



TECHNICAL MANUAL GREEN STAR SA

OFFICE DESIGN & AS BUILT v1.1



TECHNICAL MANUAL GREEN STAR SA OFFICE DESIGN & OFFICE AS BUILT VERSION 1.1 2014

On the cover:

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Rating Achieved: 4 Star

Green Building Council South Africa

Green Star SA – Office Design & Office – As Built v1.1 2014 Technical
Manual

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Introduction

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All sections can be downloaded individually from the Certification Engine. Please note individual dates as references to last update for each credit.

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Authorisation and Disclaimer

Authorisation and Disclaimer

The Green Star SA Rating System and the rating tools have been developed with the assistance and participation of representatives from many organisations. The rating tools are subject to further development in the future. The views and opinions expressed in this Technical Manual have been determined by the GBCSA and its Committees.

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This Technical Manual is no substitute for professional advice. You should seek your own professional, and other appropriate, advice on the matters addressed by it.

As a condition of use of this Technical Manual, you covenant not to sue, and agree to release the GBCSA, its officers, agents, employees, contractors (including any Assessor, any member of the Technical Working Group and any Independent Chair) and its members from and against any and all claims, demands and causes of action for any injury, loss, destruction or damage (including, without limitation, equitable relief and economic loss) that you may now or hereafter have a right to assert against such parties as a result of your use of, or reliance on, this Technical Manual.

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Acknowledgements

Acknowledgements

GREEN STAR – OFFICE V1.1 2014

The Green Star SA – Office v1.1 rating tool provides for both Green Star SA – Office Design and Green Star SA – Office As Built ratings, through separate documentation paths. The tool has been updated from the original version 1.0 released in 2008, which in turn was adapted from the Australian Green Star – Office v3 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 – Office v1 rating tool.

SPONSORSHIP

SA Cities Network and the GBCSA founding members provided much-needed financial support to develop the Green Star – Office v1 rating tool and this Technical Manual for the commercial office sector.

SUPPORT

The Green Building Council of South Africa acknowledges the tremendous 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. The GBCSA would particularly like to thank CEO Romily Madew, Green Star Executive Director Robin Mellon, and National Technical Manager for Tool Operations Elena Bondareva.

ADDITIONAL EXPERTISE

The GBCSA also thanks all the individuals and organisations who provided feedback and expertise to the technical development of the Green Star SA – Office v1 rating tool and Technical Manual. Their advice and guidance is greatly appreciated.

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Change Log

The GBCSA reserves the right to correct errors and omissions in the Green Star SA - Office 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 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
01 April 2009	Added "na" clause and functionality to Man-1 Green Star SA Accredited Professional; Error message in column J revised to provide an error when anything other than a number or "na" is entered into the Number of Points Achieved column of credits with not applicable clauses; Fixed error in water calculator, rainwater harvesting section, to include the capacity of the rainwater tank into the calculation of potable water reduction due to rainwater harvesting.
21 September 2009	Deleted "petrol/diesel" from "All petrol/diesel generators . . ." in the second bullet point of Emi-9 Credit Criteria; Corrected math error in the "Sub-total weighted points achieved" value on the Credit Summary page; Corrected math error in the calculation of "Predicted Indoor tap Water Consumption from calculation L/day/m2" for indoor taps in the Potable Water Calculator; Added fire protection to the list of building services specifically called out in the Man-2 credit criteria, to match the Technical Manual information;
06 November 2009	Changed colour scheme of tool to match new Green Star SA branding; Revised Mat-11 Credit Criteria to make it more clear that the second point is not contingent upon the first point being achieved: changed "An additional point is awarded where" to "One point is awarded where"; Corrected typographical error in IEQ-2 Credit Criteria for naturally ventilated spaces to say "for at least 95% of each space" rather than "for at least 90% of each space";
26 April 2010	Eco-0 Conditional Requirement revised as per Retail Centre v1 tool; General formatting revised and category summary added to all category spreadsheets;
05 May 2010	Useable area (UA) link from 'Building Input' sheet to 'Potable Water Calculator' sheet corrected;
02 June 2010	Potable water calculator errors corrected and updated for flexibility (to align with GSSA Retail Centre v1 PWC); Energy calculator format changed; Conditional requirement formats changed.
01 July 2010	Corrected error messages in 'Energy Calculator', 'Innovation' and 'Credit Summary' sheets.
01 July 2010	Minor change to hot water energy use calculation in 'Energy Calculator' to match Energy Calculator and Modelling Protocol Guide.
26 July 2010	Corrected error in 'Energy Calculator' caused by missing calculation cells. Removed reference to Green Star SA - Retail Centre v1 Technical Manual in 'Energy' sheet.
17 January 2011	Split Man-6 credit to allow for a divide in achievable points.
27 September 2011	Corrected error in 'Energy Calculator' relating to 'on site

Acknowledgements

	generation' calculations.
19 July 2012	Added Mpumalanga to 'Building Input' tab.
10 August 2012	Error corrected in potable water calculator with respect to links to sewage calculator.
01 September 2012	R1 & R2 Pre-Submission checklists added. Applicant Declaration added.
17 January 2013	Deleted "Retail Centre" and replaced with "Office" in the ECO-0 Conditional requirement comments
12 January 2013	Added Revised credit criteria for EMI-05 Water Pollution applicable for all projects registered after 08 November 2012
13 March 2013	Added in R1 and R2 Pre-Submission Checklist that all documents (each page) is labelled to indicate which Documentation Requirement it is submitted towards. Added several dates under Building Input. Added in R2 Pre-Submission Checklist that project team must submit 2 x images/renderings of project in the general section Added extra space for additional descriptions of sanitary fittings in Potable Water Calculator.
13 November 2013	Corrected error in the Potable Water Calculator calculations
25 November 2013	Corrected error in the Potable Water Calculator calculations
22 August 2014	Added extra space for additional descriptions of sanitary fittings in Potable Water Calculator.
14 November 2014	All erratum to date incorporated into credits
14 November 2014	All TC/CIR relevant to each credit issued to date included at the end of each credit
14 November 2014	Modelling Protocols added to end of each relevant credit
14 November 2014	IEQ 1 and IEQ 2 combined as per PEB, ventilation rates updated accordingly
14 November 2014	IEQ-4 Daylight Modelling updated to allow for additional methods as per PEB
14 November 2014	IEQ-6 High Frequency Ballasts credit omitted
14 November 2014	ENE-1 Energy Modelling Protocol updated
14 November 2014	ENE-1 Vertical transport and escalator calculator added as a separate sheet
14 November 2014	MAT-7 PVC Minimisation credit omitted

Green Star SA Credits

Green Star SA Credits

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 of development.

Green Star SA will have rating tools for different phases of the building lifecycle (design, construction, operations, refurbishment or fit-out) 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.

Green Star SA Credits

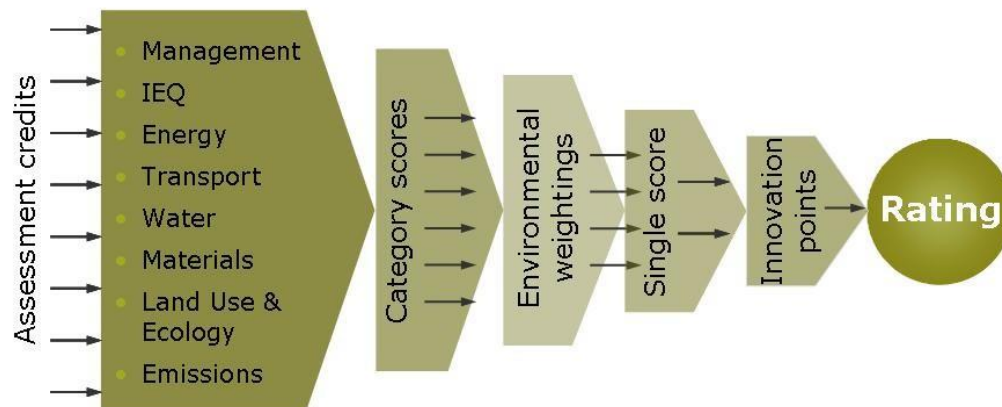


Figure 1: Structure of the Green Star SA rating system

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.

The categories are 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.

Once all credits in each category are assessed, a percentage score for the category is calculated. A Green Star SA environmental weighting factor is then applied to each of the project's category scores to reach a single score. Green Star SA environmental weighting factors vary across rating tools to reflect differing environmental concerns and imperatives for different building types and lifecycle phases. By applying a weighting to each Category Score, Green Star SA ensures that each category is appropriately represented within the rating tool, in line with current knowledge and GBCSA opinion¹.

To encourage the development and spread of innovative technologies, designs and processes that could improve buildings' environmental performance, an 'Innovation' category is included in each Green Star SA rating tool. The Innovation category is not subject to an environmental weighting factor as the innovation could fall under any number of Green Star SA categories.

Green Star SA Credits

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 14 Energy points are achieved out of a total available of 30 then the Category Score is 47%.

NOTE: the Green Star SA rating is based on Weighted Category Scores and NOT the total number of points achieved.

WEIGHTED CATEGORY SCORE

The Weighted Category Score is calculated as follows:

$$\text{Weighted Category Score} = \text{Category Score (\%)} \times \text{Weighting Factor (\%)} \times 100.$$

Using the example provided in the Category Score section above, the Weighted Category Score for Energy, with a weighting factor of 25%, is $0.47 \times 0.25 \times 100 = 11.8$.

All category weightings are provided in Appendix A.

SINGLE SCORE

The single (i.e. overall) score is determined by adding together all the Weighted Category Scores plus the Innovation points. The maximum possible score for the weighted categories is 100, with an additional five points available for Innovation.

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

¹ NOTE: Green Star SA rating tools have the flexibility to allow for periodic updating of credits and weightings within the various tools.

This is necessary to allow Green Star SA to adapt to best practice and remain at the leading edge of industry practice.

Green Star SA Credits

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 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 designs, projects or buildings that achieve a Green Star SA rating of Four, Five or Six Stars.

Notwithstanding this, the use of Green Star SA rating tools is certainly not restricted to market leaders nor tied to a formal certification by the GBCSA. Green Star SA deliberately maintains the full range of ratings from One Star through to Six Stars so that designs, projects or buildings that do not qualify for certification can use the Green Star SA rating tools as a guide to track and improve their environmental initiatives.

A rating tool that provides a single score must include some assumptions regarding the relative importance or environmental impact of different building features. Green Star SA uses the framework adopted by Green Star Australia which in turn is used by the United Kingdom's BREEAM (Building Research Establishment's Environmental Assessment Method) to provide more flexibility in the approach to weightings by providing a two-tiered weighting structure as follows:

- Each credit category (e.g. Energy, Indoor Environment Quality etc.) has an environmental weighting
- The number of points allocated to each issue (e.g. daylight and noise in IEQ category) is effectively a weighting among issues within the credit category.

This approach also means that if a credit is deemed to be 'not applicable' to a particular project, the credit can simply be removed from the scoring.

Green Star SA Credits

CATEGORY WEIGHTINGS

The Green Building Council of Australia (GBCA) investigated the weightings used by LEED and BREEAM and conducted their own national survey in the formulation of Green Star's initial weightings.

In South Africa, the weightings were derived through consultation with industry experts considering the Australian weightings and deliberating on the relative importance of issues in the South African context.

The following table summarises the weightings for the Australian and South African Office tools.

	Australian Green Star – Office v3	South African Green Star SA – Office v1
Management	10	9
Indoor Environment Quality	20	15
Energy	25	25
Transport	10	9
Water	12	14
Materials	10	13
Ecology	8	7
Emissions	5	8
	100	100

Table App-A.1: Comparison of Weightings with different Environmental Rating tools

Green Star SA Credits

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 two points in the Management category to projects that have a Green Star SA Accredited Professional as a member of their team. In the case of Green Star SA – Office, the Green Star SA Accredited Professional's involvement must have commenced prior to schematic design and be engaged throughout the design, construction and delivery period.

Please refer to Man-1 'Green Star SA Accredited Professional' section for further information.

Green Star SA Accredited Professionals are experienced building industry practitioners who have demonstrated their understanding of the Green Star SA rating system and the benefits of integrated design. 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 updates regarding how to maintain Green Star SA Accredited Professional Status. 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.

Green Star SA Office Rating Tool

Green Star SA Office Rating Tool

Green Star SA – Office validates the environmental initiatives of the design phase of new office construction or base building refurbishment; or construction and procurement phase of a commercial office building.

Green Star SA – Office is a design and/or as built phase rating tool that aims to:

- Encourage the implementation of new and emerging technologies;
- Reduce the environmental impact of development through direct and indirect initiatives (e.g. it is difficult to quantify the environmental benefit of metering water and energy, but this will clearly enable the building to be better managed during operation.);
- Encourage a new approach to designing and constructing buildings by rewarding best practice and excellence;
- Ensure that effective design strategies are implemented without overlay of operational management and user behaviour; and
- Allow different designs to have their environmental initiatives fairly benchmarked.

The rating tool is used to assess both the Design and As Built phases of new office development or base building refurbishment. The same Green Star SA - Office tool is used for both Design and As Built certifications, but different documentation is required by the project team. The Green Star SA – Office Design certification was created to ensure that environmental impacts were considered at the design stage of a building, and the documentation to validate these conditions is specific to that which can be demonstrated at the design stage only. Green Star SA – Office As Built certification assesses the same design initiatives, but the validation documentation differs in that it is retrospective and therefore assesses that which is relevant to the construction of the building. The primary difference between the Green Star SA – Office Design and the Green Star SA – Office As Built is that the documentation required to verify environmental initiatives varies depending on whether the building is at the design phase or has been built/refurbished.

Green Star SA – Office addresses both the Green Star SA – Office Design and Green Star SA – Office As Built certification in one Technical Manual.

ASSESSMENT CREDITS

Green Star SA – Office 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.

Green Star SA Office Rating Tool

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 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 can not be addressed and are not applicable to the project.

For example, a naturally ventilated building may have no need for refrigerants. In this case, it would be impossible to demonstrate that the building allows for an automatic refrigerant recovery system. In this instance, points awarded for including an automatic refrigerant recovery system would not be available to the project and would not contribute to the overall project weighted score.

CONDITIONAL REQUIREMENTS

Green Star SA – Office v1.1 has two criteria that must be achieved (known as 'Conditional Requirements') in order to obtain a Green Star SA – Office v1.1 Certified Rating. The Conditional Requirements fall within the Energy and Land Use and Ecology categories. Please refer to these sections of the Technical Manual for further details.

ALLOCATION OF CREDITS WITHIN CATEGORIES

The credits in each category have an effective weighting by virtue of the number of points awarded versus the total points available. The points available correlate with, but are not always linearly proportional to, the environmental impact.

It is not the intent of Green Star SA – Office v1.1 to benchmark the operational performance of buildings and, as a result, the tool provides comparable benchmarked outcomes rather than estimates of actual performance.

Green Star SA Certification

Green Star SA Certification

A design, project or building cannot publicly claim a Green Star SA rating unless the GBCSA has certified the rating. The GBCSA will commission one or more third-party Assessors to check and validate the project's self-rating and recommend (or oppose) a Green Star SA Certified Rating.

Green Star SA – Office v1.1 certification identifies projects that have demonstrated a commitment to a specific level of environmental sustainability by informing the industry of the design performance of the project in terms that are widely understood and accepted.

The benefits of certification include:

- Gaining market recognition as a leader in the green building industry;
- Establishing a competitive commercial advantage when seeking occupants/users of the facility; and
- Validating the achievement through third party assessment.

ELIGIBILITY

To be eligible for Green Star SA assessment, projects must meet all four provisions of the Green Star SA Eligibility Criteria detailed below.

1. Spatial Differentiation
2. Space Use
3. Conditional Requirements
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(s) is eligible.

Whenever unsure, project teams can request an eligibility confirmation from the GBCSA by forwarding a brief description of the project to greenstarsa@gbcsa.org.za.

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 achieve a meaningful result and to send a clear message to the marketplace, Green Star SA rating tools are only applicable to distinct projects and not to project components.

To be eligible for a Green Star SA – Office v1.1 assessment, the building must be clearly distinct from surrounding buildings and be both of the following:

- A building with a distinct street address and entry, and
- A freestanding building OR fully autonomous building inconsequentially laterally adjacent to an existing building(s).

NOTE: Shared building services (such as Mechanical, HVAC plant, water treatment etc.) or amenities (waste rooms, bicycle facilities, car parks etc.) do not affect the Building's eligibility for Green Star SA assessment. However, please review specific credits in this Technical Manual and see the GBCSA's website for guidance on how they must be addressed for the purposes of the Green Star SA submission.

Green Star SA Certification

ELIGIBILITY CRITERION 2: SPACE USE

Whenever the Building has multiple uses (e.g. retail, office, residential), in order to meet the Eligibility Criteria 2, building uses addressed by any given Green Star SA rating tool must jointly account for at least 80% of the total building's Gross Floor Area (GLA).

To be eligible for a Green Star SA – Office v1.1 assessment, a minimum of 80% of the building's gross floor area (GFA), measured to exclude internal car park(s) must be classified as Commercial Office space.

Should the total Commercial Office space be less than 80% the building may be eligible for assessment under future Green Star SA rating tools.

ELIGIBILITY CRITERION 3: CONDITIONAL REQUIREMENTS

The Green Star SA rating tools have a number of Conditional Requirements (such as minimal energy efficiency and protecting land of high agricultural value). Regardless of how many other credits the Building achieves, it will not be eligible for a Green Star SA Certified rating unless all of the rating tool's Conditional Requirements are met.

There are two Conditional Requirements in Green Star SA – Office v1.1:

- **Ene – Conditional Requirement**
The building must demonstrate energy performance equal to or better than a notional building constructed to the “deemed to comply” fabric and building services clauses of SANS 204 Energy Efficiency in Buildings 2008 version.
- **Eco – Conditional Requirement**
The building must be a refurbishment or not be on land of high ecological value. To fulfil this requirement none of the following must be applicable to the site:
 - Prime agricultural land;
 - Within 100m of primary vegetation;
 - Class 1 Ridge or within a defined buffer;
 - Presence of Red Data species or habitat for Red Data species or within a defined buffer; or
 - Within 100m of a wetland or river.

ELIGIBILITY CRITERION 4: TIMING OF CERTIFICATION

Green Star SA 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.

- Submissions for a ‘Design’ Certified Rating can be lodged as soon as the required evidence is available; this could be prior to commencement of construction. The Certified Rating can be achieved prior to practical completion, but no later than 24 months after practical completion.
- Submissions for an ‘As Built’ Certified Rating can be lodged following the practical completion of the project. The Certified Rating must be achieved within 24 months after practical completion.
-

Green Star SA Certification

Certification Process

Up to date information on the certification process is outlined in detail on the GBCSA website: <http://www.gbcsa.org.za>. Templates, forms and checklists are available on this website to guide projects through the process.

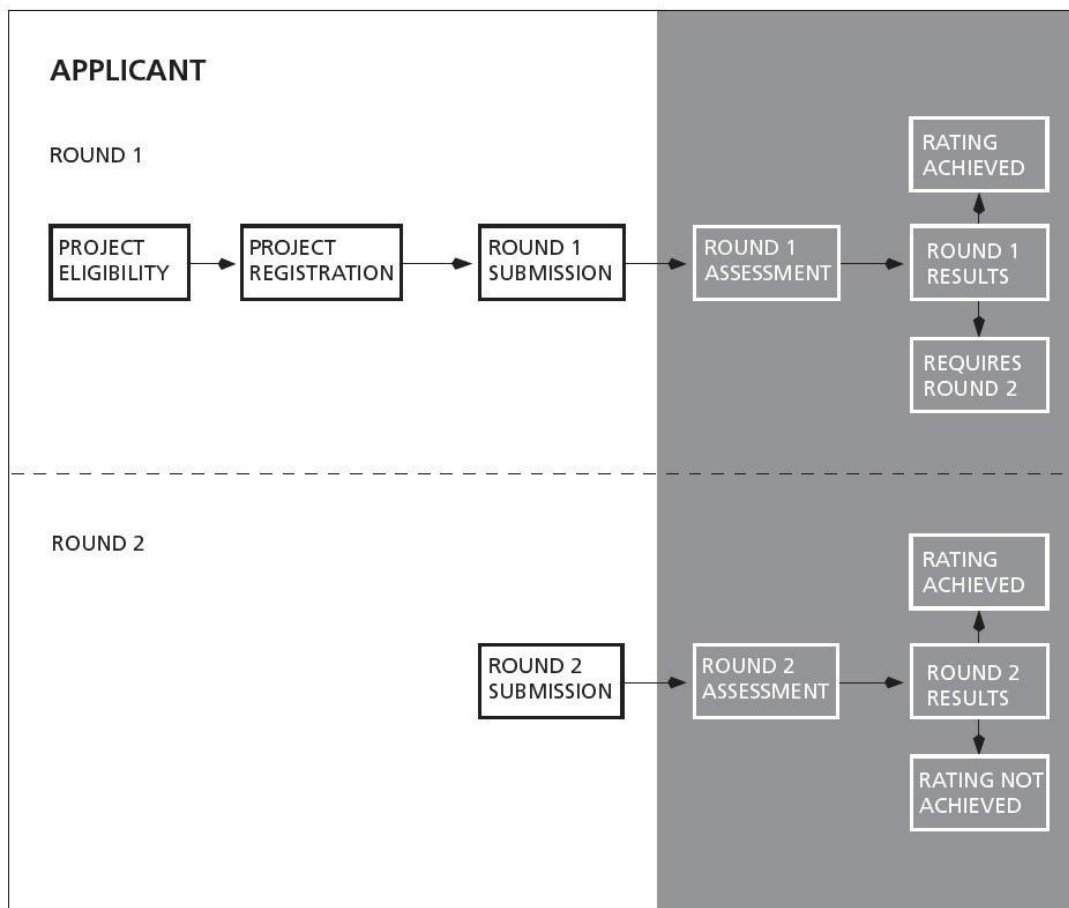


Figure 2: Overview of certification process

Registration

Registration establishes a connection with the GBCSA and gives the project access to essential information and assistance with the submission process. Registration and project certification is only available to projects that meet the eligibility criteria for Green Star SA – Office v1.1 (see above).

Part one of the Certification Fee (50%) must be paid to the GBCSA upon registration of a project, and an executed Certification Agreement must be received by the GBCSA to finalise a projects' registration. Details of the Certification Fees can be found on the GBCSA's website.

Preparing the Submission(s)

Once your project is registered, the project team should prepare documentation, drawings and calculations to satisfy the Green Star SA Credit requirements. If appointed, the Green Star SA Accredited Professional 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 – Office v1.1 Technical Manual as there are only two rounds of Assessment and one opportunity for resubmission (Appeal) available.

Assessor(s) will not award the point(s) unless it is demonstrated that all the requirements have

Green Star SA Certification

been met exactly as detailed in the Technical Manual.

Round 1 Submission

To ensure receipt of the Round 1 assessment results within six weeks of the submission date, the project contact must inform the GBCSA of the date of submission at least two weeks prior to the anticipated submission date. Due to the costs associated of arranging an Assessment Panel, any late submissions are subject to a minimum penalty fee of R 1000. Once an initial submission date has been forfeited, a new date must be scheduled with the GBCSA. The same conditions apply to the revised date.

Part two of the Certification Fee (50%) must be paid to the GBCSA on or before the submission date.

Please note that if a Credit Interpretation Request (CIR) has been submitted, an assessment cannot take place until it has been resolved.

The GBCSA reserves the right to conduct a pre-assessment review of a project submission prior to the commissioning of a review by the Assessor(s). A project may be required to resubmit if the pre-assessment review suggests that the quality of the submission would result in an excessive number of credits denied or credits 'To Be Confirmed'. There is no fee associated with this additional pre-assessment.

Round 1 Assessment

The Assessment Panel, containing one or more third-party Assessors and an Independent Chair, will review the submission. Recommendations will then be made to the GBCSA. The GBCSA reserves the right to question the findings of the Certification Assessment Panel.

The GBCSA will forward the results of the Round 1 assessment to the project contact and the applicant. The project may accept the results as the final rating or request to resubmit documentation for credits 'to be confirmed' for a Round 2 assessment.

Round 2 Submission

Upon receipt of the results of the Round 1 Assessment, the project may request to resubmit documentation for credits 'to be confirmed'. Each project has only one opportunity for resubmission, which may include:

- Additional/revised documentation to demonstrate fulfilment of Credit Criteria;
- Alteration to project design that results in meeting Credit Criteria; and
- Credit Interpretation Requests (CIRs) to clarify alternative compliance.

To ensure receipt of the Round 2 assessment results within four weeks of submission, the project contact must inform the GBCSA of the date of submission at least two weeks prior to submission. Due to cost of arranging an Assessment Panel, late submissions are subject to a minimum penalty fee of R 1000

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 score of 45 or above, the GBCSA will award a Certified Rating and notify the Applicant via an award letter.

Certified Rating not Awarded

If a desired Certified Rating is not achieved, the project may be eligible to Appeal. Please see the GBCSA website for further details.

Technical Clarifications and Credit Interpretation Requests

Green Star SA Certification

The Green Star Technical Clarifications and Credit Interpretation Request (CIR) rulings provide an essential source of information to all projects undertaking Green Star assessment. They are available on the GBCSA website <http://www.gbcsa.org.za>.

Technical Clarifications often represent the GBCSA answers to technical queries and complement Green Star SA Technical Manuals (e.g. the Assessment Team will use the Technical Clarifications as public precedent). They do not amend but clarify the Credit Criteria or Compliance Requirements. They are an extension of the Technical Manual; it is the responsibility of the project teams to stay up-to-date with this section of the GBCSA website.

The CIR rulings offer alternative compliance options whenever those have been deemed equivalent in meeting the Aim of Credit. A registered project may submit a CIR if the project team feels that the Aim of Credit has clearly been satisfied via a solution that does not adhere to the stated Compliance Requirements of the relevant Technical Manual.

Updating Green Star Office

Green Star SA – Office v1.1 was developed on the basis of information available at the time of its development. Some issues have not been addressed in Green Star SA – Office v1.1 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, etc.);
- Lack of clear benchmarks or guidelines relating to buildings (e.g. electro-magnetic radiation); 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 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 Office V1.1

Ongoing Feedback

The GBCSA encourages feedback on all Green Star rating tools, including Green Star SA – Office v1.1. Feedback is to be sent to greenstarsa@gbcsa.org.za for consideration by the GBCSA.

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

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.

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.

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 – Plant matter such as trees, grasses, agricultural crops or other biological material; all materials of recent plant or animal origin.*

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

BMS – See Building Management System.

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 Maintenance Guide (BMG) – A detailed guide for the building owner or manager on assessing and maintaining the building's services and external building fabric.

Building Management Control System (BMCS) – As per BMS.

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 Users' Guide (BUG) – 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 (CO₂) – 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.*

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Computational Fluid Dynamics (CFD) – numerical analysis of problems involving 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.

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

Chlorofluorocarbons (CFCs) – CFCs are refrigerants which cause ozone depletion when released in the atmosphere.

CIR – See Credit Interpretation Request.

Client – The building/project owner or developer 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 fuel (cars and electricity generation) and deforestation.

CLO Constant – The CLO Constant refers to the clothing variable used to assess the Predicted Mean Vote (PMV). It recognises that people are warmer if they are wearing more clothes.

Chain of custody (CoC) – The path taken by raw materials, processed materials, and products from the forest to the consumer, including all successive stages of processing, transformation, manufacturing and distribution. All parties in the chain of custody must be CoC certified by FSC.

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.

Constructed Wetland – A human-made habitat for waterfowl and other forms of wildlife, often using greywater or rainwater catchments' overflow.*

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.

Contractor – The main contractor or builder engaged to construct or refurbish the building.

CSIR – Council for Scientific & Industrial Research – See http://www.csir.co.za/Built_environment/.

CSIRO – Australian Commonwealth Scientific and Research Organization – See <http://www.csiro.au>.

Cradle-to-Cradle – Derived from the 'Cradle-to-Grave' design methodology but ensures that end-of-life will result in materials that will become nutrients or feedstock for recycling into other valuable products.*

Cradle-to-Grave – Design methodology that takes into account all stages of the life cycle of a product, service or building but does not seek to revive it after disposal.

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 Compliance Requirements of the relevant Technical Manual. CIRs are considered by the GBCSA with the consultation from the Technical Working Group and other independent consultants, and the resulting rulings may set precedent and be used to update Green Star SA rating tools.

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.

DEAT – South Africa Department of Environment, Agriculture and Tourism – See <http://www.deat.gov.za>.

Deconstruction – A process to carefully dismantle or remove useable materials from structures, as an alternative to demolition; it maximises the recovery of valuable building materials for reuse and

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recycling and minimises the amount of waste landfilled.*

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

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.

DOH – South Africa Department of Health – See <http://www.doh.gov.za>.

DWAF – South Africa Department of Water Affairs and Forestry – See <http://www.dwaf.gov.za>.

Ecology – A branch of science concerned with the interrelationship of organisms and their environment.*

Ecology, first law of – Gerrett Hardin's concept that 'we can never do merely one thing', sometimes referred to as the 'Law of Unintended Consequences'.*

Ecosystem – An interconnected and symbiotic grouping of animals, plants, fungi and micro-organisms that sustains life through biological, geological and chemical activity.*

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.*

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.*

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

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

EPA – Environment Protection Authority/Agency.

EMP – Environmental Management Plan.

EMS – Environmental Management System.

Environmental Tobacco Smoke (ETS) Also known as secondhand smoke, consists of airborne particles emitted from the burning of cigarettes, pipes and cigars, and exhaled by smokers. The particles contain compounds some of which are known to cause cancer.

ESKOM – South Africa Electricity Supply Commission – see <http://www.eskom.co.za> **FFL** – Finished Floor Level.

Functionally Autonomous Building – A building that does not rely on any other building for primary access or identification.

FSC – Forest Stewardship Council – See <http://www.fsc.org>.

FSC Certification – A certification system for timber products which confirms that timber has been harvested in a sustainable manner.

GFA – See Gross Floor Area.

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

Greenbelt Zones – Zones or areas in or around a city where the removal of native vegetation is

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prohibited and/or parks and other open, undeveloped, and vegetated space is protected.*

Green Building – A Green Building 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) – The GBCSA is 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.

Greenfield Site – Land on which no development has previously taken place; usually understood to be on the periphery of an existing built-up area.*

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) – Trace gases such as carbon dioxide, water vapour, methane, and CFCs that are relatively transparent to the higher-energy sunlight, but trap the lower-energy infrared radiation.*

Greenwash – Disinformation disseminated by an organisation so as to present an environmentally responsible public image.*

Greywater – Waste water recovered from sinks, 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.*

Ground Water – A general term for the water beneath the Earth's surface.

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. For the purposes of the Green Star SA submission, Gross Floor Area should be calculated as the building Construction Area (using SAPOA definition 1st Aug 2005) less the area of car parking.

GWP – See Global Warming Potential.

