- Item 3: 'Jessica' chairs = Item score 85%
- Item 4: Re-used workstations = Item score 100%
- Item 5: 'Live' workstations = Item score 30%
- Item 6: Cupboards = Item score 20%
- Item 7: Tables = Item score 20%

Loose Furniture Please enter data in white fields only Points Available: 7

Total Number of Furniture Items in the Project: 30 Points Generated: 4.7 Overall Score: 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

			Option 1	Option 2					
#	Name of Supplier and Brief Description of Item	Total Number of Items	Certified Product	Re-used	Product Stewardship	Re-used, Recycled or Certified Content	Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

These item scores appear in the 'item score' column at the far right of the calculator.

Step 2: Calculating the overall score

- Item 1: 'Lucy' task chairs

  Weighted item score = 30% x 5 = 1.5
- Item 2: 'Sarah' task chairs

  Weighted item score = 100% x 5 = 5
- Item 3: 'Jessica' chairs

  Weighted item score = 85% x 5 = 4.25
- Item 4: Re-used workstations

Weighted item score = 100% x 5 = 5

- Item 5: 'Live' workstations

  Weighted item score = 30% x 5 = 1.5

- Item 6: Cupboards

  Weighted item score= 20% x 3 = 0.6

- Item 7: Tables

  Weighted item score = 20% x 2 = 0.4

Loose Furniture Please enter data in white fields only **Points Available:** 7

Total Number of Furniture Items in the Project: 30 **Points Generated:** 4.7 **Overall Score:** 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

			Option 1	Option 2					
#	Name of Supplier and Brief Description of Item	Total Number of Items	Certified Product	Re-used	Product Stewardship	Re-used, Recycled or Certified Content	Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

Total of weighted scores = 1.5 + 5 + 4.25 + 5 + 1.5 + 0.6 + 0.4

= 18.25

Overall score = total weighted scores / total number of items

= 18.25 / 30

= 61%

Thus, the overall score for the Furniture calculator is 61%, which will appear in the 'overall score' field at the top right of the Furniture Calculator.

Step 3: Calculating the points generated

The points generated in a Calculator are determined by the overall score. In this example, 7 points are available. The points generated therefore = 61% of 7 points = 4.7

The 'Points Generated' will not automatically be recognised by the GBCSA unless the documentation requirements are submitted and deemed in accordance with the stipulations the documentation requirements.

INT-Mat-2 Furniture

POINTS AVAILABLE 8

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Mat-3 Assemblies

POINTS AVAILABLE **8**

AIM OF CREDIT

To recognise the selection of assemblies that has a reduced environmental impact compared to available alternatives.

CREDIT CRITERIA

Up to eight points are awarded where the assemblies used have a reduced environmental impact as determined by the Assemblies Calculator against the following criteria:

- Certified product
  - 80% of an item's total mass is certified by a recognised 3rd party certification scheme
- Reused:
  - 80% by area, length, volume or mass of the assembly item must be retained or reused
- Product stewardship
  - Assembly item must have an end-of-life purpose in the form of either:
    - A formalised take back scheme, OR
    - Item has been designed for disassembly
- Re-used, recycled or certified content
  - 40% of the item's mass is reused, recycled, or certified content or a combination
- Manufacturer ISO 14001 certification
  - 80% of the item's mass must be sourced from manufacturing facilities that are certified to ISO 14001

If the material cost of assemblies represents less than 1% of the project's total contract value, this credit is 'Not Applicable' and is excluded from the Points Available used to calculate the Materials Category score.

Please refer to the Calculator guide section below for detailed descriptions and additional information relating to the Assemblies Calculator.

INT-Mat-3 Assemblies

POINTS AVAILABLE **8**

Calculator credit criterion	Calculator input options available	Criterion score (%)	Comment
Compliance route 1			
Certified product	Level A	100	Selecting Option 1 as the compliance route will grey out all criteria under Option 2, as a final product score will be calculated based on the Option 1 compliance level.
	Level B	85	
	Level C	75	
Compliance route 2			
Reuse	Yes	100	If compliance is achieved for this criterion, no further entries are required as this is the maximum product score available.
	No	0	
Product Stewardship	Take back- lease	30	For compliance under any of these criteria, the scores applied to each criteria are added together to give the final product score.
	Take back- purchase	25	
	Designed for disassembly or re-use	30	
Reused, recycled or certified content	Yes	20	
	No	0	
ISO 14001 manufacturers	Yes	20	
	No	0	

Table 1: Score contributions for responses to the Criteria

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Completed Assemblies calculator 2. Short report 3. Project-specific schedule of all items 4. Written confirmation from Contractor 5. Supporting evidence

Completed assemblies calculator with all inputs correctly entered corresponding to all supporting documentation requirements provided.

Short report by a suitably qualified professional that describes how the Credit Criteria have been met and:

For certified products:

- Providing a summary of all certified products in the project, their certification ranking, and relevant certifying scheme

For reused products:

- Providing calculations and a summary table confirming the stipulated proportion of re-used assemblies in the project

For design for disassembly and/or reuse:

- Identifying the furniture elements designed for disassembly and/or reuse
- Describing the process involved for reclaiming each element
- Identifying potential reuse options for each of those items
- Providing calculations and a summary table confirming that the stipulated proportion of the relevant assemblies is designed for disassembly and reuse

For items with re-used, recycled, or certified content:

- Providing calculations showing how the proportion of re-used, recycled, or certified content was derived. The results must be tabulated to clearly demonstrate:
  - All components in the item
  - Mass of each component
  - Mass of re-used, recycled, or certified content in each component
  - Percentage of re-used, recycled, or certified content for an item

For items from ISO 14001 certified manufacturing facilities:

- Providing a summary of all qualifying products in the project and their manufacturers
- If not 100% from same manufacturer, tabulating the mass of each compliant assemblies component and total weight proportion
- ISO 14001 certification number for each product and component claimed.

Where the credit is claimed as 'Not Applicable'

- Providing calculations showing the percentage of the total cost of assemblies specified of the total cost of the project.

Project-specific schedule of all items prepared by the relevant project team member listing all the products relevant to the credit, stating the type and quantity of these items

Written confirmation from the tenant that the products listed in the project specific schedule have been installed in the project

Supporting evidence

For certified products:

- **Copy of the certification licence(s)** or certificate for each material or item. The certification must be current at the time of installation and the certification scheme must be recognised by the GBCSA at level A, B or C.
- In the case of timber and bamboo products, a copy of the FSC or PEFC chain of custody certificates (CoC) must be submitted.

For reused products or content:

If purchased from a second-hand retailer, such as an auction house

- Purchase receipts/delivery receipts

If materials were used on the current site by a previous occupant or installed by a building owner as part of make good processes prior to fitout works by the tenant:

- Confirmation from the tenant that the items were in use onsite prior to the project works and that they have now been re-installed onsite

If materials were relocated to the site from the new tenant's, or occupants', previous fitout or building:

- Mover's inventory from the previous location.

  OR

- Inventory/schedule or images from the previous fitout showing clearly the items that have been re-used in the new fitout

For Recycled content:

- **Statement of confirmation** from manufacturer confirming all recycled claims as referenced in the short report

For the take back schemes:

- **Copy of the signed contract** between the tenant and the manufacturer clearly:
  - stipulating the terms and conditions of the take back scheme, confirming the commitment to take back the quantity of the product or material supplied to the project
  - nominating the intended reuse of the product/materials
  - listing the manufacturer's details (i.e. registered name, address, email address, telephone number and website as applicable)

For design for disassembly:

- **Drawing(s)** marked-up to show detail drawings of connections demonstrating that the relevant assemblies elements can be disassembled without cutting, material damage, or hindrance from adjacent materials;
- **Comprehensive Disassembly Plan** that:
  - Identifies which materials are designed to be recovered during assemblies disassembly;
  - Details how (in terms of technique, expertise and technology required) the identified materials and products should be recovered, indicating the order of disassembly to enable them to be extracted without material damage or interference from other assemblies materials/elements.

For items from ISO 14001 certified manufacturing facilities:

- **Copy of ISO 14001 certification** that is valid from each manufacturer
- **Manufacturer's confirmation** listing all the components (if applicable)

ADDITIONAL GUIDANCE

The GBCSA Interiors tool has 4 calculators, one of which is the Assemblies Calculator. Each of these calculators is evaluated against specific credit criteria, the results of which are captured in the calculator input excel sheets. The credit criteria evaluate to what extent interior finishes are reused, contain certified content, have incorporated product stewardship in the consideration of the product/material, and have been manufactured in an environmentally responsible way.

The information provided in the credit criteria and Additional Guidance merely summarises the key considerations. Project teams must consult the Assemblies Calculator Guide (below) for detailed information regarding criteria definitions, how the calculators operate and how to input into the excel sheets correctly.

BACKGROUND

Environmentally responsible assemblies addresses the impact of assemblies products on the environment by considering all aspects of the design and manufacturing process.

There are a number of ways for assemblies to reduce the impact on the environment, and many of these are rewarded within this credit. These include using recycled materials in the manufacturing process and using products that can be disassembled and recycled after their useful life. The aspiration is for a closed-loop cycle in which materials and products are perpetually recycled so as to avoid disposal in landfills.

This credit rewards assemblies that are re-used or have been certified according to independent 3rd party product certification schemes. Rewarding responsible choices of assemblies encourages manufacturers, suppliers and users to have environmental considerations for the product's life cycle.

ISO 14001 Standard

ISO 14001, is an internationally recognized standard that sets out the criteria for an Environmental Management System (EMS). It does not state requirements for environmental performance, but maps out a framework that a company or organization can follow to set up an effective EMS. It can be used by any organization that wants to improve resource efficiency, reduce waste, and drive down costs. Meeting this standard can provide assurance to company management and employees as well as external stakeholders (customers and shareholders) that environmental impacts are being measured and improved.

ISO 14001, as with other ISO 14000 standards, is voluntary with its main aim to assist companies in continually improving their environmental performance. Organizations are responsible for setting their own targets and performance measures, with the standard serving to assist them in the subsequent monitoring and measurement of these.

While being ISO 14001 certified does not guarantee high environmental performance of a product, it assists companies to better manage the goal of reducing their environmental impacts which could include a reduction in waste, consumption of resources and operating costs.

REFERENCES & FURTHER INFORMATION

Environmental Protection Agency (EPA) Product Stewardship website
http://www.epa.gov/epawaste/conserve/tools/stewardship/index.htm

Australian Government Product Stewardship website
http://www.environment.gov.au/settlements/waste/product-stewardship/index.html

ISO 14001 website
http://www.iso.org/iso/home/standards/management-standards/iso14000.htm

Forest Stewardship Council (FSC)
http://www.fsc.org/

Programme for Endorsement of Certified Wood (PEFC)
http://www.pefc.org/

Rainforest Alliance, Sustainable Forestry (SmartWood)
http://www.rainforest-alliance.org/
http://www.rainforest-alliance.org/forestry.cfm?id=certification

Australian Forestry Standard
http://www.forestrystandard.org.au

ASSEMBLIES CALCULATOR GUIDE

The scope of the Assemblies Calculator is as follows:

INT-Mat-3 Assemblies

POINTS AVAILABLE 8

Items referred to as 'assemblies' include all internal walls, partitions, demountable partitions, suspended ceilings and joinery used within project floor areas that are permanently covered and protected from the elements. The following inclusions, exclusions and definitions apply:

Internal walls and partitions: Internal walls and partitions are defined to mean non-load bearing space dividers that are not part of the building envelope. This includes any internal partitions, furniture dividers and non-load bearing walls installed within the tenancy.

Face material: Face materials refer to any ceiling tiles; lay in suspended ceiling tiles and any material over a frame. It also includes any cladding system to a roof structure which, if not included,

Joinery: Joinery includes, but is not limited, to the following items:

> Toilet partitions; shower partitions including shower screens; doors; bench seats; vanities; lockers; kitchens; laundry cupboards; shelving units; bumper rails; decorative trim; built-in wardrobes; cupboards; and internal stairs.

Ceilings: Ceilings only include suspended ceilings. Reference to ceilings in the fitout calculators relates to the face material only, not the grid and other components of the suspended ceiling.

Demountable partitions: Demountable partitions are defined to be internal space dividers that are usually non-load bearing. Many of the partitions have a permanent finish which requires no decoration.

Exposed substrate: Exposed substrate refers to an area of exposed roof structure that is not covered with ceiling board or another material or product.

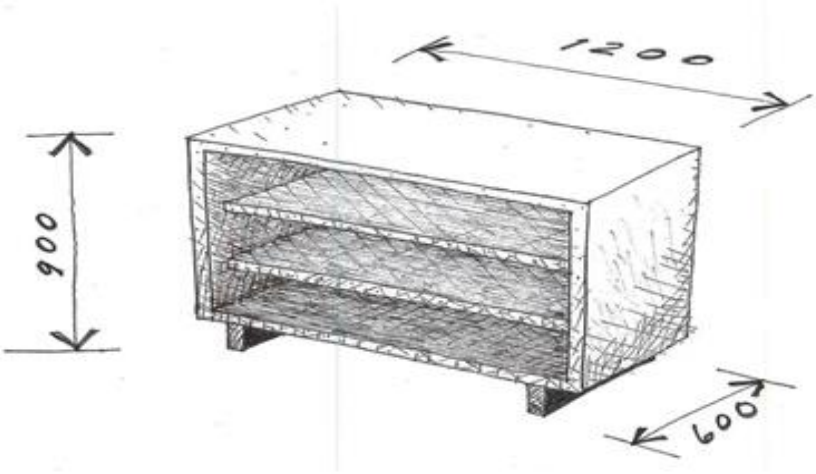
Exclusions

- Certain wall components are excluded, such as studs, insulation, skirting and cornices. Hardware, such as light switches, is also excluded from the assessment of internal walls.
- Storage units that may be purchased 'off-the-shelf' are excluded from the Assemblies Calculator. These are assessed under the Furniture Calculator as storage units.

Definition of area

For the purposes of the Assemblies Calculator, the area of an assembly item is defined as:

- Area of ceilings = area shown in ceiling plan.
- Area of walls, partitions and joinery = the total length of the item multiplied by its total height.



The area of the shelving unit = 1.2m x 0.9m = 1.08m^2

Figure 1: How to calculate the area of an item for the Assemblies calculator

Entering information into the Assemblies Calculator

The steps outlined below must be followed when completing the calculator

Step 1: Total quantity of items

Enter the total area of assembly items in the project in square metres.

'Total Area of Assembly Items in the Project' is displayed at the top centre of each Assemblies Calculator screen.

Step 2: Name of supplier and brief description

Enter the name of supplier, the product's brand name and type in the column called 'Name of Supplier and Brief Description of Item'. One entry may represent a single assemblies' item or a group of similar assemblies' items. Each entry must represent assemblies sourced from the same supplier.

For reused items, enter "re-used storage units" or "re-used shelfing unit" etc.

Step 3: Total area of each item

Enter information in the column called 'Total Number of Items'. A total must be entered for each item listed in an Assemblies Calculator. See inclusions and exclusions as stated in the scope and definitions section above.

Step 4: Response to the criteria

Enter information about an item type under one or more of the criteria columns.

Calculator criteria

There are two compliance options available to project teams and these are discussed below. For each line item in each one of the calculators, project teams must pursue either Option 1 or Option 2. Both options cannot be pursued for individual products or materials although each of the calculators

can have a mix of Option 1 and 2, depending on the mix of products and materials that are selected. For each line item entered in the respective calculators, an item score is calculated. This represents the points awarded out of 100 points available for a specific environmental criterion. The maximum item score therefore for a product is 100%. The item score is subsequently multiplied with the number of items of that product, to achieve the weighted score, which informs the final score. The item scoring associated with each of these options is described in more detail below.

Option 1: GBCSA-approved 3rd party certification scheme

This option rewards team that procure products and materials that have been assessed by a 3rd party certification scheme. These are initiatives that independently assess the environmental performance of products and materials. There are many Ecolabels available on the market.

The GBCSA has approved a list of 3rd party certification schemes (i.e. Ecolabels) based on an assessment framework that evaluates the Ecolabel according to several environmental, social and legal criteria. Depending on the outcomes of the GBCSA assessment, the Ecolabel is certified according to level A, B or C, indicating the level of environmental performance.

The GBCSA has approved a list of 3rd party certification schemes (i.e. Ecolabels) and these are provided in the General section and on the GBCSA website (https://www.gbcsa.org.za/rating-tools/products-materials/).

In the calculator, select the level (A, B or C) for each item that is certified by a 3rd party product certification scheme or select no (or leave blank) for all other items that are not certified. The selected level will give a corresponding item score.

Option 2: Deemed to satisfy criteria

Products and materials that have not been assessed by a GBCSA approved 3rd party certification scheme can still have positive environmental features and are subsequently awarded in the deemed to satisfy option. The deemed to satisfy option has four criteria in each calculator, each with associated options and items scores. The four criteria are:

- DTS Criteria 1: Dematerialization
- DTS Criteria 2: Product Stewardship
- DTS Criteria 3: Certified, Recycled or Reused content
- DTS Criteria 4: Responsible Manufacturing

DTS Criteria 1: Dematerialization is whether or not the product is reused or, alternatively, if no product has been used at all, via an exposed substrate (the exposed substrate option is not applicable to furniture). If the product is reused or no product is used (and the substrate is exposed), it is awarded an item score of 100% for the product and all other criteria thereafter are not applicable.

Reused products:

For a product to be defined as reused, at least 80% by area, length, volume or mass of the item must be retained (the metric chosen must be justified) via one of the following ways:

- purchased from a second-hand retailer, such as an auction house;
- items that were used on the current site by a previous occupant or installed by a building owner as part of 'making good' prior to fitout works by the tenant;
- relocated to the site from the new tenant's, or occupant's, previous fitout or building

To enter an item as 'dematerialised', select 'Yes - reused for items that are re-used' and select 'No' (or leave blank) for all other items.

DTS Criteria 2: Product Stewardship:

Product stewardship is an environmental management approach that calls for increased responsibility by manufacturers, designers and consumers to consider the end of life impact of materials and products. This approach acknowledges a shared responsibility in how we dispose of products and consider how the end of a product's life will impact on the environment and human health. This concept is alternatively referred to as extended product responsibility (EPR).