Habitat – (1) The natural home of an animal or plant; (2) The sum of the environmental conditions that determine the existence of a community in a specific place.*

Habitat Fragmentation – Habitat disruption where natural habitat is broken into small, relatively isolated sections.*

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.

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.*

High Density Polyethylene plastic (HDPE) – HDPE is a type of plastic that can be used to make pipes and other plastic products.

Holistic – A wide-reaching approach to a theory, a task, or a problem that encompasses all the elements of the system because of the interdependency of those elements.*

HVAC – See Heating, Ventilation and Air Conditioning.

Hydrochlorofluorocarbons (HCFCs) – HCFCs are refrigerants that cause ozone depletion when released in the atmosphere.

Hydrofluorocarbons (HFCs) – HFCs are commonly used to replace HCFC refrigerants to reduce the ozone depletion potential (ODP); however, HFC refrigerants have a high Global Warming Potential

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(GWP).

Independent Chair – A person independent of the GBCSA, nominated by the GBCSA, knowledgeable and with experience in the green building industry, who has such appropriate assessment qualifications as the GBCSA may from time to time determine who is responsible for reviewing the report of the Assessor(s) prior to the Assessor(s) making a recommendation to the GBCSA in respect of the development.

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

Indicators – (1) A measurement or reporting tool used to gauge how well a society is achieving its economic environmental and societal goals; (2) A species of plant or animal, or a community, whose occurrence serves as evidence that certain environmental conditions exist.*

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

Integrated Fit-out – A fit-out where the tenancy design and construction is fully coordinated with the base building design and construction.

Intergovernmental Panel on Climate Change – UN agency set up to provide the decision-makers and others interested in climate change with an objective source of information about climate change. Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation. Findings of the IPCC played a role in the establishment of the Kyoto Protocol under the UN Framework Convention on Climate Change. See <http://www.ipcc.ch>.

Interdependent Projects – Projects that share services and amenities.

International Energy Agency (IEA) – Acts as energy policy advisor to 28 member countries in their effort to ensure reliable, affordable and clean energy for their citizens. See <http://www.iea.org>.

IPCC – See Intergovernmental Panel on Climate Change.

ISO 14001:2004 – An international standard which specifies requirements for an Environmental Management System (EMS).

Kyoto Protocol – The Kyoto Protocol is an international agreement reached in 1997 in Kyoto, Japan to address the problems of climate change. (See also IPCC)

Landfill – An area where solid waste is deposited. In a sanitary facility, a hole in the ground is lined so that materials will not escape, and it is covered with layers of dirt as it is progressively filled. When completely filled, it is capped and sealed with more dirt and topsoil.*

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 of a Product – 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 from buildings that is directed upward to the sky or is directed off the site.

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'.

MET Values – MET refers to human metabolic rate and corresponds to the amount of heat (sensible and latent) released from the human body. It is used to size air conditioning equipment and to assess

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the Predicted Mean Vote (PMV) when calculating thermal comfort.

Mixed-Mode Ventilation – A ventilation strategy that combines natural ventilation and mechanical ventilation, allowing the building to be ventilated either naturally or mechanically according to the season or ambient temperatures.

Mixed-Use Development – The use of a single building for different purposes simultaneously.

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. A building can still be termed 'naturally ventilated' if it contains propeller type ceiling fans provided they only recirculate air and their energy use is included in the energy modelling.

Non-Potable Water – Water collected on-site 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.*

O&M Manual – Operations and Maintenance Manual.

Occupied Space: Areas that are predominantly:

- Work spaces (e.g. cellular offices, open plan offices, meeting rooms, food preparation areas, laboratories, consulting rooms, workshops – small scale and high density work spaces)
- Large event spaces (e.g. dry sports halls, swimming pool areas, halls, arts theatres, libraries, assembly areas, sales areas – general, sales areas – chilled, performance areas (stage), check in areas, baggage reclaim areas, security check areas, fitness suites, gyms, fitness studios and ice rinks);
- Common areas (e.g. receptions, waiting rooms, eating/drinking areas, laundries, common rooms/staff rooms/lounges, public circulation areas, foyers and lobbies); and
- Learning spaces (e.g. classrooms and lecture rooms) are all expected to form part of the Occupied space.

Most corridors are to be excluded from the calculation of Occupied Space. Where corridors are exclusively used for transit between spaces (i.e. do not act as a foyer, lounge, waiting space, or reception), and where these corridors are bound in both sides by a wall these are to be excluded. 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. Occupied Space also excludes enclosed fire stairs, storage areas, toilets, tea kitchens, changing facilities, bathrooms, display areas, IT equipment and plant rooms.

ODP – See Ozone Depleting Potential.

Office Building – Building with occupancy class G1 (office) as defined in SANS 10400-A

OHS – Occupational Health and Safety.

Organically Certified Products – Products certified by a specialist organic certification body.

Organisation for Economic Co-operation and Development (OECD) – See www.oecd.org.

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.*

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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 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.*

PPB – Parts Per Billion.

PPM – Parts Per Million.

Post-Consumer Recycled Content – A product composition that contains some percentage of material diverted from the product user's waste stream.

Post-Industrial 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.*

Potable Water – Water that is drinkable i.e. safe to be consumed.

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 quoted in the Technical Manual (ISO 7730), thermally dissatisfied people are those who will vote hot, warm, cool or cold on the 7-point thermal sensation scale (PMV).

Primary function – The function accounting for over 50% of the GFA.

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

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humidity.

PVC – Polyvinyl chloride.

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'.*

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. Downcycling – 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.

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.*

Renewable Resources – Resources that can be replenished at a rate equal to or greater than its rate of depletion (i.e. solar, wind, geothermal and biomass resources).*

Riparian Buffer Zone (RBZ) – Describe lands adjacent to streams where vegetation is strongly influenced by the presence of water.

SABS – see **South African Bureau of Standards** **SANS** – see **South African National Standard**

SAPOA – see **South African Property Owners Association**

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 shell and core office includes finishes and fit-out to landlord areas only with services capped off within the riser at each floor and office areas left as a structural shell.

Sick Building Syndrome (SBS) – (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 Institute of Architects (SAIA) – see <http://www.saia.org.za>

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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).*

Standard Hours of Occupancy – 8am to 6pm, Monday to Friday.

Sustainable Development – An approach to progress that meets the needs of the present without compromising the ability of future generations to meet their needs.*

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

Tenancy Fit-out Guide (TFG) – A detailed guide for the design team responsible for the fit-out 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.

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

UA – See Usable Area.

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

Usable Area (UA) – The floor area capable of exclusive occupation by the tenant (refer SAPOA definition 1st Aug 2005). Consists of the total area of the building enclosed by the Dominant face, adjusted by deducting all Common Areas and Major Vertical Penetrations. No deductions shall be made for columns.

VAV systems – Variable Air Volume air conditioning systems.

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

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).

VLT – Visual Light Transmittance.

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

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.

WC – Water Closet (i.e. toilet).

WHB – Wash Hand Basin.

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

Xeriscape Garden – A water-conserving garden, or garden 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 garden 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 Assn).

A guide to the reader of the Technical Manual

A guide to the reader of the Technical Manual

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. Green Star SA rates building attributes, not operations; a solution that is not an inherent building attribute and relies on operational measures to achieve desired performance cannot meet the Aim of Credit. 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 Assessor(s). This section is divided in two areas: project performance requirements and submission guidelines.

All projects must meet the performance and documentation requirements to be awarded the credit points. Please note that the Assessor(s) 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 Assessor(s) reserve the right to request additional documentation in order to clarify any credit point.

Each credit has a submission checklist that lists the requirements for the assessment of a Design and an As Built rating. All evidence collated must meet requirements set out in the 'Design Rating' or 'As Built Rating' documentation section of each credit in the Technical Manual as well as the general guidelines outlined in the Submission Requirements section on the GBCSA website. Note that each project should submit documentation relevant to Design or As Built, not both, depending upon which certification is being pursued.

ADDITIONAL GUIDANCE

This section contains additional information which is applicable to some projects. Where applicable, all information in Additional Guidance is mandatory. The Assessor(s) 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.

REFERENCES & FURTHER INFORMATION

All credits within the Green Star SA rating tools are based on science and research; some of this research is provided as reference material in this section. The GBCSA recommends reading more about the issues in the credits; several interesting suggestions for further reading are provided in this section.

Credit Summary Table

Credit Table Summary

CATEGORY	TITLE	CREDIT NO.	POINTS AVAILABLE
Management			
	Green Star SA Accredited Professional	Man-1	2
	Commissioning Clauses	Man-2	2
	Building Tuning	Man-3	2
	Independent Commissioning Agent	Man-4	1
	Building Users' Guide	Man-5	1
	Environmental Management	Man-6	2
	Waste Management	Man-7	3
	Airtightness Testing	Man-8	1
	TOTAL		14
Indoor Environment Quality			
	Ventilation	IEQ - 1	2
	Carbon Dioxide Monitoring and Control	IEQ - 3	1
	Daylight	IEQ - 4	3
	Daylight Glare Control	IEQ - 5	1
	Electric Lighting Levels	IEQ - 7	1
	External Views	IEQ - 8	2
	Thermal Comfort	IEQ - 9	2
	Individual Comfort Control	IEQ - 10	2
	Hazardous Materials	IEQ - 11	1
	Internal Noise Levels	IEQ - 12	2
	Volatile Organic Compounds	IEQ - 13	3
	Formaldehyde Minimisation	IEQ - 14	1
	Mould Prevention	IEQ - 15	1
	Tenant Exhaust Riser	IEQ - 16	1
	Environmental Tobacco Smoke (ETS) Avoidance	IEQ - 17	1
	TOTAL		24
Energy			
	Conditional Requirement	Ene -	0
	Greenhouse Gas Emissions	Ene - 1	20
	Energy Sub-metering	Ene - 2	2
	Lighting Power Density	Ene - 3	4
	Lighting Zoning	Ene - 4	2
	Peak Energy Demand Reduction	Ene - 5	2
	TOTAL		30
Transport			
	Provision of Car Parking	Tra - 1	2
	Fuel-Efficient Transport	Tra - 2	2
	Cyclist Facilities	Tra - 3	3
	Commuting Mass Transport	Tra - 4	5
	Local Connectivity	Tra - 5	2
	TOTAL		14

Credit Summary Table

Water			
Occupant Amenity Water	Wat - 1	5	
Water Meters	Wat - 2	2	
Landscape Irrigation	Wat - 3	3	
Heat Rejection Water	Wat - 4	4	
Fire System Water Consumption	Wat - 5	1	
	TOTAL	15	
Materials			
Recycling Waste Storage	Mat - 1	2	
Building Reuse	Mat - 2	5	
Reused Materials	Mat - 3	1	
Shell and Core or Integrated Fit-out	Mat - 4	1	
Concrete	Mat - 5	3	
Steel	Mat - 6	3	
Sustainable Timber	Mat - 8	2	
Design for Disassembly	Mat - 9	1	
Dematerialisation	Mat - 10	1	
Local sourcing	Mat - 11	2	
	TOTAL	21	
Conditional Requirement	Eco -	0	
Topsoil	Eco - 1	1	
Reuse of Land	Eco - 2	2	
Reclaimed Contaminated Land	Eco - 3	2	
Change of Ecological Value	Eco - 4	4	
	TOTAL	9	
Emissions			
Refrigerant / Gaseous ODP	Emi - 1	1	
Refrigerant GWP	Emi - 2	2	
Refrigerant Leaks	Emi - 3	2	
Insulant ODP	Emi - 4	1	
Watercourse Pollution	Emi - 5	3	
Discharge to Sewer	Emi - 6	5	
Light Pollution	Emi - 7	1	
Legionella	Emi - 8	1	
Boiler and Generator Emissions	Emi - 9	1	
	TOTAL	17	
Innovation			
Innovative Strategies & Technologies	Inn-1	2	
Exceeding Green Star SA Benchmarks	Inn-2	2	
Environmental Design Initiatives	Inn-3	1	
	TOTAL	5	

Management

Management

The credits within the Management Category promote the adoption of environmental principles from project inception, design and construction phases, to commissioning, tuning and operation of the building and its systems.

Management initiatives may include: engaging a professional with a thorough understanding of green building principles and Green Star SA; recycling demolition and construction waste; managing construction activities to minimise pollution and maximise soil and air quality protection; enhanced commissioning and tuning of building systems.

Green Star SA rating tools aim to recognise and reward building attributes that reduce the building's environmental impact throughout its lifecycle. Since much of a building's impact is attributed to the operational phase of its lifecycle, proper commissioning and tuning can ensure that all systems operate to their design potential. Personnel training, and ongoing information management, enable building users to contribute to the building's environmental performance.

Green Star SA rewards project teams for developing a comprehensive Building Users' Guide to inform the building owner, tenants and personnel of the environmental features in the building and the requirements for their maintenance. Additionally, Green Star SA makes recommendations on resource consumption.

In South Africa, construction and demolition waste accounts for at least 25% of all waste generated (*Gauteng Provincial State of the Environment Report (SoER) June 2004*) and in developed countries it is often as much as 40%. Implementation of appropriate strategies during the construction phase of a building can significantly reduce this figure.

The Management Category aims to highlight the importance of a holistic and thoroughly integrated approach to constructing a building with good environmental performance.

Indoor Environmental Quality

Indoor Environmental Quality

Each of the credits within the Indoor Environment Quality (IEQ) category of Green Star SA targets the wellbeing of the occupants. The credits address how the HVAC system, lighting, indoor air pollutants and some building attributes contribute to a good indoor environmental quality.

Comfort factors addressed within this category are external views, individual climate control and noise levels. Health issues such as minimisation of indoor Volatile Organic Compounds, asbestos and Formaldehyde emissions as well as mould prevention are also addressed in this category.

The IEQ category in the Green Star SA rating tool aims to balance other categories. For example, reductions in energy consumption could easily be achieved by reducing the amount of fresh air delivered to occupants, but this would potentially be at the expense of the occupant comfort and wellbeing. The IEQ category in the Green Star SA tool encourages healthy and good indoor environmental quality and many points towards a Green Star SA certification are available in this category. The best overall Green Star SA rating is obtained by balancing the requirements for achieving good IEQ while also concentrating on reducing energy usage etc.

IEQ is also a critical element of healthy buildings. Poor IEQ is considered to be the principal cause of Sick Building Syndrome (SBS) which, according to scientific research, has a substantial price tag in lost productivity and even more in health sector costs.

It is well documented that health problems resulting from indoor air pollution have become one of the most acute environmental problems related to building activities. Indoor air quality, directly related to Sick Building Syndrome and productivity, is considered in the Performance Indicators for both commercial and residential buildings.

The IEQ category in Green Star SA addresses the indoor environment quality and rewards project teams that are designing buildings and workspaces that provide comfortable and healthy spaces for their occupants.

Energy

Energy

The credits within the Energy Category target an overall reduction in energy consumption. Such reduction has an impact upon greenhouse gas and other emissions associated with energy generation from fossil fuels. Reductions in energy consumption can be achieved through more efficient use of energy in buildings. Reductions in emissions and capacity may also be achieved through generation of energy from alternative sources.

If 'upstream' emissions from heat and electricity are included, emissions from buildings account for 20% of global greenhouse gas emissions, according to the 2006 Stern Review on the Economics of Climate Change.

South Africa contributed carbon emissions of around 9.2 tonnes of CO₂ per capita in 2004, making it the 41st worst polluter from 206 countries. This figure is much higher than neighbouring countries (Botswana 2.4 tonnes, Namibia 1.2 tonnes, Swaziland 0.9 tonnes, and Mozambique 0.1 tonnes). This is not simply due to its larger economy; the emissions in relation to GDP are also higher at 2.0 metric tonnes of CO₂ per \$1,000 GDP (Botswana 0.44 tonnes, Namibia 0.44 tonnes, Swaziland 0.40 tonnes, and Mozambique 0.37 tonnes). According to the City of Cape Town Smart Living Handbook, 2007, South Africa produces approximately 8 tonnes of CO₂ per capita – twice the global average of 4 tonnes, and nearly eight times the African average of 1.1 tonnes.

Production of South Africa's energy is largely from incineration of non-renewable fossil fuels and is the country's greatest contributor of greenhouse gas emissions. Energy efficient design of buildings is essential to realise the environmental improvement potential that exists. There is potential for substantial environmental savings through energy efficiency measures in South African office buildings.

For example, CO₂ emissions can be reduced by around one tonne per year by monitoring and adjusting heating, ventilation and air conditioning (HVAC) systems by allowing just two degrees of variance. Greater efficiency of energy use, energy demand reduction methods and generation of energy from alternative sources are all means of addressing this urgent issue. With the current shortfall in electrical generation capacity in South Africa, reducing buildings' electrical energy usage has the added benefit of reducing strain on the infrastructure and minimizing the need for load shedding.

Transport

Transport

All credits within the Transport category have the same underlying principle; to reward the reduction in automotive commuting by simultaneously discouraging it and encouraging use of alternative transportation.

Motor vehicles in general, and the use of private cars in particular, are responsible for many forms of pollution. Global warming is directly affected by motor vehicle use due to the high amounts of energy required to build cars and supporting infrastructure and services, as well as the fuels that in turn 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.

There is a need to maximise alternative transport options if the use and environmental impact of car commuting is to be reduced. Options available may include trains, buses, minibus taxis, light rail and trams, water-based transport such as ferries, 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.

The proportion of transport's contribution to regional and global carbon emissions varies by country and region, but the Western Cape energy profile for 2004 shows that transport accounts for 34.9% of total energy consumption by all economic sectors. (http://www.wcapeenergy.net/energy_profile.htm) This translates into more than 22% of carbon emissions for the province – a higher proportion than some other countries, such as Australia where the transport sector accounted for 13.5% of greenhouse gas emissions in 2004.

(<http://www.environment.gov.au/soe/2006/publications/report/pubs/soe-2006-report.pdf>)

Reducing dependency on motor vehicles and private car use is an important means of reducing overall greenhouse gas emissions. Switching to transport modes that have low or zero carbon emissions can help support South Africa's long-term mitigation scenario for climate change, published in 2007 by the Department of Environment Affairs and Tourism. (www.environment.gov.za/HotIssues/2008/LTMS/A%20LTMS%20Scenarios%20for%20SA.pdf) Many office-based commuters are in a position to make such a switch, particularly where the building's design, facilities and location deliberately support alternative transport modes.

Water

Water

Within the Water Category, credits address the reduction of potable water use through efficient design of building systems, rainwater collection and water reuse.

Global water consumption has risen almost ten-fold since 1900, and many parts of the world are now reaching the limits of their supply. In South Africa, water has long been considered a precious and high-demand resource, essential for all living things. Fresh water supplies are increasingly affected by a range of factors including catchment locations, contaminated sources (*Draft Water Conservation Strategy Paper* – Feb 2000, DWAF) drought and rising demand as government embarks on projects to provide potable water to all communities. In 2006, “The South African government had provided safe drinking water to 16 million people since 1994.” (*Water provision is key to healthy development of children (SA)* – DWAF, 16 November 2006)

However, it should be noted that South Africa falls in a region with low and unreliable rainfall and therefore potable water sources do not get adequate annual replenishment from rainwater. A paper written by The Department of Water Affairs & Forestry (DWAF): Directorate of Water Resource Planning, on water availability per Water Management Area clearly shows that there is limited capacity to extend water allocation to new consumers in most areas especially those in the western part of the country where rainfall is erratic.

(<http://www.dwaf.gov.za/WAR/documents/WMAWaterAvailability23Feb06.pdf>)

Therefore sustainable use of potable water in South Africa would not only protect the already stressed sources but also ensure future availability of this precious resource.

Leakage on building premises is not so much of a problem as improved pressure test standards during commissioning of water supply systems has virtually eliminated water wastage through leakage. However, at municipality level the problem of water leaks is a major challenge and the DWAF is assisting, “...reducing water losses, estimated at 29%, to 15%.” (*National Water Summit Speech by Mrs LB Hendricks, Minister of Water Affairs and Forestry*, Gallagher Estate, Midrand, Gauteng, 17 March 2008. Available at

<http://www.dwaf.gov.za/Communications/MinisterSpeeches/2008/NWS17Mar08.doc>)

The use of cooling towers for heat rejection in air conditioning systems is also common and contributes to significant water usage in buildings.

In addition to reducing the demand for water, efficient use of water in buildings can save building owners money in operational costs, Green Star SA aims to simultaneously reduce the pressure and minimise the impacts on the environment from extensive water use in the built environment. Demand for potable water can be reduced through recycling from rainwater, greywater and blackwater. Currently, a very small proportion of buildings have grey or rain water recycling plants.

“A moderate sized office building of 10,000m² typically consumes over 20,000 litres per day, or more than 7 million litres per year; enough to supply 40 average homes.” (Australian Government Department of the Environment and Heritage, 2006, p8)

Green Star SA is encouraging measures to reduce the potable water consumption in buildings. Such reductions will ease the pressure on the South Africa water sources as well as contribute to more cost efficient operation of buildings.

Materials

Materials

Within the Materials Category of Green Star SA, the credits 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 production and use of building materials can have serious impacts on the environment. Energy is used to extract, produce and transport building materials; natural resources are exploited to be used in building materials; the industrial production process of the materials causes pollution; and when the material ends up as waste, it becomes difficult to process.

The environmental impact from building materials is reduced by limiting the quantities of virgin building materials used in projects and choosing the least harmful when using virgin building materials. The Green Star SA rating tool rewards initiatives and strategies to do so.

Materials and resource concepts that are rewarded under Green Star SA include, but are not limited to: sustainable timber; reuse of building façade and structure; and recycled content of concrete and steel. In particular, this category attempts to focus on the lifespan and lifecycle.

Land Use and Ecology

Land Use and Ecology

The credits allocated within the Land Use and Ecology Category of the Green Star SA – Office rating tool promote initiatives to improve or reduce impacts on ecological systems and biodiversity. The term 'biodiversity' is used to describe the variety of life in an area, including the number of different species, the genetic wealth within each species, the interrelationships between them, and the natural areas where they occur

(<http://www.botany.uwc.ac.za/envFacts/facts/biosa.htm>).

South Africa has an immensely rich species diversity which is brought on as a result of its wide range of climatic conditions and many variations in topography. In combination, climate and topography give rise to broad vegetation zones which, together with their associated animal life, are called biomes. The land mass of South Africa represents just 2% of the earth's total land surface and contains almost 10% of the world's total known bird, fish and plant species, and over 6% of the world's mammal and reptile species

(<http://www.botany.uwc.ac.za/envFacts/facts/biosa.htm>).

South Africa is one of 17 countries that have been termed as Megadiverse, these 17 countries collectively house two thirds of the world's biodiversity (<http://www.megadiverse.org>).

Threats to South Africa's Biodiversity

Unfortunately this immense natural wealth is under extreme pressure resulting from human demands placed on the environment through economic development, agriculture and urbanisation. Invasive alien vegetation also contributes to the problem.

Many credits in other categories of the Green Star SA rating tools have an indirect impact on the land use and ecology of the South African environment; Emi-5 'Watercourse Pollution', for example, addresses the rainwater run-off from buildings and hard surfaces in an attempt to prevent pollution from reaching nearby natural watercourses. This category, however, addresses the direct impact of a project on the ecological value of the site (Australian Green Star Office Design v3 Rating Tool).

Green Star SA rating tools aim to reduce the impacts on ecological value from urban development, and recognise and reward projects which both minimise harm and enhance the quality of local ecosystems.

Emissions

Emissions

The credits in the Emissions Category target the environmental impacts of a building's emissions. The Green Star SA rating tools target emissions including and relating to watercourse pollution, light pollution, ozone depletion, global warming, Legionella and sewerage.

Traditionally in South Africa, stormwater has been transported separately from the sewerage system. Unlike sewerage it receives little, if any, treatment and is channeled as rapidly as possible from within urban areas to the nearest waterway, which has caused increased pollution to watercourses. The necessity to deal with both the quantity and quality of runoff is now recognised, as well as benefit from capturing and recycling the stormwater.

Light travelling up into the night sky or spilling on to neighbouring properties is also seen as a form of pollution; it can disrupt the habits of migratory species, causing major impacts upon overall biodiversity. Light pollution might also disrupt biological rhythms and otherwise interfere with the behaviour of nocturnal animals and insects.

Substances such as Chlorofluorocarbons (CFCs) as well as Hydrochloroflourocarbons (HCFCs), used as refrigerants and in insulation materials, deplete the ozone layer as well as contribute to global warming when emitted. (*ChloroFluorocarbons, Ozone Hole Watch*, <http://www.nas.nasa.gov/About/Education/Ozone/cfc.html>) Long-term damage to the Earth's stratospheric ozone layer will expose living organisms to harmful radiation from the sun.

Innovation

Innovation

The Innovation Category is included within the Green Star SA – Office v1.1 rating tool as a way of encouraging, recognising and rewarding the spread of innovative technologies, designs and processes for commercial building applications that impact upon environmental performance.

The Innovation category encourages the demonstration of efforts to apply sustainable development principles to the wider process of designing & 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 Green Building Council of South Africa. Any single initiative submitted under Innovation 1 (Innovative Strategies and Technologies) will be awarded to a maximum of 10 projects under the same rating tool (e.g. Offices) before no longer being considered 'innovative' and rewarded within this category; a database of innovative initiatives from certified projects will be accessible from the GBCSA website for projects to check before submission of documentation. The GBCSA will also be regularly publishing a list of innovation challenges to the web site which projects can target under Innovation 3 (Environmental Design Initiatives)

There is a maximum of ten points available in total within the Innovation Category, which can be targeted under the various credits in a combination of ways – refer to individual credits for details.

General TC / CIR

General TC/CIR

Green Star SA - Office V1 : General: - General

Technical Clarification: When to excluded an Auditorium from an Office project's GFA and UA

Technical Clarification Number: GEN00-T-OB1-0846

Guidance: 2014-11-06

Where the project team has to determine the GFA for an Office project that has an Auditorium, it can be excluded from the Office GFA and hence, therefore the Usable Area where it can be demonstrated all of the following:

- The Auditorium is used predominately by outside visitors and students;
- It is a raked auditorium that can hold/seat more than 50 people;
- It is not for the Primary or Exclusive use of the tenants.

Credit Interpretation Request: Base Building

Credit Interpretation Request Number: GEN00-T-OB1-0603

Ruling: 2012-11-12

Where the term 'base building' is used, unless stated otherwise within the relevant credit, this refers to the entire base building (i.e. GFA).

Technical Clarification: As built documentation for a Design submission

Technical Clarification Number: GEN00-T-OB1-0566

Guidance: 2012-09-11

Green Star SA awards buildings at two phases, the DESIGN and AS BUILT stage with certifications where the required criteria has been achieved of the specific rating the project has been registered for. The DESIGN stage certification awards the project team's design as instructed to the contractor and the AS BUILT rewards the final constructed Green Star SA registered building.

Green Star SA assessors are instructed to assess buildings under ONE of these rating types (Design OR As Built), and as such the GBCSA will not accept AS BUILT documentation as part of the DESIGN submission.

The GBCSA are not able to allow the precedent of accepting both Design and As Built documentation within one submission as this could have unintended consequences including but not limited to the following:

- Confusion and complexity in assessment through the misalignment in documentation and the stage at which the documentation was produced.
- The Design certification may not be a true reflection of the building's design. I.e. projects can be awarded for designing in accordance with certification requirements even if this was not achieved in the design process.
- Projects completing Design ratings after practical completion in order to submit As Built documents where the Design criteria is not met.

General TC / CIR

For this reason the GBCSA encourages project teams to register for an AS BUILT certification so as to be awarded for those instances where the project team has gone beyond their contractual obligations that were agreed upon during the DESIGN phase.

Technical Clarification: 'Contract Value' - definition

Technical Clarification Number: GEN00-T-OB1-0515

Guidance: 2012-06-14

This Technical Clarification supersedes GEN00-T-OB1-0028 issued on 2009-03-30.
The GBCSA provides the following guidance:

Contract Value is defined as 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 fees, contingencies and any other items included as part of the contract amount.

There are a number of credits [e.g. Reused Materials (Mat-3), Concrete (Mat-5), Steel (Mat-6), Sustainable Timber (Mat-8)] that reference this definition of Contract value.
As such, the following items must be excluded when using the contract value for calculations of such credits:

- Preliminaries;
- Demolition works;
- Consultants, design fees, project management fees;
- Works outside the site area; and
- Buildings or areas within the site that are not being assessed for purposes of Green Star SA.

Where a number of amenities or services are shared between buildings, the cost apportioned to the Green Star SA registered building must be equivalent to the use that the building will have of these facilities (e.g. if a shared parking has 100 spaces but 40 are being allocated to the Green Star SA registered building, then 40% of the car park cost must be allocated to the project's contract value).

A letter from a Quantity Surveyor or cost planner showing the breakdown of the excluded costs and the total cost for the project undergoing the Green Star SA rating must accompany the documentation submitted as evidence towards the projects Green Star SA assessment.

Technical Clarification: Typical Floor Plan submission for multi-storey buildings

Technical Clarification Number: GEN00-T-OB1-0446

Guidance: 2012-05-22

The GBCSA recognises that in a multi-storey building (such as a high-rise building) there may be typical floor plans i.e. floor plans that have exactly the same perimeter wall construction, configuration/layout and size.
In addition, there may be typical building services layout drawings representing a number of floors, where the configuration, layout and size of these floors do not vary in such a way as to affect compliance with credit criteria of particular credits in the rating tool.

The following provides guidance where a multi-storey building has a typical floor plan(s):

Where the 'Documentation Requirements' (for Design and/or As Built) requires any plan drawings as

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evidence that confirms compliance, the submission and inclusion of typical floor plans is acceptable, provided that for that specific credit, compliance with the credit criteria will not vary per floor. Where typical floor plans are used, the following documentation should be submitted:

- A brief description motivating that for the specific credit in question, compliance with the credit criteria will not vary per floor represented by the 'typical floor' plan(s). This can be given in the Short Report where applicable or as a separate document preceding the drawings.
- 'Typical floor' plan drawing(s) clearly marked and named as such and submitted in accordance with the stipulated documentation requirements for the relevant targeted credit.

Credit Interpretation Request: Contractual documents and Appendices

Credit Interpretation Request Number: GEN00-T-OB1-505

Ruling: 2012-05-17

For the purposes of Green Star SA, where Green Star SA criteria, benchmarks and/or conditions are required to be contained in contractual documents; it is acceptable that these criteria, benchmarks and/or conditions are contained in Appendices to the principal contract document, given that the conditions and the Appendices in which they are contained, are clearly referenced in the principal contract document.

Technical Clarification: Scope of delivery – 'Conventional', 'Integrated' and 'Shell & Core' (REPLACES GEN00-T-OB1-0048 issued 16 Oct 2009)

Technical Clarification Number: GEN00-T-OB1-0380

Guidance: 2012-01-11

The following provides guidance as to the scope of delivery for Conventional, Integrated and Shell & Core:

Conventional Delivery:

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with ceilings, finishes (e.g. floor coverings and paint), generic mechanical services (e.g. ducts from air supply and return risers, or other HVAC equipment, with generic control zone/diffuser/return layouts), generic electrical services (e.g. generic lighting layout) and complete wet services. The fitout to tenant areas is intended to be generic and non-tenant specific.

Integrated Fitout:

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with ceilings, finishes (e.g. floor coverings and paint), specific mechanical services (e.g. ducts from air supply and return risers, or other HVAC equipment, with fitout specific control zone/diffuser/return layouts), specific electrical services (e.g. fitout specific lighting layout) and complete wet services. The fitout to tenant areas are tenant specific.

Shell & Core:

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with no ceilings, floor coverings, lighting systems nor partition walls. Mechanical services are not installed within tenant areas, with ducts from air supply and return

General TC / CIR

risers finishing within 1m of the face of the riser (for central air systems), or no other tenant-side systems installed (e.g. indoor units). A raised floor or underfloor air distribution (UFAD) system may be installed in a Shell & Core scenario provided floor coverings are not installed. No fitout is provided in a Shell & Core scenario.

Technical Clarification: Quantity surveyor report and short report

Technical Clarification Number: GEN00-T-OB1-0357

Guidance: 2012-01-06

This Technical Clarification is applicable to Mat-3 Reused Materials, Mat-6 Steel, Mat-7 PVC Minimisation, Mat-8 Sustainable Timber, Mat-9 Design for Disassembly, Mat-10 Dematerialisation and Mat-11 Local Sourcing.

Where the 'Documentation Requirements' (for Design and As Built) request a 'Short report' and a 'Quantity Surveyor report', if the 'Short report' is prepared by the Quantity Surveyor, it is permitted that one consolidated report satisfying both 'Documentation Requirements' be submitted instead of two separate documents.

Where the 'Short report' is not prepared by the Quantity Surveyor (e.g. green building consultant, Accredited Professional, structural engineer etc.), both the 'Short report' and 'Quantity Surveyor report' must be submitted independently.

The purpose of the 'Quantity Surveyor report' is to validate data (e.g. quantities, costs, Project's contract value etc.) referenced within the 'Short report'.

Technical Clarification: Project registration date and TCs/CIRs

Technical Clarification Number: GEN00-T-OB1-0307

Guidance: 2012-01-05

The registration date used to determine the applicability of TCs and CIRs published on the GBCSA website (where within the TC/CIR it is indicated as dependent on registration date) is deemed as the date of first registration of the project for a Green Star SA certification under a particular rating tool, independent of whether it is Design or As Built certification.

Technical Clarification: Usable Area (UA) and Gross Floor Area (GFA)

Technical Clarification Number: GEN00-T-OB1-0350

Guidance: 2011-11-23

The GBCSA recognises that determining and recording the UA and GFA of a project for Green Star SA is often performed using CAD, with the resulting CAD drawings unlikely to be issued "For Tender", "For Construction" or "As Built" and are more likely to be issued "For Information". To reduce Green Star SA documentation related activities, drawings prepared to calculate and demonstrate UA and GFA are not required to be issued "For Tender", "For Construction" or "As Built" and issued "For Information" drawings will be accepted. This is strictly for the purposes of demonstrating the UA and GFA only. Please note that all other drawings submitted for the purposes of Green Star SA must be

General TC / CIR

issued “For Tender”, “For Construction” or “As Built” as per the particular credit documentation requirements as stipulated in the relevant Green Star SA Technical Manual.

Technical Clarification: Internal walls in office areas

Technical Clarification Number: GEN00-T-OB1-0276

Guidance: 2011-06-01

Where internal walls within Office areas are provided as part of the ‘base building provision’ (i.e. will not change based on tenant requirements), project teams may include these within the Green Star SA submission, but should ensure they are included consistently across the submission. (E.g. finishes to these walls may need to be included in the IEQ-13 credit.)

Technical Clarification: Additional Guidance

Technical Clarification Number: GEN00-T-OB1-0120

Guidance: 2010-12-23

The Additional Guidance section of each credit contains additional information which is applicable to some projects. Where applicable, all information in Additional Guidance is mandatory. The Assessor(s) reserve the right to determine whether or not a project meets the requirements of this section. The details of what documentation needs to be included in a submission are set out in the Documentation Requirements section of each credit. Assessors will not ask for documentation that is not listed in the Documentation Requirements, unless something in the provided documentation shows non-compliance with the Credit Criteria or Additional Guidance, whereby the Assessors can ask for a declaration or explanation.

Technical Clarification: Documentation requirements - specifications

Technical Clarification Number: GEN00-T-OB1-0084

Guidance: 2010-12-22

Where projects are unable to provide specifications required in the Documentation Requirements of a credit, Tender Issue or Construction Issue drawings may replace the specifications, provided that:

- o They contain all the information required in the Technical Manual to define the design and scope of work;
- o They are accompanied by a short report from a suitably qualified Engineer describing how the Credit Criteria is met; and
- o All other documentation for the credit is provided in accordance with the Technical Manual.

In addition, construction supervisor, consultant or client instructions (site instructions or variation orders) may be used, provided that they give a level of detail similar to that of a specification, and are supported by documentary evidence of the acceptance of such an instruction by the relevant party.

General TC / CIR

Technical Clarification: Project member organisation name change

Technical Clarification Number: GEN00-T-OB1-0094

Guidance: 2010-08-13

Where an organisation involved in the project undergoes a change of name which leads to inconsistencies in documentation within the submission, the project team is required to include a letter from the organisation clearly stating the original name and the new name of the organisation, and that the engagement, contract or sub-contract of the organisation is still valid, and that the scope of works has not changed as a result of the name change. For inclusion in Round 1 submissions, please include the letter in the 'General' section ensuring it is brought to the attention of the Assessors. For inclusion in Round 2 submissions, please include the letter in each credit submitted where there exists an inconsistency in the documentation between Round 1 and Round 2 and note this additional documentation in the credit cover sheet, referencing this Technical Clarification.

Technical Clarification: Documentation requirements - specifications

Technical Clarification Number: GEN00-T-OB1-0091

Guidance: 2010-07-27

Where extract(s) from specification(s) are required in the Documentation Requirements for a credit, actual pages from project-specific specification(s) are required, showing the project name and revision, and all requirements for the 'extract(s) from specification(s)' prescribed in the Documentation Requirements for the credit. Where the project name and/or revision does not appear on every page of the specification(s), it is acceptable to include the relevant extract page(s), complete with the specification(s) cover sheet(s) indicating the project name and revision. Text copied from specifications into Green Star SA reports or letters does not demonstrate the same contractual obligation and is not acceptable. Product data sheets on their own do also not substitute for specifications, as they do not demonstrate the same contractual obligation. It is acceptable to replace general product requirements with the specification of a specific product, as long as a manufacturer's product data sheet is provided for the product, demonstrating compliance with the relevant criteria required by the Documentation Requirements. The specification and product data sheets together must still include all requirements of the 'extract(s) from specification(s)' prescribed in the Documentation Requirements for the credit.

Technical Clarification: Car parking and external areas

Technical Clarification Number: GEN00-T-OB1-0037

Guidance: 2009-06-03

Drive aisles and access areas within parking lots are to be allocated to "Car Parking Area". Access roads and driveways outside of parking lots are to be allocated to "External Areas".

Technical Clarification: 'Material Cost' - definition

Technical Clarification Number: GEN00-T-OB1-0029

General TC / CIR

Guidance: 2009-03-31

There are a number of credits [e.g. Reused Materials (Mat-3), Concrete (Mat-5), Steel (Mat-6), Sustainable Timber (Mat-8)] that reference the cost of materials as a percentage of total contract value. The cost of a material may include transport/shipping costs to the project site, but may not include installation costs, equipment for installation, contractor fee, contingencies or any other amounts.

Technical Clarification: Construction Issue drawings

Technical Clarification Number: GEN00-T-OB1-0027

Guidance: 2009-03-27

For Design submissions, Construction Issue drawings are acceptable alternatives to Tender Issue drawings.

Technical Clarification: Contractual documentation

Technical Clarification Number: GEN00-T-OB1-0025

Guidance: 2009-03-17

Hand written declarations or letters signed by one party are not considered valid contractual evidence.

Technical Clarification: Green Star SA - Office v1 and medical consulting offices

Technical Clarification Number: GEN00-T-OB1-0015

Guidance: 2009-02-06

Medical consulting offices falling under SABS 0400 occupancy class G1 (Offices) may be submitted and certified under the Green Star SA - Office rating tool. However, medical treatment facilities classified as E2 occupancy (Hospital) may not be submitted or certified under the Office tool.

Technical Clarification: "Supplementary Area" exclusions from Gross Floor Area (GFA)

Technical Clarification Number: GEN00-T-OB1-0001

Guidance: 2009-02-05

Covered walkways, balconies and patios not protected from the elements are "Supplementary Area" per SAPOA definitions of building area and are not included in the Gross Floor Area (GFA). The GFA refers to all parts of a building that are permanently covered and can be protected from the elements. Car parking (including under-cover car parking) should not be included.

General TC / CIR

MAN-1 Green Star SA Accredited ProfessionalPOINTS
AVAILABLE**2****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 design and construction phases.

CREDIT CRITERIA

Two points are awarded where:

A principal participant in the design team is a Green Star SA Accredited Professional and has been engaged by the building owner to provide sustainability advice from the schematic design phase through to construction completion.

DOCUMENTATION REQUIREMENTS

To be deemed 'engaged', in line with the Aim of Credit, the Green Star SA Accredited Professional must contribute substantially, i.e. attend at least 50% of all project design meetings and 75% of all building services meetings.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Proof of accreditation • Letter of appointment • Signed statement of involvement	• Proof of accreditation • Letter of appointment • Signed statement of involvement

Proof of Accreditation:

- A copy of the nominated Green Star SA Accredited Professional's accreditation certificate; OR
- A printout of the relevant page of the online Green Star SA Accredited Professional Directory, found on the GBCSA website, signed and dated by the project's Green Star SA Accredited Professional, with his/her name underlined.

Letter of Appointment for the Green Star SA Accredited Professional, listing his or her scope of works.

Signed Statement of involvement from the Green Star SA Accredited Professional stating that he or she has attended at least 50% of all project design meetings and 75% of all building services meetings.

MAN-1 Green Star SA Accredited ProfessionalPOINTS
AVAILABLE**2****ADDITIONAL GUIDANCE**

Should the role of the Green Star SA Accredited Professional be fulfilled by different individuals throughout the project, the evidence listed under Documentation Requirements must be submitted for each Accredited Professional. As the value to the project must not be compromised by the handover, projects must also provide a description of the handover procedures for all of the roles of the original Green Star SA Accredited Professional.

BACKGROUND

It is hoped that Green Star SA Accredited Professionals will be of assistance in informing and advising clients and fellow designers on environmentally sustainable solutions and generally leading projects to better environmental outcomes.

REFERENCES & FURTHER INFORMATION

Green Building Council of South Africa

<http://www.gbcsa.org.za>

Green Star SA Accredited Professional Database

<http://www.gbcsa.org.za>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: MAN1 -T-OB1-744

Guidance: 2013-10-29

Signed Statement of Involvement

The GBCSA confirm that where an Accredited Professional is not available to complete the 'signed statement of involvement', it is acceptable for this statement to be completed by the AP's manager with the AP's name clearly stated.

The confirmation is still required to confirm that the AP has attended at least 50% of all project design meetings and 75% of all building services meetings.

MAN-1 Green Star SA Accredited ProfessionalPOINTS
AVAILABLE**2****Technical Clarification Number: MAN1-T-OB1-0030****Guidance:** 2009-03-31

Timing of design phase

If the schematic design phase of the project was begun prior to 1 June, 2009, this credit may be marked 'Not Applicable' and be excluded from the points available, used to calculate the Management Category Score. Type 'na' in the No. of Points Achieved column.

MAN-2 Commissioning Clauses

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise commissioning and handover initiatives that ensure that all building services can operate to optimal design potential.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where it is demonstrated that:

- Comprehensive pre-commissioning, commissioning, and quality monitoring are contractually required to be performed for all building services (BMS, mechanical, electrical, hydraulic and fire protection); AND
- The works outlined above are done in exact accordance with CIBSE Commissioning Codes. Alternatively, ASHRAE Commissioning Guideline 1-1996 can be used for the mechanical services.

An additional point is awarded where it is demonstrated that:

- The point above is achieved; AND
- The design team and contractor are in a position to transfer project knowledge to the building owner/manager through all of the following:
 - Documented design intent;
 - As built drawings;
 - Operations and Maintenance Manual;
 - Commissioning Report; and
 - Training of building management staff.

DOCUMENTATION REQUIREMENTS

For most projects, the building services addressed by this credit are deemed to include HVAC, BMS, hydraulic, electrical and fire protection.

It must be clearly demonstrated that the commissioning requirements have been integrated into the project thoroughly, by a suitably qualified professional(s).

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

MAN-2 Commissioning ClausesPOINTS
AVAILABLE**2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Extract(s) from the Commissioning Specification • Project Timeline/Programme • Confirmation from building owner Extra information required where the additional point is claimed: • Short report on design intent • Extract(s) from the M&E specifications	• Extract(s) from Commissioning Report(s) Extra information required where the additional point is claimed: • Short report on design intent • Extracts from O&M manual • Details of training provided

Extract(s) from the Commissioning Specification where the requirements for the project commissioning are defined. Relevant items must be highlighted, and must demonstrate that the commissioning is required to be in exact accordance with CIBSE Commissioning Codes for all services or ASHRAE Commissioning Guideline 1-1996 for the mechanical services and CIBSE Commissioning Codes for the other services.

Project Timeline/Programme demonstrating the inclusion of a commissioning period and relevant milestones, as well as their impact on the rest of the project activities. This is to try to avoid situations where the commissioning period is 'lost' in the rush to handover the building to the client.

Confirmation from the building owner indicating the building owner's commitment to incorporate the commissioning requirements into the project in accordance with the specifications.

Short report on design intent

This may be in the form of extracts from the Scheme Stage Design Report or similar. The Building Users' Guide (credit Man-5) would also satisfy this requirement. The report must outline the design intent and include the following items:

- Energy & Environmental Strategy including initiatives intended to enhance energy efficiency and minimise greenhouse gas emissions; and
- Building Services – description of the basic functions and operation of the following systems: BMS, mechanical, HVAC (heating and cooling) , hydraulic, fire protection, ventilation, electrical systems, lighting and domestic hot water.

Each referenced system must be accompanied by the following documentation:

- A simplified diagram of the system; and
- A description of its intended operation and its conditions.

Extract(s) from the M&E specifications

The specifications must list the contractor's requirements to provide the owner with the following at building handover:

MAN-2 Commissioning Clauses

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- As built/as installed drawings;
- The Commissioning Report; and
- Training to ensure that building management staff have all the information and understanding needed to operate and maintain the features and systems in the building.

Extracts from Commissioning Report (s) must:

- Demonstrate that the services were commissioned in compliance with CIBSE Commissioning Codes for all services or the ASHRAE Commissioning Guideline 1-1996 for the mechanical services and CIBSE Commissioning Codes for all other services.
- Include commissioning dates, records of all functional/commissioning testing undertaken, a list of any future seasonal testing, and a written list of outstanding commissioning issues; and
- Include the outcomes and changes made to the building as a result of the commissioning process, accounting for all of the recommendations.
- Reference appended extracts of commissioning records for major plant and equipment (including chillers, boilers, heat pumps, air handling units, water treatment/recycling systems, onsite generation systems, water distribution (chilled, heating hot water and domestic hot and cold water), lighting system, air distribution, lifts and vertical transportation systems and automated controls (within the BMS and/or Energy metering, HVAC, and wet services) as deemed appropriate by the relevant project team members involved in the commissioning process and as referenced in the Commissioning Report.

Extract(s) from the Operations and Maintenance (O&M) Manual

Describe how the facility will be operated and by whom, as well as the desired level of training and orientation required for the building occupants to understand and use the building systems.

Details of training provided to building management staff

Confirmation that sufficient training is being or will be provided to ensure that building managers or staff members have all the information and understanding needed to operate and maintain the commissioned features and systems of the building. The training provided must include at a minimum:

- Information provided in the Design Intent Report (including energy/environmental features);
- Review of controls set up, programming, alarms and troubleshooting;
- Review of O&M manuals;
- Building operation (start up, normal operation, unoccupied operation, seasonal changeover, shutdown);
- Measures that can be taken to optimise energy efficiency;
- Occupational Health & Safety (OH&S) issues;
- Maintenance requirements and sourcing replacements; and
- Obtaining and addressing occupant satisfaction feedback.

ADDITIONAL GUIDANCE

Commissioning works must be carried out by competent specialists with relevant qualifications.

MAN-2 Commissioning Clauses

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Where appropriate, information transferred to the building owner may be in the form of a comprehensive Building Users' Guide (see Man-5 'Building Users' Guide').

Wherever 'Building Services' are referred to in Man-2, this should be taken to include, but not be limited to, BMS, mechanical, HVAC (heating and cooling), hydraulic, fire protection, ventilation, electrical systems, lighting and domestic hot water.

Whilst not required by the referenced standards, project teams are strongly encouraged to consider the implications of commissioning on indoor air quality, e.g. through establishing an indoor air quality commissioning plan at the design stage with specific provisions for ensuring that this plan is met during and after commissioning.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – If any component of the project is delivered as shell and core or an integrated fit-out, the scope of commissioning as defined in the specifications must cover the entire traditional scope of fit-out provided by the base building (e.g. electrical, mechanical, hydraulic and BMS systems even if some elements will be installed by the tenant). Commissioning must check against the documented base building design and ensure that the building operates to its design potential.
- **As Built** – If any component of the project is delivered as shell and core or an integrated fit-out, the scope of commissioning must cover the entire traditional scope of fit-out provided by the base building (e.g. electrical, mechanical, hydraulic and BMS systems even if some elements were installed by the tenant). Therefore, if the design is such that the base build systems will be affected by the tenant works, this credit can only be obtained after the completion of the relevant fit-out works when the systems have been fully commissioned. Commissioning must check against the documented base building design and confirm that the building operates to its design potential.

BACKGROUND

Few buildings work as initially intended by their design teams. As responsibility passes from the design team to the contractor to the building owner to the operation & maintenance team, there are significant opportunities for processes to go wrong, for misunderstandings, and for strategy to give way to practical expediency.

The successful transfer of building information at commissioning stage will allow:

- Building operators to understand in detail what they need to do to operate the facility and further tune it to continuously improve and respond to changes in circumstance;
- Maintenance personnel to understand how to service the particular systems, not only for reliable operations, but also for energy efficiency;
- Occupants to understand the limits within which they must function to maintain the design performance; and
- Future modifiers to understand the design basis for the building and the systems so that these are not compromised by any changes.

Building Information Technology system

Utilising the skills of the building IT provider upfront, within the development team, will assist in making the most effective use of the building IT system. By capitalising on open system technologies the building owner benefits from the overall cost efficiencies offered by integration and demonstrates a commitment to system accountability. A properly designed

MAN-2 Commissioning Clauses

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building IT system is simpler to audit and fine-tune.

Considering building IT at the planning stage of the development has benefits that include:

- Demonstrating a commitment by the developer to provide a building where performance may be simply audited and reported;
- Pre-commissioning and commissioning stages for the building services that are more effective, as the system becomes a valuable tool to fine-tuning the building's performance. An integrated system may give the user an holistic view of the building's performance, allowing the user to see the effects of one system on another; and
- The reduced cost and increased environmental benefit of utilising open technologies. By their design, these systems require less hardware and cabling to be installed, thereby offering efficiencies in installation, hardware cost and space requirements.

CIBSE Commissioning Code M: Commissioning Management

CIBSE Commissioning Code M presents current standards of commissioning practice in the form of recommendations and guidance. The Code acknowledges that it may be used in a variety of contractual frameworks. Users will need to ensure that the use of the Code is considered when contractual arrangements are being made, to ensure that the recommendations of the Code are not in conflict with those of the contract. It is important that contractual arrangements make allowance at the design stages for the needs of commissioning engineers and the time required to commission building services systems properly.

ASHRAE Guideline 1-1996 – The HVAC Commissioning Process

This guideline describes the commissioning process that ensures the Heating, Ventilation, and Air Conditioning (HVAC) systems perform to their 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 pre-design through final acceptance and post-occupancy, including any changes in building and occupancy requirements after initial occupancy. Included in the guidelines are:

- A programme for the training of operation and maintenance personnel.
- Procedures for the preparation of documentation of owner's assumptions and requirements, including:
 - Design intent, basis of design, and expected performance;
 - Verification and functional performance testing;
 - Details on the process for conducting verification and functional performance testing;
 - Operation and maintenance criteria; and
 - Details on the process for maintaining system performance to meet the current design intent after initial occupancy.

REFERENCES & FURTHER INFORMATION

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

ASHRAE Guideline 1-1996 – The HVAC Commissioning Process

<http://www.ashrae.org/publications/page/683> ASHRAE Handbook New Building Commissioning

MAN-2 Commissioning Clauses

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ASHRAE Guideline 0-2005, The Commissioning Process
CIBSE (Chartered Institution of Building Services Engineers, U.K.)

<http://www.cibse.org>

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 M: Management

CIBSE Commissioning Code R: Refrigeration

CIBSE Commissioning Code W: Water Distribution Systems

BSRIA (Building Services Research and Information Association, UK)

<http://www.bsria.co.uk>

BSRIA Application Guide AG3/89.3 Commissioning Air Systems

BSRIA Application Guide AG 1/91 Commissioning of VAV systems in Buildings

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: MAN2 -T-OB1-764

Guidance: 2014-02-14

Alternative Documentation

This email pertains to the Technical Clarification (TC) submitted for the Man-2 Commissioning and Man-3 Building Tuning credits, seeking approval to submit alternative documentation (extracts from building contracts) for the Man-2 and Man-3 credits in place of 'Extracts(s) from the Commissioning Specification' and 'Extract(s) from the Specification(s)'.

The CIR request is conditionally approved. The approval of this CIR is thus contingent on the following:

All the information required to demonstrate compliance with the credit criteria in both the 'Extracts(s) from the Commissioning Specification' and 'Extract(s) from the Specification(s)' for Man 2 and Man 3 respectively is included in the proposed alternative documentation (i.e. extracts from the building contract).

Please note that the other documentation requirements stipulated in the Green Star SA – Office v1 Technical Manual must still be adhered to.

MAN-2 Commissioning Clauses

POINTS
AVAILABLE

2

Note that this Technical Clarification will be uploaded to the TC, CIR & Errata database available on the GBCSA website.

Technical Clarification Number: MAN2 -T-OB1-717

Guidance: 2013-08-16

Commissioning reports

The GBCSA notes that there are a number of credits that refer to commissioning reports as a compliance requirement. The GBCSA notes that these credits are not dependent on the Man-2 credit being targeted or achieved. Project teams can still choose whether or not to target the Man-2 credits if the subsequent credits (i.e. ENE-1, ENE-4, Wat-1, Wat-2 and IEQ-1) are targeted. If a project is targeting the Man-2 credit, extracts from the Commissioning Report produced from Man-2 can then be used to demonstrate compliance with the other subsequent credits provided it complies with the documentation requirements for these credits. If the Man-2 credit is not targeted, commissioning for the other credits need to be done in accordance to the stipulated requirements of that particular credit.

Technical Clarification Number: MAN2-T-OB1-0370

Guidance: 2012-06-13

Commissioning Clauses - lifts and vertical transportation systems
(*SUPERSEDED by MAN2-T-OB1-0430 from 2012-06-13*)

Technical Clarification Number: MAN2 -T-OB1-0430

Guidance: 2012-06-13

Guidance on building services / sub-services included within the scope of Man-02 and Man-03

Please refer to the 'Man-02 and Man-03 Supplementary Info Document' attached (below), it shows which services are required to be addressed under both the Man-2 and Man-3 credits, and for Man-2, shows which ASHRAE / CIBSE documents are applicable to each in terms of the credit criteria. Where no suitable ASHRAE / CIBSE document is available, the project team's 'Nominated Commissioning' applies. Please note further guidance on 'Nominated Commissioning' is given below the table in the document.

Supplementary Information

[MAN-02 and MAN-03 Supplementary Info Document.pdf](#)

MAN-2 Commissioning Clauses

POINTS
AVAILABLE**2****Technical Clarification Number: MAN2-T-OB1-0275****Guidance:** 2012-06-13**Commissioning Clauses - On site electrical generation systems**
(SUPERSEDED by MAN2-T-OB1-0430 from 2012-06-13)**Technical Clarification Number: MAN2-T-OB1-0227****Guidance:** 2012-01-06**Demonstration of compliance with CIBSE Commissioning codes - Guidance**

To provide Project Teams with further guidance regarding the information which would be expected to be included within the Commissioning Records 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;

- 1) 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 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;
- 2) Requirements for witnessing including full details of tolerances applicable to all parameters;
- 3) Commissioning program including specific period of time for client witnessing;
- 4) Appropriate health and safety risk assessment and method statements for the tasks to be completed;
- 5) Commissioning method statement for each system;
- 6) Pre-commissioning checklists for each system;
- 7) Commissioning checklists; and,
- 8) 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

MAN-2 Commissioning Clauses

POINTS
AVAILABLE**2**

important and represent an improvement from conventional commissioning practices in South Africa and demonstrate the use of the CIBSE Commissioning Codes.

Technical Clarification Number: MAN2-T-OB1-0358

Guidance: 2012-01-06

Fitout delivery type and scope of Man-2 Commissioning Clauses

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the Man-2 Commissioning Clauses credit criteria must cover the entire traditional scope of fit-out provided by the base building (i.e. conventional delivery). Therefore, if the design is such that the commissioning of the base build systems will be affected by the tenant works, the scope of the credit criteria extends to full base build final commissioning.

For spaces delivered as 'Shell & Core' for a Design rating, it must be clear that the 'extract(s) from specification' and 'confirmation from building owner' demonstrate the contractual requirement and owner commitment (respectively) for final commissioning of those base build systems that are affected by the tenant works, once the tenant works are completed.

For spaces delivered as 'Shell & Core' for an As Built rating, it must be clear that the 'extract(s) from Commissioning Reports' demonstrate the base build systems not affected by tenant works have been commissioned (as per the Documentation Requirements) and it is clearly demonstrated through the list of outstanding commissioning issues that final commissioning of those base build systems that are affected by the tenant works will be undertaken, once the tenant works are completed. It is not required that final commissioning of affected base build systems is completed before the Green Star SA submission is completed. It is necessary, however, to clearly demonstrate that the outstanding commissioning issues will be addressed.

The following errata have been included in this credit:

MAN2 -E-OB1-509 : Text missing from description of documentation (2012-05-22)

MAN2-E-OB1-0168 : Green Star SA - Office v1 Technical Manual: Page 9 (2012-05-22)

MAN2-E-OB1-0249 : Green Star SA - Office v1 Technical Manual: Page 11 (2012-01-27)

MAN2-E-OB1-0248: Green Star SA - Office v1 Technical Manual: Page 10 (2011-02-08)

MAN-3 Building Tuning

POINTS
AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise commissioning initiatives that ensure optimum occupant comfort as well as energy and water efficient services performance throughout the year

CREDIT CRITERIA

Two points are awarded where:

- After handover, the building owner implements tuning of all building systems; AND
- A relevant member of the design team is involved in the tuning process; AND
- Monthly monitoring is undertaken and the outcomes are reported to the building owner quarterly to allow corrective action to be taken; AND
- Full re-commissioning is undertaken 12 months after practical completion; AND
- A Building Tuning Report on the outcomes of the tuning process will be provided to the building owner and made available to the design team.

DOCUMENTATION REQUIREMENTS

The building tuning process must include:

- Verification that systems are performing to their design potential during all variations in climate and occupancy;
- Optimisation of time schedules to best match occupant needs and system performance; and
- Alignment of the systems' operation to the attributes of the built space they serve.

Re-commissioning refers to the process of undertaking a review of all systems to the scope of the initial pre-occupancy commissioning. Re-commissioning is intended to incorporate any modifications identified as necessary or beneficial during the building tuning period and to improve the performance of building operation. The term does not refer to the re-setting of the systems to the initial commissioning settings.

It must be demonstrated that the project design reflects the commitment to building tuning; that the owner endorses this commitment; and that a feedback process has been established.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

MAN-3 Building Tuning

POINTS
AVAILABLE **2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Extract(s) from the specification(s) • Project timeline/programme • Confirmation from the building owner	• Building tuning contract with contractor • Building tuning contract with relevant design team member

Extract(s) from the specification(s):

- Including a requirement for a minimum 12-month tuning process which includes no less than monthly monitoring, quarterly reviews and reporting, and a full re-commissioning service carried out 12 months after practical completion in accordance with design intent documentation from the design team, with a Building Tuning Report generated for the building owner; and
- Listing the roles and responsibilities of the various parties to be involved during this period.

Project timeline/programme

Demonstration of the inclusion of the building tuning period and milestones in the project timeline, and/or specifying dates for the monitoring and re-commissioning works.

Confirmation from the building owner committing to:

- Employ a building tuning team to carry out the necessary services including production of a Building Tuning report which is to be reviewed by the design team member and made available to the other project team members; and
- Verification that systems are performing to their design potential during all variations in climate and occupancy; and
- Optimisation of time schedules to best match occupant needs and system performance; and
- Alignment of the systems' operation to the attributes of the built space they serve
- The incorporation of building tuning outcomes into the project.

Building tuning contract with the contractor must:

- Show the scope, timeframe, milestones, and deliverables of the building tuning process;
- Be signed by the building owner and the contractor; and
- Verification that systems are performing to their design potential during all variations in climate and occupancy; and
- Optimisation of time schedules to best match occupant needs and system performance; and
- Alignment of the systems' operation to the attributes of the built space they serve
- Stipulate that a Building Tuning Report be generated by the building tuning team once the building tuning process has been finalised. This Report must be reviewed by the relevant design team member and must subsequently be made available to the building owner and other project team members.

Building tuning contract with the relevant design team member must stipulate that the design team member is required to review the Building Tuning Report as generated by the building tuning team.

MAN-3 Building Tuning

POINTS
AVAILABLE **2**

ADDITIONAL GUIDANCE

For Shell and Core or Integrated Fit-Out Projects

- **Design** – If any component of the project is delivered as shell and core or an integrated fit-out, the scope of building tuning as defined in the specifications must cover the entire traditional scope of fit-out provided by the base building (e.g. electrical, mechanical, hydraulic and BMS systems even if some elements are installed by the tenant). Re-commissioning must check against the original commissioning reports and documented base building design and ensure that the building operates to its design potential.
- **As Built** – If any component of the project is delivered as shell and core or an integrated fit-out, the scope of building tuning as defined in the contracts must cover the entire traditional scope of fit-out provided by the base building (e.g. electrical, mechanical, hydraulic and BMS systems even if some elements were installed by the tenant). Re-commissioning must check against the original commissioning reports and documented base building design and ensure that the building operates to its design potential.