Product stewardship can be achieved in the following ways in the calculators:

- Committing to a take back scheme
- Demonstrating that the product/material has been designed for disassembly
- Procuring products and materials that have long term durability (this only applies to the furniture calculator)

Take back scheme:

A take back scheme is a contract between a client and manufacturer, committing the manufacturer to taking back the material or product at its end of life, for the purpose of reusing or recycling the product as an input to a new value chain of goods. Take back schemes can either be part of formal programmes offered by manufacturers or suppliers, or they can be project specific arrangements. However, the nominated reuse of the product/material must be identified and clearly explained. The take back scheme needs to be a signed contract between both parties and cannot include exemptions related to limitations of timing of product return, or minimum quantity of product to be accepted.

Design for disassembly

Design for disassembly-requires products to be readily disassembled with the use of non-specialist tools where parts can be separated into elemental components for re-use, recycling or re-processing.

An item is considered to be designed for reuse when at least 50% of the item (by mass) can be readily disassembled and has a clear recyclable value.

The aim of this credit encourages designers to think of how products are assembled at the onset of the design stage, and effectively inform the process so that the product reuse is ensured after disassembly. Design for disassembly develops products that can be readily and easily disassembled and parts can be separated into components for re-use, recycling or re-processing.

Durability (this is only applicable to the furniture calculator):

Durability is defined as the number of years covered by a manufacturer's or supplier's warranty and is intended to reward project teams that procure products designed for quality and for long term use. It is calculated according to the length of the manufacturer's or supplier's warranty of the product. There are three categories:

- Level C: 5 - 7 years
- Level B: Between 7 and 10 years

- Level A: More than 10 years

To enter product stewardship, select 'Yes' for the relevant option (i.e. leased item, purchased with a product stewardship contract, warranty contract or designed for disassembly) and select 'No' (or leave blank) for all other items.

DTS Criteria 3: Certified, Recycled or Reused content:

This criterion rewards products that contain a proportion of materials that deliver environmental benefits. In order to qualify, at least 40% of the item's mass consists of any combination of the following:

Re-used material: An item qualifying as reused must be retained or be reused from a previous installation

Recycled content: Post-consumer material that has been diverted from landfill. Pre-consumer materials such as rework, regrind, or scrap, generated in a manufacturing process and capable of being reclaimed within the same process that generated it, are not considered recycled. This credit rewards post-consumer recycled content only and not post-industrial recycled content.

Certified Content: item contains material or components that are certified by a GBCSA-recognised product certification scheme or certified by a forest certification scheme, namely Forestry Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC).

To enter re-used, recycled or certified content, select 'Yes' for items where at least 40% of the item's mass consists of any combination of the following:

- Re-used components;
- Independently verified recycled content;
- Components certified by a product certification standard recognised by the GBCSA
- Timber and bamboo components that are certified by a recognised forest certification scheme, namely FSC (Forestry Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification).

Calculating re-used, recycled, and certified content

The example bellows shows how to calculate the proportion of re-used, recycled and certified content for a workstation made from several components.

Each 'Live' workstation from Furniture Downtown is made up of the following four components:

1. Worktop made from timber that has a chain of custody certification from a forest certification scheme, namely FSC.

   100% of the worktop's mass is counted towards re-used, recycled, or certified content calculations.

2. New aluminium frame with no recognised documentation to show that it contains re-used, recycled or certified content.

0% of the frame's mass is counted towards re-used, recycled or certified content calculations.

3. Polymer screens supplied as part of each workstation, containing 20% independently verified recycled content.

   20% of the screen mass is counted towards re-used, recycled or certified content calculations.

4. Storage unit as part of each workstation, certified by a GBCA-recognised product certification scheme.

   100% of the storage component's mass is counted towards re-used, recycled or certified content calculations.

The tool includes a Component Calculator to assist teams in demonstrating how a product may comply to obtain a score under this criterion. A screenshot of this calculator is provided below.

Project teams must provide 'screenshots' of this calculator for each applicable product with their submission documentation to demonstrate how compliance is achieved.

Component Worksheet Please enter data in white fields only

Name of assembly / piece furniture: Live workstation (Furniture Downtown)

Total Mass of Item: 32.50 kg

Component	Component Material	Total Mass of Component [kg]	% of component with qualifying content	Mass compliant
Worktop	Timber	8.00 kg	100%	8.00 kg
Frame	Aluminium	6.50 kg	0%	0.00 kg
Screens	Polymer with 20% RC	9.00 kg	20%	1.80 kg
Storage Unit	Steel	9.00 kg	100%	9.00 kg
				0.00 kg
				0.00 kg
	TOTALS	32.50 kg		18.80 kg
				58%

This product CAN contribute for Option 2c

Refer to the Fitout Calculator Guide for detailed instructions

In the example above, 58% of the 'Live' workstation mass qualifies for compliance through being re-used, recycled, or having certified content. This exceeds the requirement of minimum 40% mass. Therefore, Furniture Downtown's 'Live' workstation qualifies as a compliant product with re-used, recycled, or certified content.

DTS Criteria 4: Responsible Manufacturing:

This criterion rewards products that have been manufactured in an ISO 14001 certified facility. In order to comply, 80% of the mass of the product or materials must be sourced from manufacturing facilities that are certified to ISO 14001.

An ISO 14001 certification is a management system tool designed to help an organisation administer and control its Environmental impact and compliance with regulations. ISO 14001 does this by guiding the development and implementation of policies, objectives and processes. ISO 14001 certifications are authorised by independent external auditors and need to be reviewed annually for compliance and to maintain their validity. ISO 14001 certified facilities will have certificates that demonstrate their certification, stipulating the period of validity and the external auditing party who verified the certification.

ISO 14001certified Environmental Management System (EMS) ensures that organisations:

- Commit to environmental objectives and targets
- Identify key environmental impacts and aspects associated with their business operations as well as mitigation measures, if necessary
- Develop systems and procedures for documentation, reporting and auditing the key environmental considerations and impacts
- Track and monitor their water and energy usage, as well as their waste generation and materials utilizations, with the aim of continually improving environmental performance over time.

Manufacturer

For the purposes of the Materials Calculators, this is the maker who delivers a finished product. If there are several key manufacturers for a given product, ISO 14001 certification will be required from each manufacturer. This does not include parties who process or extract raw materials e.g. foresters, miners, etc.

Manufacturing facility

For the purposes of this criterion, a 'manufacturing facility' is where product components are manufactured from raw materials, whilst the final product may be assembled in this facility, a manufacturing facility is not the same as the warehousing or assembly only facility.

To enter an item with Manufacturer ISO 14001 Certification, select 'Yes' for items that have at least 80% of the mass of their total content sourced from manufacturing facilities that are certified to ISO 14001 and select 'No' for all other items.

Point calculation

To calculate the number of Green Star SA credit points generated in the Materials Calculators, the following processes described below are followed:

- Calculating the 'item score'
- Calculating the 'weighted item score'
- Calculating the 'overall score'

- Calculating the 'points generated'.

a) Item score

The item score is the criterion score that is allocated for the different responses to the criteria. The maximum score that an item can achieve is 100%.

b) Weighted item score

A weighted score is calculated for each item by multiplying the item score with the quantity of that item. Below is an example that demonstrates how 'Jessica' chairs from Comfort Chairs which are certified by a Level B GBCSA-approved scheme generates an item score of 85%.

The total number of items for this product is 5.This gives a weighted item score of:

= (85% x 5)

= 4.25 weighted item score

Loose Furniture Please enter data in white fields only **Points Available:** 7

Total Number of Furniture Items in the Project: 30 **Points Generated:** 4.7 **Overall Score:** 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

			Option 1	Option 2					
#	Name of Supplier and Brief Description of Item	Total Number of Items	Certified Product	Re-used	Product Stewardship	Re-used, Recycled or Certified Content	Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

c) Overall score

The overall score is calculated by adding all the weighted item scores in the calculator and dividing them by the total quantity of relevant items included in the calculator. The overall score is calculated as follows:

$$\textbf{Overall score} = \frac{\text{Total of all weighted item score}}{\text{Total quantity of relevant items in the project}}$$

d) Credit Points generated

The number of 'Points Generated' is calculated based on the overall score. This number is displayed in the 'Points Generated' field at the top of the calculator. The number of points available varies for each Materials Calculator and is defined in the 'Credit Criteria' for the relevant Green Star SA credit.

If a project team achieves and overall score of 90% or more, the full credit score will be awarded. Where the overall score is lower than 90%, points are awarded as a percentage of the points available. The final score is rounded to include one decimal point. Where more than 1 point is available the overall score determines the points generated as follows:

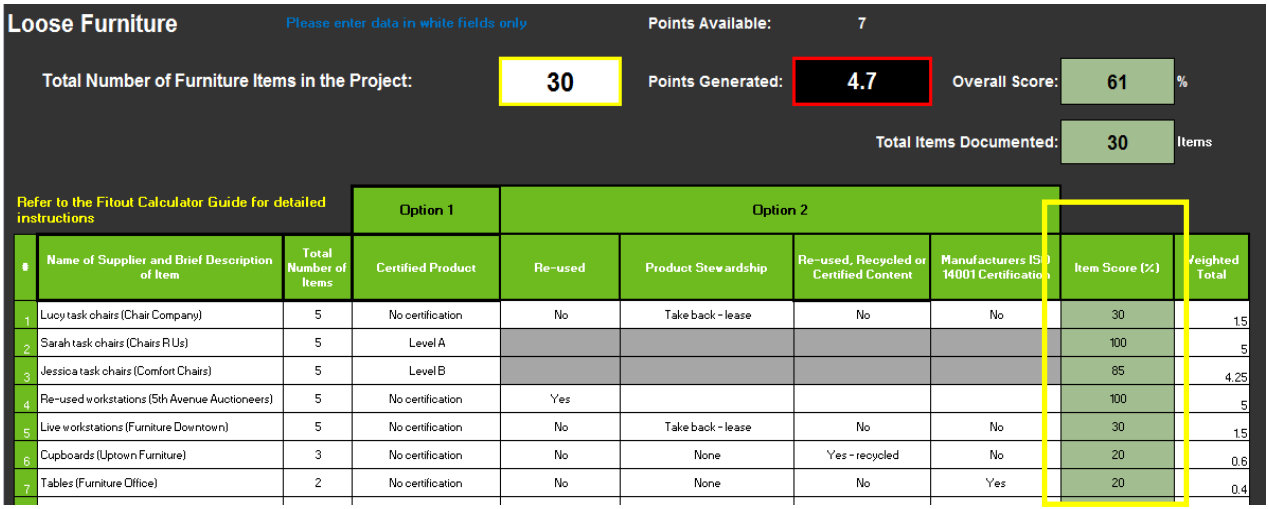
$$\textbf{Points generated} = \frac{\text{Overall Score}}{90} \times \text{Number of points available}$$

An example of the point calculation is shown below:

Example of point calculation

Step 1: Calculating the item score

- Item 1: 'Lucy' task chairs = Item score 30%
- Item 2: 'Sarah' task chairs = Item score 100%
- Item 3: 'Jessica' chairs = Item score 85%
- Item 4: Re-used workstations = Item score 100%
- Item 5: 'Live' workstations = Item score 30%
- Item 6: Cupboards = Item score 20%
- Item 7: Tables = Item score 20%



Loose Furniture — Please enter data in white fields only — Points Available: 7

Total Number of Furniture Items in the Project: 30 — Points Generated: 4.7 — Overall Score: 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

#	Name of Supplier and Brief Description of Item	Total Number of Items	Option 1: Certified Product	Option 2: Re-used	Option 2: Product Stewardship	Option 2: Re-used, Recycled or Certified Content	Option 2: Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

These item scores appear in the 'item score' column at the far right of the calculator.

Step 2: Calculating the overall score

- Item 1: 'Lucy' task chairs

  Weighted item score = 30% x 5 = 1.5

- Item 2: 'Sarah' task chairs

  Weighted item score = 100% x 5 = 5

- Item 3: 'Jessica' chairs

  Weighted item score = 85% x 5 = 4.25

- Item 4: Re-used workstations

  Weighted item score = 100% x 5 = 5

- Item 5: 'Live' workstations

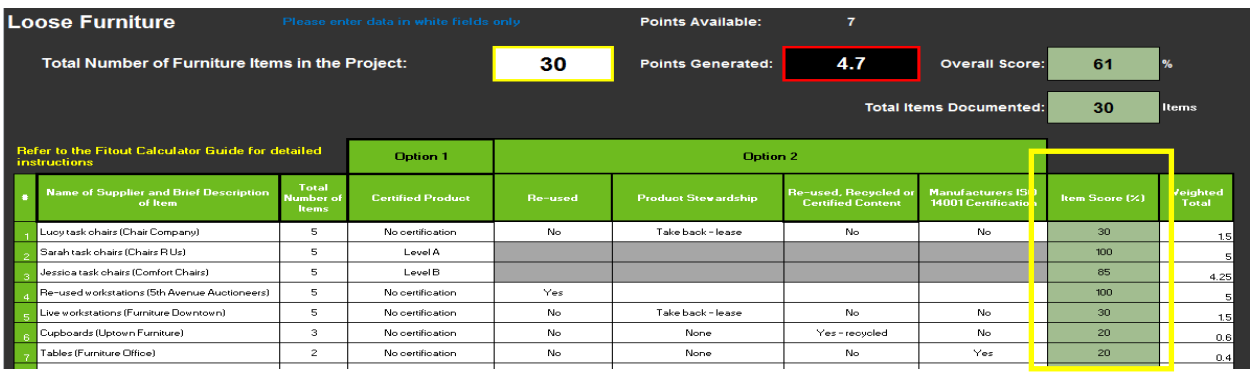
  Weighted item score = 30% x 5 = 1.5

- Item 6: Cupboards

  Weighted item score= 20% x 3 = 0.6

- Item 7: Tables

  Weighted item score = 20% x 2 = 0.4



Loose Furniture — Please enter data in white fields only — Points Available: 7

Total Number of Furniture Items in the Project: 30 — Points Generated: 4.7 — Overall Score: 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

#	Name of Supplier and Brief Description of Item	Total Number of Items	Option 1: Certified Product	Option 2: Re-used	Option 2: Product Stewardship	Option 2: Re-used, Recycled or Certified Content	Option 2: Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

Total of weighted scores = 1.5 + 5 + 4.25 + 5 + 1.5 + 0.6 + 0.4

= 18.25

Overall score = total weighted scores / total number of items

= 18.25 / 30

= 61%

Thus, the overall score for the Furniture calculator is 61%, which will appear in the 'overall score' field at the top right of the Furniture Calculator.

Step 3: Calculating the points generated

The points generated in a Calculator are determined by the overall score. In this example, 7 points are available. The points generated therefore = 61% of 7 points = 4.7

The 'Points Generated' will not automatically be recognised by the GBCSA unless the documentation requirements are submitted and deemed in accordance with the stipulations the documentation requirements.

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Mat-4 Flooring

POINTS AVAILABLE **6**

AIM OF CREDIT

To recognise the selection of flooring that has a reduced environmental impact compared to available alternatives.

CREDIT CRITERIA

Up to six points are awarded where the flooring used has a reduced environmental impact as determined by the Flooring Calculator against the following criteria:

- Certified product
  - 80% of an item's total mass is certified by a recognised 3rd party certification scheme
- Reused or exposed substrate:
  - 80% by area, length, volume or mass of the flooring item must be retained or reused

    OR
  - No additional flooring has been used such as exposed concrete
- Product stewardship
  - Flooring item must have an end-of-life purpose in the form of either:
    - A formalised take back scheme, OR
    - Item has been designed for disassembly
- Re-used, recycled or certified content
  - 40% of the item's mass is reused, recycled, or certified content or a combination
- Manufacturer ISO 14001 certification
  - 80% of the item's mass must be sourced from manufacturing facilities that are certified to ISO 14001

If the material cost of flooring represents less than 1% of the project's total contract value, this credit is 'Not Applicable' and is excluded from the Points Available used to calculate the Materials Category score.

Please refer to the Calculator guide section below for detailed descriptions and additional information relating to the Flooring Calculator.

INT-Mat-4 Flooring

POINTS AVAILABLE **6**

Calculator credit criterion	Calculator input options available	Criterion score (%)	Comment
Compliance route 1			
Certified product	Level A	100	Selecting Option 1 as the compliance route will grey out all criteria under Option 2, as a final product score will be calculated based on the Option 1 compliance level.
	Level B	85	
	Level C	75	
Compliance route 2			
Reuse	Yes	100	If compliance is achieved for this criterion, no further entries are required as this is the maximum product score available.
	No	0	
Product Stewardship	Take back- lease	30	For compliance under any of these criteria, the scores applied to each criteria are added together to give the final product score.
	Take back- purchase	25	
	Designed for disassembly or re-use	30	
Reused, recycled or certified content	Yes	20	
	No	0	
ISO 14001 manufacturers	Yes	20	
	No	0	

Table 1: Score contributions for responses to the Criteria

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Completed calculator 2. Short report 3. Project-specific schedule of all items 4. Written confirmation from Contractor *5.* Supporting evidence

Completed flooring calculator with all inputs correctly entered corresponding to all supporting documentation requirements provided.

Short report by a suitably qualified professional that describes how the Credit Criteria have been met and:

For certified products:

- Providing a summary of all certified products in the project, their certification ranking, and relevant certifying scheme

For reused products:

- Providing calculations and a summary table confirming the stipulated proportion of re-used flooring in the project

For design for disassembly and/or reuse:

- Identifying the flooring elements designed for disassembly and/or reuse
- Describing the process involved for reclaiming each element
- Identifying potential reuse options for each of those items
- Providing calculations and a summary table confirming that the stipulated proportion of the relevant flooring is designed for disassembly and reuse

For items with re-used, recycled, or certified content:

- Providing calculations showing how the proportion of re-used, recycled, or certified content was derived. The results must be tabulated to clearly demonstrate:
  - All components in the item
  - Mass of each component
  - Mass of re-used, recycled, or certified content in each component
  - Percentage of re-used, recycled, or certified content for an item

For items from ISO 14001 certified manufacturing facilities:

- Providing a summary of all qualifying products in the project and their manufacturers
- If not 100% from same manufacturer, tabulating the mass of each compliant flooring component and total weight proportion
- ISO 14001 certification number for each product and component claimed.