BACKGROUND

Commissioning has traditionally been undertaken in a limited period of time at the end of the project, often with little budget remaining. It is done with the ambient climatic conditions at the time and usually with the building unoccupied.

It is now commonly accepted that a period of troubleshooting or 'sea trials' is required after the initial handover and occupation in order for buildings to achieve maximum energy performance. This should include post-occupancy evaluation, preferably involving the design team to give useful feedback to all stakeholders. Building tuning also aims to ensure that the systems are functioning correctly during all weather seasons, and is particularly valuable in buildings which are intended to operate in 'mixed mode' or with more sophisticated or complicated control systems.

The benefits of a 12-month commissioning period include:

- Verifying that systems are performing at their optimum efficiency during all climatic variations for the occupied building;
- Having an opportunity for the systems to be tuned to optimise time schedules to best match occupant needs and system performance; and
- Aligning a system's operations to the attributes of the built space it serves.

MAN-3 Building Tuning

POINTS
AVAILABLE **2**

REFERENCES & FURTHER INFORMATION

CIBSE Guide F – *Energy Efficiency in Buildings* (2004)

CIBSE Guide M – *Maintenance engineering and management* (2008) BSRIA AG 21/98 – *Feedback for Better Building Services Design*

For commissioning references, refer to Man-2 credit.

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: MAN3-T-OB1-0797

Guidance: 2014-05-09

Simple Domestic Hot Water Systems

The project team's proposal for excluding from the credit requirements minor domestic hot water systems that have no adjustment barring thermostats and have no timer settings is approved.

The GBCSA notes that the said DHW system may be excluded from compliance requirements of the Man-3 credit for the following factors:

- The scale of the DHW system (200 litre cylinder with electric element and solar collector) is not highly significant in terms of overall building energy consumption
- Provided the system does not operate on timers which may require adjustment based on occupancy, there is no adjustment for seasonal or occupancy variation

Technical Clarification Number: MAN3-T-OB1-764

Guidance: 2014-02-14

Alternative Documentation

This email pertains to the Technical Clarification (TC) submitted for the Man-2 Commissioning and Man-3 Building Tuning credits, seeking approval to submit alternative documentation (extracts from building contracts) for the Man-2 and Man-3 credits in place of 'Extracts(s) from the Commissioning Specification' and 'Extract(s) from the Specification(s)'.

MAN-3 Building Tuning

POINTS
AVAILABLE **2**

The CIR request is conditionally approved. The approval of this CIR is thus contingent on the following:

All the information required to demonstrate compliance with the credit criteria in both the 'Extracts(s) from the Commissioning Specification' and 'Extract(s) from the Specification(s)' for Man 2 and Man 3 respectively is included in the proposed alternative documentation (i.e. extracts from the building contract).

Please note that the other documentation requirements stipulated in the Green Star SA – Office v1 Technical Manual must still be adhered to.

Note that this Technical Clarification will be uploaded to the TC, CIR & Errata database available on the GBCSA website.

Technical Clarification Number: MAN3-T-OB1-764

Guidance: 2014-02-12

Alternative Documentation

All the information required to demonstrate compliance with the credit criteria in both the 'Extracts(s) from the Commissioning Specification' and 'Extract(s) from the Specification(s)' for Man 2 and Man 3 respectively is included in the proposed alternative documentation (i.e. extracts from the building contract).

Technical Clarification Number: MAN3-T-OB1-764

Guidance: 2014-02-12

Alternative Documentation

All the information required to demonstrate compliance with the credit criteria in both the 'Extracts(s) from the Commissioning Specification' and 'Extract(s) from the Specification(s)' for Man 2 and Man 3 respectively is included in the proposed alternative documentation (i.e. extracts from the building contract).

Please note that the other documentation requirements stipulated in the Green Star SA – Office v1 Technical Manual must still be adhered to.

Technical Clarification Number: MAN3-T-OB1-0375

Guidance: 2012-06-13

Building Tuning - lifts and vertical transportation systems

(SUPERSEDED by MAN3-T-OB1-0430 from 2012-06-13)

MAN-3 Building Tuning

POINTS
AVAILABLE **2**

Technical Clarification Number: MAN3-T-OB1-0430

Guidance: 2012-06-13

Guidance on building services / sub-services included within the scope of Man-02 and Man-03

Please refer to the 'Man-02 and Man-03 Supplementary Info Document' attached (below), it shows which services are required to be addressed under both the Man-2 and Man-3 credits, and for Man-2, shows which ASHRAE / CIBSE documents are applicable to each in terms of the credit criteria. Where no suitable ASHRAE / CIBSE document is available, the project team's 'Nominated Commissioning' applies. Please note further guidance on 'Nominated Commissioning' is given below the table in the document.

Supplementary Information

[MAN-02 and MAN-03 Supplementary Info Document.pdf](#)

Technical Clarification Number: MAN3-T-OB1-0039

Guidance: 2012-06-13

Scope: (SUPERSEDED by MAN3-T-OB1-0430 from 2012-06-13)

Credit Interpretation Request Number: MAN3-C-OB1-0274

Ruling: 2011-05-30

Building tuning period commencement

The Credit Interpretation Request (CIR) seeking approval to commence the 12 month building tuning period, as prescribed in Man-3 Building Tuning Credit Criteria in the Green Star SA Office v1 Technical Manual, at a date beyond the practical completion date of the Green Star SA project, is conditionally approved.

The CIR Review Panel holds the opinion that it is likely that some Green Star SA projects will not be in a position to commence the 12 month building tuning period immediately upon practical completion for reasons which may limit the beneficial outcomes intended (e.g. speculative development with low occupancy levels etc.). It is therefore acceptable that the 12 month building tuning period (in accordance with the Green Star SA Office v1 Technical Manual) commences at a date after the Green Star SA project's practical completion date. However the 12 month building tuning period must commence within 2 years of the practical completion of the Green Star SA project (in acknowledgement of Green Star SA 'Eligibility Criterion 4: Timing of Certification'.

MAN-3 Building Tuning

POINTS
AVAILABLE **2**

The following errata have been included:

MAN3-E-OB1-0429 (2012-03-06): **Green Star SA - Office v1 Technical Manual: Page 16**

MAN3-E-OB1-0146 (2011-01-06): **Green Star SA - Office v1 Technical Manual: Page 16**

MAN3-E-OB1-0170 (2011-01-06): **Green Star SA - Office v1 Technical Manual: Page 15**

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MAN-4 Independent Commissioning Agent

POINTS
AVAILABLE**1**

AIM OF CREDIT

To ensure buildings are designed with regard to future maintenance and are correctly commissioned before handover.

CREDIT CRITERIA

One point is awarded where an experienced person not part of the normal design team has been appointed to:

- Provide independent advice on commissioning & maintenance issues to the building owner and the design team; AND
- Produce input at preliminary design stage covering commissioning, maintenance and replacement of building services; AND
- Produce a short guide to commissioning/maintenance at detailed design stage, highlighting access issues and replacement of plant; AND
- Monitor and verify the commissioning of all building systems.

DOCUMENTATION REQUIREMENTS

The Independent Commissioning/Maintenance Specialist must meet the following criteria:

- Be suitably qualified or experienced (i.e. be a registered professional engineer or qualified technician with relevant, documented working knowledge of either designing or commissioning the type of HVAC, hydraulic, electrical and fire suppression systems used in the project);
- Not be directly involved in the day-to-day project design or implementation;
- Be an objective advocate of the building owner, with the following responsibilities:
 - Be engaged by, and report directly to, the building owner;
 - Provide maintenance and commissioning advice to the project team from the beginning of schematic design through practical completion of the project, interacting with the team throughout all stages of construction;
 - Be involved, at a minimum, at the beginning of each major stage in the documentation of the project (schematic design, design development, construction documentation, tendering and specifications) at the beginning of construction and regularly involved during the construction phase of the project;
 - Introduce commissioning standards and strategies early in the design process;
 - Review the basis of design and design intent as well as preliminary working drawings;
 - Review the commissioning process that covers the following wherever present: air distribution systems, boilers, automatic controls, lighting, refrigeration systems and water distribution systems;
 - Coordinate with the building owner, design team and contractor throughout the

MAN-4 Independent Commissioning AgentPOINTS
AVAILABLE**1**

commissioning, testing and adjustment phases;

- Observe, review and approve results of all testing undertaken by the contractor;
- Monitor and verify the commissioning of all systems;
- Prepare a Commissioning Report including recommendations to the building owner on the performance of commissioned building systems; and
- Be involved in the quarterly fine-tuning process and the final re-commissioning of the building.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• CV of the Independent Agent • Preliminary design stage input • Short guide to maintenance/commissioning	• CV of the Independent Agent • Proof of Agent's involvement in project • Commissioning report

CV of the Independent Agent detailing the qualifications and experience relevant to the project.

Preliminary design stage input from the Independent Agent. This could take the form of a short report or notes or comments on drawings if appropriate. Input must cover the following:

- Installation and replacement of large items of plant where this is not straightforward;
- Access provision to allow safe maintenance of plant, especially where roof mounted plant is envisaged; and
- Any unusual commissioning requirements.

Short guide to maintenance/commissioning written by the Independent Agent and covering the following topics:

- Installation and replacement of large items of plant;
- Access provision to allow safe maintenance of plant, especially where roof mounted plant is envisaged; and
- Commissioning requirements for the project.

Proof of the Independent Agent's involvement in the project could take the form of the 'preliminary design stage report' (see above) provided this is written by the Independent Agent. Alternatively the demonstration of the agent's involvement in meetings early on in the design process through the provision of copies of meeting minutes and attendees; or a list of correspondence and reporting provided by the Independent Agent to the design team.

Commissioning Report summarising the major findings and recommendations of the commissioning process.

MAN-4 Independent Commissioning Agent

POINTS
AVAILABLE

1

ADDITIONAL GUIDANCE

The primary goal of the Independent Commissioning Agent is to independently identify system deficiencies as early in the project as possible and track their status until they are corrected.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – If any component of the project is delivered as shell and core or an integrated fit-out, the scope of the Independent Agent must cover the entire traditional scope of fit-out provided by the base building (e.g. electrical, mechanical, hydraulic and BMS systems even if some elements will be installed by the tenant).
- **As Built** – If any component of the project is delivered as shell and core or an integrated fit-out, the scope of the Independent Agent must cover the entire traditional scope of fit-out provided by the base building (e.g. electrical, mechanical, hydraulic and BMS systems even if some elements were installed by the tenant). Therefore, if the design is such that the base build systems will be affected by the tenant works, this credit can only be obtained after the completion of the relevant fit-out works when the systems have been fully commissioned.

BACKGROUND

Maintenance and commissioning are all too often given a low priority during the early design stages, particularly since the design team may have little practical experience of the issues involved.

If safe access for maintenance of plant is not provided, then plant will not be maintained and will not operate efficiently. For example, it is unreasonable to expect maintenance personnel to climb ladders while carrying heavy tools or bulky filters. Similarly, access doors into plant rooms should be wide enough to allow removal and replacement of equipment, and so on.

An Independent Commissioning Agent provides an extra set of eyes for the project team and may be more likely than the design team and contractor to be able to highlight any problems and make sure that correctional measures are taken. Independent Commissioning Agents have become a common requirement for commissioning work internationally.

By involving the agent early on in the design process, many of the operational and maintenance problems can be 'designed out' of a building.

A formal risk assessment can be a useful tool in deciding on the severity and likelihood of various risks (both during construction and during operation and maintenance) and allowing the team to decide whether these are acceptable residual risks or whether the design should be altered to avoid them.

REFERENCES & FURTHER INFORMATION

For commissioning references refer to Man-2 credit.

MAN-4 Independent Commissioning AgentPOINTS
AVAILABLE**1****TECHNICAL CLARIFICATIONS AND ERRATUM**

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request Number: MAN4-C-OB1-0041

Ruling: 2009-06-29

Multiple independent commissioning agents

The Credit Interpretation Request (CIR) to allow the role of independent commissioning agent to be played by multiple people with different expertise is granted, provided that the project team demonstrates that all other credit criteria are met, including involvement of the commissioning agent(s) from the beginning of schematic design

MAN-5 Building Users' GuidePOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise information management that enables building users to optimise the building's environmental performance.

CREDIT CRITERIA

One point is awarded where:

A simple and easy-to-use Building Users' Guide, which includes information relevant for the building users, occupants and tenants' representatives, is developed and made available to the building owner.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Building Users' Guide	• Building Users' Guide • Confirmation of issue to the owner

Building Users' Guide:

A complete Building Users' Guide which includes all the information outlined in this credit must be provided for assessment.

The Building Users' Guide must be a short and easily readable document, suitable for a lay person. It should not include detailed information on maintenance and spare parts etc – rather it should refer to the relevant O&M manual for this information.

The Building Users' Guide should including the following information:

- Energy & Environmental Strategy – Description of the building initiatives intended to enhance energy efficiency and minimise greenhouse gas emissions, including quantification of the potential water, energy and greenhouse gas emissions, and financial (i.e. operational) savings."
- Monitoring and Targeting – Details on energy, water, indoor environment quality and waste targets and benchmarks for the building, such as W/m², and on the metering & sub-metering strategy

MAN-5 Building Users' Guide

POINTS
AVAILABLE

1

- **Building Services**
Description of basic function and operation of the following, with simplified systems diagrams and an explanation of energy saving features:
 - Ventilation;
 - Heating system;
 - Cooling system;
 - Electrical systems;
 - Lighting; and
 - Domestic hot water.
 - **Transport Facilities**
Car parking requirements and provision of cyclist facilities, conditions of access, and appropriate use. Also provide, where applicable, local public transport information, maps and timetables, and details or links on alternative methods of transport to the workplace, such as carpooling.
 - **Materials & Waste Policy**
Include instructions on proper use for less common practices, such as composting, as well as information on recycling including:
 - What can be recycled;
 - Where the recycling storage areas are; and
 - Schedules for waste and recycling removal.
 - **Expansion/Re-fit Considerations**
Include a list of environmental recommendations for consideration, highlighting in particular the areas covered in the Building Users' Guide. Consider examples such as use of environmentally friendly materials, reuse of other materials, or exhausts for printing and photocopying rooms.
 - **References & Further Information**
Should include links to online 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.
- Confirmation of issue to the owner** via one of the following two methods:
- The provision of the official transmittal; or
 - Through a letter from the owner confirming receipt of the document

ADDITIONAL GUIDANCE

The provision of a building Operations and Maintenance (O&M) manual does not meet this requirement. The O&M manual typically only provides the detailed specialist information required by building managers and maintenance staff/contractors.

MAN-5 Building Users' Guide

POINTS
AVAILABLE**1**

BACKGROUND

The Building Users' Guide is expected to provide details on the everyday operation of the building and the systems building occupants encounter, making it easy for all occupants within the building to understand. The aim of the credit is to ensure that design features are used efficiently and that changes to office space are managed in the most environmentally appropriate manner.

This credit targets management personnel, building occupants and tenant representatives who make facilities management decisions and who monitor internal facility performance against environmental measures. Information contained in the Building Users' Guide should be passed on to the personnel making those management decisions and performing reviews of facilities, so that they are aware of the environmental impacts of the building and the tenancies.

REFERENCES & FURTHER INFORMATION

The following websites and manuals provide guidance on the type of information that could be included in the Building Users' Guide.

CIBSE TM31:2003 *Building Log Books*

<http://www.cibse.org>

Tenancy Guidelines:

British Council of Offices

<http://www.bco.org.uk>

Queensland Government – *Ecologically Sustainable Office Fit-out Guideline*

<http://www.build.qld.gov.au>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following errata have been incorporated into the body of the credit:

MAN5-E-OB1-0431 (2012-03-14) – Change of Document Description

MAN-6 Environmental Management

POINTS
AVAILABLE

2

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 two points are awarded independently of each other and as follows:

One point is awarded where it is demonstrated that:

- The contractor implements a comprehensive, project-specific Environmental Management Plan (EMP) for the works in accordance with Section 3 of the New South Wales (Australia) Environmental Management System guidelines 2007.

One point is awarded where it is demonstrated that:

- The Contractor has valid ISO14001 Environmental Management System (EMS) accreditation prior to and throughout the project.

DOCUMENTATION REQUIREMENTS

The project-specific EMP must be provided for assessment. It must be clear that subcontractors must adhere to the provisions of the EMP.

The contractor must have valid ISO14001 accreditation prior and throughout the construction.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
If claiming for EMP: • Short report • Environmental Management Plan If claiming for EMS accreditation: • Contractor ISO14001 certificate • Confirmation of subcontractor adherence to ISO14001 requirements	If claiming for EMP: • Short report • Environmental Management Plan If claiming for EMS accreditation: • Contractor ISO14001 certificate: • Confirmation of Subcontractor adherence to ISO14001 requirements

Short report prepared by a relevant project team member that correlates the provisions of the EMP with Section 3 of the New South Wales (Australia) Environmental Management System guidelines 2007.

Environmental Management Plan: A comprehensive, project-specific EMP, clearly

MAN-6 Environmental Management

POINTS
AVAILABLE**2**

demonstrating compliance with the requirements of Section 3 of the New South Wales (Australia) Environmental Management System guidelines 2007.

Contractor's ISO14001 certificate that is current and valid, demonstrating that an appropriate EMS is operating within that organisation.

Confirmation of subcontractor adherence to ISO14001 requirements: A letter of confirmation from the contractor stating that any subcontractors relevant to the project will/did adhere to applicable ISO14001 requirements.

ADDITIONAL GUIDANCE

Environmental Management Plan (EMP)

The commitment to future provision of the EMP does not meet the Credit Criteria. The EMP must be fully comprehensive and project-specific. The GBCSA expects that where an EMP has been correctly implemented, an internal audit trail is kept as evidence for ongoing compliance during construction.

Environmental Management Systems (EMS) Certification

ISO 14001 is a requirement of the contractor and should be valid for the entire construction period.

ISO14001 Alternatives

In smaller organisations (fewer than 30 staff) simple 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 Auditors report confirming evidence of effective use of an appropriate tool must be provided to achieve the credit.

All systems are to follow the basic stages of top level commitment, identification of impacts, review, target setting, action plan, monitoring and reporting. The process is to be frequent and ongoing. Any of these systems must set out the following:

- A degree of high level commitment;
- Key responsibilities with names attached;
- Key environmental impacts identified and prioritised as part of a review process;
- Targets and an action plan; and
- Monitoring processes, with the reporting of this monitoring to senior management.

BACKGROUND

Construction and demolition are responsible for significant impacts, especially at the local level. These arise from site disturbance, pollution, construction waste, and water and energy use. It is important that responsibility is taken for creating and executing management procedures to minimise or avoid these impacts. ISO14001 is applicable worldwide and provides management tools for organisations or project teams to control their environmental impacts and to improve their environmental performance. These tools can provide significant tangible economic benefits, including:

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

MAN-6 Environmental Management

POINTS
AVAILABLE

2

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

REFERENCES & FURTHER INFORMATION

National Environmental Management Act No. 107 of 1998

NEMA Regulations Government Notice R385 of 2006

Listing Notice 1 Government Notice R386 of 2006

Listing Notice 2 Government Notice R387 of 2006

Department of Environment, Agriculture and Tourism (DEAT)

www.deat.gov.za

Department of the Environment and Heritage Model Environmental Management System for Commonwealth Agencies:

<http://www.environment.gov.au/settlements/publications/government/ems/model.html>

International Organization for Standardization ISO14001 – Environmental Management Systems

<http://www.iso.org>

Department of Commerce Buildings and Infrastructure: Environmental Services

<http://www.dpws.nsw.gov.au>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Alternative submission for compliance for EMP - Section 3 of New South Wales EMP 2nd Ed (2009)

Technical Clarification Number: MAN6-T-OB1-0811

Guidance: 2014-08-11

Alternative compliance path for submitting an EMP - to Section 3 of New South Wales: The GBCSA will accept compliance within the relevant sections of the Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005). This is to be demonstrated by completion of the checklist as provided in Table Man-6.1 extract.

The GBCSA note that it is the project team's responsibility to ensure that all legislative requirements relating to the EMP are achieved in accordance with the National Environmental Management Act (NEMA). The Green Star SA requirements listed (Table Man-6.1 extract) are intended to be applied alongside and in addition to any legislative requirements. As such, should any of the Green Star SA requirements listed for the EMP be in contravention with legislative requirements for the project, the project team is to comply with the said legislative requirements

MAN-6 Environmental Management

POINTS
AVAILABLE**2**

and clearly justify within the short report and Man-6.1 compliance checklist why the specific Green Star SA requirement could not be applied.

Supplementary Information

[Table Man-6.1 extract.pdf](#)

Technical Clarification Number: MAN6-T-OB1-0811

Guidance: 2014-08-11

Alternative submission for compliance for EMP - Section 3 of New South Wales EMP 2nd Ed (2009)

Alternative compliance path for submitting an EMP - to Section 3 of New South Wales: The GBCSA will accept compliance within the relevant sections of the Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005). This is to be demonstrated by completion of the checklist as provided in Table Man-6.1 extract.

The GBCSA note that it is the project team's responsibility to ensure that all legislative requirements relating to the EMP are achieved in accordance with the National Environmental Management Act (NEMA). The Green Star SA requirements listed (Table Man-6.1 extract) are intended to be applied alongside and in addition to any legislative requirements. As such, should any of the Green Star SA requirements listed for the EMP be in contravention with legislative requirements for the project, the project team is to comply with the said legislative requirements and clearly justify within the short report and Man-6.1 compliance checklist why the specific Green Star SA requirement could not be applied.

Supplementary Information

[Table Man-6.1 extract.pdf](#)

Technical Clarification Number: MAN6-T-OB1-0634

Guidance: 2013-03-14

Contractors complying with ISO 14001 requirement

It is required that the main contractor on site (contractor who has overall responsibility of the site at any stage) has a valid ISO 14001 Environmental Management System (EMS) accreditation prior to and throughout the project construction. This can also be achieved where the subcontractors adhere to the main contractors ISO 14001 requirements or for smaller companies showing alternative compliance as in the Green Star SA Office v1 technical manual.

Where contracts will be split and contractors appointed independently of each other, the bulk earthworks and piling contractors that do not hold an ISO 14001 certificate nor will they be appointed as subcontractors adhering to a main contractor's ISO 14001 responsibilities, unfortunately does not comply with the Green Star SA requirements. It is required that all

MAN-6 Environmental ManagementPOINTS
AVAILABLE**2**

contractors must either hold an ISO 14001 certificate, adhere to the ISO 14001 requirements of the main contractor or for small companies show alternative compliance as in the Green Star SA Office v1 technical manual on page 28.

Technical Clarification Number: MAN6-T-OB1-0108

Guidance: 2012-03-14

Demolition Environmental Management Plan

(REVISED from TC issued 2010-10-13)

Where demolition activity is undertaken on the project site within 2 years from the date of practical construction commencement (the date upon which the clean project site is handed over to the main contractor), the scope of the whole demolition contract must be included within the scope of the project specific Environmental Management Plan. Projects registered prior to the 13th October 2010 and projects where demolition commenced prior to the 13th October 2010 may elect to include or exclude the aforementioned requirements. Projects registered after the 13th October 2010 must comply with the aforementioned requirements unless demolition commenced prior to the 13th October 2010.

Technical Clarification Number: MAN6-T-OB1-0376

Guidance: 2010-10-13

Alternative documentation requirements

Where a project is pursuing a Design rating and a principle building contract has not yet been awarded, the following alternative documentation may be submitted for this credit:

Contractor's ISO14001 certificate

As an alternative to the contractor's ISO14001 certificate, the project team may submit an extract from the tender documentation explicitly requiring the contractor to have ISO14001 certification at commencement of construction and that the contractor will maintain this certification throughout the full construction phase of the project.

Confirmation of subcontractor adherence to ISO14001 requirements:

As an alternative to the confirmation of subcontractor adherence to ISO14001 requirements, the project team may submit an extract from the tender documentation where it is explicitly required that any subcontractors relevant to the project are to adhere to all applicable ISO14001 requirements.

Technical Clarification Number: MAN6-T-OB1-0100

Guidance: 2010-08-25

MAN-6 Environmental Management

POINTS
AVAILABLE**2**

Reference document update

Please note that the "New South Wales (Australia) Environmental Management System guidelines 2007" document has been updated and is replaced by "NSW Government Environmental Management Systems Guidelines 2nd Edition (Sept 2009)". The updated document is available for download on the GBCSA website (www.gbcsa.org.za/resources/publications.php). Projects may use either of the two documents referenced in this Technical Clarification.

Technical Clarification Number: MAN6-T-OB1-0098

Guidance: 2010-08-23

Documentation

For the short report documentation required, in correlating the provisions of the EMP with Section 3 of the New South Wales (NSW) Environmental Management System guidelines 2007, projects must utilise the checklist from Appendix B of the NSW guidelines, including the 'Enhancements for major contracts' list. For the section beginning with 'Cross-references to, or inclusion of, other environmental and other management related documents such as' the project must reference or include these documents if they exist. If these documents do not exist for the project, simply state so in the submittal.

Technical Clarification Number: MAN6-T-OB1-0017

Guidance: 2009-02-06

Separate EMPs

If it can be demonstrated that all contractors and subcontractors on the building project are contractually required to adhere to the EMP, EMS or WMP, each direct contractor does not need to provide a separate plan.

Technical Clarification Number: MAN6-T-OB1-0005

Guidance: 2009-02-05

EMP authorship

The EMP need not be produced by the contractor, as long as the EMP is specific to the project and it is clear that the contractor and all subcontractors are contractually required to adhere to it.

MAN-7 Waste ManagementPOINTS
AVAILABLE**3****AIM OF CREDIT**

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

CREDIT CRITERIA

Up to three points are awarded where:

- The contractor implements a Waste Management Plan (WMP), retains waste records and issues quarterly reports to the building owner; AND
- A percentage (by mass) of all demolition and construction waste is reused or recycled as follows:
 - One point for 30% of the waste;
 - Two points for 50% of waste; and
 - Three points for 70% of waste.

DOCUMENTATION REQUIREMENTS

It must be clearly demonstrated that evidence accounts for all of the demolition and construction waste, that the stipulated proportion of waste has been reused or recycled, and that the owner will be informed of this process on a quarterly basis.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Green Star SA – Office Design	Green Star SA – Office As - Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the principal building contract has been awarded: • Extract(s) from the contract(s) Where the principal building contract has not yet been awarded: • Extract(s) from the tender documentation	• Short report • Waste Management Plan

MAN-7 Waste Management

POINTS
AVAILABLE

3

Extract(s) from the contract(s) of the contract conditions between the contractor and either the developer or the building owner stipulating in the body of the contract the full criteria for reuse/recycling of the stated proportion of construction and demolition waste; the exact provisions of the Credit Criteria must be found in the body (rather than Appendices) of the document.

Extract(s) from the tender documentation requiring the recycling of the stated proportion of construction and demolition waste by the contractor and sub-contractors; the exact provisions of the Credit Criteria must be found in the body (rather than Appendices) of the document.

Short report from the contractor confirming compliance with the Credit Criteria by tabulating all categories of waste (wood, metal, concrete, general, etc.) with their corresponding quantities and indicating how they were reused/recycled. The reused/recycled quantities are to be summed to indicate the total diverted from landfill and divided by the total generated waste to indicate the diversion percentage to landfill. The short report must summarise and reference all receipts demonstrating the waste types, waste recipients, total amount (by mass) of waste and dates removed from site within a table. The actual appended receipts to verify the reporting methodology only need to be the very first and final waste removal receipt (with dates indicated), one waste receipt for each waste recipient and one receipt per waste type in order to justify the inputs into the summary within the short report. It is not necessary to append all receipts within the submission, provided that all receipts are however summarised within the short report.

Waste Management Plan used for the site, describing how all generated waste is monitored, which types of waste will be collected for recycling or for reuse, how recycling will occur, and who is responsible for the various aspects of the plan. The waste management plan should include instructions to crew and sub-contractors on recycling and reuse procedure. The waste management plan is to be developed prior to construction start, and is to be implemented for the entire construction duration.

ADDITIONAL GUIDANCE

Informal recycling

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

Bulk recycling

If a sub-contractor is engaged to sort and recycle construction waste on the project's behalf and does it on a 'bulk' basis, not on a project basis, the credit can be claimed if the sub-contractor can provide evidence of diverting the percentage of waste on average.

Measurement by volume

If waste is measured by volume rather than mass, the contractor must convert the results to mass using the densities given below.

Solid Waste Type	Density (kg/m ³)
Cardboard	60
Gypsum wallboard	300
Rubble	830

MAN-7 Waste Management

POINTS
AVAILABLE**3**

Steel	600
Wood	180
Mixed waste	210

Table Man-7.2: *Densities to be assumed for different solid waste types*

For any materials which are not listed in Table Man-7.2: Densities to be assumed for different solid waste types

Projects may submit their own densities along with accompanying calculations in their Green Star SA submission. Projects must demonstrate how the density was arrived at and how calculations were done (incl. the starting point of assumed density of the material/ product). The density of some materials can vary widely depending on their composition and manufacture (e.g. concrete could include asphalt, gravel, or many other materials). Projects 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.

Exclusions

Any waste that is not normally sent to landfill is not addressed by this credit, such as soil (from land clearing and excavation activities), land clearing debris or waste that legally must be withheld from general construction waste (such as asbestos). Quantities of hazardous waste, land clearing debris and soil are not considered demolition and construction waste and are not included in either the reused/recycled or total waste of the project.

Common materials and reuses

Numerous building materials and components can be recovered or recycled. Common materials and reuses include:

- Bricks and concrete used for clean-fill;
- Timber to be salvaged for new structural or material use; timber waste ground into mulch or garden compost;
- Crushed concrete used as road-base;
- Plasterboard crushed for soil conditioner or for the manufacture of new plasterboard;
- Steel, aluminium and other metals for reuse in the manufacture of new metal products;
- Foam insulation and packaging for new insulation or soft structural forms;
- Pallets for reuse;
- Clean plastic from packaging for new packaging materials;
- Carpet and ceiling tiles may be taken back for reconditioning/recycling by the manufacturer;
- Light fixtures for cleaning and reuse;
- Furniture for refurbishing and reuse; and
- Crushed tiles for paving or landscape decoration.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria for the entire scope of the base building construction works. Fit-out works of shell and core projects will not fall within the scope of assessment.

MAN-7 Waste Management

POINTS
AVAILABLE**3**

- **As Built** – The documented design must demonstrate compliance with the Credit Criteria for the entire scope of the base building construction works. Fit-out works of shell and core projects do not fall within the scope of assessment.

BACKGROUND

Traditionally, the bulk of construction waste has gone to landfill, and it has been estimated by the Gauteng Provincial State of the Environment Report (SoER), June 2004, that construction and demolition waste within South Africa makes up approximately one fourth of all waste generated. This occurs despite the fact that much of the waste can be considered as a valuable resource for reuse or recycling.

Waste management on building sites is becoming increasingly common. As the availability of suitable land for landfill diminishes, and concerns about the environmental implications of waste become more widespread, reuse and recycling practices increase.

At the National Waste Summit held in Polokwane in September 2001, the Polokwane Declaration was adopted which commits South Africa to a reduction of 50% in the amount of waste being land filled by 2012 and to zero waste by 2022. Future waste legislation will promote reuse and recycling, and require manufacturers to develop products that do not create waste and that can easily be recycled.

REFERENCES & FURTHER INFORMATION

Gauteng Provincial Guidelines for the Minimisation of Building and Demolition Waste (will be on the website from September 2208)

Gauteng State of the Environment Report

<http://www.gdace.gpg.gov.za/EnvirReport.htm>

National State of the Environment Report – Waste Management

<http://soer.deat.gov.za/themes.aspx?m=58>

Onsite Minimising Construction Waste, Maximising Competitiveness

<http://onsite.rmit.edu.au>

Polokwane Declaration

http://www.environment.gov.za/ProjProg/WasteMgmt/Polokwane_declare.htm

TECHNICAL CLARIFICATIONS AND ERRATUM

The following errata have been incorporated into the body of the credit:

MAN7-E-OB1-0643 (2013-02-22): Short Report requirements

MAN7-E-OB1-0171 (2011-01-06): Additional requirements

MAN7-T-OB1-0045 (2009-09-10): Volume to weight conversion

MAN-8 Airtightness Testing

POINTS
AVAILABLE

1

AIM OF CREDIT

To encourage and recognise measures to reduce uncontrolled air leakage in buildings, and reward the testing and achievement of good airtightness levels.

CREDIT CRITERIA

One point is awarded where:

An air test is carried out on the completed building in accordance with CIBSE TM23:2000 (Testing buildings for air leakage) to assess leakage rates, and a leakage rate of less than $15\text{m}^3/\text{hr}/\text{m}^2$ is achieved at a relative pressure of 50Pa.

DOCUMENTATION REQUIREMENTS

The building air tightness test process must include:

- Pressurisation of all occupied parts of the building and measurement of air leakage rate;
- Remedial sealing measures if required and re-testing of the building; and
- Demonstration that the building achieves the required standard.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Extract(s) from the specification(s) • Project timeline/programme	• Air tightness test report

Extract(s) from the specification(s) including a requirement for air tightness testing to be carried out on completion of the project and for remedial measures and retesting to achieve the $15\text{m}^3/\text{hr}/\text{m}^2$ level of performance.

Project timeline demonstrating the inclusion of the building testing in the project timeline. The testing is likely to be on the project critical path and it is important that all parties are aware of the time requirements.

Air tightness test report including details of the test methodology, air flow rates and envelope area calculations, and final air leakage rate achieved in $\text{m}^3/\text{hr}/\text{m}^2$.

MAN-8 Airtightness Testing

POINTS
AVAILABLE**1**

ADDITIONAL GUIDANCE

The testing method is described in CIBSE TM23 *Testing Buildings for Air Leakage* and consists of sealing all permanent openings, attaching a fan to blow air into the building, and measuring the air flow required to maintain a constant pressure.

More guidance on typical construction details to achieve a good standard of airtightness can be found in BRE report 448 *Airtightness in Commercial and Public Buildings*.

BACKGROUND

Infiltration is uncontrolled air leakage through cracks and gaps in the building fabric. It is affected strongly by design decisions and construction quality. Pressure and temperature differences between the inside and the outside of the building lead to infiltration, which will rise and fall uncontrollably; this is largely in response to fluctuations in external wind speed and air temperature.

Significant amounts of energy are wasted through leaky construction of buildings. In naturally ventilated buildings this leads to excessive use of heating in winter (as well as user comfort issues associated with draughts). In air conditioned buildings, this leads to excessive use of both heating in winter and cooling in summer.

Studies in the UK on leaky buildings indicate that exfiltration of warm air can account for as much as 50% of the total heat loss through the envelope. Total space heating costs in a tight building may be up to 40% less than in a leaky building.

Buildings should therefore be designed and constructed to minimise infiltration. The design must however ensure that sufficient fresh air is provided by ventilation. In a well-designed tight building, fresh air enters either through controllable ventilation openings, for example trickle vents in naturally ventilated buildings, or via mechanical ventilation plant. Where infiltration is minimised, uniform ventilation and warmth is achievable and a good comfort level can be maintained.

The rate of 15m³/hr/m² is that achieved in typical existing building stock in the UK [BRE report 448 *Airtightness in Commercial and Public Buildings*]. Current building regulations in the UK require a higher target, but it is recognized that the South African climate is less harsh and that designers and contractors will need time to adapt construction techniques to improve airtightness.

While SANS 204:2008 includes some requirements for airtightness standards of windows, it does not currently include a requirement for testing completed buildings. Since many air leakage paths occur at interfaces between components (e.g. cracks between windows and walls, gaps between roof eaves and walls, etc) a whole building air leakage test is the most effective way of determining the building airtightness.

MAN-8 Airtightness Testing

POINTS
AVAILABLE**1**

REFERENCES & FURTHER INFORMATION

CIBSE (Chartered Institution of Building Services Engineers, U.K.) TM 23 *Testing Buildings for Air Leakage*

<http://www.cibse.org>

ANSI /ASTM-E779-03 *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*

<http://www.astm.org>

Airtightness in Commercial and Public Buildings, BRE report BR 448, 2002

<http://www.bre.co.uk> and <http://www.brebookshop.com/>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Nil found

IEQ-1 Ventilation

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise designs that provide ample amounts of good quality outside air to counteract build-up of indoor pollutants.

CREDIT CRITERIA

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 Useable 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 Useable 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
 - 66% improvement for 2 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 UA, 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;

For the purposes of this credit, the Useable Area' is Occupied Space.

IEQ-1 VentilationPOINTS
AVAILABLE**2****DOCUMENTATION REQUIREMENTS**

Green Star SA – Office v1.1 Design	Green Star SA – Office v1.1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender drawing(s) Additionally for mechanically ventilated spaces: • Extract(s) from tender documentation	• Short report • As Built drawing(s) Additionally for mechanically ventilated spaces: • Extract(s) from Commissioning Report(s)

Short report 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 tender/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,

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.

Extract(s) from tender documentation clearly demonstrating the design occupant density and design outside-air rates for each occupied space.

IEQ-1 Ventilation

POINTS
AVAILABLE

2

Tender / 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.

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.

ADDITIONAL GUIDANCE

The systems claimed for this credit must be documented consistently throughout the submission, especially within related credits (e.g. IEQ-3 'Carbon Dioxide Monitoring and Control', IEQ-9 'Thermal Comfort' or Ene-1 'Greenhouse Gas Emissions').

Supplementary outside air systems

Supplementary outside air systems can be incorporated. However, note the following:

- The supplementary system must operate and deliver the air to the occupied space whenever the air conditioning / ventilation 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.

Naturally ventilated spaces

It must be clearly demonstrated that areas nominated as 'naturally ventilated' have opening areas which meet the requirements of SANS 10400-O:2011.

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

IEQ-1 Ventilation

POINTS
AVAILABLE

2

of time the space operates in either mode.

Underfloor displacement ventilated spaces

For the purposes of Green Star SA certification, for an underfloor air distribution system to qualify as a displacement ventilation system, the air velocity at the diffuser may not exceed 0.5m/s (as per ASHRAE PR 949) 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. Should project teams wish to motivate systems with velocities, temperatures or locations for supply / return air that are not in compliance with these parameters, it must be clearly justified how induction of foul air in the room will not take place, and thus that displacement ventilation will occur as opposed to the mixing of foul air and supply air in the room.

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)

Based on the above rationale, for the purposes of this credit, 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 1.2.

IEQ-3 ‘Carbon Dioxide Monitoring and Control’

For mechanically ventilated spaces, the submissions between this credit and IEQ-3 ‘Carbon Dioxide Monitoring and Control’ must correlate. If the Carbon Dioxide (CO₂) monitoring system specified or installed (refer to IEQ-3 ‘Carbon Dioxide Monitoring and Control’) is designed to decrease the outside air rates to below those used to achieve this credit, then the points achieved shall be reduced to reflect the minimum ventilation rates set by the CO₂ monitoring and control system. If this credit is claimed, the minimum threshold must correlate to the rate claimed in IEQ-3 ‘Carbon Dioxide Monitoring and Control’. The occupant density referenced for ventilation credits must be consistent with the design occupant density stipulated in the mechanical services specification.

The following reference set points (in parts-per-million) are established within IEQ-3 ‘Carbon Dioxide Monitoring and Control’ to correlate with this credit as follows:

- 650PPM for 33% increase
- 600PPM for 66% increase

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

IEQ-1 Ventilation

POINTS
AVAILABLE**2**

BACKGROUND

SANS 10400-O sets minimum permissible ventilation rates, giving consideration to health and ventilation amenity. 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. A comparison between different international standards for recommended fresh air levels in offices is as follows:

- CIBSE A guide (2006) gives 10l/s/p (assumes no smoking)
- ASHRAE 62 (2007) 2.5l/s/p plus 0.3l/s/m² which typically gives around 5.5 to 8.5 l/s/p
- Higher rates (e.g. 12 l/s/p) are now relatively common in Europe and America, due to concerns about 'sick building syndrome' etc. The Green Star SA rate of 150% increase corresponds to 12.5 l/s/p.

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 IEQ.

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.

<http://www.ashrae.org>

ASHRAE 62 (2007) Ventilation for Acceptable Air Quality

CIBSE A guide (2006) Environmental Design

<http://www.cibse.org>

SABS (South African Bureau of Standards)

<http://www.sabs.co.za>

IEQ-1 VentilationPOINTS
AVAILABLE**2****TECHNICAL CLARIFICATIONS AND ERRATUM**

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Nil applicable

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS
AVAILABLE

1

AIM OF CREDIT

To encourage and recognise the provision of response monitoring of Carbon Dioxide levels to ensure delivery of optimum quantities of outside air.

CREDIT CRITERIA

One point is awarded where:

Naturally ventilated spaces

95% of the UA is naturally ventilated in accordance with SANS 10400-O; AND Ventilation rates are directly controlled by occupants; AND

Carbon dioxide monitoring is provided for every 100m² of area of occupied floor plan to give an audible/visual alarm if CO₂ levels rise above 1,000ppm.

Mechanically ventilated spaces

- A carbon dioxide (CO₂) monitoring and control system with a minimum of one CO₂ sensor at all return points on each floor, is provided to facilitate continuous monitoring and adjustment of outside air ventilation rates to each level, to ensure independent control of ventilation rates to achieve outside air requirements;

OR

- HVAC systems provide 100% outside air with no recirculated component.

Mixed-mode ventilated spaces

Both modes of operation must satisfy the relevant mechanical and natural ventilation criteria.

DOCUMENT REQUIREMENTS

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Naturally ventilated spaces

It must be clearly demonstrated that areas nominated as 'naturally ventilated' have been designed to meet the requirements of SANS 10400-O; that they can be occupied without mechanical ventilation; and that no air conditioning has been provided for them.

If the operation of natural ventilation openings is automated, it must have a manual override function to be deemed 'directly controlled by occupants'.

Locations of the carbon dioxide sensors must be clearly shown on drawings.

Mechanically ventilated spaces

Systems must have the capability to supply the necessary quantity of outside air at all times. Two types of system can qualify for the credit:

- 1) Systems where the fan speed is controlled using Carbon Dioxide (CO₂) sensors. To qualify,

IEQ-3 Carbon Dioxide Monitoring & ControlPOINTS
AVAILABLE**1**

the sensors must:

- Be located at all return air points on each floor (usually ducts); location purely within risers does not support the Aim of Credit. Location within return ducts only or within return ducts and return risers is acceptable; and
- Be linked to an automated monitoring system (e.g. BMS) or equivalent to ensure continuous adjustment of the outside air rates.

2) Systems designed to provide 100% outside air with no recirculated component. To qualify, the following is required:

- The AHU(s) must not have an economy cycle configuration, (i.e. which would allow the building manager to change the mode of operation to recycle air).
- The AHU(s) must be controlled at fixed speed rather than variable volume.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated spaces: • Short report • Opening Area Schedule • Tender drawings For mechanically ventilated spaces with Carbon Dioxide sensors: • Short report • Extract(s) from the specification(s) • Tender schematic mechanical drawings For systems that provide 100% outside air: • Short report • Extract(s) from the specification(s) • Tender schematic mechanical drawings	For naturally ventilated spaces: • Short report • Opening Area Schedule • As built drawings For mechanically ventilated spaces with Carbon Dioxide sensors: • Short report • As built schematic mechanical drawings • As built point schedule • Extract(s) from the O&M Manual For systems that provide 100% outside air: • Short report • As built schematic mechanical drawings • Extract(s) from the Commissioning Records

Short report prepared by a mechanical engineer that describes how the Credit Criteria have been met by:

- For naturally ventilated spaces, referencing the schedule of openings, and confirming that the minimum requirements of SANS 10400-O will be exceeded for at least 95% of the UA; and
- For mechanically ventilated spaces, describing the configuration of each ventilation system and its method of operation, and providing a schedule confirming the minimum outside air rate supplied by each AHU together with the UA of each zone served by each AHU."

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

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS
AVAILABLE

1

include the openings area expressed as a percentage of the room floor area, to demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

Extract(s) from the specification(s) that identify the proposed HVAC system(s) and outline its requirements and operation.

Tender drawings for each typical naturally ventilated space, with CO₂ sensors and ventilation openings clearly indicated and dimensioned.

Tender schematic mechanical drawings of the HVAC system(s) for each typical mechanically ventilated space, indicating the mechanical system, its configuration, location of all key elements (such as AHUs or CO₂ sensors), the area served by each AHU/CO₂ sensor, and nominating the outside-air supply rates. Where the system supplies 100% outside air with no recirculation component, the drawings must identify the AHU and clearly demonstrate that no return air ducts are installed.

As built drawings for each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly indicated and dimensioned.

As built schematic mechanical drawings of the HVAC system(s) for each typical space, indicating their configuration, location of all key elements (such as ventilation openings, AHUs and CO₂ sensors), the area served by each AHU/CO₂ sensor, and nominating the outside-air supply rates. Where the system supplies 100% outside air with no recirculation component, it must be clear that the system does not have any air recirculation capacity.

As built point schedule indicating the connection and control strategy between the CO₂ sensors and the automated monitoring system.

Extract(s) from the O&M manual describing the on-going operation and maintenance requirements of the CO₂ sensors.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems have been commissioned and found to operate as intended by the design. In addition:

- For mechanically ventilated spaces where the system supplies 100% outside air with no recirculation component, demonstrating that 100% outside air is provided at all times and in all modes of operation, and that return ducts are used for indirect tempering only.
- For naturally ventilated spaces, demonstrating that the building operates as a naturally ventilated office space in accordance with SANS 10400-O and requires no mechanical air conditioning for occupancy.

ADDITIONAL GUIDANCE

If the Carbon Dioxide (CO₂) monitoring system is designed to decrease the outside air rates to below those used to achieve credits in IEQ-1 'Ventilation Rates' then the credits achieved in IEQ-1 'Ventilation Rates' shall be reduced to reflect the minimum ventilation rates set by the CO₂ monitoring and control system. If credit is claimed under IEQ-1 'Ventilation Rates', the minimum threshold must correlate to the rate claimed in IEQ-1 'Ventilation Rates'. The occupant density referenced for ventilation credits must be consistent with the design occupant density stipulated in the mechanical services specification.

The following reference set points (in parts-per-million) are established to correlate with IEQ-1 'Ventilation Rates':

- 800 PPM for 7.5l /s per person;

IEQ-3 Carbon Dioxide Monitoring & ControlPOINTS
AVAILABLE**1**

- 700 PPM for 10 l/s per person; and
- 640 PPM for 12.5 l/s per person.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

Higher than normal levels of Carbon Dioxide can be an indicator of inadequate ventilation and impact upon the quality of the breathable air within an enclosed office space. This situation can have substantial effects on the wellbeing of the occupants and, subsequently, on their productivity.

The installation of Carbon Dioxide monitoring systems can detect Indoor Air Quality (IAQ) problems, automatically adjust ventilation supply rates and alert those responsible for building operation before IAQ problems become significant.

REFERENCES & FURTHER INFORMATION

CIBSE Guide H – Building Control Systems

<http://www.cibse.org>

ASHRAE – HVAC Systems & Equipment 2008

ASHRAE 62 (2007) *Ventilation for Acceptable Air Quality*

<http://www.ashrae.org>

Department of Environment and Water Resources (2001), *State of Knowledge Report: Air Toxics and Indoor Air Quality in Australia*. Canberra.

<http://www.environment.gov.au/atmosphere/airquality/publications/sok/chapter8.html>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS
AVAILABLE**1**

Technical Clarification: 100% outside air provision

Technical Clarification Number IEQ03-T-OB1-483

Guidance: 2012-04-25

For the purposes of the IEQ-03 credit, where HVAC systems provide 100% outside air with no recirculated component, it must be clearly shown that these AHU's do not have an economy cycle configuration. The following additional guidance is also provided:

- If the AHU's have return air ducting for heat recovery purposes only, the Short Report must clearly confirm that the configuration does not allow for any mixing of supply and return air. Any specifications and drawings submitted must be in accordance with this confirmation (i.e. must not show any allowance for mixing of supply and return air).
- AHU's may be controlled via variable volume fans, however it must be shown that the control system does not allow the ventilation rate to reduce below the statutory ventilation rate requirements, or where the IEQ-1 credit is targeted, below the ventilation rate claimed in the IEQ-1 credit. This requirement must be clearly stated in the Short Report and shown in the tender documentation (specifications or drawings)

Technical Clarification: Application of SANS 10400-O

Technical Clarification Number: IEQ03-T-OB1-442

Guidance: 2012-04-02

Wherever 'SANS 10400-O' is referred to within the IEQ-3 credit, this relates to SANS 10400-O:1990 for the purposes of Green Star SA – Office v1 rating tool. It is the project team's responsibility to ensure however that the latest relevant building regulations are complied with for statutory purposes."

Technical Clarification: Schematic mechanical drawings

Technical Clarification Number: IEQ3-T-OB1-0117

Guidance: 2010-11-16

In the absence of 'schematic mechanical drawings', mechanical plan drawings are deemed an acceptable substitute provided that all of the information required to be communicated within the 'schematic mechanical drawing' is contained, and clearly identified, within the mechanical plan drawing. The intent of 'schematic mechanical drawings' is to clearly communicate essential information pertaining to mechanical air or water distribution systems. Project teams are to ensure that ALL the equivalent essential information expected on a schematic mechanical drawing is clearly identified on the mechanical plan drawing.

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS
AVAILABLE

1

The following Errata have been included:

IEQ03-E-OB1-442 Application of SANS 10400-O (2012-04-02)

IEQ3-E-OB1-0151 Green Star SA - Office v1 Technical Manual: Page 55 (2011-01-06)

IEQ3-E-OB1-0157 Green Star SA - Office v1 Technical Manual: Page 54 (2011-01-06)

IEQ-4 Daylight

POINTS
AVAILABLE**3**

Version 1.1: The Daylight modelling credit has been updated to allow additional compliance methods which have become accepted through other Green Star SA Rating Tools, and in particular the Public and Education Buildings one.

AIM OF CREDIT

To encourage and recognise designs that provide good levels of daylight for building users.

CREDIT CRITERIA

Up to three points are awarded in this credit; there are two alternative credit criteria:

- The percentage of the UA that has a measured Daylight Factor (DF) of not less than 2.0%, at desk-height level (720mm AFFL) under a uniform design sky;
OR
- The percentage of the UA that has a Daylight Illuminance (DI) of at least 250 Lux, as measured at finished floor level (FFL) under a uniform design sky
OR
- The percentage of the UA that has a Daylight Illuminance (DI) of at least 300 Lux, based on an annual dynamic simulation model, for 50% of the standard occupied hours (Daylight Autonomy (DA) incremental method)

Points are awarded based on percentage of UA as follows:

- One point is awarded for 30% of UA;
- Two points are awarded for 60% of UA; or
- Three points are awarded for 90% of UA.

DOCUMENT REQUIREMENTS

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, they must be justified.

- 0.3 for floor (assumes a light-coloured carpet);
- 0.7 for walls (assumes white paint); and
- 0.8 for ceilings (assumes white paint).

The Daylight Modelling Report must include all information required in 'Additional Guidance' and the daylight modelling must reflect the actual documented design. The inputs used for this credit must be used consistently throughout the submission, demonstrating congruity with the building design.

IEQ-4 DaylightPOINTS
AVAILABLE**3**

Compliance for this credit cannot be demonstrated by measurement of actual daylight levels in the building.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
- Daylight modelling report OR - Short report - Façade drawings - Roof drawings - Architectural Plan drawings - Site plan extending to surrounding areas - Extract(s) from the specification(s)	- Daylight modelling report OR - Short report - As built façade drawings - As built roof drawings - As built plan drawings - As built site plan extending to surrounding areas - Final glazing schedule - Manufacturer's data sheet(s) - Confirmation from the contractor

Daylight modelling report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Describing the methodology and/or modelling software used to calculate the DF or DI;
- Describing the building model including values of reflectance and transmittance used for each relevant material/glazing;
- Showing legible floor plan outputs from the daylight modelling for each plan area claimed to have either a DF of not less than 2.0%, or a DI of at least 250 Lux;
- Providing a summary table that identifies all spaces within the building's UA, nominates spaces that comply and their area, identifies the DF or DI value within those spaces, and provides calculations to confirm that compliant areas jointly contribute to the claimed percentage of the UA;
- Where compliance is on the basis of DF, describing the design sky used for the daylight model; and
- Where compliance is on the basis of DI, confirming the calculation method is as described in the Additional Guidance section.

Short report prepared by a relevant project team member and supported by the design and referencing drawings that describes how the Credit Criteria has been met using hand

IEQ-4 Daylight

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calculations:

- Identifying all spaces within the building;
- Nominating the spaces where the Credit Criteria has been met, and their area;
- Providing calculations for the DF within each compliant space; and
- Providing a summary table to demonstrate that compliant spaces jointly account for the stipulated proportion of the UA.
- Highlighting the size of the calculation grid used in the model.

Façade drawings identifying the façade materials in the design

Roof drawings identifying the materials in the design

Architectural plan drawings clearly identifying those areas considered to have a DF of 2.0%, or a DI of at least 250 Lux, with the UA of each section clearly shown.

Site plan extending to surrounding areas identifying heights and location of surrounding buildings.

Extract(s) from the specification(s) where all glazing properties and minimum visual transmittance levels are nominated.

As built façade drawings identifying the façade materials in the design (drawings should preferably be isometric, not 3D).

As built roof drawings identifying the materials in the design (drawings should preferably be isometric, not 3D).

As built plan drawings clearly identifying those areas considered to have a DF of 2.0%, or a DI of at least 250 Lux, with the UA of each section clearly shown.

As built site plan drawings extending to surrounding areas showing heights and location of surrounding buildings.

Final glazing schedule identifying all glazing within the project by application, properties – including the colour, thickness, type and Visual Light Transmittance (VLT). However, where specific products are referenced on the final glazing schedule, these must be accompanied by product datasheets indicating the properties including the colour, thickness, type and Visual Light Transmittance (VLT)."

Manufacturer's Data Sheet(s) (or equivalent) indicating the type and properties such as the minimum visual transmittance of the glass or glazing products supplied to the project.

Confirmation from the contractor that the glazing installed is as per the glazing schedule above.

ADDITIONAL GUIDANCE

Analysis grid

All software calculates DF, DI or DA at points on a plan. Some programs calculate results for an almost infinite number of points, providing very accurate results. Other modelling programs request the user to identify a point matrix on the floor plan.

IEQ-4 Daylight

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Modelling to calculate the DF, DI or DA must consider the total floor area and be calculated at finished floor level (FFL) for at least 1 analysis point for each 1m² and for all partial square metre segments resulting from the floor plan geometry.

A maximum 1m² grid must be overlaid over the floor plan to determine these points and at all perimeters, the grid must begin within 1 metre of the external façade. Results are then calculated in the centre point for each square in the grid.

Modelling Guidance

Permanent partitions must be included within the modelling of this credit. Temporary partitions can be excluded only if they are shown to be not be in place for most of the occupied hours in the building (for instance, auditorium partitions). Office workstation partitions can be ignored if they are less than 1.5 metres high. All other fitout partitions must be included. Compliance for this credit cannot be demonstrated by measurement of actual daylight levels in the building. The Daylight Modelling Report must reflect the actual documented design. Representative typical floors and spaces can be modelled instead of modelling the entire building. It must be justified in the daylight modelling report that the typical floors represent the 'worst case' scenario amongst the floors it represents (including overshadowing by adjacent buildings).

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, they must be justified.

- 0.3 for floor (assumes a light-coloured carpet);
- 0.7 for walls (assumes white paint);
- 0.8 for ceilings (assumes white paint); and
- 0.5 for surrounding buildings (discussed below).

The daylight modelling report must reflect the actual documented design. The inputs used for this credit must be used consistently throughout the submission, demonstrating congruity with the building design.

Overshadowing

Overshadowing must be taken into account in modelling. A nearby building or feature (such as a cliff face) is defined as overshadowing the proposed building if:

- The overshadowing building or object height is least a third of the height of the proposed building; and
- Where the angle between the nearest point at the top of the overshadowing building and the nearest point at the base of the proposed building is greater than the June 21 (winter) midday altitude of the sun.

Unless otherwise justified within the daylight report with reference to supporting evidence, a minimal reflectance of 0.5 must be used for surrounding buildings.

Typical Floor Plans

The GBCSA recognises that in a multi-storey building (such as a high-rise building) there may be typical floor plans i.e. floor plans that have exactly the same perimeter wall construction, configuration/layout and size.

Submission of typical floor plans is acceptable in place of separate drawings for each floor, provided that compliance with the credit criteria will not vary per floor. Where typical floor plans are used, the following documentation should be submitted:

IEQ-4 Daylight

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- A brief description within the Daylight Report motivating that compliance with the credit criteria will not vary per floor represented by the 'typical floor' plan(s).
- 'Typical floor' plan drawing(s) clearly marked and named as such, showing compliance with the documentation requirements for 'Tender/As Built Drawings'.

Daylight Factor method

The Daylight Factor (DF) describes the proportion of internal illuminance over external illuminance, expressed as a percentage.

$$\text{Daylight Factor} = \frac{\text{Internal Illuminance (lux)}}{\text{External Horizontal Illuminance (lux)}} \times 100\%$$

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 2.5% means that internal light levels average 250 lux at this particular outside lighting level.

Daylight Factor is most commonly calculated using a CIE (Commission International de l'Eclairage) Overcast Sky. However, Green Star SA recommends the use of a Uniform Sky because it allows easier comparison with the Daylight Illuminance method. Calculation using a CIE Overcast Sky is acceptable, but note that this method will usually give lower results than that calculated using a Uniform Sky. Note that if software does not have a pre-set option for a Uniform Sky, it can often be set up manually.

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.

Daylight Illuminance method

The Daylight Illuminance (DI) levels must be simulated at 12 noon on the equinox (21st March/September) using a Clear Sky. Light levels above 250 lux can count towards the credit. The Clear Sky illuminance levels for the particular location used in the simulation, should represent a horizontal illuminance level that is exceeding 85% of the time between the hours of 8am and 6pm throughout the working year. Note that this can be done via either adapting the sky data itself or adjusting the results as a ratio of the sky condition used to what would represent 85%.

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 Daylight Autonomy model can be done assuming that all shading devices are static, including all blinds. Blinds can be assumed to be open. The climate data, used must be the same as used in Ene-1 'Greenhouse Gas Emissions'. Time intervals must be set at intervals of no more than one hour.

An incremental Daylight Autonomy method is to be used in confirming compliance with this credit. Project teams may not make use of a continuous Daylight Autonomy method to confirm compliance.

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AVAILABLE**3**

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. Alternative software may be used, after successful submission of a CIR showing that the results are similar to that of the listed software.

CIE Design Sky

Figure IEQ-4.1 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

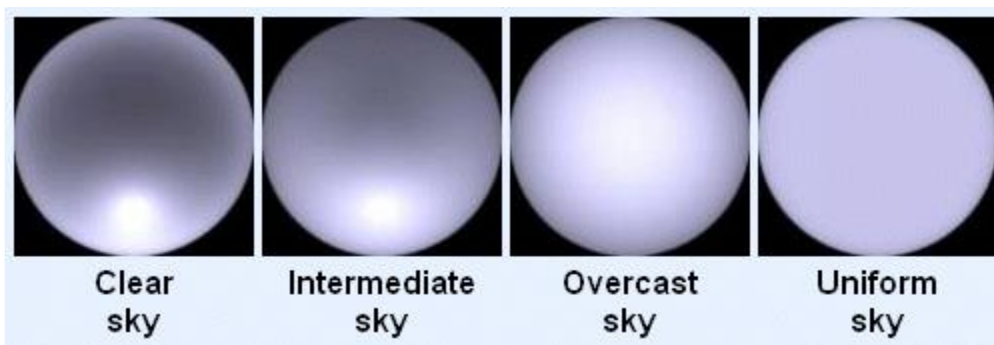


Figure IEQ-4.1: Illustration of the different CIE design skies.

Compliance for this credit cannot be demonstrated by measurement of actual daylight levels in the building.

Hand 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.

The daylight factor D is estimated using equation:

$$D = \frac{T A_w \theta}{A (1-R^2)}$$

Where:

T = the diffuse light transmittance of the glazing, including a correction factor for the effect of dirt (see below)

A_w = 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;

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.

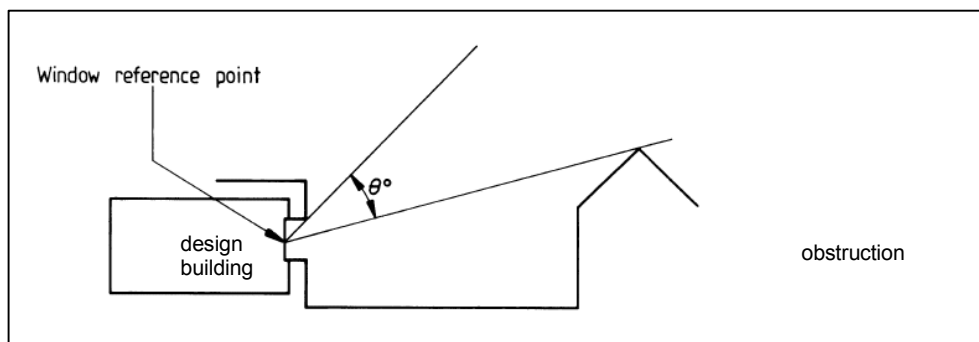
IEQ-4 DaylightPOINTS
AVAILABLE**3**

Figure IEQ-4.1: Diagram illustrating angle to be used in hand calculation of daylight factor.

Glazing orientation	vertical	sloping	horizontal
Dirt correction factor	0.9	0.8	0.7

Table IEQ-4.1: Dirt correction factor to be used in hand daylight calculations

Frame type	metal frame (patent glazing)	metal frame	wood frame
Framing correction factor	0.9	0.8	0.7

Table IEQ-4.2: Default framing factors to be used if actual window framing factor is not known.