Where the credit is claimed as 'Not Applicable'

- Providing calculations showing the percentage of the total cost of flooring specified of the total cost of the project.

Project-specific schedule of all items prepared by the relevant project team member listing all the products relevant to the credit, stating the type and quantity of these items

Written confirmation from the tenant that the products listed in the project specific schedule have been installed in the project

Supporting evidence

For certified products:

- **Copy of the certification licence(s)** or certificate for each material or item. The certification must be current at the time of installation and the certification scheme must be recognised by the GBCSA at level A, B or C.
- In the case of timber and bamboo products, a copy of the FSC or PEFC chain of custody certificates (CoC) must be submitted.

For reused products or content:

If purchased from a second-hand retailer, such as an auction house

- Purchase receipts/delivery receipts

If materials were used on the current site by a previous occupant or installed by a building owner as part of make good processes prior to fitout works by the tenant:

- Confirmation from the tenant that the items were in use onsite prior to the project works and that they have now been re-installed onsite

If materials were relocated to the site from the new tenant's, or occupants', previous fitout or building:

- Mover's inventory from the previous location.

  OR

- Inventory/schedule or images from the previous fitout showing clearly the items that have been re-used in the new fitout

For exposed substrate:

- Statement of confirmation from the relevant team member confirming that the 'exposed concrete' area entered in the Flooring Calculator has been provided without any floor covering

  OR

- Images or As-built drawings that clearly indicate the area of exposed concrete. These must correlate with the 'exposed concrete' area entered in the Flooring Calculator

For Recycled content:

- **Statement of confirmation** from manufacturer confirming all recycled claims as referenced in the short report

For the take back schemes:

- **Copy of the signed contract** between the tenant and the manufacturer clearly:

- stipulating the terms and conditions of the take back scheme, confirming the commitment to take back the quantity of the product or material supplied to the project
- nominating the intended reuse of the product/materials
- listing the manufacturer's details (i.e. registered name, address, email address, telephone number and website as applicable)

For design for disassembly:

- **Drawing(s)** marked-up to show detail drawings of connections demonstrating that the relevant flooring elements can be disassembled without cutting, material damage, or hindrance from adjacent materials;
- **Comprehensive Disassembly Plan** that:
  - Identifies which materials are designed to be recovered during flooring disassembly;
  - Details how (in terms of technique, expertise and technology required) the identified materials and products should be recovered, indicating the order of disassembly to enable them to be extracted without material damage or interference from other flooring materials/elements.

For items from ISO 14001 certified manufacturing facilities:

- **Copy of ISO 14001 certification** that is valid from each manufacturer
- **Manufacturer's confirmation** listing all the components (if applicable)

ADDITIONAL GUIDANCE

The GBCSA Interiors tool has 4 calculators, one of which is the Flooring Calculator. Each of these calculators is evaluated against specific credit criteria, the results of which are captured in the calculator input excel sheets. The credit criteria evaluate to what extent interior finishes are reused, contain certified content, have incorporated product stewardship in the consideration of the product/material, and have been manufactured in an environmentally responsible way.

The information provided in the credit criteria and Additional Guidance merely summarises the key considerations. Project teams must consult the Calculator Guide for detailed information regarding criteria definitions, how the calculators operate and how to input into the excel sheets correctly.

BACKGROUND AND ADDITIONAL GUIDANCE

Environmentally responsible flooring addresses the impact of flooring products on the environment by considering all aspects of the design and manufacturing process.

There are a number of ways for the flooring products to reduce their impact on the environment, and many of these are rewarded within this credit. These include using recycled materials in the manufacturing process, using products that can be disassembled and recycled after their useful life

and using products that have durability/ longevity. The aspiration is to create a closed-loop cycle in which materials and products are perpetually recycled to avoid disposal in landfills.

This credit also rewards floor surfaces that are uncovered, such as exposed substrates, as well as re-used flooring or products that have been certified according to independent 3rd party product certification schemes.

Rewarding responsible choices of flooring materials encourages manufacturers, suppliers and users to have environmental considerationsvfor the products' life cycles such as having an agreement in place to return the flooring at the end of the life cycle for re-use or recycling.

ISO 14001 Standard

ISO 14001, is an internationally recognized standard that sets out the criteria for an Environmental Management System (EMS). It does not state requirements for environmental performance, but maps out a framework that a company or organization can follow to set up an effective EMS. It can be used by any organization that wants to improve resource efficiency, reduce waste, and drive down costs. Meeting this standard can provide assurance to company management and employees as well as external stakeholders (customers and shareholders) that environmental impacts are being measured and improved.

ISO 14001, as with other ISO 14000 standards, is voluntary with its main aim to assist companies in continually improving their environmental performance. Organizations are responsible for setting their own targets and performance measures, with the standard serving to assist them in the subsequent monitoring and measurement of these.

While being ISO 14001 certified does not guarantee high environmental performance of a product, it assists companies to better manage the goal of reducing their environmental impacts which could include a reduction in waste, consumption of resources and operating costs

REFERENCES & FURTHER INFORMATION

Reco Floor Vinyl Take Back Scheme
http://www.recofloor.org/

Carpet Recycling
http://www.carpetrecyclinguk.com/

Urban Mining
http://urbanmining.org

WRAP, Circular Economy & Resource Efficiency Experts,
http://www.wrap.org.uk

ISO 14001 website
http://www.iso.org/iso/home/standards/management-standards/iso14000.htm

Cement and Concrete Institute of South Africa (CNCI):
http://www.cnci.org.za

South African Institute of Steel Construction:
http://www.saisc.co.za

Steel Recycling Institute (US):
http://www.recycle-steel.org

Forest Stewardship Council (FSC)
http://www.fsc.org/

Programme for Endorsement of Certified Wood (PEFC)
http://www.pefc.org/

Rainforest Alliance, Sustainable Forestry (formerly SmartWood)
http://www.rainforest-alliance.org/forestry.cfm?id=certification

Environmental Protection Agency (EPA) Product Stewardship website
http://www.epa.gov/epawaste/conserve/tools/stewardship/index.htm

Australian Government Product Stewardship website
http://www.environment.gov.au/settlements/waste/product-stewardship/index.html

FLOORING CALCULATOR GUIDE

Scope and definitions

The scope of the Flooring Calculator is as follows:

Items referred to as flooring must include all exposed structural substrate (such as concrete) surfaces, internal floor coverings and underlay materials for flooring used within project floor areas that are permanently covered and protected from the elements not intrinsic to the product, must be included and counted as a separate item to the floor coverings. Typical examples include carpet pad or felt, vapour barrier membranes under timber floors, and acoustic and thermal insulation underlays.

The following inclusions, exclusions and definitions apply:

Flooring: Flooring includes, but is not limited to exposed concrete surface, floor coverings and backing materials for floor coverings. Rugs are not counted as floor coverings. This includes flooring installed by a building owner as part of a 'making good' process prior to fitout works by the tenant.

Exposed substrate: Exposed substrate is defined to mean an area of concrete or other structural floor surface that is not covered. This will include timber floors where the timber forms the actual decking of the floor. This may be polished or sealed if required.

Floor covering: Floor covering may be fixed, supported or floating. Floor covering includes, but is not limited to, carpets, carpet tiles, timber, resilient flooring, vinyl composite flooring, cork, hard flooring such as tiles and other floor coverings.

Underlay materials for floor covering: Backing materials must be counted as a separate item to the floor coverings, e.g. carpet underlay is one example of a backing material. The area of the backing materials should be counted separately to the area of a floor covering.

Exclusions: Rugs and sealants are excluded from the assessment.

Area: For the purpose of the Flooring Calculator, the area of a flooring item is defined as follows:

- Area of flooring = area shown in plan view. The plan view is a two dimensional drawing of an object showing how it would look from above.
- Includes areas of flooring, backing materials and exposed concrete floor surfaces.

Entering information into the Flooring Calculator

The steps outlined below must be followed when completing the calculator

Step 1: Total quantity of all items

Enter the total area of flooring items in the project in square metres.

'Total Area of Flooring Items in the Project' is displayed at the top centre of each Flooring Calculator.

Step 2: Name of supplier and brief description

Enter the name of supplier, the product's brand name and type, in the column called 'Name of Supplier and Brief Description of Item'. One entry may represent a single flooring item or a group of similar flooring items. Each entry must represent flooring that is sourced from the same supplier.

For reused items, enter "re-used carpet floor" or "re-used underlay" etc.

Enter the supplier's name and the product name followed by a brief description of the item.

If various components of an item are sourced from different suppliers, the item entry must include all suppliers' names, followed by a brief description of the item.

Step 3: Total area of each item

Enter information in the column titled 'Total Area of Items'. A total must be entered for each item listed in the Flooring Fitout Calculator.

Enter the total area in square metres for each type of internal flooring type including the area of:

- Flooring
- Underlay separately to the area of floor finishes
- Exposed concrete floor surfaces.

Step 4: Response to the five criteria

Enter information about an item type under one or more of the criteria columns.

Calculator criteria

There are two compliance options available to project teams and these are discussed below. For each line item in each one of the calculators, project teams must pursue either Option 1 or Option 2. Both options cannot be pursued for individual products or materials although each of the calculators can have a mix of Option 1 and 2, depending on the mix of products and materials that are selected. For each line item entered in the respective calculators, an item score is calculated. This represents

the points awarded out of 100 points available for a specific environmental criterion. The maximum item score therefore for a product is 100%. The item score is subsequently multiplied with the number of items of that product, to achieve the weighted score, which informs the final score. The item scoring associated with each of these options is described in more detail below.

Option 1: GBCSA-approved 3rd party certification scheme

This option rewards team that procure products and materials that have been assessed by a 3rd party certification scheme. These are initiatives that independently assess the environmental performance of products and materials. There are many Ecolabels available on the market.

The GBCSA has approved a list of 3rd party certification schemes (i.e. Ecolabels) based on an assessment framework that evaluates the Ecolabel according to several environmental, social and legal criteria. Depending on the outcomes of the GBCSA assessment, the Ecolabel is certified according to level A, B or C, indicating the level of environmental performance.

The GBCSA has approved a list of 3rd party certification schemes (i.e. Ecolabels) and these are provided in the General section and on the GBCSA website (https://www.gbcsa.org.za/rating-tools/products-materials/).

In the calculator, select the level (A, B or C) for each item that is certified by a 3rd party product certification scheme or select no (or leave blank) for all other items that are not certified. The selected level will give a corresponding item score.

Option 2: Deemed to satisfy criteria

Products and materials that have not been assessed by a GBCSA approved 3rd party certification scheme can still have positive environmental features and are subsequently awarded in the deemed to satisfy option. The deemed to satisfy option has four criteria in each calculator, each with associated options and items scores. The four criteria are:

- DTS Criteria 1: Dematerialization
- DTS Criteria 2: Product Stewardship
- DTS Criteria 3: Certified, Recycled or Reused content
- DTS Criteria 4: Responsible Manufacturing

DTS Criteria 1: Dematerialization is whether or not the product is reused or, alternatively, if no product has been used at all, via an exposed substrate (the exposed substrate option is not applicable to furniture). If the product is reused or no product is used (and the substrate is exposed), it is awarded an item score of 100% for the product and all other criteria thereafter are not applicable.

Reused products:

For a product to be defined as reused, at least 80% by area, length, volume or mass of the item must be retained (the metric chosen must be justified) via one of the following ways:

- purchased from a second-hand retailer, such as an auction house;
- items that were used on the current site by a previous occupant or installed by a building owner as part of 'making good' prior to fitout works by the tenant;
- relocated to the site from the new tenant's, or occupant's, previous fitout or building

To enter an item as 'dematerialised', select 'Yes - reused for items that are re-used' and select 'No' (or leave blank) for all other items.

DTS Criteria 2: Product Stewardship:

Product stewardship is an environmental management approach that calls for increased responsibility by manufacturers, designers and consumers to consider the end of life impact of materials and products. This approach acknowledges a shared responsibility in how we dispose of products and consider how the end of a product's life will impact on the environment and human health. This concept is alternatively referred to as extended product responsibility (EPR).

Product stewardship can be achieved in the following ways in the calculators:

- Committing to a take back scheme
- Demonstrating that the product/material has been designed for disassembly
- Procuring products and materials that have long term durability (this only applies to the furniture calculator)

Take back scheme:

A take back scheme is a contract between a client and manufacturer, committing the manufacturer to taking back the material or product at its end of life, for the purpose of reusing or recycling the product as an input to a new value chain of goods. Take back schemes can either be part of formal programmes offered by manufacturers or suppliers, or they can be project specific arrangements. However, the nominated reuse of the product/material must be identified and clearly explained. The take back scheme needs to be a signed contract between both parties and cannot include exemptions related to limitations of timing of product return, or minimum quantity of product to be accepted.

Design for disassembly

Design for disassembly-requires products to be readily disassembled with the use of non-specialist tools where parts can be separated into elemental components for re-use, recycling or re-processing.

An item is considered to be designed for reuse when at least 50% of the item (by mass) can be readily disassembled and has a clear recyclable value.

The aim of this credit encourages designers to think of how products are assembled at the onset of the design stage, and effectively inform the process so that the product reuse is ensured after disassembly. Design for disassembly develops products that can be readily and easily disassembled and parts can be separated into components for re-use, recycling or re-processing.

Durability (this is only applicable to the furniture calculator):

Durability is defined as the number of years covered by a manufacturer's or supplier's warranty and is intended to reward project teams that procure products designed for quality and for long term use. It is calculated according to the length of the manufacturer's or supplier's warranty of the product. There are three categories:

- Level C: 5 - 7 years
- Level B: Between 7 and 10 years
- Level A: More than 10 years

To enter product stewardship, select 'Yes' for the relevant option (i.e. leased item, purchased with a product stewardship contract, warranty contract or designed for disassembly) and select 'No' (or leave blank) for all other items.

DTS Criteria 3: Certified, Recycled or Reused content:

This criterion rewards products that contain a proportion of materials that deliver environmental benefits. In order to qualify, at least 40% of the item's mass consists of any combination of the following:

Re-used material: An item qualifying as reused must be retained or be reused from a previous installation

Recycled content: Post-consumer material that has been diverted from landfill. Pre-consumer materials such as rework, regrind, or scrap, generated in a manufacturing process and capable of being reclaimed within the same process that generated it, are not considered recycled. This credit rewards post-consumer recycled content only and not post-industrial recycled content.

Certified Content: item contains material or components that are certified by a GBCSA-recognised product certification scheme or certified by a forest certification scheme, namely Forestry Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC).

To enter re-used, recycled or certified content, select 'Yes' for items where at least 40% of the item's mass consists of any combination of the following:

- Re-used components;
- Independently verified recycled content;
- Components certified by a product certification standard recognised by the GBCSA
- Timber and bamboo components that are certified by a recognised forest certification scheme, namely FSC (Forestry Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification).

Calculating re-used, recycled, and certified content

The example bellows shows how to calculate the proportion of re-used, recycled and certified content for a workstation made from several components.

Each 'Live' workstation from Furniture Downtown is made up of the following four components:

1. Worktop made from timber that has a chain of custody certification from a forest certification scheme, namely FSC.

   100% of the worktop's mass is counted towards re-used, recycled, or certified content calculations.

2. New aluminium frame with no recognised documentation to show that it contains re-used, recycled or certified content.

   0% of the frame's mass is counted towards re-used, recycled or certified content calculations.

3. Polymer screens supplied as part of each workstation, containing 20% independently verified recycled content.

   20% of the screen mass is counted towards re-used, recycled or certified content calculations.

4. Storage unit as part of each workstation, certified by a GBCA-recognised product certification scheme.

   100% of the storage component's mass is counted towards re-used, recycled or certified content calculations.

The tool includes a Component Calculator to assist teams in demonstrating how a product may comply to obtain a score under this criterion. A screenshot of this calculator is provided below.

Project teams must provide 'screenshots' of this calculator for each applicable product with their submission documentation to demonstrate how compliance is achieved.

Component Worksheet Please enter data in white fields only

Name of assembly / piece furniture: Live workstation (Furniture Downtown)

Total Mass of Item: 32.50 kg

Component	Component Material	Total Mass of Component [kg]	% of component with qualifying content	Mass compliant
Worktop	Timber	8.00 kg	100%	8.00 kg
Frame	Aluminium	6.50 kg	0%	0.00 kg
Screens	Polymer with 20% RC	9.00 kg	20%	1.80 kg
Storage Unit	Steel	9.00 kg	100%	9.00 kg
				0.00 kg
				0.00 kg
	TOTALS	32.50 kg		18.80 kg
				58%

This product CAN contribute for Option 2c

Refer to the Fitout Calculator Guide for detailed instructions

In the example above, 58% of the 'Live' workstation mass qualifies for compliance through being re-used, recycled, or having certified content. This exceeds the requirement of minimum 40% mass. Therefore, Furniture Downtown's 'Live' workstation qualifies as a compliant product with re-used, recycled, or certified content.

DTS Criteria 4: Responsible Manufacturing:

This criterion rewards products that have been manufactured in an ISO 14001 certified facility. In order to comply, 80% of the mass of the product or materials must be sourced from manufacturing facilities that are certified to ISO 14001.

An ISO 14001 certification is a management system tool designed to help an organisation administer and control its Environmental impact and compliance with regulations. ISO 14001 does this by guiding the development and implementation of policies, objectives and processes. ISO 14001 certifications are authorised by independent external auditors and need to be reviewed annually for compliance and to maintain their validity. ISO 14001 certified facilities will have certificates that demonstrate their certification, stipulating the period of validity and the external auditing party who verified the certification.

ISO 14001certified Environmental Management System (EMS) ensures that organisations:

- Commit to environmental objectives and targets
- Identify key environmental impacts and aspects associated with their business operations as well as mitigation measures, if necessary
- Develop systems and procedures for documentation, reporting and auditing the key environmental considerations and impacts
- Track and monitor their water and energy usage, as well as their waste generation and materials utilizations, with the aim of continually improving environmental performance over time.