IEQ-4 Daylight

POINTS
AVAILABLE**3**

When two or more windows in a room face in different directions or have different obstructions, the daylight factor for each window should 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 UA claimed.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – If any component of the project is delivered as shell and core, the reference reflectance values must be used for calculations. For all Green Star SA – Office Design and Green Star SA – Office As Built assessments, only base-building installed partitions (e.g. load bearing walls) must be included; tenant-installed partitions should not be included in the modelling/calculations.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out. For all Green Star SA – Office Design and Green Star SA – Office As Built assessments, only base-building installed partitions (e.g. load bearing walls) must be included; tenant-installed partitions should not be included in the modelling/calculations.

BACKGROUND

General Guidance

The sun has been used for centuries to light building interiors during the day but many buildings today tend to place great emphasis on artificial lighting.

However; studies are now starting to show that the increased reliance on artificial lighting is having a detrimental impact on occupant health and wellbeing. Whilst this has not been studied to the full effect in commercial office buildings, a significant body of research has begun to document the impact of natural light in schools and on students.

In educational environments, the research consistently indicates that students in classrooms with access to natural light perform better in all academic fields than students without natural light at the same school. The advantage of using students as case studies is that generally the benchmarks are identical, allowing a reasonable degree of comparison in performance.

International research has also found that students studying in environments with natural light have better attention rates, are less prone to being distracted or disruptive, and have 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 of day, which is driven by access to daylight. The natural changes in light that occur over the course of the day drive the circadian rhythms and remind the body that it is not evening.

Whilst most of the current research has been developed for school environments, the improvements measured in students are likely to not only improve occupant health and wellbeing, but also productivity. These benefits can be readily transferred to an office environment and are likely to provide financial as well as health and wellbeing improvements.

REFERENCES & FURTHER INFORMATION

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1999), *Daylighting and Window Design*

www.cibse.org

Baker, N & Steemers, K 2002, *Daylighting Design of Buildings*, James & James, London.

Illuminating Engineering Society of Australia (2001), *Skylight Availability in Australia – data and their application to design*, Dr Nancy Ruck.

<http://www.iesanz.org/>

International Energy Agency (2000), *Daylighting in Buildings*

<http://www.iea.org/>

British Standard BS 8206: Part 2 : 1992, *Lighting for Buildings : Code of Practice for Daylighting*

<http://www.bsi-global.com>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Internal walls in Office areas

Technical Clarification Number: IEQ4-T-OB1-0276

Guidance: 2011-06-01

Where internal walls within Office areas are provided as part of the 'base building provision' (i.e. will not change based on tenant requirements), project teams may include these within the Green Star SA submission, but should ensure they are included consistently across the submission. (E.g. these walls should be included in the IEQ-4 daylight analysis.)

The following Errata have been included:

IEQ4-E-OB1-0648 Green Star SA - Office v1 Technical Manual: Page 61 (2013-03-14)

IEQ4-E-OB1-0453 Green Star SA - Office v1 Technical Manual: Page 61 (2012-03-14)

IEQ4-E-OB1-0293 Green Star SA - Office v1 Technical Manual: Page 61 (2011-08-08)

IEQ4-E-OB1-0153 Green Star SA - Office v1 Technical Manual: Page 60 (2011-01-06)

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POINTS
AVAILABLE

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IEQ4-E-OB1-0154 Green Star SA - Office v1 Technical Manual: Page 61 (2011-01-06)

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE**1**

AIM OF CREDIT

To encourage and recognise buildings that are designed to reduce the discomfort of glare from natural light.

CREDIT CRITERIA

One point is awarded where it is demonstrated that glare from daylight is reduced through any combination of the following:

- Where, for each typical glazing configuration or atrium, fixed shading devices shade the working plane, 1.5m in from the centre of the glazing, from direct sun at desk height (720mm AFFL) for 80% of standard working hours;

OR

- Where blinds or screens are fitted on all glazing and atria as a base building provision and meet the following criteria:
 - Eliminate 95% of all direct sun penetration ; AND
 - Are controlled with an automatic monitoring system; AND
 - Are equipped with a manual override function accessible by occupants; AND
 - Have a visual light transmittance (VLT) of <10%.

DOCUMENT REQUIREMENTS

The glare control devices must be provided by the base building to meet the Credit Criteria. Automated blinds must be controlled by the Building Management System (BMS) or an equivalent control system; control by a manually-activated switch does not suffice.

Projects can use a combination of fixed external blinds and automated internal blinds, with different systems on each orientation, to achieve this credit.

Fixed shading

The typical glazing system on the façade must be analysed, demonstrating that it shades the stipulated proportion of the UA for at least 80% of working hours throughout the year, and the stereographic diagrams must be supported by the documented design.

Occupant controlled, automated blinds/screens

The documented blinds/screens must meet all of the following requirements:

- Be provided by the base building owner/developer;
- Be automated and controlled by a BMS system or equivalent to prevent 95% of all direct sunlight penetration during standard occupancy hours;
- Be fitted with manual occupant override; and
- Have a VLT of less than 10%.

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE

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If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
- Short report Where Credit Criteria is met using fixed shading: - Tender façade drawings Where Credit Criteria is met using internal blinds/screens: - Extract(s) from the specification(s) - Tender façade drawings	- Short report Where Credit Criteria is met using fixed shading: - As built facade drawings Where Credit Criteria is met using internal blinds/screens: - As built facade drawings - Confirmation from the contractor(s)

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Identifying all spaces where glare is minimised and nominating their areas;
- Nominating the solution(s) used to minimise glare in each space; and
- Where internal blinds/screens are used, describing how 95% of all direct sun penetration will be avoided.

Tender façade drawings of the building and any atria marked up to show:

- Each typical glazing system (see 'Additional Guidance') in the design and its orientation;
- The glare control solution(s) used for each typical glazing system or atrium;
- The extent of fixed shading for that glazing system or atrium;
- Wherever necessary, construction detail drawings of the glare control devices; and
- Where external shading is used, stereographic diagram at the working plane, 1.5m in from the centre of that glazing system, demonstrating that the point is shaded for at least 80% of standard working hours.

Extract(s) from the specification(s) that stipulate how the Credit Criteria will be achieved:

- Indicating the daylight glare control system within the design;
- For any internal blinds/screens, stipulating a VLT of less than 10%; how they will be automated; and how the occupant manual override must perform; and
- Stating that blinds/screens are monitored with an automatic control system and equipped with an occupant manual control override function for occupants.

As built facade drawings of the building and any atria marked up to show:

- Each typical glazing system (see 'Additional Guidance') in the design and its orientation;
- The glare control solution(s) used for each typical glazing system or atrium;
- The extent of fixed shading for that glazing system or atrium;

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE

1

- Wherever necessary, construction detail drawings of the glare control devices; and
- Where external shading is used, stereographic diagram at the working plane, 1.5m in from the centre of that glazing system, demonstrating that the point is shaded for at least 80% of standard working hours.

Confirmation from the contractor identifying the type, quantity and location of the glare control devices installed in the building. Manufacturer's Data Sheet(s) (or equivalent) should be provided indicating the type and VLT properties of the blinds/screens.

ADDITIONAL GUIDANCE

All base-building glare control devices must be included in the daylight modelling if IEQ-4 'Daylight' credit is claimed.

As glare can be experienced from any orientation, all facades must meet the Credit Criteria regardless of the façade/atrium orientation.

For Green Star SA credits, viewing facades are defined as any part of the building's façade through which occupants can view the external environment.

Blinds located within the window frame (and between panes) are deemed internal blinds.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

While daylight is generally accepted as beneficial by improving the internal environment and saving on artificial lighting energy, it can also cause significant glare problems. The provision of blinds can overcome this problem by offering occupant control to deal with local glare.

Direct sunlight or patches of sunlight on internal surfaces, including reflections of windows on computer screens, can cause discomfort due to glare. Although a subjective and complex phenomenon, much of the research into the physiological basis of glare indicates that there are certain common factors influencing the levels of discomfort and/or visual impairment associated with glare including:

- Contrast between the luminance level of the light source and ambient/background luminance;
- Contrast between ambient/background luminance and the luminance/ illuminance of the task;
- Reflections;
- Size and number of glare sources;
- Length of time that the glare source is present; and
- Relative position of the glare source in the field of view.

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE**1**

Shading is essential in preventing glare caused by direct sunlight. Research proves that conventional internal blinds are only marginally effective, and hence this credit requires fixed or automated (with manual override) shading.

REFERENCES & FURTHER INFORMATION

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1999), *Daylighting and Window Design*

<http://www.cibse.org>

IESNA (Illuminating Engineering Society of North America) (1993), *Lighting Handbook, 9th edition, Reference & Application*

<http://www.iesna.org>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Definition of VLT vs TV

Technical Clarification Number: IEQ5-T-OB1-0662

Guidance: 2013-04-23

The GBCSA notes that for the purposes of Green Star SA, the terms Visual light transmittance (VLT) and Visible transmittance (TV) can be used interchangeably as they refer to the same concept (i.e. the amount of light in the visible portion of the spectrum that passes through a glazing material)

Technical Clarification: Solid opaque blinds

Technical Clarification Number: IEQ5-T-OB1-612

Guidance: 2013-01-07

The GBCSA confirm that for the purposes of proving compliance with the IEQ-5 Daylight Glare Control credit, solid (not perforated or woven) opaque blinds such as solid metallic or solid timber blinds can be assumed to have a VLT of < 10%. Confirmation from the manufacturer or manufacturers datasheets detailing the nature of the material component must be provided in the submission however and this assumption clearly stated referencing this Technical Clarification.

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE**1**

Similarly, in most instances 'block-out' fabric blinds will also have a VLT < 10%. For 'block-out' fabric blinds, where the VLT of the material is not known, project teams can confirm through Technical Clarification (TC) that the material composition is similar in nature to another fabric with a known VLT < 10%. Confirmation from the manufacturer or manufacturers datasheets detailing the nature of the material component must be provided within the TC submitted.

Credit Interpretation Request: Alternative credit criteria compliance methodology

Credit Interpretation Request Number: IEQ5-C-OB1-0311

Ruling: 2012-01-10

The Credit Interpretation Request (CIR) seeking approval for a proposed alternative credit criteria compliance methodology is conditionally granted.

The CIR Review Panel opinion is that the use of architectural modelling software and associated plug-in programs (e.g. Google Sketch-Up and 1001Shadows) to demonstrate compliance with the credit criteria is deemed acceptable as many 3D CAD packages have the ability to draw shadows at any time based on the sun path. Therefore such programs have the potential to assess the hours a given point is in sunlight for the purposes of this credit.

However such programs often lack the functionality of assessing a point for a detailed time schedule or period (i.e. yearly working hours, as available in more advanced solar analysis programs). To minimise non-automated computation time, it is an acceptable approximation that the analysis of a point be evaluated on discrete reference days which are representative of the variation in vertical solar angle during different seasons. An average may then be taken of the reference days analysed.

The CIR Review Panel conditionally grant this alternative compliance methodology conditional of the following requirements:

- The methodology is applied to each window/glazing element with a whole building model only (i.e. not individual models of windows/glazing elements). This is to account for the impact of adjacent windows/glazing elements and the intrusion of direct daylight on the adjoining analysis point on facades where low-angle sun is prevalent;
- The methodology is applied to façade windows/glazing elements only. It is not acceptable to assess clerestory windows or roof lights. If such elements exist, an alternative methodology must be proposed by CIR and approved separately;
- The analysis dates are the summer solstice, winter solstice and either autumn or spring equinox, with average of the three results deemed as the annual average for the purpose of demonstrating compliance with the credit criteria.

The CIR Review Panel intention of this CIR is to enable a broader range of software packages to be used for the purpose of demonstrating compliance with the credit criteria.

Technical Clarification: Definitions - "occupied hours", "standard hours of occupancy" and "standard working hours"

Technical Clarification Number: IEQ5-T-OB1-0110

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE**1**

Guidance: 2010-11-02

For the purpose of this credit, “occupied hours”, “standard hours of occupancy” and “standard working hours” are defined as equivalent and equal to the operational profile of the ‘HVAC plant’ as detailed in the applicable Energy Calculator & Modelling Protocol Guide. This definition is applicable to both mechanically ventilated spaces and naturally ventilated spaces (irrespective of the inclusion of HVAC plant or not). Please note these definitions do not amend the ‘Occupancy’ profiles as defined in the applicable Energy Calculator & Modelling Protocol Guide.

Credit Interpretation Request: Calculation methodology

Credit Interpretation Request Number: IEQ5-C-OB1-0081

Ruling: 2010-06-10

The Credit Interpretation Request (CIR) seeking to use the sunlight hours methodology in place of stereographic diagrams is approved conditionally, as long as the following criteria are demonstrated. The project must set up a grid at desk height (720mm AFFL) starting 1.5 metres in from all glazing (or any source of natural light) and extending throughout the floor plan on a 1m x 1m maximum grid, to 1.5 metres from all daylight sources. All grid points 1.5m and further in must be shaded from direct sun for 80% of standard working hours. Projects must provide output indicating values for every grid point, clearly demonstrating compliance. Projects are encouraged to provide a coloured grid with grid colours scaled to indicate where compliance is and is not achieved, demonstrating that any points where compliance is not achieved are outside the required calculation zone. It must be clear that all sources of natural light have been accounted for, including skylights and atria.

Technical Clarification: Manual blinds

Technical Clarification Number: IEQ5-T-OB1-0071

Guidance: 2010-05-21

In addition to the Credit Criteria stated in the technical manual, the following additional credit criteria have been developed. Projects using the following criteria can claim one point for this credit. This criteria can be used in conjunction with the criteria stated in the technical manual, or by itself.

One point is awarded where it is demonstrated that glare from daylight is reduced through the fitting of blinds or screens on all glazing and atria as a base building provision and meet the following criteria:

- Eliminate 95% of all direct sun penetration; AND
- Have a visual light transmittance (VLT) of $\leq 10\%$; AND
- Can be controlled by all affected occupants within each floor or area.

Projects seeking to claim this alternative methodology must use the documentation requirements for Occupant Controlled, Automated Blinds/Screens as stated in the credit criteria, with the exception of the provision of an automated motorized control for these blinds.

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE

1

Credit Interpretation Request: Direct sun penetration CORRECTION

Credit Interpretation Request Number: IEQ5-C-OB1-0065

Ruling: 2010-05-13

The requirement to eliminate all direct sun penetration for this credit has been modified. Where the second bullet point of the credit criteria (for blinds or screens) states "eliminate all direct sun penetration" must be changed to "eliminate 95% of all direct sun penetration". This change accounts for the need to allow a small sliver of light to enter between the wall and the edges of the blind.

Credit Interpretation Request: Tinted Glazing

Credit Interpretation Request Number: IEQ5-C-OB1-0067

Ruling: 2010-05-12

The Credit Interpretation Request (CIR) to deem the combination of tinted glazing and fixed shading devices, which are shown to be effective via a daylight glare model, equivalent to the credit criteria, is granted conditionally on the project's ability to demonstrate that the solution, as designed and built, will result in a reduction of glare to the user equivalent to that which is stated in the credit criteria.

Projects must submit a CIR that shows how the specific solution is equivalent to meeting the Credit Criteria. The documentation submitted with the CIR must show:

- The methodology used to create the daylight glare model and the software used;
- How the selected points represent the areas that would be effected by glare;
- That all terms are clearly defined within the report;
- The Name, type, glazing properties, and location of glazing (please ensure that this is clear); and
- How the results in the model are equivalent to that of the Credit Criteria in the Technical Manual.

Projects using this methodology must show that the above requirements are met in the documentation. Please ensure that all documentation is clearly correlated and highlighted.

The following Errata have been incorporated into the credit:

IEQ5-E-OB1-0152 Green Star SA - Office v1 Technical Manual: Page 68 (2011-01-06)

IEQ5-E-OB1-0158 Green Star SA - Office v1 Technical Manual: Page 67 (2011-01-06)

IEQ5-E-OB1-0159 Green Star SA - Office v1 Technical Manual: Page 68 (2011-01-06)

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE **1**

IEQ5-E-OB1-0160 Green Star SA - Office v1 Technical Manual: Page 67 (2011-01-06)

IEQ-7 Electric Light Levels

POINTS
AVAILABLE**1**

AIM OF CREDIT

To encourage and recognise base building provided office lighting that is not over designed.

CREDIT CRITERIA

One point is awarded where:

The office lighting design achieves an average maintained illuminance level of no more than 400 Lux for 95% of the office UA as calculated at the working plane (720mm AFFL).

DOCUMENT REQUIREMENTS

It must be clearly demonstrated that the documentation accurately reflects the entire design, even if only typical lighting layouts are documented. In addition to documenting the design, projects can demonstrate compliance through measurements during the commissioning process.

Where compliance is demonstrated via measurement, all submissions must provide measurements on a grid of no more than 1m x 1m, with all measurements taken at least 0.5m away from a window.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

IEQ-7 Electric Light Levels

POINTS
AVAILABLE

1

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Tender reflected ceiling plan (RCP) drawings • Isometric lighting measurement drawings	Where compliance is demonstrated through design implementation: • Short report • As built reflected ceiling plan (RCP) drawings Where compliance is demonstrated through measurement: • Short report • Extract(s) from the Commissioning Records • As built reflected ceiling plan (RCP) drawings

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Listing each typical lighting layout;
- Showing the UA served by each layout;
- Providing an area summary demonstrating that areas with maintained illuminance level of no more than 400 Lux jointly account for at least 95% of the Commercial Office UA; and
 - Where compliance is by design method:
 - Providing illuminance calculations demonstrating:
 - The maximum lighting levels for each layout;
 - The working plane used; and
 - Compliance with the percentage UA requirements.
 - Where compliance is by measurement method:
 - Providing details of measurement method used and plans showing the location of all measurements.

Extract(s) from the specification(s) where the maximum maintained illuminance lighting levels are stipulated.

Tender reflected ceiling plan (RCP) drawings for each typical ceiling layout, marked up to demonstrate compliance with the Credit Criteria, with the location, type and expected maintained illuminance of all luminaires clearly indicated.

IEQ-7 Electric Light Levels

POINTS
AVAILABLE

1

Isometric lighting measurement drawings marked up to show the location and size of all areas where maintained illuminance levels exceed 400 Lux.

Extract(s) from the Commissioning Records demonstrating that the lighting system has been commissioned and operates as intended by the design, indicating that:

- Lighting levels for 95% of the UA of each typical lighting layout are no greater than 400 Lux; and
- All measurements were taken at the working plane of 720mm AFFL.

As built reflected ceiling plan (RCP) drawings for each typical ceiling layout, demonstrating Where compliance is demonstrated through design implementation:

- The office UA spaces (with areas) modelled in the illuminance calculations.

Where compliance is demonstrated through measurement:

- All measurement locations demonstrating that measurements were conducted on a grid of no more than 1m x 1m, with all measurements taken at least 0.5m away from a window
- The maintained illuminance measured at the measurement locations.

ADDITIONAL GUIDANCE

Maintained illuminance refers to the average illuminance of a light fitting over its lifetime (dust and other factors taken into account). 400 Lux is the maximum (at any point), not average (over a floor or space) value for maintained illuminance.

Full lighting capacity (not dimmed) must be included in calculations. Green Star SA assesses the capacity of a building's attributes to reduce its environmental impact; allowing for greater luminance levels does not meet the aim of this credit because tenant operations and/or behaviour can reverse the effort of the commissioning and utilise the full capacity of the design.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

Lighting luminance levels are an important factor in determining occupant wellbeing and health in an office. Lighting that is too dim or too bright can cause discomfort and strain for office occupants.

A building owner and lighting designer usually provide office-standard lighting before the office space has a tenant and the usage of the space is known. This often results in ceiling mounted light fittings being used to provide an illumination level suitable for reading almost everywhere, even though only about 5–10 percent of the office space will require this lighting level. There are two main references to design lighting levels in South African standards.

IEQ-7 Electric Light Levels

POINTS
AVAILABLE

1

The **Occupational Health & Safety Act (OHS Act 1993)** sets absolute minimum lighting levels in various spaces in order to ensure the safety of occupants. These appear to have been written before computers were in widespread use in offices. For offices the following levels are defined:

Location	Place or type of activity	Illuminance (Lux)
OFFICE	Entrance halls and reception areas	100
	Conference rooms, general offices, typing and filing	300
	Computer and business machine operation	500
	Drawing offices	500

Table IEQ-7.1: *Excerpt from OHS Act 1993 Schedule*

It is the project team's responsibility to determine with the local authorities which classification should be used for each space in the building to ensure compliance with the OHS Act.

SANS10114-1:2005 Interior Lighting

Makes reference to the OHS Act, and also makes recommendations for design lighting levels for 500 Lux to most areas of an office. Note that while compliance with the OHS Act is mandatory, compliance with SANS10114-1 is not.

International Standards

Many international standards now recognise that when most occupants in an office are using computers with modern screens, significantly lower light levels than 500 Lux can be comfortable. This then allows significant savings in energy consumption.

CIBSE Lighting Guide 7 (Office Lighting) 2005 recommends light levels of 300 Lux for purely screen based work or 500 Lux for mixed or mainly paper-based tasks. The standard also stresses the importance of reducing glare and the benefits of indirect lighting and illuminating the surfaces of the office (i.e. walls and ceiling) to minimise contrast.

In general Green Star SA Office tools assume most work to be focused on screen-based tasks. Task lighting can be provided to allow occupants to control the lighting on their workspace and provide higher lighting levels when required.

REFERENCES & FURTHER INFORMATION

CIBSE Lighting Guide 7 (Office Lighting) 2005
<http://www.cibse.org>

The Occupational Health & Safety Act (OHS Act 1993)
<http://www.acts.co.za/ohs/index.htm>

SANS10114-1:2005 Interior Lighting
<http://www.sabs.co.za>

IEQ-7 Electric Light Levels

POINTS
AVAILABLE**1**

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Electric lighting levels and 'Shell & Core' spaces

Technical Clarification Number: IEQ7-T-OB1-0361

Guidance: 2012-01-10

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

For spaces delivered as 'Shell & Core', where no luminaires are provided, as evidenced through the provision of a fully documented design within the tender documentation (Design rating) or as installed As Built documentation and commissioning reports (As Built rating), compliance with the Credit Criteria cannot be demonstrated.

Technical Clarification: Documentation clarification

Technical Clarification Number: IEQ7-T-OB1-0343

Guidance: 2011-11-08

Where compliance is demonstrated through design (Design rating) or design implementation (As Built rating), and the 'Short Report' contains illuminance calculations demonstrating the maximum maintained lighting levels for each layout, the working plane used and compliance with the percentage UA requirements, it is not necessary to include 'Isometric lighting measurement drawings'. These may be excluded from the 'Documentation Requirements' of the Green Star SA Office v1 Technical Manual.

IEQ-7 Electric Light Levels

POINTS
AVAILABLE

1

The following Erratum have been incorporated into the body of the credit:

IEQ7-E-OB1-0344 Green Star SA - Office v1 Technical Manual: Page 77 (2011-11-08)

IEQ-8 External Views

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise designs that provide occupants with a visual connection to the external environment.

CREDIT CRITERIA

Up to two points are awarded where:

A significant portion of the office UA has a direct line of sight to the outdoors or into an adequately sized and day-lit atrium:

- One point for 60% of the UA;
- OR
- Two points for 80% of the UA.

DOCUMENT REQUIREMENTS

External views

Where compliance is achieved through external views, the following must be achieved:

- The view must extend from the perimeter of the building unblocked by solid structures (i.e. there must not be another building within eight metres);
- The area behind any solid portion of the perimeter of the external wall or atrium must be excluded from the calculations; and
- 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-8.1. Sight lines must take into account thickness of external walls (there must be a clear line of sight to the outside).

IEQ-8 External Views

POINTS
AVAILABLE

2

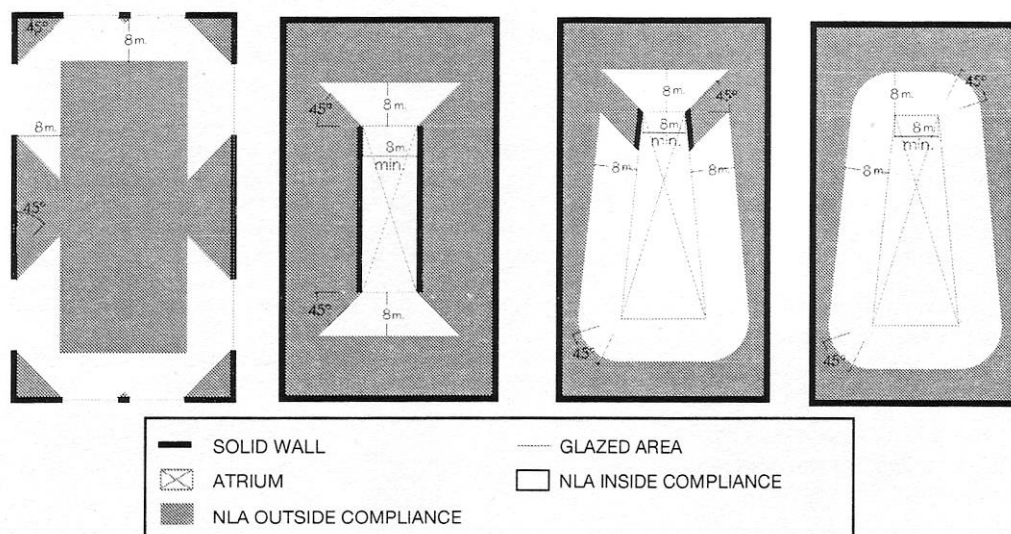


Figure IEQ-8.1: Diagrams illustrating areas that comply with the Credit Criteria given various atria shapes.

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;
- If the office 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 minimum daylight factor of 2.5% is for 90% of the atrium area on each level for which compliance is claimed;
- The base of the internal atrium is considered to be at the lowest level of BCA Commercial Office space (even if the actual base of atrium is several floors lower); and
- The sight line is to be measured at by extending a perpendicular line from the atrium/window; a line at 45 degree can be used at the corners of atrium/windows. Sight lines must take into account thickness of external walls (there must be a clear line of site to the outside).

IEQ-8 External ViewsPOINTS
AVAILABLE**2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender drawings	• Short report • As built drawings
Where compliance is achieved through use of atria, the following is also required:	Where compliance is achieved through use of atria, the following is also required:
• Daylight modelling report	• Daylight modelling report

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Referencing drawings;
- Providing calculations of the total Commercial Office UA within eight metres of vision glazing or daylight atrium; the area behind any solid portion of the perimeter of the external wall or atrium must be excluded from the calculations; and
- Providing a summary table demonstrating that compliant UA jointly accounts for the stipulated percentage of the UA.

Tender drawings

- Floor plans of all typical floors marked up to show any atria and their dimensions, the location of vision glazing and all UA within eight metres of vision glazing or daylight atrium, excluding the area behind any solid portion of the perimeter of the external wall or atrium and indicating sight lines where relevant;
- Sight lines must take into account thickness of external walls (there must be a clear line of sight to the outside) and must extend eight metres from the perimeter of the building (i.e. there must not be another building within eight metres); and
- Elevation drawings showing shape of vision glazing.

As built drawings

- Floor plans of all typical floors marked up to show any atria and their dimensions, the location of vision glazing and all UA within eight metres of vision glazing or daylight atrium, excluding the area behind any solid portion of the perimeter of the external wall or atrium and indicating sight lines where relevant;
- Sight lines must take into account thickness of external walls (there must be a clear line of sight to the outside) and must extend eight metres from the perimeter of the building (i.e. there must not be another building within eight metres); and
- Elevation drawings showing location and shape of vision glazing.

Daylight modelling report demonstrating, with inputs justified by the documented design, the Daylight Factor in the atria.

IEQ-8 External Views

POINTS
AVAILABLE**2**

ADDITIONAL GUIDANCE

Vision glazing does not include windows below 720mm or above 2400mm AFFL. Skylights are therefore not classed as vision glazing.

If the office space opens directly onto the atrium (i.e. no internal glazing is installed), then the internal perimeter of the atrium may be used for the calculations.

BACKGROUND

There is increasing evidence that eyestrain and related health problems can be significantly reduced in situations where the eyes can be refocused periodically on a distant object. This is easier to achieve where there is a nearby window with a view out. This is especially important where occupants spend significant periods of time in front of computer monitors or closely studying paperwork as in a typical office.

REFERENCES & FURTHER INFORMATION

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1999), Publications – *Daylighting and Window Design*
<http://www.cibse.org>

Queensland University of Technology (2001), *Modification of Atrium Design to Improve Thermal and Daylighting Performance*
<http://adt.library.qut.edu.au/adt-qut/uploads/approved/adt-QUT20020326.155817/public/01front.pdf>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Internal walls in Office areas

Technical Clarification Number: IEQ8-T-OB1-0449

Guidance: 2012-03-14

Where internal walls within office areas are provided as part of the 'base building provision' (i.e. will not change based on tenant requirements), project teams must include these within the Green

IEQ-8 External ViewsPOINTS
AVAILABLE**2**

Star SA submission, but should ensure they are included consistently across the submission. Where internal walls are not considered part of the 'base building' (e.g. office partition walling), these may be excluded for calculations demonstrating compliance with the credit criteria.

Technical Clarification: Day-lit atria and compliant external views - alternative methodology and additional guidance

Technical Clarification Number: IEQ8-T-OB1-0369

Guidance: 2012-01-10

This Technical Clarification provides further guidance for the inclusion of day-lit atrium and the external views provided by such design features. The criteria for day-lit atria to account for external views are provided on Page 80 of the Green Star SA - Office v1 Technical Manual. This further guidance pertains to the minimum daylight factor of DF2.5% and how compliance is claimed for views on a particular level of an atrium.

Previously, to claim compliant views into a day-lit atrium, 90% of the horizontal plan area of the atrium needed to achieve a daylight factor of not less than DF2.5%. This resulted in an outcome where by if 85% of an atria was compliant, no external views could be claim. This 90% criteria is viewed as problematic.

The GBCSA wish to clarify that Project Teams may now apply a 'proportional-based' method to determining compliant external 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 has a DF of 2.5% or greater, 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 UA each) with a adequately sized atrium. An analysis of the maximum external view UA claimed due to the atria (only) on each floor indicates compliant UA of 100m² on each floor. Daylight modelling indicates that on the top level, 94% of the horizontal plan area of the atria achieves a DF of not less than 2.5%, 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 UA 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.

This is deemed as a more reasonable method for accounting for external views into an appropriately sized day-lit atrium.

IEQ-9 Thermal ComfortPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise buildings that achieve a high level of thermal comfort.

CREDIT CRITERIA

Up to two points are awarded where a high level of thermal comfort is achieved for 95% of the office UA through any combination of the following:

Naturally ventilated spaces

Where naturally ventilated buildings achieve credit criteria for IEQ-10 'Individual Comfort Control', up to two points are awarded if the internal temperatures are within the ASHRAE Standard 55-2004 Acceptability Limits for at least 98% of occupied hours during the year:

- One point for internal temperatures within the 80% Acceptability Limits;

OR

- Two points for internal temperatures within the 90% Acceptability Limits.