Manufacturer

For the purposes of the Materials Calculators, this is the maker who delivers a finished product. If there are several key manufacturers for a given product, ISO 14001 certification will be required from each manufacturer. This does not include parties who process or extract raw materials e.g. foresters, miners, etc.

Manufacturing facility

For the purposes of this criterion, a ‘manufacturing facility’ is where product components are manufactured from raw materials, whilst the final product may be assembled in this facility, a manufacturing facility is not the same as the warehousing or assembly only facility.

To enter an item with Manufacturer ISO 14001 Certification, select ‘Yes’ for items that have at least 80% of the mass of their total content sourced from manufacturing facilities that are certified to ISO 14001 and select ‘No’ for all other items.

Point calculation

To calculate the number of Green Star SA credit points generated in the Materials Calculators, the following processes described below are followed:

- Calculating the ‘item score’
- Calculating the ‘weighted item score’
- Calculating the ‘overall score’

- Calculating the 'points generated'.

a) Item score

The item score is the criterion score that is allocated for the different responses to the criteria. The maximum score that an item can achieve is 100%.

b) Weighted item score

A weighted score is calculated for each item by multiplying the item score with the quantity of that item. Below is an example that demonstrates how 'Jessica' chairs from Comfort Chairs which are certified by a Level B GBCSA-approved scheme generates an item score of 85%.

The total number of items for this product is 5.This gives a weighted item score of:

= (85% x 5)

= 4.25 weighted item score

Loose Furniture Please enter data in white fields only **Points Available:** 7

Total Number of Furniture Items in the Project: 30 **Points Generated:** 4.7 **Overall Score:** 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

			Option 1	Option 2					
#	Name of Supplier and Brief Description of Item	Total Number of Items	Certified Product	Re-used	Product Stewardship	Re-used, Recycled or Certified Content	Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

c) Overall score

The overall score is calculated by adding all the weighted item scores in the calculator and dividing them by the total quantity of relevant items included in the calculator. The overall score is calculated as follows:

$$\text{Overall score} = \frac{\text{Total of all weighted item score}}{\text{Total quantity of relevant items in the project}}$$

d) Credit Points generated

The number of 'Points Generated' is calculated based on the overall score. This number is displayed in the 'Points Generated' field at the top of the calculator. The number of points available varies for each Materials Calculator and is defined in the 'Credit Criteria' for the relevant Green Star SA credit.

If a project team achieves and overall score of 90% or more, the full credit score will be awarded. Where the overall score is lower than 90%, points are awarded as a percentage of the points available. The final score is rounded to include one decimal point. Where more than 1 point is available the overall score determines the points generated as follows:

$$\text{Points generated} = \frac{\text{Overall Score}}{90} \times \text{Number of points available}$$

An example of the point calculation is shown below:

Example of point calculation

Step 1: Calculating the item score

- Item 1: 'Lucy' task chairs = Item score 30%
- Item 2: 'Sarah' task chairs = Item score 100%
- Item 3: 'Jessica' chairs = Item score 85%
- Item 4: Re-used workstations = Item score 100%
- Item 5: 'Live' workstations = Item score 30%
- Item 6: Cupboards = Item score 20%
- Item 7: Tables = Item score 20%

Loose Furniture Please enter data in white fields only Points Available: 7

Total Number of Furniture Items in the Project: 30 Points Generated: 4.7 Overall Score: 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

#	Name of Supplier and Brief Description of Item	Total Number of Items	Option 1: Certified Product	Option 2: Re-used	Option 2: Product Stewardship	Option 2: Re-used, Recycled or Certified Content	Option 2: Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

These item scores appear in the 'item score' column at the far right of the calculator.

Step 2: Calculating the overall score

- Item 1: 'Lucy' task chairs

  Weighted item score = 30% x 5 = 1.5

- Item 2: 'Sarah' task chairs

  Weighted item score = 100% x 5 = 5

- Item 3: 'Jessica' chairs

  Weighted item score = 85% x 5 = 4.25

- Item 4: Re-used workstations

  Weighted item score = 100% x 5 = 5

- Item 5: 'Live' workstations

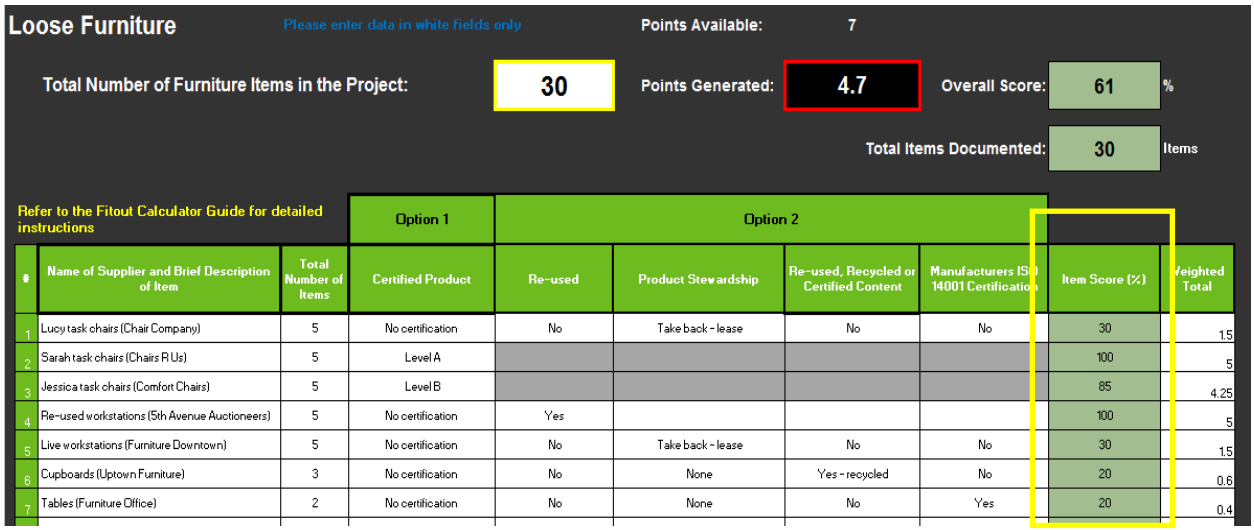
  Weighted item score = 30% x 5 = 1.5

- Item 6: Cupboards

  Weighted item score= 20% x 3 = 0.6

- Item 7: Tables

  Weighted item score = 20% x 2 = 0.4



Loose Furniture — Please enter data in white fields only — Points Available: 7

Total Number of Furniture Items in the Project: 30 — Points Generated: 4.7 — Overall Score: 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

#	Name of Supplier and Brief Description of Item	Total Number of Items	Option 1: Certified Product	Option 2: Re-used	Option 2: Product Stewardship	Option 2: Re-used, Recycled or Certified Content	Option 2: Manufacturers ISO 14001 Certificatio	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

Total of weighted scores = 1.5 + 5 + 4.25 + 5 + 1.5 + 0.6 + 0.4

= 18.25

Overall score = total weighted scores / total number of items

= 18.25 / 30

= 61%

Thus, the overall score for the Furniture calculator is 61%, which will appear in the 'overall score' field at the top right of the Furniture Calculator.

Step 3: Calculating the points generated

The points generated in a Calculator are determined by the overall score. In this example, 7 points are available. The points generated therefore = 61% of 7 points = 4.7

The 'Points Generated' will not automatically be recognised by the GBCSA unless the documentation requirements are submitted and deemed in accordance with the stipulations the documentation requirements.

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Mat-5 Wall Coverings

POINTS AVAILABLE **3**

AIM OF CREDIT

To encourage and recognise the selection of wall coverings that have a reduced environmental impact compared to available alternatives.

CREDIT CRITERIA

Up to three points are awarded where the wall coverings used have a reduced environmental impact as determined by the Wall Coverings Calculator against the following criteria:

- Certified product
  - 80% of an item's total mass is certified by a recognised 3rd party certification scheme
- Reused or exposed substrate:
  - 80% by area, length, volume or mass of the wall covering item must be retained or reused

    OR
  - No additional wall covering materials has been used such as exposed concrete
- Product stewardship
  - Wall covering item must have an end-of-life purpose in the form of either:
    - A formalised take back scheme, OR
    - Item has been designed for disassembly
- Re-used, recycled or certified content
  - 40% of the item's mass is reused, recycled, or certified content or a combination
- Manufacturer ISO 14001 certification
  - 80% of the item's mass must be sourced from manufacturing facilities that are certified to ISO 14001

If the material cost of wall coverings represents less than 1% of the project's total contract value, this credit is 'Not Applicable' and is excluded from the Points Available used to calculate the Materials Category score.

Please refer to the Calculator guide section below for detailed descriptions and additional information relating to the Wall Coverings Calculator.

INT-Mat-5 Wall Coverings

POINTS AVAILABLE 3

Calculator credit criterion	Calculator input options available	Criterion score (%)	Comment
Compliance route 1			
Certified product	Level A	100	Selecting Option 1 as the compliance route will grey out all criteria under Option 2, as a final product score will be calculated based on the Option 1 compliance level.
	Level B	85	
	Level C	75	
Compliance route 2			
Reuse	Yes	100	If compliance is achieved for this criterion, no further entries are required as this is the maximum product score available.
	No	0	
Product Stewardship	Take back- lease	30	For compliance under any of these criteria, the scores applied to each criteria are added together to give the final product score.
	Take back- purchase	25	
	Designed for disassembly or re-use	30	
Reused, recycled or certified content	Yes	20	
	No	0	
ISO 14001 manufacturers	Yes	20	
	No	0	

Table 1: Score contributions for responses to the Criteria

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Completed calculator 2. Short report 3. Project-specific schedule of all items 4. Written confirmation from Contractor *5.* Supporting evidence

INT-Mat-5 Wall Coverings

POINTS AVAILABLE 3

Completed Wall Coverings calculator with all inputs correctly entered corresponding to all supporting documentation requirements provided.

Short report by a suitably qualified professional that describes how the Credit Criteria have been met and:

For certified products:

- Providing a summary of all certified products in the project, their certification ranking, and relevant certifying scheme

For reused products:

- Providing calculations and a summary table confirming the stipulated proportion of re-used wall coverings in the project

For design for disassembly and/or reuse:

- Identifying the wall covering elements designed for disassembly and/or reuse
- Describing the process involved for reclaiming each element
- Identifying potential reuse options for each of those items
- Providing calculations and a summary table confirming that the stipulated proportion of the relevant wall covering is designed for disassembly and reuse

For items with re-used, recycled, or certified content:

- Providing calculations showing how the proportion of re-used, recycled, or certified content was derived. The results must be tabulated to clearly demonstrate:
  - All components in the item
  - Mass of each component
  - Mass of re-used, recycled, or certified content in each component
  - Percentage of re-used, recycled, or certified content for an item

For items from ISO 14001 certified manufacturing facilities:

- Providing a summary of all qualifying products in the project and their manufacturers
- If not 100% from same manufacturer, tabulating the mass of each compliant wall covering component and total weight proportion
- ISO 14001 certification number for each product and component claimed.

Where the credit is claimed as 'Not Applicable'

- Providing calculations showing the percentage of the total cost of wall covering specified of the total cost of the project.

Project-specific schedule of all items prepared by the relevant project team member listing all the products relevant to the credit, stating the type and quantity of these items

Written confirmation from the tenant that the products listed in the project specific schedule have been installed in the project

Supporting evidence

For certified products:

- **Copy of the certification licence(s)** or certificate for each material or item. The certification must be current at the time of installation and the certification scheme must be recognised by the GBCSA at level A, B or C.
- In the case of timber and bamboo products, a copy of the FSC or PEFC chain of custody certificates (CoC) must be submitted.

For reused products or content:

If purchased from a second-hand retailer, such as an auction house

- Purchase receipts/delivery receipts

If materials were used on the current site by a previous occupant or installed by a building owner as part of make good processes prior to fitout works by the tenant:

- Confirmation from the tenant that the items were in use onsite prior to the project works and that they have now been re-installed onsite

If materials were relocated to the site from the new tenant's, or occupants', previous fitout or building:

- Mover's inventory from the previous location.

  OR

- Inventory/schedule or images from the previous fitout showing clearly the items that have been re-used in the new fitout

For exposed substrate:

- Statement of confirmation from the relevant team member confirming that the 'exposed concrete' area entered in the Wall Coverings Calculator has been provided without any wall covering

  OR

- Images or As-built drawings that clearly indicate the area of exposed concrete. These must correlate with the 'exposed concrete' area entered in the Wall Coverings Calculator

For Recycled content:

- **Statement of confirmation** from manufacturer confirming all recycled claims as referenced in the short report

For the take back schemes:

- **Copy of the signed contract** between the tenant and the manufacturer clearly:

- stipulating the terms and conditions of the take back scheme, confirming the commitment to take back the quantity of the product or material supplied to the project
- nominating the intended reuse of the product/materials
- listing the manufacturer's details (i.e. registered name, address, email address, telephone number and website as applicable)

For design for disassembly:

- **Drawings(s)** marked-up to show detail drawings of connections demonstrating that the relevant wall covering elements can be disassembled without cutting, material damage, or hindrance from adjacent materials;
- **Comprehensive Disassembly Plan** that:
  - Identifies which materials are designed to be recovered during building disassembly;
  - Details how (in terms of technique, expertise and technology required) the identified materials and products should be recovered, indicating the order of disassembly to enable them to be extracted without material damage or interference from other wall covering materials/elements.

For items from ISO 14001 certified manufacturing facilities:

- **Copy of ISO 14001 certification** that is valid from each manufacturer
- **Manufacturer's confirmation** listing all the components (if applicable)

ADDITIONAL GUIDANCE

The GBCSA Interiors tool has 4 calculators, one of which is the Wall Coverings Calculator. Each of these calculators is evaluated against specific credit criteria, the results of which are captured in the calculator input excel sheets. The credit criteria evaluate to what extent interiors finishes are reused, contain certified content, have incorporated product stewardship in the consideration of the product/material, and have been manufactured in an environmentally responsible way.

The information provided in the credit criteria and additional guidance merely summarises the key considerations. Project teams must consult the Calculator Guide (below) for detailed information regarding criteria definitions, how the calculators operate and how to input into the excel sheets correctly.

BACKGROUND

The choice of environmentally responsible wall coverings address the impact of wall covering products on the environment by considering all aspects of the design and manufacturing process.

There are a number of ways for the wall covering products to reduce their impact on the environment, and many of these are rewarded within this credit. These include using recycled materials in the

manufacturing process, using products that can be disassembled and recycled after their useful life and using products that have durability/ longevity. The aspiration is to create a closed-loop cycle in which materials and products are perpetually recycled so as to avoid disposal in landfills.

This credit also rewards wall surfaces that are either uncovered, such as exposed concrete or exposed substrate material, as well as re-used wall coverings or products that have been certified according to independent 3rd party product certification schemes.

There is very little evidence in the market for product stewardship, which encourages manufacturers, suppliers and users to consider the product's life cycle by having an agreement in place to return the wall coverings at the end of the life cycle for re-use or recycling.

ISO 14001 Standard

ISO 14001 is an internationally recognized standard that sets out the criteria for an Environmental Management System (EMS). It does not state requirements for environmental performance, but maps out a framework that a company or organization can follow to set up an effective EMS. It can be used by any organization that wants to improve resource efficiency, reduce waste, and drive down costs. Meeting this standard can provide assurance to company management and employees as well as external stakeholders (customers and shareholders) that environmental impacts are being measured and improved.

ISO 14001, as with other ISO 14000 standards, is voluntary with its main aim to assist companies in continually improving their environmental performance. Organizations are responsible for setting their own targets and performance measures, with the standard serving to assist them in the subsequent monitoring and measurement of these.

While being ISO 14001 certified does not guarantee high environmental performance of a product, it assists companies to better manage the goal of reducing their environmental impacts which could include a reduction in waste, consumption of resources and operating costs.

REFERENCES & FURTHER INFORMATION

"Guide to Choosing Eco-Friendly Wall coverings"
http://www.homeportfolio.com/article/sustainable-wallpaper-101

ISO 14001 website
http://www.iso.org/iso/home/standards/management-standards/iso14000.htm

Cement and Concrete Institute of South Africa (CNCI)
http://www.cnci.org.za

South African Institute of Steel Construction
http://www.saisc.co.za

Steel Recycling Institute (US)
http://www.recycle-steel.org

Forest Stewardship Council (FSC)
http://www.fsc.org/

Programme for Endorsement of Certified Wood (PEFC)

http://www.pefc.org/

Rainforest Alliance, Sustainable Forestry (formerly SmartWood)
http://www.rainforest-alliance.org/forestry.cfm?id=certification

Environmental Protection Agency (EPA) Product Stewardship website
http://www.epa.gov/epawaste/conserve/tools/stewardship/index.htm

Australian Government Product Stewardship website
http://www.environment.gov.au/settlements/waste/product-stewardship/index.html

WALL COVERINGS CALCULATOR GUIDE

Scope and definitions

The scope of the Wall Coverings Calculator is as follows:

Wall covering items must include all internal wall finishes and internal exposed materials, such as concrete, masonry, or timber, that are used within project floor areas which are permanently covered and protected from the elements.

The following inclusions, exclusions and definitions apply:

Walling: Walling is defined as an upright structure, which includes, but is not limited to, concrete, masonry, timber or plaster for wall coverings.

Exposed substrate: Exposed substrate is an area of concrete, masonry or timber wall surface that is not covered by plaster or cladding, or another product or material. This may be polished, varnished or sealed if required.

Wall covering: Wall coverings may be fixed, supported or floating. Wall coverings include, but are not limited to paint, vinyl, tiles, timber, cork, paper, digital printing and textiles.

Exclusions: Rugs and sealants are excluded from the assessment; however, they are included within the scope of the Reduced Exposure to Air Pollutants credit. Internal walls and partitions are assessed as joinery under the Assemblies Calculator.

Area
For the purpose of the Wall Coverings Calculator, the area of a wall covering item is defined as follows:

- Area of wall covering = the total length of the wall covering multiplied by its total height. Include areas of wall coverings and exposed concrete/masonry or timber wall surfaces.

Entering information into the Wall covering Calculator

The steps outlined below must be followed when completing the calculator

Step 1: Total quantity of all items

Enter the total area of the wall covering items in the project in square metres.

'Total Area of Wall Covering Items in the Project' is displayed at the top centre of the Wall Coverings Fitout Calculator.

Step 2: Name of Supplier and Brief Description of Item

Enter the name of supplier, the product's brand name and type, in the column called 'Name of Supplier and Brief Description of Item'. One entry may represent a single wall covering item or a group of similar wall covering items. Each entry must represent a wall covering that is sourced from the same supplier.

For reused items which meet the requirements for Criterion 1, enter "re-used timber wall covering" etc.

Enter the supplier's name and the product name followed by a brief description of the item.

If various components of an item are sourced from different suppliers, the item entry must include all suppliers' names, followed by a brief description of the item.

Step 3: Total area of each item

Enter information in the column called 'Total Area of Items'. A total must be entered for each item listed in the Wall Coverings Fitout Calculator. See inclusions and exclusions as stated in the scope and definitions section **Error! Reference source not found.** above.

Enter the total area in square metres for each type of internal wall covering type including the area of:

- Wall Coverings
- Exposed materials (e.g. concrete/masonry/timber) wall surfaces.

Step 4: Response to the criteria

Enter information about an item type under one or more of the criteria columns.

Calculator criteria

There are two compliance options available to project teams and these are discussed below. For each line item in each one of the calculators, project teams must pursue either Option 1 or Option 2. Both options cannot be pursued for individual products or materials although each of the calculators can have a mix of Option 1 and 2, depending on the mix of products and materials that are selected. For each line item entered in the respective calculators, an item score is calculated. This represents the points awarded out of 100 points available for a specific environmental criterion. The maximum item score therefore for a product is 100%. The item score is subsequently multiplied with the number of items of that product, to achieve the weighted score, which informs the final score. The item scoring associated with each of these options is described in more detail below.

Option 1: GBCSA-approved 3rd party certification scheme

This option rewards team that procure products and materials that have been assessed by a 3rd party certification scheme. These are initiatives that independently assess the environmental performance of products and materials. There are many Ecolabels available on the market.

The GBCSA has approved a list of 3rd party certification schemes (i.e. Ecolabels) based on an assessment framework that evaluates the Ecolabel according to several environmental, social and

legal criteria. Depending on the outcomes of the GBCSA assessment, the Ecolabel is certified according to level A, B or C, indicating the level of environmental performance.

The GBCSA has approved a list of 3rd party certification schemes (i.e. Ecolabels) and these are provided in the General section and on the GBCSA website (https://www.gbcsa.org.za/rating-tools/products-materials/).

In the calculator, select the level (A, B or C) for each item that is certified by a 3rd party product certification scheme or select no (or leave blank) for all other items that are not certified. The selected level will give a corresponding item score.

Option 2: Deemed to satisfy criteria

Products and materials that have not been assessed by a GBCSA approved 3rd party certification scheme can still have positive environmental features and are subsequently awarded in the deemed to satisfy option. The deemed to satisfy option has four criteria in each calculator, each with associated options and items scores. The four criteria are:

- DTS Criteria 1: Dematerialization
- DTS Criteria 2: Product Stewardship
- DTS Criteria 3: Certified, Recycled or Reused content
- DTS Criteria 4: Responsible Manufacturing

DTS Criteria 1: Dematerialization is whether or not the product is reused or, alternatively, if no product has been used at all, via an exposed substrate (the exposed substrate option is not applicable to furniture). If the product is reused or no product is used (and the substrate is exposed), it is awarded an item score of 100% for the product and all other criteria thereafter are not applicable.

Reused products:

For a product to be defined as reused, at least 80% by area, length, volume or mass of the item must be retained (the metric chosen must be justified) via one of the following ways:

- purchased from a second-hand retailer, such as an auction house;
- items that were used on the current site by a previous occupant or installed by a building owner as part of 'making good' prior to fitout works by the tenant;
- relocated to the site from the new tenant's, or occupant's, previous fitout or building

To enter an item as 'dematerialised', select 'Yes - reused for items that are re-used' and select 'No' (or leave blank) for all other items.

DTS Criteria 2: Product Stewardship:

Product stewardship is an environmental management approach that calls for increased responsibility by manufacturers, designers and consumers to consider the end of life impact of materials and products. This approach acknowledges a shared responsibility in how we dispose of products and consider how the end of a product's life will impact on the environment and human health. This concept is alternatively referred to as extended product responsibility (EPR).

Product stewardship can be achieved in the following ways in the calculators:

- Committing to a take back scheme
- Demonstrating that the product/material has been designed for disassembly

- Procuring products and materials that have long term durability (this only applies to the furniture calculator)

Take back scheme:

A take back scheme is a contract between a client and manufacturer, committing the manufacturer to taking back the material or product at its end of life, for the purpose of reusing or recycling the product as an input to a new value chain of goods. Take back schemes can either be part of formal programmes offered by manufacturers or suppliers, or they can be project specific arrangements. However, the nominated reuse of the product/material must be identified and clearly explained. The take back scheme needs to be a signed contract between both parties and cannot include exemptions related to limitations of timing of product return, or minimum quantity of product to be accepted.

Design for disassembly

Design for disassembly-requires products to be readily disassembled with the use of non-specialist tools where parts can be separated into elemental components for re-use, recycling or re-processing.

An item is considered to be designed for reuse when at least 50% of the item (by mass) can be readily disassembled and has a clear recyclable value.

The aim of this credit encourages designers to think of how products are assembled at the onset of the design stage, and effectively inform the process so that the product reuse is ensured after disassembly. Design for disassembly develops products that can be readily and easily disassembled and parts can be separated into components for re-use, recycling or re-processing.

Durability (this is only applicable to the furniture calculator):

Durability is defined as the number of years covered by a manufacturer's or supplier's warranty and is intended to reward project teams that procure products designed for quality and for long term use. It is calculated according to the length of the manufacturer's or supplier's warranty of the product. There are three categories:

- Level C: 5 - 7 years
- Level B: Between 7 and 10 years
- Level A: More than 10 years

To enter product stewardship, select 'Yes' for the relevant option (i.e. leased item, purchased with a product stewardship contract, warranty contract or designed for disassembly) and select 'No' (or leave blank) for all other items.

DTS Criteria 3: Certified, Recycled or Reused content:

This criterion rewards products that contain a proportion of materials that deliver environmental benefits. In order to qualify, at least 40% of the item's mass consists of any combination of the following:

Re-used material: An item qualifying as reused must be retained or be reused from a previous installation

Recycled content: Post-consumer material that has been diverted from landfill. Pre-consumer materials such as rework, regrind, or scrap, generated in a manufacturing process and capable of being reclaimed within the same process that generated it, are not considered recycled. This credit rewards post-consumer recycled content only and not post-industrial recycled content.

Certified Content: item contains material or components that are certified by a GBCSA-recognised product certification scheme or certified by a forest certification scheme, namely Forestry Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC).

To enter re-used, recycled or certified content, select 'Yes' for items where at least 40% of the item's mass consists of any combination of the following:

- Re-used components;
- Independently verified recycled content;
- Components certified by a product certification standard recognised by the GBCSA
- Timber and bamboo components that are certified by a recognised forest certification scheme, namely FSC (Forestry Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification).

Calculating re-used, recycled, and certified content

The example bellows shows how to calculate the proportion of re-used, recycled and certified content for a workstation made from several components.

Each 'Live' workstation from Furniture Downtown is made up of the following four components:

1. Worktop made from timber that has a chain of custody certification from a forest certification scheme, namely FSC.

   100% of the worktop's mass is counted towards re-used, recycled, or certified content calculations.

2. New aluminium frame with no recognised documentation to show that it contains re-used, recycled or certified content.

   0% of the frame's mass is counted towards re-used, recycled or certified content calculations.

3. Polymer screens supplied as part of each workstation, containing 20% independently verified recycled content.

   20% of the screen mass is counted towards re-used, recycled or certified content calculations.

4. Storage unit as part of each workstation, certified by a GBCA-recognised product certification scheme.

   100% of the storage component's mass is counted towards re-used, recycled or certified content calculations.

The tool includes a Component Calculator to assist teams in demonstrating how a product may comply to obtain a score under this criterion. A screenshot of this calculator is provided below.

Project teams must provide 'screenshots' of this calculator for each applicable product with their submission documentation to demonstrate how compliance is achieved.

Component Worksheet Please enter data in white fields only

Name of assembly / piece furniture: Live workstation (Furniture Downtown)

Total Mass of Item: 32.50 kg

Component	Component Material	Total Mass of Component [kg]	% of component with qualifying content	Mass compliant
Worktop	Timber	8.00 kg	100%	8.00 kg
Frame	Aluminium	6.50 kg	0%	0.00 kg
Screens	Polymer with 20% RC	9.00 kg	20%	1.80 kg
Storage Unit	Steel	9.00 kg	100%	9.00 kg
				0.00 kg
				0.00 kg
	TOTALS	32.50 kg		18.80 kg
				58%

This product CAN contribute for Option 2c

Refer to the Fitout Calculator Guide for detailed instructions

In the example above, 58% of the 'Live' workstation mass qualifies for compliance through being re-used, recycled, or having certified content. This exceeds the requirement of minimum 40% mass. Therefore, Furniture Downtown's 'Live' workstation qualifies as a compliant product with re-used, recycled, or certified content.

DTS Criteria 4: Responsible Manufacturing:

This criterion rewards products that have been manufactured in an ISO 14001 certified facility. In order to comply, 80% of the mass of the product or materials must be sourced from manufacturing facilities that are certified to ISO 14001.

An ISO 14001 certification is a management system tool designed to help an organisation administer and control its Environmental impact and compliance with regulations. ISO 14001 does this by guiding the development and implementation of policies, objectives and processes. ISO 14001 certifications are authorised by independent external auditors and need to be reviewed annually for compliance and to maintain their validity. ISO 14001 certified facilities will have certificates that demonstrate their certification, stipulating the period of validity and the external auditing party who verified the certification.

ISO 14001certified Environmental Management System (EMS) ensures that organisations:

- Commit to environmental objectives and targets

- Identify key environmental impacts and aspects associated with their business operations as well as mitigation measures, if necessary
- Develop systems and procedures for documentation, reporting and auditing the key environmental considerations and impacts
- Track and monitor their water and energy usage, as well as their waste generation and materials utilizations, with the aim of continually improving environmental performance over time.

Manufacturer

For the purposes of the Materials Calculators, this is the maker who delivers a finished product. If there are several key manufacturers for a given product, ISO 14001 certification will be required from each manufacturer. This does not include parties who process or extract raw materials e.g. foresters, miners, etc.

Manufacturing facility

For the purposes of this criterion, a 'manufacturing facility' is where product components are manufactured from raw materials, whilst the final product may be assembled in this facility, a manufacturing facility is not the same as the warehousing or assembly only facility.

To enter an item with Manufacturer ISO 14001 Certification, select 'Yes' for items that have at least 80% of the mass of their total content sourced from manufacturing facilities that are certified to ISO 14001 and select 'No' for all other items.

Point calculation

To calculate the number of Green Star SA credit points generated in the Materials Calculators, the following processes described below are followed:

- Calculating the 'item score'
- Calculating the 'weighted item score'
- Calculating the 'overall score'
- Calculating the 'points generated'.

a) Item score

The item score is the criterion score that is allocated for the different responses to the criteria. The maximum score that an item can achieve is 100%.

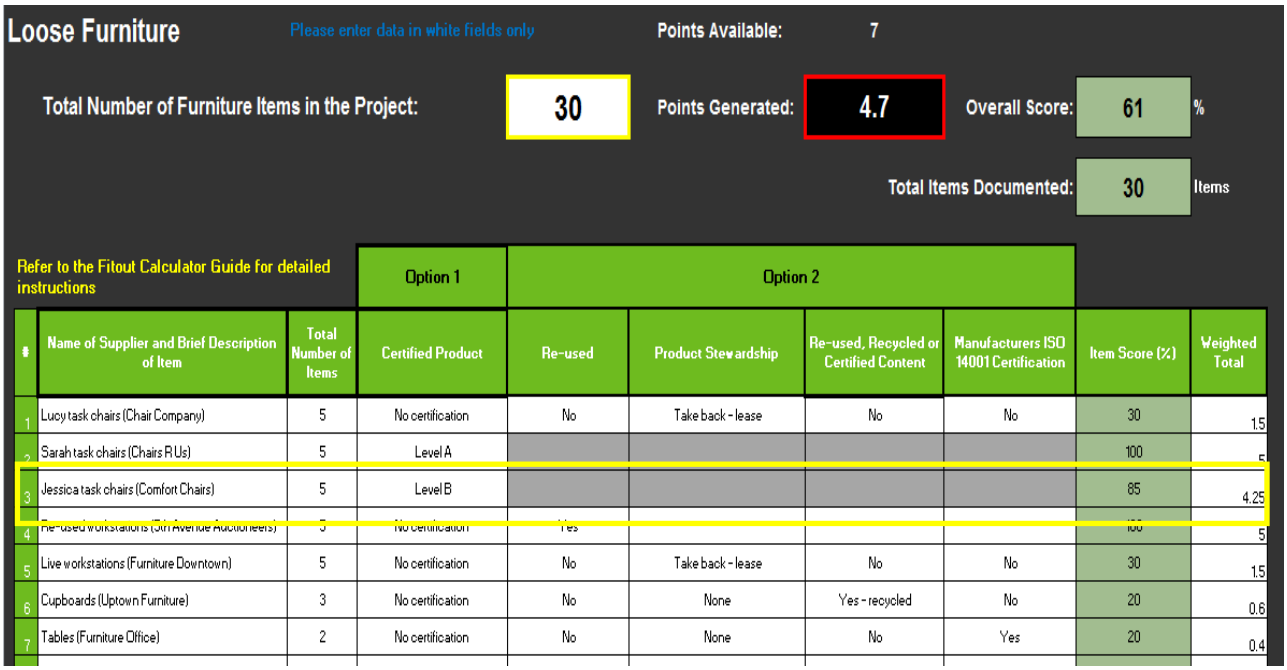
b) Weighted item score

A weighted score is calculated for each item by multiplying the item score with the quantity of that item. Below is an example that demonstrates how 'Jessica' chairs from Comfort Chairs which are certified by a Level B GBCSA-approved scheme generates an item score of 85%.

The total number of items for this product is 5.This gives a weighted item score of:

= (85% x 5)

= 4.25 weighted item score



Loose Furniture — Please enter data in white fields only — Points Available: 7

Total Number of Furniture Items in the Project: 30 — Points Generated: 4.7 — Overall Score: 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

			Option 1	Option 2					
#	Name of Supplier and Brief Description of Item	Total Number of Items	Certified Product	Re-used	Product Stewardship	Re-used, Recycled or Certified Content	Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (Jo'burg Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

c) Overall score

The overall score is calculated by adding all the weighted item scores in the calculator and dividing them by the total quantity of relevant items included in the calculator. The overall score is calculated as follows:

$$\textbf{Overall score} = \frac{\text{Total of all weighted item score}}{\text{Total quantity of relevant items in the project}}$$

d) Credit Points generated

The number of 'Points Generated' is calculated based on the overall score. This number is displayed in the 'Points Generated' field at the top of the calculator. The number of points available varies for each Materials Calculator and is defined in the 'Credit Criteria' for the relevant Green Star SA credit.

If a project team achieves and overall score of 90% or more, the full credit score will be awarded. Where the overall score is lower than 90%, points are awarded as a percentage of the points available. The final score is rounded to include one decimal point. Where more than 1 point is available the overall score determines the points generated as follows:

$$\textbf{Points} = \frac{\text{Overall Score}}{} \times \text{Number of}$$

generated = $\frac{\text{points available}}{90}$

An example of the point calculation is shown below:

Example of point calculation

Step 1: Calculating the item score

- Item 1: 'Lucy' task chairs = Item score 30%
- Item 2: 'Sarah' task chairs = Item score 100%
- Item 3: 'Jessica' chairs = Item score 85%
- Item 4: Re-used workstations = Item score 100%
- Item 5: 'Live' workstations = Item score 30%
- Item 6: Cupboards = Item score 20%
- Item 7: Tables = Item score 20%

Loose Furniture Please enter data in white fields only **Points Available:** 7

Total Number of Furniture Items in the Project: 30 **Points Generated:** 4.7 **Overall Score:** 61 %

Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

			Option 1	Option 2					
#	Name of Supplier and Brief Description of Item	Total Number of Items	Certified Product	Re-used	Product Stewardship	Re-used, Recycled or Certified Content	Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

These item scores appear in the 'item score' column at the far right of the calculator.