Mechanically ventilated spaces

Up to two points are awarded if 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 during the year:

- One point for PMV levels between -1 and +1, inclusive;

OR

- Two points for PMV levels between -0.5 and +0.5, inclusive.

Mixed-mode ventilated spaces

For mixed-mode buildings, the systems should be modelled as they are expected to operate and the same criteria used as for a mechanically ventilated space.

DEEMED TO SATISFY CRITERIA for air conditioned spaces

As a more complex interaction of factors affects thermal comfort in mixed-mode, mechanically ventilated and fully naturally ventilated spaces/buildings, modelling should be used to inform their design.

For a fully mechanically air conditioned building one point is automatically awarded, without the requirement for thermal modelling, where all of the following criteria are met and clearly demonstrated:

- Dry Bulb Temperature within range of 20°C to 24°C;
- Mean radiant temperature of within the range of 20°C to 27°C OR shading is provided to meet the Credit Criteria of IEQ-5 'Glare Control';
- Relative Humidity within range of 40% to 60%;
- Air velocity not more than 0.2m/s with no supply directed at occupants (unless they have direct control of the air flow e.g. displacement grilles, task air nozzles); and

IEQ-9 Thermal Comfort

POINTS
AVAILABLE

2

- The HVAC system must have separate internal and perimeter zones that each provide independent heating, cooling and air volumes and meet the following criteria:
 - No individual perimeter zone can exceed 100m²;
 - A perimeter zone can serve no more than one façade orientation unless the second orientation is negligible (i.e. perimeter length is not to exceed four meters); and
 - Each zone must have a thermostat located in that zone.

Projects may choose to input the design criteria into simple PMV calculator software programs and/or do hand calculations for mean radiant temperature.

DOCUMENT REQUIREMENTS

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 'Ventilation Rates') and be clearly justified by the documented design (for Green Star SA – Office Design assessment) or by the as built evidence (for Green Star SA – Office As Built assessment).

Note that for Green Star SA – Office As Built, on-site thermal comfort measurement is not an acceptable way to demonstrate compliance with the Credit Criteria.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Naturally ventilated buildings

Adaptive Comfort Standard (ACS) is used as defined in ASHRAE Standard 55-2004. The analysis must show that for 98% of occupied hours during a year, the operative temperature in the space is within the 80% or 90% acceptability limits as defined in the standard (also refer Additional Guidance).

Mechanically ventilated spaces:

Thermal comfort modelling must use default values for clothing, metabolic rate and air velocity as outlined in Additional Guidance.

Mixed-mode spaces

For mixed-mode buildings, thermal comfort criteria should be carried out on the basis of the assumed operation of the systems (i.e. it can be assumed that the air conditioning system will be in operation on the warmest days). The same mode of operation must also be used in the Ene-1 energy modelling credit.

Green Star SA – Office Design	Green Star SA – Office As Built

IEQ-9 Thermal ComfortPOINTS
AVAILABLE**2**

Submit all the evidence and ensure it readily confirms compliance. • Thermal comfort report • Tender drawings • Extract(s) from the specification(s) Where compliance is via the Deemed to Satisfy criteria: • Short report • Tender drawings	Submit all the evidence and ensure it readily confirms compliance. • Thermal comfort report • As built drawings • Extract(s) from the Commissioning Records Where compliance is via the Deemed to Satisfy criteria : • Short report • As built drawings • Extracts(s) from the Commissioning Report

Thermal comfort report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Referencing specification(s) and drawings;
- For naturally ventilated buildings, summarising the thermal comfort calculations for the project design and aligning them with ASHRAE Standard 55-2004; and referencing and appending any evidence to justify that the system will operate as designed; and
- For mechanically ventilated spaces, summarising thermal comfort calculations for the project design and demonstrating that the PMV targets are achieved. The Thermal Comfort Report must include:
 - Thermal modelling simulation output including hourly PMV levels for each day of the year that the space is occupied;
 - A summary of mean radiant temperatures, air temperatures and humidity from the simulation and details of the weather data used;
 - A description of the HVAC system and drawings showing how the building layout has been zoned for the thermal comfort analysis;
 - A description of the methodology and software package used for determining the thermal comfort levels;
 - The clothing, metabolic rate and air movement values used (see standard variable values below);
 - A summary of the hourly thermal comfort results, mean radiant temperatures, air temperatures and humidity for each zone; and
 - A description of the year's worth of weather data used.

Tender drawings

- Plans marked up to indicate all zones assessed for thermal comfort;
- Façade, roof and, wherever relevant, section drawings showing the materials in the design; and

IEQ-9 Thermal Comfort

POINTS
AVAILABLE**2**

- For naturally ventilated spaces, indicating and dimensioning all ventilation openings, inlets and outlets.

Extract(s) from the specification(s) where the thermal properties of all materials that are used as inputs for demonstrating compliance are nominated.

Short report prepared by a relevant project team member that demonstrates that the Deemed to Satisfy criteria have been met, addressing all of the HVAC Design and Building Fabric Performance criteria of the Deemed-to-Satisfy approach, and referencing and appending any justification, tender drawings and evidence necessary.

As built drawings

- Plans marked up to indicate all zones assessed for thermal comfort;
- 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.

Extract(s) from the Commissioning Records demonstrating via commissioning results that the building has been commissioned and operates as intended by the design.

IEQ-9 Thermal ComfortPOINTS
AVAILABLE**2****ADDITIONAL GUIDANCE**

Any shading that meets the Credit Criteria of IEQ-5 'Daylight Glare Control' can be included in thermal modelling estimations; all other shading and blinds must be excluded.

Projects may choose to input the design criteria into simple PMV calculator software programs and/or do hand calculations for mean radiant temperature.

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-9.1: 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.

Internal loads

Internal loads shall be assigned as defined in the Green Star SA – Office v1 Energy Calculator & Modelling Protocol Guide.

Zone distribution

Perimeter zones of less than four meters shall be modelled independently to prevent averaging of heat fluxes and temperatures from invalidating the results (i.e. the comfort predictions shall be measured two metres from the internal face of the façade). The thermal comfort result is to be calculated on an area weighted average between perimeter zones and centre zones.

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 as defined in the Green Star SA – Office v1 Energy Calculator & Modelling Protocol Guide.

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The following CLO, MET and Air Velocity constants shall be used:

For Air Conditioned and Mixed Mode Offices:

- Default values are not prescribed for air velocity for mechanically-ventilated spaces/buildings, as those values are highly dependent on the systems installed.

For Naturally Ventilated Offices:

- For determining the frequency of PMV >0.5:
 - CLO = 0.6
 - MET = 1.2
 - Air Velocity = 0.30m/s
- For determining the frequency of PMV < -0.5:
 - CLO = 0.95
 - MET = 1.2
 - Air Velocity = 0.15m/s

These standard values were based on values published in ISO7730 (*International Thermal Comfort Code*). In addition to being conducted in accordance with ISO7730, thermal modelling must account for the effects of direct sunlight. The default air velocity above must be used unless the system has clearly been designed for different air velocity limits.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out. If any component of the project is delivered as shell and core, all assumptions must be conservative and documented clearly and consistently throughout the submission.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

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 levels and metabolic rates.

Some examples of where one might feel uncomfortable, despite ambient conditions of 21-24°C include:

- Feeling too hot in direct sun on a 22°C day;
- Feeling cold from the draught in an air conditioned office; and
- Feeling hot in an air conditioned car on a very hot day.

This credit aims to encourage projects to design for comfort, rather than temperature. To assist, there is an international standard (ISO7730) that was developed to measure thermal

IEQ-9 Thermal Comfort

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comfort, rather than temperature, to assess the comfort of building occupants.

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-9.2: 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.

REFERENCES & FURTHER INFORMATION

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) (2004),

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ASHRAE 55P – *Thermal Environmental Conditions for Human Occupancy*
<http://www.ashrae.org/publications>

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) (1997),
ASHRAE Fundamentals Handbook 1997
<http://www.ashrae.org/publications>

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1992), Standard 55-1992 -
Thermal environmental conditions
<http://www.cibse.org>

ISO (International Organisation for Standardisation). 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>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Shell & Core compliance, IEQ-9.

Credit Interpretation Request Number: IEQ9-C-OB1-709

Ruling: 2013-09-26

The GBCSA note that where buildings are delivered as 'Shell & Core' or where tenant layout designs are not yet defined, the following methodology for the modelling of HVAC under the IEQ-9 credit is deemed acceptable.

Thermal comfort using PMV relies on 6 key factors as per below, provided air conditioning is provided these are largely the same for air based systems.

Air Temperature – As per notional building, the modelling protocol guide already allows a default air temperature band for buildings where no client brief exists.

Radiant Temperature – This applies to perimeter zones and internal surfaces and is calculated during the simulation. Where internal finishes are not installed, either conservative assumptions are to be made or it is to be shown that tenants are contractually required to install the finishes included in the analysis.

Humidity- This is normally not controlled directly in buildings however provided air conditioning is included in the building this is calculated during the simulation.

Clothing – As defined in the technical manual

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POINTS
AVAILABLE**2**

Metabolic rate – as defined in the technical manual

Air velocity – 0.14m/s is to be used as per guidance from the Green Star SA - Public and Educational Buildings tool for typical artificially ventilated spaces

Furthermore, the following is to be considered:

Zoning

IEQ-09 modelling requires rezoning of the building as per existing TC's. Therefore, since even buildings with defined HVAC zones have to change their zoning to suit the requirements, the current requirements for zoning should be used.

Supply Air Simulation

A constant air volume system can be used as the results would be more conservative than using the variable air volume system of the notional building.

As such, using the methodology above, the building will be able to show thermal comfort improvements.

Technical Clarification: Thermal comfort and 'Shell & Core' spaces

Technical Clarification Number: IEQ9-T-OB1-0362

Guidance: 2013-07-22

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office Design v1 Technical Manual.

The thermal comfort within a mechanically ventilated space is highly influenced by the design of the HVAC system within the space. Where a mechanically ventilated space is not provided with a complete HVAC system, as evidenced through the provision of a fully documented design within the tender documentation (Design rating) or as installed As Built documentation and commissioning reports (As Built rating), compliance with the Credit Criteria cannot be demonstrated.

Technical Clarification: HVAC plant operating schedules

Technical Clarification Number: IEQ9-T-OB1-0597

Guidance: 2012-11-05

Should operating schedules of HVAC equipment be used as part of the energy performance or thermal comfort strategy, e.g. night flushing or early start-up of HVAC plant, the actual HVAC plant operating schedules for the related equipment as supported by tender documentation (Design) or

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commissioning data (As Built) may be used for the Ene-1 actual building modelling and IEQ-9 credit modelling.

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 modelling protocol should be used.

Note that for the Ene-1 notional building, the HVAC plant operating schedules in the energy modelling protocol should be used.

Technical Clarification: Revised documentation requirement - Thermal comfort report

Technical Clarification Number: IEQ9-T-OB1-0387

Guidance: 2012-01-20

The following updates the documentation requirements of the 'Thermal comfort report' required for both Design and As Built submission as per Page 85 of the Green Star SA - Office v1 Technical Manual. This update is applicable to naturally ventilated buildings, mechanically ventilated spaces and mixed-mode spaces:

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;
- 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 modelled 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 temperatures and resulting acceptability range;

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- 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.

Technical Clarification: Thermal comfort and 'Shell & Core' spaces

Technical Clarification Number: IEQ9-T-OB1-0362

Guidance: 2012-01-10

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

The thermal comfort within a mechanically ventilated space is highly influenced by the design of the HVAC system within the space. Where a mechanically ventilated space is not provided with a complete HVAC system, as evidenced through the provision of a fully documented design within the tender documentation (Design rating) or as installed As Built documentation and commissioning reports (As Built rating), compliance with the Credit Criteria cannot be demonstrated.

Technical Clarification: Revised credit criteria for naturally ventilated spaces

Technical Clarification Number: IEQ9-C-OB1-0341

Guidance: 2011-11-04

The following updates the thermal comfort credit criteria within the Green Star SA Office v1 Technical Manual for naturally ventilated spaces (only);

Naturally ventilated spaces

Two credit criteria compliance routes are available for naturally ventilated spaces, as follows:

Up to two points are awarded if the internal operative temperatures are within the ASHRAE Standard 55-2004 Acceptability Limits for at least 98% of occupied hours during the year:

- One point for internal temperatures within the 80% Acceptability Limits;

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OR

- Two points for internal temperatures within the 90% Acceptability Limits.

OR

Up to two points are awarded if the Predicted Mean Vote (PMV) levels, calculated in accordance with ISO7730 using standard clothing and metabolic rate values as provided, are within the following limits for at least 90% of occupied hours during the year:

- One point for PMV levels between -1 and +1 (inclusive);

OR

- Two points for PMV levels between -0.5 and +0.5 (inclusive).

The use of ASHRAE 55-2004 Acceptability Limits of operative temperature for determining thermal comfort may only be used where the naturally ventilated space satisfies the following requirements:

- The space is equipped with operable windows that open to the outdoors, and can be readily opened and adjusted by occupants of the space;
- The space is not provided with a mechanical cooling system (space heating is permitted however the Acceptability Limits are not applicable when the heating system is in operation); and,
- The occupants of the space may freely adapt their clothing to the indoor thermal conditions.

Where the naturally ventilated space does not satisfy these requirements, the ASHRAE 55-2004 Acceptability Limits cannot be used, and Predicted Mean Vote (PMV) levels calculated in accordance with ISO7730 must be used to determine thermal comfort of the space.

Technical Clarification: Perimeter zones - clarification

Technical Clarification Number: IEQ9-T-OB1-0318

Guidance: 2011-09-30

For thermal comfort modeling, 'perimeter zones' are considered to be zones that are on an external façade surface or an unconditioned space that has external surfaces. For example, zones adjacent to a naturally ventilated unconditioned atrium (i.e. experiencing external conditions) would be considered 'perimeter zones', however zones adjacent to internal stair core or storerooms that are entirely surrounded by conditioned spaces would not be considered 'perimeter zones'. Such zones for thermal comfort modeling may or may not coincide with control zones as defined in the mechanical design

Technical Clarification: CLO and MET values - additional guidance

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AVAILABLE**2****Technical Clarification Number: IEQ9-T-OB1-0297****Guidance:** 2011-07-21

The GBCSA wishes to provide further guidance regarding the application of CLO and MET values for thermal comfort modelling. The CLO and MET values detailed on Page 88 of the Green Star SA Office v1 Technical Manual must be used for air conditioned & mixed mode offices AND naturally ventilated offices. These are to remain consistent, irrespective of strategies used to provide comfort. Values for air velocity for air conditioned & mixed-mode offices are not prescribed as those values are highly dependent on the systems installed. Selected values for these strategies must be justified with reference to the system design. For naturally ventilated offices, the values prescribed must be used.

Technical Clarification: Zone distribution - clarification**Technical Clarification Number: IEQ9-T-OB1-0298****Guidance:** 2011-07-21

Where a mechanical design incorporates zones adjacent to a façade which are in excess of 4m deep from the façade, for the purposes of thermal comfort modelling only, these must be divided into a perimeter zone of not more than 4m deep from the façade and a centre/internal zone. This is to accurately account for the influence of heat fluxes and temperatures in the perimeter zone. It is not required that actual HVAC designs incorporate a 4m perimeter zone. The division of a larger zone adjacent to a façade is for modelling purposes only. The thermal comfort result is to be calculated on an area weighted average.

Credit Interpretation Request: PMV assessment at expected historical maximum and minimum ambient temperatures

Credit Interpretation Request Number: IEQ9-C-OB1-0113**Ruling:** 2010-11-10

The Credit Interpretation Request (CIR) seeking to assess the Predicted Mean Vote (PMV) values for compliance to the credit criteria at the expected maximum summer and minimum winter ambient temperatures only, based on historical metrological data for the site, is denied.

The CIR Review Panel notes that the PMV measure of thermal comfort is calculated from a range of variables including occupant metabolic rate, occupant clothing levels, radiant surface temperature, zone air temperature, zone humidity and zone air velocity. Many of these variables are constantly changing within the occupied zones of a building due to the combination of external climatic influences (e.g. ambient temperature, solar radiation, humidity etc.), internal loads (sensible and latent) and the response of the building's HVAC system to these influences to maintain air temperature within the control band and set points. As such, it is possible that although zone air temperature can be maintained within the target control band and set points at the proposed extreme ambient conditions, the influence of the other contributing variables may cause PMV results to exceed the acceptable range prescribed in the credit criteria. This may occur at any

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AVAILABLE**2**

occupied hour of the year and is not limited to the worst case ambient conditions (historical or otherwise). Hence hourly simulation is required to assess how many hours of the total occupied hours of the year do the PMV results exceed the acceptable range prescribed in the credit criteria to determine compliance with the credit criteria.

Technical Clarification: Definitions - "occupied hours", "standard hours of occupancy" and "standard working hours"

Technical Clarification Number: IEQ9-T-OB1-0110

Guidance: 2010-11-02

For the purpose of this credit, "occupied hours", "standard hours of occupancy" and "standard working hours" are defined as equivalent and equal to the operational profile of the 'HVAC plant' as detailed in the applicable Energy Calculator & Modelling Protocol Guide. This definition is applicable to both mechanically ventilated spaces and naturally ventilated spaces (irrespective of the inclusion of HVAC plant or not). Please note these definitions do not amend the 'Occupancy' profiles as defined in the applicable Energy Calculator & Modelling Protocol Guide.

Technical Clarification: Documentation amendment

Technical Clarification Number: IEQ9-T-OB1-0085

Guidance: 2010-06-17

Based on feedback from the assessors and project teams, the following documentation is no longer required at the time of a Green Star SA - As Built submission for this credit:

* Extract(s) from the specification(s)

All other documentation must be provided as per the Technical Manual at the time of submission.

The following errata have been incorporated:

IEQ9-E-OB1-0302 (2011-08-08) Green Star SA - Office v1 Technical Manual: Page 83

IEQ9-E-OB1-0162 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 85

IEQ-10 Individual Thermal Comfort Control

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise designs that facilitate individual control of thermal comfort.

CREDIT CRITERIA

Up to two points are awarded where it is demonstrated that user controls are provided for the base building heating, cooling and ventilation systems (where present) as follows:

Naturally ventilated spaces

User controls are defined as an individually controllable ventilation opening of not less than 0.75m², together with individual temperature control or thermostatic control to the local heat source (if a heating system is provided).

- One point where user controls are provided every 30m² for 90% of the UA; OR
- Two points where user controls are provided every 15m² for 90% of the UA.

Mechanically ventilated spaces

The base building HVAC system allows for tenant installation of user control of air supply rate, air temperature or mean radiant temperature:

- One point where user controls are provided every 30m² for 90% of the UA; OR
- Two points where user controls are provided every 15m² for 90% of the UA.

Mixed-mode ventilated spaces

For mixed-mode buildings, the above mechanical and natural ventilation user control criteria must be achieved.

DOCUMENT REQUIREMENTS

It must be clearly demonstrated that any combination of systems provides for individual user control for the nominated proportion of the office UA.

Naturally ventilated spaces

Where the building is naturally ventilated, it must be clearly demonstrated that it is designed to require no mechanical air conditioning and that each ventilation opening must have an operable area of not less than 0.75m². If the building is provided with heating, the heat source must have local temperature control or be under thermostatic control.

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Mechanically ventilated spaces

Mechanically ventilated and air conditioned spaces must incorporate controls to allow occupants to modify the local temperature and/or air speed. Adjustable floor or ceiling grilles are only acceptable when adjustment can be made by any occupant without using any tools and when the system has been designed to allow for this level of control.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated spaces: • Short report • Opening Area Schedule • Tender drawings For mechanically ventilated spaces: • Short report • Tender drawings • Extract(s) from the specification(s)	For naturally ventilated spaces: • Short report • Opening Area Schedule • As built drawings For mechanically ventilated spaces: • Short report • As built drawings • Extract(s) from the Commissioning Records

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Describing how the design provides for individual control, detailing its operation, accessibility and controls; and
- For the As Built rating with mechanically ventilated spaces, referencing the as built drawings and the Commissioning Records; and providing a summary table of the naturally ventilated, mixed-mode ventilated, mechanically ventilated spaces in the building, their areas; the AHU(s) or ventilation openings that serve each space.

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 demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

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Extract(s) from the specification(s) that identify the proposed HVAC system(s) and outline its requirements and operation or requirements for individual controls.

Tender drawings

- For naturally ventilated spaces, plans, section and/or elevations (whichever relevant) drawings showing the location and size of ventilation openings, showing, inlets and outlets, and that separate operable windows are provided to every 30m² or 15m² of UA (including enclosed spaces). In addition, mechanical or electrical drawings showing the heat emitter locations (if provided) and details of controls.
- For mechanically ventilated spaces, mechanical drawings showing:
 - The configuration of the HVAC system, location of diffusers and thermostats or other individual control devices and extent of UA that is served by those devices;
 - That diffusers, thermostats or other individual control devices are provided for every 30m² or 15m² of UA claimed (including enclosed spaces); and
 - That they are connected to a services system capable of providing discreet, individual control to those areas.

As built drawings

- For naturally ventilated spaces, plan, section and/or elevation (whichever relevant) drawings showing the location and size of ventilation openings, and that separate operable windows are provided to every 30m² or 15m² of UA (including enclosed spaces). In addition, mechanical or electrical as built drawings showing the heat emitter locations (if provided) and details of controls.
- For mechanically ventilated spaces, plan and mechanical drawings, showing:
 - The configuration of the HVAC system, location of diffusers and thermostats or other individual control devices and extent of UA that is served by those devices;
 - That diffusers, thermostats or other individual control devices are provided for every 30m² or 15m² of UA claimed (including enclosed spaces); and
 - That they are connected to a services system capable of providing discreet, individual control to those areas.
- For each typical naturally ventilated space, drawings with ventilation openings, inlets and outlets clearly indicated and dimensioned.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems have been commissioned and found to operate as intended by the design.

ADDITIONAL GUIDANCE

Typically conventional ceiling-mounted air distribution systems are unable to provide individual control over ventilation and temperature in an office. This is because they supply air from above to many workstations.

IEQ-10 Individual Thermal Comfort Control

POINTS
AVAILABLE**2**

In a mechanically ventilated building there are several methods of achieving individual occupant control. In these systems, supply air outlets usually provide for manual control by way of adjustable diffusers in the floor at each workspace or via personal HVAC systems with controllable air vents integrated into workstation desks or partitions. These systems usually require an underfloor air distribution system. Because air is supplied locally to the occupied zone, supply air temperatures are usually warmer than conventional ceiling based systems to avoid draft discomfort to the occupants.

Another system includes a ceiling-level swivelled vertical air jet (McGill jet) in each workstation. The advantage of this approach is the elimination of secondary fan energy and the capacity to operate without a raised floor. However, installations that include overhead jets may require a minimum pressure of 100 Pascals in the air distribution ducts.

Importantly the air outlet must be very close to the individual to:

- Allow low air velocity to be effective;
- Bring air to the individual below room temperature; and
- Facilitate individual air flow control to increase ventilation efficiency.

Naturally ventilated buildings can achieve individual control by allowing occupants to adjust individual ventilation openings (windows etc.). Individual control over shading devices is to be considered to allow control of mean radiant temperatures.

Whenever a naturally ventilated building claims IEQ-1 'Ventilation Rates', it is assumed that natural ventilation is sufficient and the project must only demonstrate that natural ventilation openings are provided as per the specified frequencies. However, whenever a naturally ventilated building does not claim IEQ-1 'Ventilation Rates' the project must demonstrate both that the natural ventilation openings are provided as per the specified frequencies and that they are no less than 0.75m². An opening of 0.75m² is deemed to be large enough to enable successful ventilation.

Refer to ASHRAE Fundamentals Handbook 1997 Chapter 31 for more guidance on localised ventilation systems.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out. If any component of the project is delivered as shell and core, all assumptions must be conservative and documented clearly and consistently throughout the submission.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

IEQ-10 Individual Thermal Comfort Control

POINTS
AVAILABLE

2

BACKGROUND

Providing individual control of thermal comfort systems allows occupants to customise the indoor environment to their own preference.

'Thermal Comfort,' Chapter 8 in the *ASHRAE Handbook of Fundamentals*, 2001, indicates vast differences between people's needs for thermal comfort, strongly indicating the need for individual control. This can have a significant benefit for occupant comfort by:

- Increasing occupant satisfaction and productivity; and
- Lowering occupant complaint level—fewer trouble calls for building management.

Individual control has been shown to widen the range of comfort temperatures. This can provide substantial energy savings in both heating and cooling. In particular it means that a naturally ventilated environment may be possible for increased periods of the year.

'Age of air' experiments indicate better penetration of the ventilation component than with systems which both supply and return air at the false ceiling.

Feedback from building occupants overseas has been positive, because individual personal control of the workstation provides a sense of personal empowerment. Subjective estimates of improved productivity have been noted in a range of 0-10 percent.

REFERENCES & FURTHER INFORMATION

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S.)
Developing an adaptive model of thermal comfort and preference – final report on ASHRAE RP884

<http://www.ashrae.org>

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S.)
(2005), *ASHRAE Fundamentals Handbook 2005*

<http://www.ashrae.org>

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S.)
Draft ASHRAE Comfort Standard 55

<http://www.ashrae.org>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

IEQ-10 Individual Thermal Comfort Control

POINTS
AVAILABLE**2**

Technical Clarification

Individual comfort control and 'Shell & Core' spaces

Technical Clarification Number

IEQ10-T-OB1-0363

Guidance

2012-01-10

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

The individual thermal comfort control within a mechanically ventilated space is highly influenced by the design of the HVAC system within the space. Where a mechanically ventilated space is not provided with a complete HVAC system, as evidenced through the provision of a fully documented design within the tender documentation (Design rating) or as installed As Built documentation and commissioning reports (As Built rating), compliance with the Credit Criteria cannot be demonstrated.

Technical Clarification

UA percentage - correction

Technical Clarification Number

IEQ10-T-OB1-0076

Guidance

2010-05-31

The requirement to provide user controls for every 30m² or 15m² for this credit has been modified. For both naturally ventilated and mechanically ventilated spaces, the bullet points of the credit criteria which state "user controls are provided every 30m² [or 15m²] of the UA" should be changed to "user controls are provided every 30m² [or 15m²] for 90% of the UA". This change accounts for case where tenants will install within the UA storerooms, toilet rooms, eT., which do not need controls.

The following errata have been included:

IEQ10-E-OB1-0129 Green Star SA - Office v1 Technical Manual: Page 91 (2011-01-06)

IEQ-10 Individual Thermal Comfort Control

POINTS
AVAILABLE

2

IEQ-10 Individual Thermal Comfort Control

POINTS
AVAILABLE

2

IEQ-11 Hazardous MaterialsPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise actions taken to reduce health risks to occupants from the presence of hazardous materials.

CREDIT CRITERIA

One point is awarded where:

- A comprehensive hazardous materials survey has been carried out on the project site, as defined by the South African Occupational Health and Safety Act (OH&S) and/or other relevant legislation; and
- Whenever asbestos, lead or polychlorinated biphenyls (PCBs) were found, they have been removed in accordance with the standards listed under Table IEQ-11.1.

For new developments or developments in which none of the above hazardous materials were found in the survey, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Indoor Environment Quality Category Score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Hazardous materials survey Where asbestos, lead or polychlorinated biphenyls were found, the following supplementary documentation is also required, once materials have been removed: • Hazardous materials survey or contractual commitment	• Short report • Hazardous materials survey Where asbestos, lead or polychlorinated biphenyls were found, the following supplementary documentation is also required: • Disposal receipts

Short report prepared by a suitable professional that describes how the Credit Criteria have been met.

For Office Design: Hazardous materials survey that has been carried out in the existing building.

IEQ-11 Hazardous Materials

POINTS
AVAILABLE

1

- Where hazardous materials were found, a new survey must be carried out showing that hazardous materials have been removed and disposed of according to the standards listed under Table IEQ-11.1, or a contractual commitment to remove hazardous materials in accordance with the standards and legislation listed in Table IEQ-11.1.

For Office As built: Hazardous materials survey detailing asbestos, lead and polychlorinated biphenyls report from a suitably qualified person.

Disposal receipts from the contractor (or suitable sub-contractor(s)) confirming that the asbestos, lead and polychlorinated biphenyls have been removed and disposed in accordance with the standards listed under Table IEQ-11.1.

ADDITIONAL GUIDANCE

It must be clear from the submitted documentation that the following hazardous materials will be removed as per the relevant standards or legislation.

Hazardous Materials	Relevant Standards or Legislation
Asbestos	Occupational Health and Safety legislation and the Department of Water Affairs and Forestry: Minimum requirements for Handling, Classification and Disposal of Hazardous Waste.
Lead	Occupational Health and Safety legislation and the Department of Water Affairs and Forestry: Minimum requirements for Handling, Classification and Disposal of Hazardous Waste
All	Department of Water Affairs and Forestry: Minimum requirements for Handling, Classification and Disposal of Hazardous Waste

Table IEQ-11.1: List of relevant legislation & standards

Where hazardous materials have been found on site, either a contractual commitment to remove hazardous materials, or evidence that hazardous materials have been removed are acceptable methods of meeting the hazardous materials requirements for Green Star SA - Office Design (not Green Star SA – Office As Built).

Asbestos

Although asbestos is now rarely used in construction, many asbestos-containing products and materials may still be found in existing buildings. These include vinyl asbestos tiles, laboratory table tops, roofing felts, suspended ceiling tiles, and asbestos cement products (including pipes, roof and wall cladding). These types of materials do not present a significant health risk unless they are tooled, cut, drilled, sanded or otherwise abraded or machined so as to release asbestos dust.

Sprayed insulation materials containing asbestos may occur throughout buildings and other structures, especially those built from the 1950s to the mid-1980s. Such buildings will often have asbestos used in sprayed-on fireproofing/soundproofing/thermal insulation, and acoustic plaster soundproofing.

IEQ-11 Hazardous Materials

POINTS
AVAILABLE**1**

Lead

Lead is most commonly found in paints. Wherever found, it must be removed in accordance with the Occupational Health and Safety legislation and the Department of Water Affairs and Forestry: Minimum requirements for Handling, Classification and Disposal of Hazardous Waste.

Polychlorinated Biphenyls (PCBs)

PCBs are most commonly found in the ballasts of fluorescent light fixtures. Wherever found, it must be removed in accordance with the Department of Water Affairs and Forestry: *Minimum requirements for Handling, Classification and Disposal of Hazardous Waste*.

BACKGROUND

Asbestos

Asbestos is composed of strong fibres, which are long and silky in appearance. When it is processed, many very small fibres are created. Because they are very fine, they can become airborne. Once in the air, the fibres are easily inhaled or swallowed. If they are inhaled, they can cause mesothelioma, asbestosis, lung cancer and pleural diseases. These effects can take up to 40 years to develop.