Step 2: Calculating the overall score

- Item 1: 'Lucy' task chairs

  Weighted item score = 30% x 5 = 1.5
- Item 2: 'Sarah' task chairs

  Weighted item score = 100% x 5 = 5
- Item 3: 'Jessica' chairs

  Weighted item score = 85% x 5 = 4.25

- Item 4: Re-used workstations

  Weighted item score = 100% x 5 = 5

- Item 5: 'Live' workstations

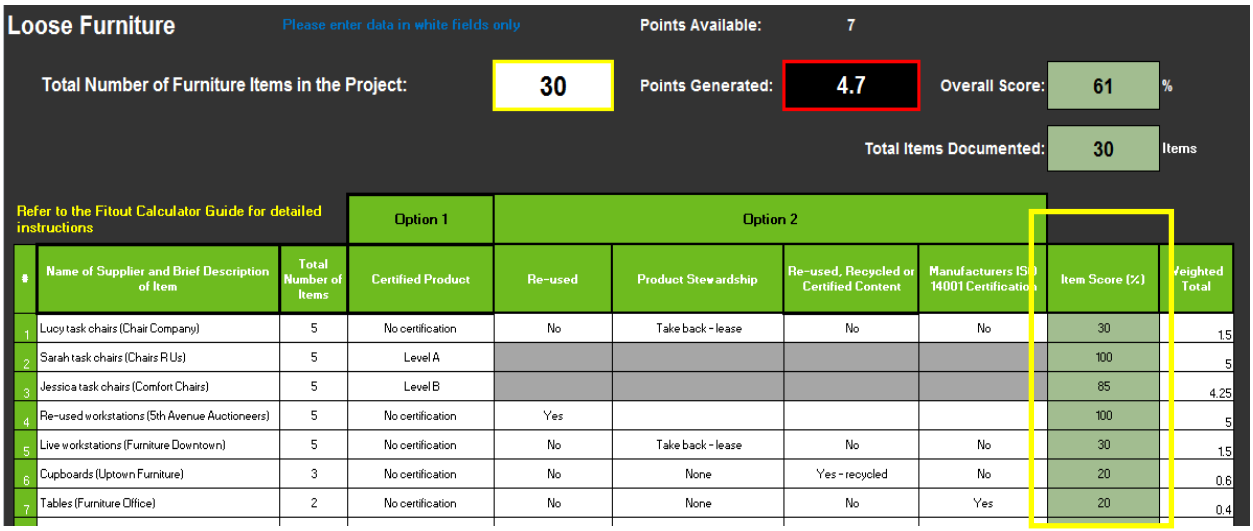
  Weighted item score = 30% x 5 = 1.5

- Item 6: Cupboards

  Weighted item score= 20% x 3 = 0.6

- Item 7: Tables

  Weighted item score = 20% x 2 = 0.4



Loose Furniture — Please enter data in white fields only — Points Available: 7

Total Number of Furniture Items in the Project: 30 — Points Generated: 4.7 — Overall Score: 61 % — Total Items Documented: 30 Items

Refer to the Fitout Calculator Guide for detailed instructions

#	Name of Supplier and Brief Description of Item	Total Number of Items	Option 1: Certified Product	Option 2: Re-used	Option 2: Product Stewardship	Option 2: Re-used, Recycled or Certified Content	Option 2: Manufacturers ISO 14001 Certification	Item Score (%)	Weighted Total
1	Lucy task chairs (Chair Company)	5	No certification	No	Take back - lease	No	No	30	1.5
2	Sarah task chairs (Chairs R Us)	5	Level A					100	5
3	Jessica task chairs (Comfort Chairs)	5	Level B					85	4.25
4	Re-used workstations (5th Avenue Auctioneers)	5	No certification	Yes				100	5
5	Live workstations (Furniture Downtown)	5	No certification	No	Take back - lease	No	No	30	1.5
6	Cupboards (Uptown Furniture)	3	No certification	No	None	Yes - recycled	No	20	0.6
7	Tables (Furniture Office)	2	No certification	No	None	No	Yes	20	0.4

Total of weighted scores = 1.5 + 5 + 4.25 + 5 + 1.5 + 0.6 + 0.4

= 18.25

Overall score = total weighted scores / total number of items

= 18.25 / 30

= 61%

Thus, the overall score for the Furniture calculator is 61%, which will appear in the 'overall score' field at the top right of the Furniture Calculator.

Step 3: Calculating the points generated

The points generated in a Calculator are determined by the overall score. In this example, 7 points are available. The points generated therefore = 61% of 7 points = 4.7

The 'Points Generated' will not automatically be recognised by the GBCSA unless the documentation requirements are submitted and deemed in accordance with the stipulations the documentation requirements.

INT-Mat-5 Wall Coverings

POINTS AVAILABLE 3

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Mat-6 Local Sourcing

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise the reduction of transport emissions, by using materials and products sourced within close proximity to the site.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

One point is awarded where:

- 50% of the project contract value is represented by materials and products that have been manufactured within South Africa

One point is awarded where:

- 20% of the project contract value is represented by materials and products that have been extracted, harvested, processed and manufactured within South Africa.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Short Report 2. Confirmation from supplier/manufacturer

Short Report prepared by a relevant project team member that describes how the Credit Criteria are met by:

- Providing a tabulated lists of all materials/products which are claimed as compliant with the Credit Criteria
- For each material/product, detailing all points of extraction and/or manufacture occur within South Africa, with reference to supporting documentation
- Providing calculations of the total value of the products, and percentage of total that demonstrate compliance with the Credit Criteria, with reference to supporting documentation

Confirmation from supplier/manufacturer, in the form of signed correspondence, for each compliant material or product confirming:

- The location of the extraction, harvesting or processing within South Africa
- The location of manufacturing within South Africa
- The quantity supplied to the project
- The weight of the product/material, where necessary

INT-Mat-6 Local Sourcing

POINTS AVAILABLE **2**

ADDITIONAL GUIDANCE

The project contract value is defined as the rand value that will be required to complete the works for the entire project. The following must be excluded from the contract value:

- Demolition works
- Consultants fees, design fees, project management fees
- Works outside the site area
- Any works relating to buildings or areas within the site that are not being assessed for purposes of Green Star SA.

Manufacturing is defined as the process in which a raw material is converted into a finished product. Assembly is not considered to be manufacturing. A material must have gone through a significant process of material conversion to be considered within the scope of 'manufacturing'.

Sufficient proof must be provided, showing all points of extraction, harvesting and processing or manufacturing, demonstrating that these points occur within South Africa. If only a fraction of a product or material has been extracted, harvested and processed or manufactured in South Africa, then only that portion (by weight) shall contribute towards credit compliance. The cost of the product must be pro-rated, based on the proportionality of the weight of the various components. For example, if the steel legs of an office desk, which have been manufactured in South Africa, weigh 80% of the desk total mass, then 80% of the desk's cost can contribute towards credit compliance.

In the case of reused or recycled products, the location from where the material was salvaged shall be equivalent to the point of extraction, and the location of the final vendor shall be the point of manufacture.

BACKGROUND

Local sourcing is defined to mean the use of construction materials that have been sourced within a certain geographic boundary or radius from a project site.

Local sourcing is a key consideration when attempting to deliver a project with environmentally responsible materials, delivering two important sustainability benefits. Buying locally means that there are fewer impacts in terms of road miles and air pollution. It also provides income to local businesses which help to support the local economy and provide employment opportunities, although this benefit is not addressed within this credit.

Transport emissions from the transport of products contribute to that product's embodied carbon. Suitably qualified professionals must make an informed decision as to whether using locally sourced, but high impact, materials is more environmentally beneficial than importing low impact materials, by looking at the project and context holistically.

REFERENCES & FURTHER INFORMATION

DEFRA, Carbon Emission Factors for Transport
http://naei.defra.gov.uk/data/ef-transport

Embodied carbon of materials

http://www.bsria.co.uk/information-membership/bookshop/publication/embodied-carbon-the-inventory-of-carbon-and-energy-ice/

BedZED materials report
http://www.bioregional.co.uk/files/publications/BedZEDMaterialsReportSummary.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Mat-7 Sundries Materials Sourcing

POINTS AVAILABLE **1**

AIM OF CREDIT

To encourage and recognise the selection of fitout finishes that have a reduced environmental impact when compared to available alternatives through responsible manufacturing, product stewardship and resource efficient design.

CREDIT CRITERIA

One point is awarded where 10%, by cost of total contract value, is comprised of nominated products and materials that contain one or more of the following responsible sourcing options:

- Manufactured in ISO 14001 certified facilities;

  OR

- Eligible for a take-back scheme;

  OR

- Contains reused or recycled content

If the materials that fall within the scope of this credit represent less than 1% of the project contract value, this credit is deemed 'Not Applicable'.

Note: The nominated products and materials are those that fall outside the scope of the fitout calculators as defined in more detail in the Additional Guidance.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA Submission Template 2. Copy of ISO 14001 certificate(s) 3. Copy of contract 4. Supporting evidence *If deemed non-applicable:* *5. Short report(2)*

GBCSA Submission Template prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Confirming the total contract value attributable to the materials specified in accordance with the information in the Additional Guidance
- Providing tabulated calculations that demonstrate credit compliance

Additionally for manufactured in ISO 14001 certified facilities:

- Confirming which materials have been manufactured in an ISO 14001 certified facility, and providing the name of the supplier

Additionally for a take-back scheme:

- Confirming which materials and products are eligible for a take back scheme

Additionally for reused / recycled:

- Confirming which materials and products are reused or contain recycled content

If deemed non applicable:

Short report(2) prepared by a suitably qualified professional that describes how the cost associated with the responsible content credit scope, as defined in the Additional Guidance, represents less than 1% of the total project contract value.

Copy of ISO 14001 certificate(s) that is current and valid from each manufacturer with a nominated compliant product or material

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A copy of the contract between the tenant and the manufacturer clearly:

- Stipulating the terms and conditions of the take back scheme, confirming the commitment to take back the quantity of the product or material supplied to the project;
- Nominating the intended reuse of the product/materials;
- Listing the manufacturers details - registered name, address, email address, telephone number and website as applicable.

Supporting evidence

Re-used products or content:

If purchased from a second-hand retailer, such as an auction house:

- purchase receipts/delivery receipts

If materials were used on the current site by a previous occupant or installed by a building owner as part of 'making good' prior to fitout works by the tenant:

- A statement from the interior designer or architect declaring that the items were in use onsite prior to the project works and that they have now been re-installed onsite

If materials were relocated to the site from the new tenant's, or occupant's, previous fitout or building:

- Mover's inventory from the previous location OR
- As built drawings or inventory/schedule showing clearly the items that have been re-used in the new fitout

Recycled content:

- Suppliers/Manufacturer statement of confirmation confirming the recycled claims as referenced in the short report

Certified content:

- Copy of the certification licence(s) or certificate for each material or item. The licence must be current at the time of installation and the certification scheme must be recognised by the GBCSA at level A, B or C.
- In the case of timber and bamboo products, a copy of the FSC or PEFC chain of custody certificates (CoC) must be submitted. See Calculator Guide for further guidance

INT-Mat-7 Sundries Materials Sourcing

POINTS AVAILABLE 1

ADDITIONAL GUIDANCE

Responsible content scope

The scope of this credit covers all materials not covered in the materials calculators. The following (but not limited to) are included in the scope of this credit:

- Mechanical installation (ducts, plant, pipes)
- Electrical installation (wiring, conduit, fittings/fixtures)
- General fixtures/fittings (e.g. ironmongery; blinds / curtains)
- Sanitary ware / brassware
- Structural adjustments (i.e. load bearing walls or ceiling adjustments)

Note that all costs associated with any items entered in the flooring, walling, assemblies and furniture calculator do not form part of the scope that this credit targets.

Project contract value

The project contract value is defined as the rand value that will be required to complete the works for the entire project. The following must be excluded from the contract value:

- Demolition works
- Consultants fees, design fees, project management fees
- Works outside the site area
- Any works relating to buildings or areas within the site that are not being assessed for purposes of Green Star SA.

ISO 14001

In order to comply, 80% of the mass of the product or materials must be sourced from manufacturing facilities that are certified to ISO 14001.

An ISO 14001 certification is a management system tool designed to help an organisation administer and control its Environmental impact and compliance with regulations. ISO 14001 does this by helping to develop and implement policies, objectives and processes. ISO 14001 certifications are verified by independent external auditors and need to be reviewed annually for compliance and to maintain their validity. ISO 14001 certified facilities will have certificates that demonstrate their certification, stipulating the period of validity and the external auditing party who verified the certification.

ISO 14001 certified Environmental Management System (EMS) ensure that organisations:

- Commit to environmental objectives and targets
- Identify key environmental impacts and aspects associated with their business operations as well as mitigation measures, if necessary
- Develop systems and procedures for documentation, reporting and auditing the key environmental impacts and aspects
- Track and monitor their water and energy usage, as well as their waste generation and materials utilizations, with the aim of continually improving environmental performance over time.

Manufacturing

A 'manufacturer' is the maker who delivers a finished product. If there are several key manufacturers for a given product, ISO 14001 certification will be required from each manufacturer. This does not include parties who process or extract raw materials e.g. foresters, miners, etc.

A 'manufacturing facility' is where product components are manufactured from raw materials, whilst the final product may be assembled in this facility, a manufacturing facility is not the same as the warehousing or assembly only facility.

Take back scheme

A take back scheme is a contract between a tenant and manufacturer, committing the manufacturer to taking back the material or product at its end of life, for the purpose of reusing or recycling the product as an input to a new value chain of goods. Take back schemes can either be part of formal programmes offered by manufacturers or suppliers, or they can be project specific arrangements. However, the nominated reuse of the product/material must be identified and clearly explained. The take back scheme needs to be a signed contract between both parties and cannot include exemptions related to limitations of timing of product return, or minimum quantity of product to be accepted.

Product stewardship is an environmental management approach that calls for increased responsibility by manufacturers, designers and consumers to consider the end of life impact of materials and products. Product stewardship can be achieved by several ways, take back schemes being ones of those. This approach acknowledges a shared responsibility in how we dispose of products and consider how the end of a products life will impact on the environmental and human health. This concept is alternatively referred to as extended product responsibility (EPR).

Reuse and recycled content

80% of the products or material, by mass, must be reused in order for its associated cost to qualify towards credit compliance. For example, a joinery installation weighing 10 kgs, in which 8 kgs is reused wood, will be deemed a compliant products and the total cost associated with the joinery installation can contribute towards credit compliance.

40% of the products or material, by mass, must represent recycled content, in order for its associated cost to qualify towards credit compliance.

If only certain components of a product are reused, or contain recycled content, the relative proportion of weight of the compliant components, in comparison to the products total weight, can be used to proportion the products total cost.

Resources

Within a finite natural world, there are limits to be respected by human activities when it comes to production, consumption and the generation of waste. At the core of this agenda is good resource management, and an important component is resource efficiency across a product's full life cycle. A key way to promote resource efficient design is to procure products and materials that contain reused and recycled content.

Several fit out items can be sourced from reused products. For example, light fittings and carpets, can be reused. Similarly, recycled content can be incorporated into most structural materials (concrete, steel and masonry).

BACKGROUND

Responsible sourcing of materials (RSM) is an approach of supply chain management, responsible manufacture and product stewardship, and encompasses social, economic and environmental dimensions. Products can be considered "responsibly sourced" if they have come from a supply chain which has developed systems and/or processes to respond to certain environmental and socio economic issues (or issues which are deemed relevant to their operations).

INT-Mat-7 Sundries Materials Sourcing

POINTS AVAILABLE **1**

REFERENCES & FURTHER INFORMATION

ISO 14001 website
http://www.iso.org/iso/home/standards/management-standards/iso14000.htm

Cement and Concrete Institute of South Africa (CNCI)
http://www.cnci.org.za

South African Institute of Steel Construction
http://www.saisc.co.za

Steel Recycling Institute (US)
http://www.recycle-steel.org

Environmental Protection Agency (EPA) Product Stewardship website
http://www.epa.gov/epawaste/conserve/tools/stewardship/index.htm

Australian Government Product Stewardship website
http://www.environment.gov.au/settlements/waste/product-stewardship/index.html

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Eco-1 Site selection

POINTS AVAILABLE 4

AIM OF CREDIT

To encourage and recognise tenants that choose to occupy buildings/sites that have inherent credentials that support environmental sustainability.

CREDIT CRITERIA

Up to 4 points are available for this credit based on the base building's environmental attributes and performance.

Environmental attributes of the base building

One point is awarded where:

- The base building has been certified using a compliant rating system that is recognised by a recognised Green Building Council.

OR

Up to 1.5 points are awarded where the base building has a Green Star SA – Design rating at the time of certification as follows:

- Green Star SA – Design 4 star rating for 0.5 point;
- Green Star SA – Design 5 star rating for 1 point;
- Green Star SA – Design 6 star rating for 1.5 points.

OR

Up to 2 points are awarded where the base building has a Green Star SA – As Built rating at the time of certification as follows:

- Green Star SA – As Built 4 star rating for 1 point;
- Green Star SA – As Built 5 star rating for 1.5 points;
- Green Star SA – As Built 6 star rating for 2 points.

Note that a project cannot claim both Design and As Built rating points, only one of the two.

Environmental performance of the base building

Up to 2 points are awarded where the base building has a Green Star SA – Existing Building Performance rating at the time of certification as follows:

- Green Star SA – Existing Building Performance 4 star rating for 1 point;
- Green Star SA – Existing Building Performance 5 star rating for 1.5 points;
- Green Star SA – Existing Building Performance 6 star rating for 2 points.

INT-Eco-1 Site selection

POINTS AVAILABLE 4

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Proof of certified rating

Proof of certified rating must take the form of either:

- A copy of the nominated rating certificate (Green Star SA or equivalent) for the building that clearly indicates the name of project, the achieved rating and year of certification;

OR

- A screenshot of the relevant page of the online directory of certified projects, found on the relevant Green Building Council's website.

ADDITIONAL GUIDANCE

The following Green Star SA Rating Tools are available for the design and construction of new buildings and refurbishments as well the operation of existing buildings:

- Green Star SA-Office V1
- Green Star SA-Retail Centre V1
- Green Star SA- Multi-Unit Residential V1
- Green Star SA- Public & Educational Building V1
- Green Star SA- Existing Building Performance V1

Certain information approved in previous certifications will be deemed acceptable as documentation requirements for this interiors rating assessment. Such documentation should be motivated by the project team via Credit Interpretation Request.

BACKGROUND

Although the Green Star SA- Interiors rating tool is concerned with the sustainability aspects of fitouts rather than those of base-buildings, it is important that the sustainable attributes and

performance of base buildings are considered at the fitout site selection stage. The Site selection credit recognises fitouts that have been developed within buildings where active steps have been taken to reduce negative environmental impacts as far as possible.

Green Star SA certification during building design, construction and operation indicate that building owners have already taken significant steps to protect the environment and conserve valuable resources, in addition to making available healthy indoor environments for building occupants. Green Star SA certified buildings deliver many economic benefits, such as reduced operating costs, enhanced asset value, improved productivity of building occupants, and optimized life-cycle economic performance.

REFERENCES & FURTHER INFORMATION

Green Building Council of South Africa
http://www.gbcsa.org.za/projects/certified-projects/

Green Building Council of Australia
http://www.gbca.org.au/project-directory.asp

US Green Building Council
http://www.usgbc.org/projects

UK Green Building Council
http://www.breeam.org/ & http://www.greenbooklive.com/search/scheme.jsp?id=202

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Emi-1 Impacts from refrigerants and insulants

POINTS AVAILABLE **3**

AIM OF CREDIT

To encourage and recognise the avoidance of substances that contribute to the deterioration and long-term alteration of the Earth's atmosphere

CREDIT CRITERIA

Up to three points are awarded independently as follows:

Ozone Depleting Potential (ODP)

Refrigerants

Half a point is awarded where:

- For qualifying equipment provided, all refrigerants/gases have an Ozone Depletion Potential (ODP) of zero;

  OR

- No qualifying equipment is provided.

Insulants

Half a point is awarded where:

- No ozone-depleting substances are associated with either the manufacture or composition of all insulation materials in the development.

Global Warming Potential (GWP)

Up to one point is awarded where:

- The minimum percentage (by mass) of the total refrigerant charge of qualifying equipment that have a Global Warming Potential (GWP100) of 10 or less, is awarded as follows:
  - 50% (by mass) for 0.5 points;

    OR

  - 100% (by mass) for one point

Refrigerant Fugitive Emission Management

Half a point is awarded where:

- HVAC systems containing refrigerants are;
  - Contained in a moderately air tight enclosure;

  AND

INT-Emi-1 Impacts from refrigerants and insulants

POINTS AVAILABLE **3**

- Are provided with a refrigerant leak detection system to cover high-risk parts of the plant;

OR

An automatic permanent refrigerant leak detection system is specified, which is NOT based on the principle of detecting or measuring the concentration of refrigerant in air.

An additional half point is awarded where:

- The half point above is achieved;

AND

- A refrigerant recovery system is installed that is:
  - Equipped with an automated pump-down system;

  AND

  - Sized to effectively and safely capture, isolate, and store 95% (by weight) of the maximum refrigerant charge.

Where no refrigerants are used in the project, OR if all refrigerants have an ODP of zero and a GWP of 10 or less, the point for refrigerant fugitive emission management is 'Not Applicable' and is excluded from the points available, used to calculate the Emissions Category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. Manufacturer product datasheet(s) OR Letter from supplier 3. Evidence of properties

GBCSA's Submission Template prepared by a suitably qualified professional that describes how the Credit

Criteria have been met by:

•Providing a tabulated summary of each qualifying equipment within the interior fitout, and the type and mass of refrigerant/gas charge in each;

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POINTS AVAILABLE 3

Additionally where ODP and/or GWP claimed: Confirming the compliance of refrigerants/gases (ODP/GWP as applicable);

• Where no qualifying equipment provided; confirming that no qualifying equipment is provided, with details of the alternative equipment (where applicable);

• Listing all insulation applications proposed within the fitout, confirming for each application that the Credit Criteria is met with reference to the supporting documentation;

Additionally where refrigerant fugitive emission management claimed:

• Outlining the design and intended operation of the refrigerant leak detection system(s);

• Where a refrigerant recovery system provided; describing the refrigerant recovery system;

Evidence of properties of the refrigerant/gas clearly demonstrating for each refrigerant/gas referenced in the short report, the generally accepted ODP/GWP as published within reputable sources (see References).

Manufacturer product datasheet(s) Or **Letter from supplier** for

• Each qualifying equipment as referenced in the short report, clearly identifying the equipment, the type and mass of refrigerant/gas charge; and/or

• Each applicable (i.e. non-woven) insulation product referenced in the short report, clearly demonstrating that the product is free of ozone-depleting substances in both manufacture and composition.

ADDITIONAL GUIDANCE

The Atmospheric Deterioration Avoidance credit addresses the significant greenhouse gas emissions that are associated with the use of refrigerants, and in particular their selection and leakage.

Qualifying Equipment

Qualifying equipment is considered as refrigerant-based refrigeration and heat-pump equipment, and gaseous fire suppression equipment provided within the scope of the main contract of the development, and includes, but is not limited to;

- Air conditioning equipment (including reverse-cycle heat pumps), unitary or otherwise;
- Heat-pumps for domestic hot water generation; and,
- Fire suppression equipment.

It must be clear from the documentation that all qualifying equipment has been accounted for, the refrigerant/gas type(s) identified and quantified, and the refrigerants/gases demonstrated as compliant with the Credit Criteria.

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POINTS AVAILABLE 3

Where qualifying equipment is not provided, the short report must describe the alternative equipment provided (e.g. domestic hot water heat-pump is not provided as heating provided by gas boilers), or explain that no alternatives are provided (e.g. building is naturally ventilated).

Hand-held fire extinguishers are excluded from the scope of the Credit Criteria.

For refurbishments and redevelopments, existing equipment which is to be reused must comply with the Credit Criteria.

Table Emi-1.1 (over page) provides ODP & GWP for some commonly used refrigerants and gases.

Refrigerant/Gas	Global Warming Potential (GWP100)	Ozone Depletion Potential (ODP)
R11	4000	1.0
R12	8500	0.83
R22	1700	0.05
R134a	1300	0
R407c	1600	0
R410a	1900	0
R290 (propane)	3	0
R600 (butane)	3	0
R1270 (propene)	3	0
Ammonia	<1	0
Halon 1211	1300	3
HFC227ea (FM200)	2900	0
IG541	0	0
CO_2	1	0
Air	0	0
Water	<1	0

Table Emi-1.1: *ODP & GWP of some common refrigerants and gases*

Currently there are no Chlorofluorocarbon (CFC) and Hydrochlorofluorocarbon (HCFC) refrigerants available which meet the ODP requirements of this credit. The points can, however, be achieved through the use of Hydrofluorocarbons (HFCs) or hydrocarbon-based refrigerants within qualifying equipment.

Ozone Depleting Potential & Global Warming Potential

The 100-year Global Warming Potential is considered for the purpose of the Green Star SA – Public & Education Building rating tool. The GWP provides a measure of the potential for damage that a

chemical has relative to 1 unit of carbon dioxide. GWP is used to describe Global Warming Potential over 100 years and is used by the UN Intergovernmental Panel on Climate Change (IPCC).

Examples of achieving the 50% replacement may include replacing the refrigerant in either the secondary loop or the compressor of a split or variable refrigerant flow system, but not in a chilled water system (as the secondary refrigerant is commonly water). Rewarding partial change replacement encourages the uptake of natural refrigerants in a wider range of circumstances.

The primary refrigerant is the refrigerant in the compressor (or the only refrigerant in a packaged system). A secondary refrigerant is one that transfers the heat from the conditioned space to the compressor.

Where no refrigerants are used within the development, full points may be claimed for the ODP component of the credit.

Insulants

The scope of the Credit Criteria addresses insulants manufactured using blowing agents only (e.g. rigid polystyrene, rigid polyurethane, polyolefins etc.).

Fibre-based woven insulation products (e.g. glass fibre, mineral wool, polyester etc.) and foil insulation are not within the scope of the Credit Criteria as these products are not manufactured using blowing agents. As such, manufacturer product datasheets are not required for fibre-based woven insulation nor foil insulation products.

Electrical conductivity insulation (e.g. wire or cable sheathing) is also excluded from the scope of the Credit Criteria.

Common applications of applicable insulation include, but are not limited to;

- Thermal insulation;
    - Chilled/hot water pipework;
    - Refrigerant pipework;
    - Ductwork;
    - Thermal storage vessels;
    - Envelope applications (walls, roofs, floors, spandrel panels);
- Acoustic insulation.

All common applications of insulation should be nominated within the short report and the type of insulation used nominated.

Refrigerant Fugitive Emission Management

If a number of different systems are installed on a project, the documentation must account for and describe all systems within the project.

Plant rooms must be ventilated to comply with the South African building regulations, and this requirement must continue to be met in buildings with refrigerant leak detection systems.

INT-Emi-1 Impacts from refrigerants and insulants

POINTS AVAILABLE 3

The Credit Criteria for refrigerant leak detection is applicable to negative-pressure refrigerants, as the Aim of Credit is to detect any leaks of refrigerant from the vessel at any time, including those that occur when the system is not in operation.

High-risk parts of the plant include plant rooms containing chillers and other equipment with refrigerants but do not include evaporator or condenser coils.

Method based on air-sensing of refrigerant leak

The equipment must be in a moderately air-tight enclosure to allow the concentration of leaked refrigerant to build up to a detectable level. The documentation must demonstrate that the location, size and intended operation of the sensors and openings within the enclosure will enable effective operation of the leak detection system, and will not prevent small refrigerant leaks being detected.

Method based on alternative detection of refrigerant leak

Full details must be provided of how the system will automatically detect a refrigerant leak, while not triggering an alarm due to normal variations in pressure etc. Such systems (for example based on sensing the presence of refrigerant vapour in liquid-carrying pipes) are now commercially available. Systems based on monitoring pressure drops within the pipe work are not necessarily compliant with the Green Star SA requirements. There are natural fluctuations to the pressure of the refrigerant due to changes in volume and temperature of the system, and to the ambient temperature of the surroundings. Low pressure and high pressure switches, which are standard equipment on refrigerant plant, are therefore not sufficient to award the credit.

Refrigerant detectors

For a new building, permanently installed multi-point sensing detectors are to be specified. Various types are available including corona discharge (hand held only and as such does not comply with the Green Star SA requirements unless a regular {at least once a week} monitoring system is confirmed), infrared, and semi-conductor.

Indicator dyes

Fluorescent or coloured dyes can be added to the refrigerant to show leakage sites. The use of the dye must be approved by the compressor manufacturer.

Halide torch detectors

This type of detection is only appropriate for chlorine-based substances such as CFCs and HCFCs. Compounds which do not contain chlorine (e.g. HFCs) cannot be detected by this method. Non-ozone-depleting refrigerants do not register on a halide torch leak detector.

Pump down

'Pump down' is the process of removing refrigerants from a refrigeration unit, and is usually undertaken to allow maintenance or repair of the unit. Automatic pump-down to either a separate storage tank or into the heat exchanger is acceptable but only where isolation valves are fitted to contain it once fully pumped down.

The provision of manual storage cylinders or any other system which is reliant on the diligence of the maintenance staff on site is not acceptable to achieve this credit.

Small packaged units

INT-Emi-1 Impacts from refrigerants and insulants

POINTS AVAILABLE 3

Small packaged units do not need to be fitted out with a leak detection system or a refrigerant recovery system as per the Credit Criteria for this credit if the total sum of refrigerants for these units is not more than 5% of the total refrigerant volume of the project. Where the exclusion is being claimed, a tabulated summary demonstrating that 100% of all refrigerants in the project have been accounted for must be provided at the time of submission. Small packaged units must still comply with the ODP & GWP requirements.

BACKGROUND

Building services have an impact on the amount of damage done to the ozone layer from Chlorofluorocarbons (CFCs) and Hydrochloroflourocarbons (HCFCs). These substances are used as refrigerants and blowing agents and have been known to cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun.

The use of Chlorofluorocarbons (CFCs) and Hydrochloroflourocarbons (HCFCs) as refrigerants has been addressed under the International Montreal Protocol, and subsequent phase-out programs have resulted in the removal of these substances from the market. Following the Montreal Protocol the production of CFCs are now banned. HCFCs are still ozone-depleting but have a much lower ozone depletion potential than CFCs, and are considered a transitional chemical to aid the CFC phase out. They are commonly used as refrigerants, solvents, and blowing agents for some plastic foam insulations, and are scheduled to be completely phased out by 2030 according to the US Environmental Protection Agency and the Montreal Protocol. The replacements currently favoured by the industry are Hydrofluorocarbons (HFCs) which still have a high global warming potential (GWP).

Hydrofluorocarbons (HFCs), are also used as blowing agents for manufacturing foam insulation and have the advantage of being non-ozone-depleting (since they don't contain chlorine or bromine), but they are significant greenhouse gases. Most HFCs are also expensive to manufacture. An alternative is a hydrocarbon blowing agent, usually pentane.

Global Warming Potential (GWP)

The GWP provides a measure of the potential for damage that a chemical has relative to one unit of Carbon Dioxide, the primary greenhouse gas. Figures in excess of 3000 times are not uncommon amongst some refrigerants currently specified. Their long half-life is a major contributory factor in this.

Hydrocarbons and ammonia-based refrigerants have low or zero GWP. As such they are preferable long-term options. These refrigerants are gradually becoming available and are valid alternatives to HFCs. Note that if using Ammonia refrigerant, a Health & Safety risk assessment must be carried out since it is corrosive and hazardous if released in large quantities. However, due to its pungent smell, leaks are normally detected before they reach hazardous concentrations.

Ozone Depleting Potential (ODP)

Ozone depletion is measured as the Ozone Depleting Potential (ODP) of a product, and is dependent on its chlorine content, plus factors such as molecular durability. The ODP data provides a measure of the potential for damage that a chemical has relative to that of the refrigerant type CFC11. CFC11 has an ODP of 1 and is the most damaging of the CFCs.

Refrigerant Fugitive Emission Management

INT-Emi-1 Impacts from refrigerants and insulants

POINTS AVAILABLE 3

It is common practice during the maintenance of HVAC systems containing refrigerants to dispose of the refrigerants in the system, where an automatic system of refrigerant containment is not included in the system design. This large release of refrigerants to the atmosphere can cause significant environmental damage, particularly if the refrigerants have a high ozone depletion or global warming potential.

Refrigerants with an ozone depletion potential (ODP) of zero can still cause considerable damage to the environment in terms of accelerating global warming. The specification of automatic refrigerant pump down in addition to leak detection can further limit potential losses and damage to the environment, and can also have subsequent economic benefits to the building owner.

REFERENCES & FURTHER INFORMATION

Guidance note 1 New CFC's, HCFCs, HFC's and halons, Professional and practical guidance on substances that deplete the ozone layer, CIBSE, 2000.

Code of practice for the minimisation of refrigerant emissions from refrigerating systems, Institute of Refrigeration, Institute of Refrigeration, 1995.

Thermal Guidelines for Data Processing Environments, ASHRAE, 2004. BS EN378-1:2000 Refrigerating systems and heat pumps – Safety and environmental requirements – Part 1: Basic requirements, definitions, classification and selection criteria, BSI, 2000.

Institute of Refrigeration
http://www.ior.org.uk

F-gas regulations
http://ww2.defra.gov.uk/environment/quality/air/fgas/

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH) (2003), Refrigerant Selection Guide 2003. Melbourne
http://www.airah.org.au

United Nations Environmental Program Ozone Secretariat.
www.unep.org/ozone

US Environmental Protection Agency
http://www.epa.gov/ozone/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-Emi-2 Light Pollution

POINTS AVAILABLE **1.5**

AIM OF CREDIT

To encourage and recognise interior fitouts that minimise light pollution into the night sky.

CREDIT CRITERIA

Internal light sources

One point is awarded where:

- The tenant's lighting and light sources are automatically turned off when the space is not occupied. This can be achieved through a timer or occupancy sensors.

External light sources

Half a point is awarded where:

- The impact from light pollution from external sources, including signage, is minimised.

For tenants that don't have external lighting or illuminated signage, this credit is 'Not Applicable' and is excluded from the points available.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. GBCSA's Submission Template 2. As-built drawing(s) *Where external lighting is present, in addition to the above:* 3. As-built luminaire schedule and detail documentation OR Calculation Plots

GBCSA's Submission Template prepared by a suitably qualified professional that describes the submission for this credit. The short report should detail:

- The points/parts of the credit being claimed; and
- A short description of how each of the credit criteria is being met, with a correlation to the documentation submitted as required in the documentation requirements

As-built drawing(s) showing the location of any relevant luminaires, awnings, blinds, windows, sensors, timers, skylights, etc., as required.

As-built luminaire schedule and detail documentation for all external lighting, nominating the type of light fitting, light distribution in the mounting orientation chosen and quantity of each luminaire, including the relevant photometric data, together all of which shows that the luminaires do not have an upward light output ratio that exceeds 5%

Calculation Plots for all external lighting, showing that all grid points on the calculation plane return a maximum reading of 0.5 Lux to the site boundary and no greater than 0.1 Lux to 4.5m beyond the site into the night sky.

ADDITIONAL GUIDANCE

Internal light sources

This criterion only applies to the time during which the project is not regularly occupied. For example, if a project is occupied for a partial time at night (say, a restaurant), the credit is only applicable from the time the project is unoccupied (after closing hours) to the morning.

Exceptions

The following may be excluded from the requirements of this credit criterion:

- Signage related to emergency exits;
- Emergency lighting that only illuminates in the event of an emergency or power failure; and
- Safety lighting.

The impact from light pollution from internal sources must be eliminated as far as possible. There are two methods for achieving this, both methods are prescriptive.

Option A
The project lighting and light sources are automatically turned off when the project is not occupied.

The lights can be turned off either by a timer or through occupancy sensors. If the lights are turned off by a timer, these must turn off no later than an hour after closing time. If turned on by a sensor, the lights must turn off 15 minutes after no occupancy is detected. In both cases, a manual override can be present; however, the lighting must turn itself off one hour after a manual override.

A strategy for manually turning off all lights does not address this criterion.

It is also noted that janitor services are not considered regular occupation. In this case, lights can be turned on while cleaning occurs, though they must turn back off once cleaning has been completed.

In fitouts that are designed for 24 hour or nightly use this option is not relevant.

Option B
The project automatically blocks off all light coming from the fitout to the outside. This can be achieved through blinds with a minimum VLT of 10, or, through automated external louvers, or other similar means which achieve the same outcome. The method by which light is blocked off must be in place from closing time.

External light sources

There are two methods for achieving this, a prescriptive method, and a performance method.

Option A

Relative to its particular mounting orientation, no external luminaire or external light source has an Upward Light Output Ratio that exceeds 5%. Project teams must show that the Upward Light Output Ratio (ULOR) provided in the compliance documentation, is given relative to the mounting orientation of the luminaire. A luminaire with an ULOR ratio as nominated in a manufacturer's data sheet will have a different ULOR ratio when the mounting orientation of the luminaire is changed. In the event that any external luminaire is mounted in an orientation other than the one assumed by the manufacturer, the ULOR must be recalculated as part of the submission.

Awnings (or other roof or shading covers)

Awnings can be used as a means of achieving compliance with the 5% ULOR requirement where a section drawing showing the light output of the luminaire can be provided, and where the awning has the effect of blocking 95% of the output of the lamp above the horizontal. Where it is not clear that the awning is a permanent structure, points of this credit may not be awarded. Awnings in this sense refer to any permanent type of roof or shading covers that would limit the amount of light escaping to the night sky.

Upward Light Output Ratio

"Upward Light Output Ratio" is defined as per AS1158.0:2005 being: The ratio of the luminous flux emitted by a luminaire above the horizontal to that emitted by the lamp. Note that the luminous flux is measured in lumens.

Option B

Direct illuminance from external luminaire or external light source produces a maximum initial point illuminance value no greater than 0.5 Lux at the site boundary and no greater than 0.1 Lux at 4.5 metres beyond the site into the night sky, when modelled using a horizontal calculation plane set at the highest point of the building.

Calculation plane

The calculation plane must cover the area between the site boundary and building façade or vertical service to be illuminated. The horizontal calculation plane should be set at top of the building fabric – excluding spires. Calculation plane grid points to be in 0.5m spacing. All illumination results to be reported to 2 decimal places. Calculation plane 1 to extend to site boundary – maximum 0.50 Lux direct illumination at any point using initial lamp lumens. Calculation plane 2 to extend from the site boundary to 4.5m beyond the site boundary – maximum 0.10 Lux direct illumination at any point using initial lamp lumens.

Additional notes for this criterion

Perimeter lighting (or perimeter light sources) in a shop-front that is coming from inside the tenancy can be treated as either internal lighting, or external lighting. Regardless of how it is treated, the lighting or light sources cannot be excluded. Only light that is installed as part of the project scope, or that exclusively serves the tenant (say, as part of a terrace) is required to comply with the external lighting requirement. The exception to this is external signage in the building, if the external signage rights are owned by the applicant the signage must be included.

Exceptions/Exclusions

The following may be excluded from the requirements of this credit criterion:

- Signage related to emergency exits;

- Emergency lighting (external) that only illuminates in the event of an emergency/power failure; and
- Safety lighting.

External emergency lighting that is integrated into the general external lighting scheme must comply with the requirements of the credit. E.g. lights that act as general lighting but have a battery pack to ensure that they stay on in the event of a power failure

BACKGROUND

Light travelling up into the night sky (sky glow) or spilling on to neighbouring properties is a form of pollution. Lowering light pollution levels help reduce disruptions to the habits of animals within and around a site. The Light Pollution credit rewards best practice lighting as it relates to a fitout. All lighting associated with a fitout, be it internal or external is assessed and in some fitouts, light emanating from signage may also be included.

Light pollution harms the environment in many ways:

- Effect on migratory birds - nocturnal birds use the moon and stars for navigation and can become disorientated. In the US birds often crash into brilliantly-lit broadcast towers or buildings, or circle them until they drop from exhaustion;
- Disrupting biological rhythms and otherwise interfering with the behaviour of nocturnal animals and insects;
- Urban sky glow hinders professional and amateur astronomy and deprives the public of its view of the night sky; and
- Additional greenhouse gasses are emitted merely to light the night sky.

REFERENCES & FURTHER INFORMATION

The Dark Sky Society (2009), Guidelines for Good Exterior Lighting Plans
http://www.darkskysociety.org/handouts/LightingPlanGuidelines.pdf

U.S. Department of Energy, Federal Energy Management Program (2010), Exterior Lighting Guide
http://www.everlastlight.com/download/pdfs/everlast/DOE_FEMP_Exterior_Lighting_Guide.pdf

Institution of Lighting Professionals (2011), Guidance for the Reduction of Obtrusive Light
www.theilp.org.uk/documents/obtrusive-light/

CIBSE Lighting Guide 6: 1992, The Outdoor Environment Chartered Institute for Building Service Engineers
http://www.cibse.org

International Dark-Sky Association
http://www.darksky.org

Scottish Executive (2007), Controlling Light Pollution and Reducing Lighting Energy Consumption, Scottish Executive, Edinburgh, Scotland
http://www.scotland.gov.uk/Resource/Doc/170172/0047520.pdf

INT-Emi-2 Light Pollution

POINTS AVAILABLE **1.5**

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

INT-INN-1 Innovative Strategies and Technologies

POINTS AVAILABLE **10**

AIM OF CREDIT

To encourage and recognise pioneering initiatives, processes or strategies in sustainable building management and operations

CREDIT CRITERIA

Up to two points are awarded for an innovation initiative where:

- The initiative improving environmental performance is a technology or process that is considered a 'first' or 'early adopter' in South Africa or in the World;

OR

- The initiative substantially contributes to the broader market transformation towards sustainable development in South Africa or in the World.

Points are awarded as follows:

- One point is awarded when either of the above is true for the South African market;

OR

- Two points are awarded when either of the above is true for the Global market

Up to ten innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than two points in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one fitout assessment under Inn-1, Inn-2 and Inn-3 is ten (in total). Where projects target the initiative as a 'first' or 'early adopter' the first 10 (ten) Green Star SA - Interiors projects applying that initiative will be permitted to be awarded innovation points.

Refer to the GBCSA's innovation register on their website to see whether an innovation initiative has reached its capacity of 10 projects under a certain rating tool (https://www.gbcsa.org.za/rating-tools/innovation-category/).

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Short report

INT-INN-1 Innovative Strategies and Technologies

POINTS AVAILABLE **10**

Short report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative;
- Articulating the nature and magnitude of the environmental benefit achieved by the initiative(s);
- Referencing evidence and calculations, wherever appropriate, that support all claims; and
- Including any evidence necessary to demonstrate that the innovation claimed is first in the world or in South Africa (must be in the form of extracts from a peer-reviewed publication or other research acknowledgement).

Page limit of Short Report per innovation initiative targeted: the maximum allowed number of pages that will be permitted (and therefore read by the GBCSA) will be 20 pages (including all supporting documents)

ADDITIONAL GUIDANCE

Innovation points are reviewed and awarded entirely at the discretion of the GBCSA, and any decision is final.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The report must distinctly justify and quantify the environmental or advocacy benefits of the initiative. Submissions that are purely qualitative or unsupported by documented data related to the specific initiative will not be awarded Innovation points, regardless of innovative the initiative is.

In reviewing the submission, the GBCSA will consider the environmental benefit of the innovative initiative relative to existing Green Star SA – Interiors credits where relevant.

The metric used to demonstrate environmental benefit must, where possible, be the same as the metrics used in Green Star SA for similar attributes.

Information provided within the Innovation Credit applications may be used by the GBCSA to review the existing credits and/or develop new credits.

BACKGROUND

Green Star SA consists of categories, credits and benchmarks for various green building aspects that acknowledge integrated sustainable design/construction/operation - buildings are

INT-INN-1 Innovative Strategies and Technologies

POINTS AVAILABLE **10**

however complex and dynamic systems, and thus it is impossible for Green Star SA to address everything possible in the rating tools that always adequately rewards projects for innovative design, construction and operation. For this reason the Innovation category exists to allow projects to be rewarded and recognised for initiatives that are either beyond current Green Star SA benchmarks or not covered within the relevant rating tool.

The GBCSA encourages projects to go beyond what Green Star SA requires, to think 'out the box' in terms of sustainable design, construction and operation in the built environment, and the GBCSA will reward and recognise projects that do so, and are able to document the initiative appropriately.

REFERENCES & FURTHER INFORMATION

The Building Research Establishment Innovation Den
http://www.bre.co.uk/innovationden

The South African Government Department of Environmental Affairs & Tourism
http://www.environment.gov.za

The South African Government Department of Science & Technology (Research & Development Tax incentives)
http://www.dst.gov.za/r-d

The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
http://www.earthlife.org.za/

The Sustainable Energy Society Southern Africa
http://www.sessa.org.za/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata that have been issued for this credit.

INT-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE **10**

AIM OF CREDIT

To encourage and recognise projects that achieve environmental benefits in excess of the current Green Star SA benchmarks

CREDIT CRITERIA

Up to two points are awarded where there has been a substantial improvement on an existing Green Star SA credit, as follows:

- One point for a solution that results in the elimination of the specific negative environmental impact of the project targeted by an existing credit; and
- Two points for a solution that results in a substantial (e.g. 5% or greater above 'neutral') restorative environmental impact targeted by an existing credit.

Refer to the table in Additional Guidance to see for which Green Star SA credits these innovation points can be targeted, and what the required thresholds are for the relevant credits.

Up to ten innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than two points in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one fitout assessment under Inn-1, Inn-2 and Inn-3 is ten (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Short report

Short report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative;
- Identifying the credit for which the project claims to exceed the Green Star SA benchmark;
- Substantiating why exceeding the top benchmark has a positive environmental impact;
- Quantifying, consistent with the approach of the credit with the initial benchmark, the margin by which the benchmark is exceeded; and

- Referencing evidence and calculations, wherever appropriate, that supports all claims.

Page limit of Short Report per innovation initiative targeted: the maximum allowed number of pages that will be permitted (and therefore read by the GBCSA) will be 20 pages (including all supporting documents).

ADDITIONAL GUIDANCE

Innovation points are reviewed and awarded entirely at the discretion of the GBCSA, and any decision is final.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The report must distinctly justify and quantify the environmental or advocacy benefits of the initiative. Submissions that are purely qualitative or unsupported by documented data related to the specific initiative will not be awarded Innovation points, regardless of innovative the initiative is.

In reviewing the submission, the GBCSA will consider the environmental benefit of the innovative initiative relative to existing Green Star SA – Interiors credits where relevant.

The metric used to demonstrate environmental benefit must be the same metric as the one used in the Green Star SA – Interiors credit that is being exceeded. For example if the fitout significantly reduced potable water consumption the metric used must be 'in L/person/day'.

In reviewing the submission, the GBCSA will consider how many points are awarded for the credit being exceeded, the relative environmental benefits and relative score as compared to other Green Star SA – Interiors credits.

This innovation credit applies to:

- Existing Green Star SA credits with numeric benchmarks;
- Credits where the highest threshold within the credit is set below 95%; and
- Credits where exceeding the current Green Star SA benchmark would have an environmental benefit (e.g. a larger recycling waste storage area may not have additional benefit).
- The Green Star SA credits where the above conditions apply are shown in the table below (with their corresponding thresholds to achieve points under this innovation credit):

Note that where credits are not listed in the table below, that credit cannot be targeted under this credit.

INT-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE **10**

Credit	Threshold required to eliminate environmental impact (1 point)	Threshold required to have restorative environmental impact of at least 5% (2 points)
Man-1 Accredited Professional	Full professional team is Accredited Professionals under the Interiors AP qualification	Not available
Man-5 Construction Waste Management	100% of demolition and construction waste is diverted from landfill	Not available
IEQ-4 Visual Comfort: Daylight criterion	100% of the nominated area meets a Daylight Factor (DF) of at least 2.0%	Not available
	100% of the nominated area meets a Daylight Illuminance (DI) of at least 250 lux as measured at finished floor level (FFL) under a Uniform Design Sky	Not available
	100% of the nominated area meets a Daylight Illuminance of at least 300 lux based on an annual dynamic simulation model, for 50% of the standard occupied hours (Daylight Autonomy (DA) incremental method).	Not available
IEQ-4 Visual Comfort: External Views criterion	100% of the nominated area has a direct line of sight to a high quality internal or external view.	Not available

INT-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE **10**

IEQ-6 Reduced exposure to air pollutants	For all three categories of products under this credit all products used on the project have zero VOCs.	Not available
Ene-1 Greenhouse Gas Emissions	The fitout is a net zero energy tenancy (energy neutral) -	The building is a net positive energy building, and produces at least more than 5% of its energy demand that is used on a neighboring project or fed into the supply grid.
Tra-1 Commuting Mass Transport	The project is located within 1000m walking distance of at least 4 different modes of public transport stops	Not available
Tra-2 Local Connectivity	The project is located within 1000m unimpeded walking distance of at least ten amenities in compliance with the credit criteria	Not available
Tra-3 Alternative Transport	All of the tenant parking spaces provided are designated for mopeds, scooters, motorbikes, carpooling and/or electric vehicles in compliance with the credit criteria	Not available
Wat-1 Occupant Amenity Water	The fitout is a net zero water tenancy (water neutral).	The fitout is a net positive water tenancy, and produces at least more than 5% of its water demand that is used on a neighboring project or fed into the water supply network.
Mat-2 Furniture	Not available	All Furniture is reused and the project has a

INT-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE **10**

		surplus of reusable furniture (5% or more of the total reused furniture value) that is committed to another fitout project.
Mat-3 Assemblies	Not available	All Assemblies is reused and the project has a surplus of reusable assemblies (5% or more of the total reused assemblies value) that is committed to another fitout project.
Mat-4 Flooring	Not available	All Flooring is reused and the project has a surplus of reusable flooring (5% or more of the total reused flooring value) that is committed to another fitout project.
Mat-5 Wall Coverings	Not available	All Wall Coverings are reused and the project has a surplus of reusable wall coverings (5% or more of the total reused wall coverings value) that is committed to another fitout project.
Mat-6 Local Sourcing	100% of the projects material and labour is sourced from within South Africa	Not available

INT-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE **10**

BACKGROUND

Green Star SA consists of categories, credits and benchmarks for various green building aspects that acknowledge integrated sustainable design/construction/operation - buildings are however complex and dynamic systems, and thus it is impossible for Green Star SA to address everything possible in the rating tools that always adequately rewards projects for innovative design, construction and operation. For this reason the Innovation category exists to allow projects to be rewarded and recognised for initiatives that are either beyond current Green Star SA benchmarks or not covered within the relevant rating tool.

The GBCSA encourages projects to go beyond what Green Star SA requires, to think 'out the box' in terms of sustainable design, construction and operation in the built environment, and the GBCSA will reward and recognise projects that do so, and are able to document the initiative appropriately.

REFERENCES & FURTHER INFORMATION

The Building Research Establishment Innovation Den
http://www.bre.co.uk/innovationden

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http://www.environment.gov.za

The South African Government Department of Science & Technology (Research & Development Tax incentives)
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The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
http://www.earthlife.org.za/

The Sustainable Energy Society Southern Africa
http://www.sessa.org.za/

TECHNICAL CLARIFICATIONS

There are currently no technical clarifications that have been issued for this credit.

INT-INN-3 Environmental Design Initiatives

POINTS AVAILABLE **10**

AIM OF CREDIT

To encourage and recognise sustainable design initiatives, processes or strategies that are currently outside of the scope of this Green Star SA rating tool but which have a substantial or significant environmental benefit.

CREDIT CRITERIA

One point is awarded where:

- An initiative in the project viably addresses a valid environmental concern outside of the current scope of this Green Star SA tool.

Up to ten innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than one point in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one building assessment under Inn-1, Inn-2 and Inn-3 is ten (in total).

Refer to the list of Innovation Challenge Credits that can be targeted under this credit, found on the GBCSA website at https://www.gbcsa.org.za/rating-tools/innovation-category/.

DOCUMENTATION REQUIREMENTS

Green Star SA – Interiors
Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Any other relevant documentation requirements that form part of the credit-specific documentation requirements

Short report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative and proposed credit;
- Demonstrating that the proposed credit requirements have been met by the project;
- Justifying how this credit would be different to other existing Green Star SA credits, and why it deserves to be included in Green Star SA;
- Articulating the nature and quantifying the environmental benefit achieved by the initiative(s);
- Referencing evidence and calculations, wherever appropriate, that support all claims; and
- Following the format set out in the Green Star SA credits to:

- Identify the category that would hold this credit;
- Propose the Aim of the Credit; and
- Establish Credit Criteria and outline Documentation Requirements, based on research and comparison with other credits within that category, which would be sufficient for demonstrating compliance.

Page limit of Short Report per innovation initiative targeted: the maximum allowed number of pages that will be permitted (and therefore read by the GBCSA) will be 20 pages (including all supporting documents).

Additional documentation requirements: provide any other relevant documentation requirements that form part of the credit-specific documentation requirements

ADDITIONAL GUIDANCE

Innovation points are reviewed and awarded entirely at the discretion of the GBCSA, and any decision is final.

The significance of the environmental benefit of the nominated innovation must be calculated and clearly conveyed in the submission. This credit is aimed at initiatives that provide an environmental benefit and have not been addressed by existing Green Star SA Office Credit Criteria.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The reports must distinctly justify (and quantify whenever relevant) the environmental benefits of the initiative.

In essence, the report for this credit must advocate that the initiative(s) claimed for this credit be addressed by a new credit within Green Star SA.

It must be demonstrated that there is a quantified significant environmental benefit associated with the nominated innovation initiative and that it is clearly documented and integrated into the project.

Where this credit is claimed, projects must justify how this innovation initiative differs from other existing Green Star SA credits in the rating tool, and why it deserves to be included in Green Star SA for this building type. To do this, the initiative must meet the following criteria, at a minimum:

- Address a valid environmental concern;
- Be at or beyond ‘best practice’ for the current South African context;
- Be quantifiable and capable of being assessed without subjective interpretation

INT-INN-3 Environmental Design Initiatives

POINTS AVAILABLE **10**

BACKGROUND

Green Star SA consists of categories, credits and benchmarks for various green building aspects that acknowledge integrated sustainable design/construction/operation - buildings are however complex and dynamic systems, and thus it is impossible for Green Star SA to address everything possible in the rating tools that always adequately rewards projects for innovative design, construction and operation. For this reason the Innovation category exists to allow projects to be rewarded and recognised for initiatives that are either beyond current Green Star SA benchmarks or not covered within the relevant rating tool.

The GBCSA encourages projects to go beyond what Green Star SA requires, to think 'out the box' in terms of sustainable design, construction and operation in the built environment, and the GBCSA will reward and recognise projects that do so, and are able to document the initiative appropriately.

REFERENCES & FURTHER INFORMATION

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The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
http://www.earthlife.org.za/

The Sustainable Energy Society Southern Africa
http://www.sessa.org.za/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata that have been issued for this credit.