When the asbestos fibres are inhaled into the lung, the lung's defence cells try to destroy the fibres; however the defence mechanisms cannot break down asbestos. This results in the asbestos fibres remaining in the lungs and causing scarring; the inflammation continues for decades. Thickening and scarring prevents oxygen and CO₂ from travelling between the tiny air sacs of the lungs and into the blood stream; breathing becomes much less efficient.

The inflammatory process (once started) continues to progress, fuelled by the indestructible asbestos fibres even after the exposure to asbestos has ceased. Mesothelioma is a form of malignancy that arises from the cells which line the chest wall or the abdominal cavity, or cover the lung and cover the bowel in the abdominal cavity.

Asbestos was used extensively in structures such as buildings, processing plants, ships, trains and motor vehicles in the 1950s, 1960s and early 1970s. The known adverse health consequences of asbestos exposure dictate that some control is required.

Polychlorinated Biphenyl (PCBs)

Polychlorinated biphenyls (PCBs) are covered by the Stockholm Convention on Persistent Organic Pollutants. The convention provides measures to eliminate or reduce the presence of these materials in the environment.

The Convention identified the main PCB uses in industry being within heat exchange fluids; electric transformers and capacitors; and as additives in paint, carbonless copy paper, sealants and plastics.

A broad range of health problems is associated with exposure to PCBs. These health effects increase with the amount of PCBs and the length of exposure. PCBs accumulate in the body with repeated exposure and are stored in fat tissue and body organs including the liver, kidneys, lungs and brain. PCB exposure can cause:

- Chloracne (a severe, persistent acne-like rash) is the most commonly observed symptom in people exposed to high levels;
- Liver damage;

IEQ-11 Hazardous MaterialsPOINTS
AVAILABLE**1**

- Respiratory disorders;
- Thyroid gland disorders;
- Muscle and joint pain, headaches, loss of appetite, nausea, vomiting and abdominal pain;
- Cancer - PCBs are classed as Carcinogen Class 2 (probable human carcinogen); and
- Reproductive problems in animals. These include increased spontaneous abortion rates, still births, underweight births and decreased post-natal survival.

When PCBs are exposed to extreme heat they may form dioxins, which are highly toxic.

Lead (Pb)

Large amounts of lead in the body can cause pain in joints and muscles. Other symptoms of lead exposure include anaemia, nausea headaches, high blood pressure and gastric, sleep and concentration problems. In children, the symptoms of lead exposure can be poor development of motor abilities and memory, reduced attention span, and colic and gastric problems.

Lead is absorbed if dust or fumes that contain lead are swallowed or breathed in. Although small amounts of lead do not cause any specific symptoms, as much as 10% of the lead that enters an adult's body stays there, and so even small amounts can gradually build up in the body.

Any amount of lead can be a health risk for pregnant woman because the unborn baby is exposed to lead in the mother's blood. A large amount of lead in the mother's body can cause premature birth, low birth weight, or even miscarriage or stillbirth.

Lead was used for centuries in water pipes, water jugs, and bullets because it is easy to mould into different shapes. However, its use is restricted to products that are not used for food or drink.

Lead was also used in paint products. Paints containing as much as 50% lead were used on the inside and outside of houses built before 1950. Until the late 1960s, paint with more than 1% lead was still being used. By 1970, the lead content of paint was limited to 1%.

These facts about Lead are taken from the Australian Federal Government Department of Environment and Heritage's Fact Sheet on Lead.

REFERENCES & FURTHER INFORMATION

Stockholm Intervention on Persistent Pollutants

<http://www.pops.int>

South African National *Occupational Health and Safety Act*, 1993: various chapters.

<http://www.acts.co.za/ohs/index.htm>

Regulations for the prohibition of the use, manufacturing, import and export of asbestos and asbestos containing materials

<http://www.environment.gov.za/HotIssues/2007/asbestos/asbestos.html>

Sustainable Home Design, Chemical products

<http://www.sustainablehomedesign.co.za/>

Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Department of Water Affairs and Forestry, Republic of South Africa, 1998

http://www.dwaf.gov.za/Dir_WQM/docs/Pol_Hazardous.pdf

ANZECC Guidelines Polychlorinated Biphenyls Management Plan

<http://www.environment.gov.au/settlements/publications/chemicals/scheduled-waste/pubs/biphenyls.pdf>

IEQ-11 Hazardous MaterialsPOINTS
AVAILABLE**1****TECHNICAL CLARIFICATIONS AND ERRATUM**

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Documentation amendment

Technical Clarification Number: IEQ11-T-OB1-0257

Guidance: 2012-01-10

For new developments where no existing building(s) or structure(s) were present on the project site at the time of purchase, the credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality category score. To reduce documentation requirements for projects where the above is applicable, only the following documentation is required to be submitted:

- Short report prepared by a relevant project team member confirming that the development is a new development and that at the time of site purchase, no existing building(s) or structure(s) existed on the project site.

For all other scenarios, projects must adhere to the Documentation requirements as per the applicable Green Star SA Technical Manual.

Technical ClarificationL Demolition applicability
(REVISED from TC issued 2010-10-13)

Technical Clarification Number: IEQ11-T-OB1-0107

Guidance: 2010-10-13

In addition to redevelopments (where existing buildings and/or structures are to be retained within the new development), the IEQ-11 Hazardous Materials credit and compliance criteria is applicable where existing buildings and/or structures located on the project site are to be demolished within the scope of either the main contract, or as a separate demolition contract, for the project. In such cases, the comprehensive hazardous materials survey must be carried out on the project site prior to any demolition works commencing, and where hazardous materials are identified in buildings or structures proposed for demolition, the materials must be removed in accordance with the applicable standards. Projects registered prior to the date of this TC and projects where demolition commenced prior to the date of this TC may elect to include or exclude the aforementioned requirements. Projects registered after the date of this TC must comply with the aforementioned requirements unless demolition commenced prior to the date of this TC.

IEQ-11 Hazardous Materials

POINTS
AVAILABLE

1

IEQ-12 Internal Noise Levels

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level.

CREDIT CRITERIA

Up to two points are awarded where 95% of the project's UA does not exceed the maximum internal noise levels recommended in SANS 10103: 2004, as follows:

Building Services Design

- One point is awarded where, within the entire base building general office space, noise from the building services does not exceed:
 - 40dB(A)eq. For general office space
 - 45dB(A)eq. For open plan office space (>50m²)

Overall Building

- One point is awarded where, within the base building office space, the ambient sound level does not exceed:
 - 40dB(A)eq. For general office space
 - 45dB(A)eq. For open plan office space (>50m²)

DOCUMENT REQUIREMENTS

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Naturally ventilated spaces

In naturally ventilated buildings it is assumed that mechanical ventilation will not be an issue - therefore, in this instance the Building Services Design point refers to hydraulic services only.

All calculations must be carried out with ventilation openings open and any extract fans running as required for normal operation of the building.

IEQ-12 Internal Noise LevelsPOINTS
AVAILABLE**2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender drawings If Overall Building point is claimed: • Survey of external noise levels	• Short report • Survey of internal noise levels

Short report prepared by a qualified acoustics consultant that describes how Credit Criteria have been met by describing:

- All relevant internal and external noise sources; and
- Describe 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'

Tender drawings:

- Plan drawings of all typical floor plates showing any noise control features included within the design;
- Section drawings of the building showing any noise control features included within the design; and
- Detail drawings demonstrating noise control design features included within the design.

Survey of external noise levels

- This is required to confirm external noise levels. This should be carried out during normal work hours during a normal working day, and should highlight any particular local noise sources such as railways etc.

Survey of internal noise levels

- This is required to confirm average internal noise levels. Measurements should be taken for each 50m² area of UA. Refer Additional Guidance for more information.

ADDITIONAL GUIDANCE**Building services noise**

For noise from mechanical systems with excessive low frequency energy due to turbulence (rumble), significant annoyance can arise even when the A-weighted sound pressure level is below the recommended value. The acoustic consultant is to provide comment on this if applicable to the building. A weighted noise level of 40dB(A)eq. corresponds to a value of around NR34 on a Noise Rating curve.

IEQ-12 Internal Noise Levels

POINTS
AVAILABLE**2**

Overall building noise

This represents the predicted noise level inside the building due to external noise ingress as well as noise generated by building services and any other internal sources (e.g. lifts). To calculate this at design stage, survey data is required of existing external noise levels at the site, together with calculations of attenuation due to the building envelope.

Internal partitions

Internal partitions need only be considered if they are a base building provision, and if they are structural walls of internal offices; most projects can assume open-plan layout. Tenant installed partitions are not to be included.

Occupants and equipment

Noise from occupants and equipment (e.g. computers) should not be included in the analysis or measurements.

Internal noise level measurements

Measurements should be carried out to British Standard BS EN ISO 140-4:1998 by a suitably qualified acoustician. Each measurement must be taken over a period of not less than 5 minutes. Measurements should be taken in a minimum of 3 locations in rooms at a height of 1.2 m above the floor level and at least 1m away from any surface. Measurements should be taken when the office is unoccupied, but with all fans and other base building services running, and with windows open as necessary for normal operation of the building.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

Internal 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.

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 is 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.

Noise level usually lies in the range between 30dB(A) and around 100dB(A) with levels above 85dB(A) capable of causing some permanent loss of hearing. Noise levels fluctuate and a number of scales are used to represent this. These scales are referred to as dB L scales.

IEQ-12 Internal Noise Levels

POINTS
AVAILABLE

2

LAeq – This scale measures the average energy of the noise level. It is the equivalent steady state level of a fluctuating noise level. When considered over a period of time T, this is represented by the scale dB LAeqT.

LA90 – This scale measure the level that is exceeded for 90% of the time.

LA10 – This scale measures the level that is exceeded for 10% of the time i.e. the louder end of the noise range only.

REFERENCES & FURTHER INFORMATION

ASHRAE HVAC Applications Volume (2003) – Chapter 47: *Sound and Vibration Control*

CIBSE Guide (2002) – B5 *Noise and Vibration Control for HVAC*

Jones, R (1984) – *Noise & Vibration Control in Buildings*, McGraw-Hill

Lord, P and Templeton, D (1986) – *Detailing for Acoustics*, 2nd Ed., Applied Science Publishers

British Standard BS8233: 1999 *Sound insulation and noise reduction for buildings - code of practice*

British Standard BS EN ISO 140-4:1998 *Acoustics – Measurement of sound insulation in buildings and of building elements – Part 4: Field measurements of airborne sound insulation between rooms*

British Standard BS EN ISO 717-1: 1997 *Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation*

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Intermittent / Emergency generator noise (This TC replaces IEQ12-T-OB1-0218)

Technical Clarification Number: IEQ12-T-OB1-547

Guidance: 2012-07-20

After significant review, the GBCSA have concluded that emergency generators (<100hr annual operation) will not currently form part of the scope of the IEQ-12 credit for Green Star SA – Office v1 certification. As such, project teams may exclude emergency generator equipment from compliance within the IEQ-12 credit.

IEQ-12 Internal Noise LevelsPOINTS
AVAILABLE**2**

Please note the following summary of findings:

- From the review conducted, it is clear that emergency generators can in fact affect occupant IEQ significantly, and for this reason it is best practice internationally to address noise from emergency generators in this regard.
- However, it has been found that in order to address the noise generated from emergency generators in terms of the IEQ-12 credit in the Green Star SA – Office v1 tool, significant differences in how noise levels are measured in the credit as well as varying benchmarks for acceptable noise levels may need to be introduced, which is seen as a change to the current scope of the IEQ-12 credit. The GBCSA believe that this level of change in the credit is not appropriate within a single version of the tool, and as such, should take place in future revisions of the Green Star SA – Office tool or within the development of new rating tools.
- Thus in summary, the GBCSA believe noise emissions from emergency generators to be a significant IEQ as well as noise pollution concern and would encourage project teams to take this into account within their design. There are however technical aspects to addressing this issue which the current structure of the IEQ-12 credit in the Green Star SA – Office v1 tool is not able to accommodate, and as such for Green Star SA certification under the Office v1 rating tool, noise from emergency generators need not be included in the scope of the IEQ-12 credit and projects will not be assessed on this issue. Noise from emergency generators will be included for implementation review in future versions of the Green Star SA – Office rating tool as well as development of future Green Star SA rating tools.

Credit Interpretation Request: External noise level survey

Credit Interpretation Request Number: IEQ12-C-OB1-0319

Ruling: 2012-01-10

The CIR Review Panel notes that due to circumstances pertaining to site activities or neighbouring site activities, it may not be possible to conduct a survey of external noise levels throughout “normal working hours, during a normal working day” without interference of intermittent noise sources which are not an on-going characteristic of the site (e.g. construction noise emanating from the site or neighbouring sites). Where motivated and justified by the qualified Acoustic Consultant, conducting an external noise level survey on the site at a time outside of “normal working hours, during a normal working day” and applying noise level correction(s) to account for noise sources likely, but not present at the time of survey, is an acceptable methodology to satisfy the survey of external noise levels requirement. The intent of the survey of external noise levels is to appropriately inform the acoustic design response and recommendations of the qualified Acoustic Consultant. As such, it is the responsibility of the qualified Acoustic Consultant to accurately account for any noise level corrections applied in this scenario

Technical Clarification: Internal noise levels and 'Shell & Core' spaces

Technical Clarification Number: IEQ12-T-OB1-0364

Guidance: 2012-01-06

IEQ-12 Internal Noise Levels

POINTS
AVAILABLE**2**

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

The internal noise level within a mechanically ventilated space is highly influenced by the design of the HVAC system within the space. Where a mechanically ventilated space is not provided with a complete HVAC system, as evidenced through the provision of a fully documented design within the tender documentation (Design rating) or as installed As Built documentation and commissioning reports (As Built rating), compliance with the Credit Criteria cannot be demonstrated.

Technical Clarification: Representative floors

Technical Clarification Number: IEQ12-T-OB1-0070

Guidance: 2010-05-17

For the internal noise level measurements for an As Built submission, it is permissible to test a representative floor of a multi-story building with repetitive, identical floor plates, as long as the worst case of the repetitive floors is tested and the project submission clearly demonstrates and justifies that the floor tested is worst case. Any floor with a different floor plan must be tested separately.

Credit Interpretation Request: False ceilings

Credit Interpretation Request Number: IEQ12-C-OB1-0064

Ruling: 2010-05-13

The CIR requesting to subtract 3dB from the measured noise values in cases where there is an intention for tenants to install a false ceiling that is not currently in place is denied. Green Star SA – Office v1 certifies the base building that the developer has control over, and it can not be assumed that a tenant will install an additional ceiling.

Credit Interpretation Request: Measurement methodology

Credit Interpretation Request Number: IEQ12-C-OB1-0063

Ruling: 2010-05-12

The CIR requesting to replace the sampling frequency for internal noise levels with an alternative methodology is granted. The approved methodology is as follows. All area values are Usable Area.

- A minimum of one measurement is required in every enclosed room.
- For rooms up to 300m² in size, one measurement is required for every 100m².
- For rooms larger than 300m², at least 3 measurements must be taken in each zone. Zones must be laid out by the acoustician and meet the following criteria. Maximum size of a zone is 600m², and a zone is a continuous volume that is not broken up by ceiling height partitions or change of

IEQ-12 Internal Noise LevelsPOINTS
AVAILABLE **2**

floor plate direction of more than 45 degrees. Areas on either side of a 90 degree bend would have to be separate zones.

The acoustician must determine the measurement points to be representative of the noise climate in the particular area.

Credit Interpretation Request: Internal noise level measurement reference standard

Credit Interpretation Request Number: IEQ12-C-OB1-0066

Ruling: 2010-05-11

The CIR requesting to use SANS 10103:2004 as the internal noise level measurement standard in lieu of British Standard BS EN ISO 140-4:1998 is granted.

Credit Interpretation Request: External noise measurements

Credit Interpretation Request Number: IEQ12-C-OB1-0035

Ruling: 2009-05-21

The Credit Interpretation Request (CIR) seeking approval for measuring external noise on a neighbouring site, rather than the actual project site, is denied. There is no assurance that noise levels on a neighbouring site accurately reflect those on the actual project site.

The following errata have been incorporated:

IEQ12-E-OB1-0559 Green Star SA – Office v1 Technical Manual: Page 104 (2012-08-17)

IEQ12-E-OB1-0130 Green Star SA - Office v1 Technical Manual: Page 104 (2011-01-06)

IEQ12-E-OB1-0136 Green Star SA - Office v1 Technical Manual: Page 104 (2011-01-06)

IEQ-13 Volatile Organic Compounds

POINTS
AVAILABLE

3

AIM OF CREDIT

To encourage and recognise specification of interior finishes that minimise the contribution and levels of Volatile Organic Compounds in buildings.

CREDIT CRITERIA

Up to three points are awarded where the various finishes used in the project meet the benchmarks as follows:

Paints

- One point where at least 95% of all painted surfaces meet the TVOC Content Limits outlined in Table IEQ-13.1 or where no paint is used in the project.

Adhesives and sealants

- One point where 95% of all adhesives and sealants meet the TVOC Content Limits outlined in Table IEQ-13.2 or where no adhesives or sealants are used.

Carpets and Flooring

- One point where all carpets meet the TVOC emissions limits outlined in Table IEQ-13.3 OR
- Where no carpet has been installed in the project and projects wish to use low-VOC flooring, one point is awarded where all the flooring installed in the project meet the emissions limits outlined in Table IEQ-13.3.

Where no carpet has been installed in the project, the carpet point is 'Not Applicable' and is excluded from the Points Available, used to calculate the IEQ Category Score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
- Short report - Extract(s) from specification(s)	Where the point(s) are claimed for using low VOC materials: - Short report - Confirmation from contractor - VOC datasheet(s) Where the point for carpet is claimed as non-applicable: - Extract(s) from specification(s) or confirmation from contractor

IEQ-13 Volatile Organic Compounds

POINTS
AVAILABLE

3

Summary sheet prepared by a suitable professional that describes how Credit Criteria have been met by:

- Summarising how the products used meet the Credit Criteria;
- Listing and referencing all the products within the relevant category used in the project;
- Nominating the ones that meet the Credit Criteria; and
- As built compliance: Referencing the appropriate VOC datasheet.

Extract(s) from the specification(s):

- Nominating the VOC limits for each product within the relevant category type;
- Stating that the contractor is required to obtain approval of the design team or client before substituting the finishes listed in the schedule;
- Requiring that at the end of construction works, the contractor undertakes a final audit to ensure that the correct products have been used; and
- Where the project has no products from a particular category, showing where it is stipulated that no carpet; paint; adhesive/sealant is to be used in the project.

Confirmation from the contractor:

- That compliant low-VOC products were used by all subcontractors and relevant trades wherever specified, to meet the Credit Criteria by describing the application, amount, type and supplier of carpet, paint and sealants and adhesives (whichever relevant) used throughout the project; and
- Where the point for carpet is claimed as 'Not Applicable', stating that no carpet was used in the project.

VOC datasheet(s) provided by manufacturer/supplier:

- For every compliant product nominated;
- For every datasheet provided, the compliant VOC levels must be highlighted and referenced in the short report; and
- Stating the calculation method followed to determine TVOC levels of each specified product.
- The datasheets must come from:
 - An ISO/IEC 17025 registered laboratory quoting the TVOC level of each specified product;
 - OR
 - The manufacturer documenting the calculation method followed to determine TVOC levels of each specified product.

ADDITIONAL GUIDANCE

It must be clear that all finishes of a product category have been addressed by the documentation; if points are claimed for not using a product type, it must be clearly stated.

The specifications given to contractors must list all the appropriate low-VOC content or emissions (depending on the product category) next to each product used. A general clause that stipulates that Compliance is required with Green Star SA – Office Credit Criteria, even if the Compliance Requirements are included as an Appendix to the specification, will not be acceptable for demonstrating compliance.

The contractor is required to obtain approval of the design team or client before substituting the finishes listed in the specifications.

IEQ-13 Volatile Organic Compounds

POINTS
AVAILABLE

3

A final audit must be carried out by the contractor ensuring that the correct products have been used once the project has been completed.

Paints

Paints are defined as any liquid applied finishes. Any paint used in an internal application, and applied on site, must meet the TVOC Content Limits outlined in Table IEQ-13.1. This includes exterior-grade and solvent-based paints should they happen to be used in an interior application. Values should reflect the final product as mixed and ready to use, inclusive of tints.

Internal car parks are excluded from this credit. Paints used in exterior applications do not require documentation.

Adhesives and Sealants

Any adhesive and sealant product(s) used in an internal application, and applied on site, must meet the TVOC Content Limits outlined in Table IEQ-13.2. This includes both exposed and concealed applications. Internal applications are defined as any within the external vapour barrier.

Internal car parks are excluded from this credit. Sealants and adhesives used in exterior applications do not require documentation.

Carpets

All carpet product(s) must meet the TVOC emissions limits outlined in Table IEQ-13.3.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

TVOC Compliance

Compliance with Total Volatile Organic Compound (TVOC) levels listed in the sections below for Paints, Adhesives and Sealants shall be demonstrated by either:

- Providing a manufacturer-supplied VOC datasheet that documents the theoretical calculation method followed to determine TVOC levels of each specified product. Exempt compounds must not be subtracted in the calculation of VOC content.

OR

- Providing a VOC report based on experimental tests from an ISO/IEC 17025 registered laboratory quoting the TVOC level of each specified product.

'VOC' is the term used to describe the several hundred organic chemicals which have a boiling point range falling below 250 °C. These consist primarily of petrochemical solvent-type compounds e.g. aliphatic and aromatic hydrocarbons, alkenes, halogenated hydrocarbons, ketones, aldehydes and esters.

The South African usage of the concept of VOC follows a European definition in that VOCs are defined as organic solvents with a boiling point less than 250°C at 101.3kPa or a vapour pressure of 0.01mm of Hg at 21°C. The GBCSA deems this definition applicable to paints, carpets, adhesives and sealants.

Paints

Calculations must be made based on whole paint (water and tints included) by grams of VOC per litre used (VOCs by content). This method is an internationally accepted proxy to measure the total impact on indoor environmental air quality from use of a product containing VOCs. From an industry-practice approach it has been identified as the most intuitive method because architectural coatings are used on a square metre per litre (of whole paint) basis.

Values should reflect the final product as mixed and ready to use, inclusive of tints and irrespective of the number of coatings.

VOCs are to be in conformance with the grams per litre (g/l) content limits set out in the table below which have been adopted using a combination of the Good Environmental Choice Australia (GECA) standard number GECA-23-2005 version 1.0 Australian Voluntary Environmental Labelling Standard

IEQ-13 Volatile Organic Compounds

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Architectural and Protective Coatings and The Maximum TVOC Content Limits Values for Paints and Varnishes as stated in Annex II, Table A of Directive 2004/42/CE of the European Parliament and of The Council of 21 April 2004 (referred to as the EU Directive and marked by a ' * ' in the table below).

The TVOC content of the 'ready-to-use' paint shall be theoretically calculated as the sum total of the VOCs of each of the raw material components comprising the paint.

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Where the TVOC content of individual components is not known, it must be determined experimentally by one of the following testing methods as appropriate:

- ISO Method 17895 (2005), for a material with a presumed VOC content < 1%;
- ISO Method 11890-2 (2006), for a material with a presumed VOC < 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 Type/Sub Category	Max TVOC content (g/l of ready-to-use product)
Walls and ceilings - interior semi gloss	16
Walls and ceilings - interior low sheen	16
Walls and ceilings - interior flat washable	16
Ceilings - interior flat	14
Trim - gloss, semi gloss, satin, varnishes and woodstains	75
Timber and binding primers *	30
Latex primer for galvanized iron and zincalume	60
Interior latex undercoat	65
Interior sealer	65
One and two pack performance coatings for floors *	140
Any solvent-based coatings whose purpose is not covered in table	200

* EU Directive

Table IEQ-13.1: Maximum TVOC Content Limits for Paints, Varnishes and Protective Coatings

Adhesives & Sealants

This credit addresses internal applications for sealants/adhesives applied on site only, including both exposed and concealed applications (internal car parks are excluded from this credit).

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Sealants and adhesives used in exterior applications do not require documentation.

Any sealants/adhesives used in an internal application (non-occupied areas included) must meet the VOC limit criteria outlined below; this includes exterior-grade and solvent-based sealants/adhesives, should they be employed in internal applications.

VOCs are to be in conformance with the grams per litre (g/l) content limits set out in the table below which have been adopted from South Coast Air Quality Management District (California, U.S.) – Rule 1168.

Compliance Testing: Refer to South Coast Air Quality Management District Rule 1168 for testing methods. Exempt compounds must not be subtracted in the calculation of VOC content. Values should reflect the final product as mixed.

The TVOC content of the 'ready-to-use' product may also be calculated theoretically as the sum total of the VOCs of each of the raw material components comprising the product.

Where the TVOC content of individual components is not known, it must be determined experimentally 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 Type	Max TVOC content* (g/litre of product)
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry Wall & Panel adhesive	50
Multipurpose construction adhesive*	70
Structural glazing adhesive	100
Architectural sealants*	250

* Sealants used to enhance the fire and water-proofing properties are included.

Table IEQ-13.2: maximum TVOC limits for Adhesives & Sealants

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Carpets

The TVOC levels of 100% of carpets used must be in conformance with the TVOC emissions limits set out in the table below which have been adopted from the Carpet and Rug Institute Green Label (U.S.) and endorsed by the Australian Carpet Classification Scheme (ACCS) - Environmental Classification Scheme (ECS).

Compliance Testing: Refer to Carpet and Rug Institute Green Label (U.S.) OR American Society for Testing and Materials (ASTM) D 5116 Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.

For projects that do not use any carpet, the carpet point is 'Not Applicable', unless those projects wish to demonstrate compliance that all flooring used is low-VOC in accordance with the criteria established for carpets:

All carpet product(s) must comply with TVOC emissions limits as follows:

Total VOC limit	0.5 mg/m ² per hour
4-PC (4-Phenylcyclohexene)	0.05mg/m ² per hour

Table IEQ-13.3: Carpet TVOC emission limits

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

We spend over 90% of our lives indoors and our exposure to air pollutants can be far greater through breathing indoor air than outdoor air. It is commonly found for most air pollutants that indoor air concentrations are far in excess of those outdoors. Consequently there is considerable research underway concerning:

- The elimination or control of sources of indoor pollutants; and
- Ensuring that building ventilation rates are sufficient to remove pollutants for which source control is limited (refer IEQ-1 'Ventilation Rates').

In both new and existing buildings it is common to find 50 or more of these compounds at average concentrations of 200 parts per billion (ppb) in existing buildings and 1,000 ppb in new buildings. In new buildings concentration levels of 5,000 ppb have been measured. Outdoor levels are typically 10 to 20 ppb. Sources of VOCs in buildings include:

- New buildings – paints, adhesives, carpets, sealants, reconstituted wood products, new furniture, etc; and
- Established buildings – cleaning products, printed materials, office equipment, consumer

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products, dry-cleaned clothing, car exhaust, etc.

Due to the large number of compounds, indoor air concentrations are typically based on total VOC (TVOC) concentrations, and are essentially the sum of the individual concentrations.

The health implications of exposure to VOCs are consistent with 'sick building syndrome' effects including eye, nose and skin irritation, headache and lethargy. The indoor air quality goals have been set to limit exposures to much lower levels (in Australia, the past NHMRC level of concern was 500 µg/m³).

Measurement standards

For Green Star SA purposes, the two primary and internationally-accepted ways to measure the impacts of TVOCs on indoor environment quality (IEQ) include:

- Measurement by 'rate' of emission – typically reported in g or mg/m²/hr; and
- Measurement by content – reported by 'concentration' in grams of VOC per litre of product.

REFERENCES & FURTHER INFORMATION

Australian Safety and Compensation Council (1994), *Guidance Note for the Assessment of Health Risks Arising from Hazardous Substances in the Workplace* [NOHSC:3017(1994). Commonwealth of Australia, Canberra.

Australian Safety and Compensation (1995), *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:3008(1995)] 3rd Edition. Commonwealth of Australia, Canberra

South African National Occupational Health and Safety Act, 1993: various chapters.
<http://www.acts.co.za/ohs/index.htm>

Australia Green Procurement database (search for low-VOC paints, carpets and adhesives).
<http://www.greenprocurement.org/database/main.jsf>

Carpet and Rug Institute, Green Label Testing Program.
<http://carpet-rug.com>

Ecospecifier, Products and Materials database search for low-VOC paints, carpets and adhesives.
<http://www.ecospecifier.org>

Nordic Swan Ecolabelling, Ecolabelling of Panels for the Building, Decorating and Furniture Industry.
<http://www.svanen.nu/Eng/>

South Coast Air Quality Management District (U.S.), Rules and regulations.
<http://www.aqmd.gov/rules/rulesreg.html>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project

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can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: VOC data sheets (SUPERCEDED by IEQ13-T-OB1-0494 issued on 2012-06-12)

Technical Clarification Number: IEQ13-T-OB1-0043

Guidance: 2012-06-12

Technical Clarification: Revised definition of of VOC datasheets (Replaces IEQ13-T-OB1-0043 issued on 2009-08-23)

Technical Clarification Number: IEQ13-T-OB1-0494

Guidance: 2012-06-12

Please note the revised definition of VOC datasheets for the purposes of Green Star SA certification, with reference to paints, adhesives/sealants and carpets in the IEQ-13 credit, a VOC data sheet is defined as follows:

- 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-13 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 IEQ-13 credit in the Green Star SA Office v1 Technical Manual. For carpets, as the testing method and TVOC limits referenced in the IEQ-13 credit have been based on the Carpet and Rug Institute Green Label (U.S.), 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 line with the requirements of the Green Star SA – Office v1 Technical Manual.

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. Refer to the Additional Guidance section of the Green Star SA VOC credit for lists of compliant test methods.

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. Refer to the Additional Guidance section of the Green Star SA VOC credit for lists of compliant test methods

OR

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- 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 in the Additional Guidance section of the Green Star SA VOC credit. 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.
 - 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 documentation to demonstrate a product's compliance with the Credit Criteria.

Technical Clarification: Paints – additional guidance for defining and documenting paint product types and associated TVOC. (Replaces IEQ13-T-OB1-0291 issued 2012-01-11; IEQ13-T-OB1-0016 issued 2009-02-06; and IEQ13-T-OB1-0059 issued 2010-02-12)

Technical Clarification Number: IEQ13-T-OB1-0423

Guidance: 2012-02-15

In addition to the definition of paint provided in the Technical Manual paint is defined as a liquid solution of pigment in a suitable vehicle of oil, organic solvent, or water; liquid when applied but dries to form an adherent, protective, and decorative coating.

Measurement metric for paints: For demonstrating compliance with the credit criteria, the metric to be used is net surface area painted, regardless of the number of coats applied to a particular surface. Green Star SA always tries to use metrics and methodologies in use by building practitioners. The metric used by quantity surveyors for paint is painted surface area and as such this is the metric used.

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 of Table IEQ-13.1. Binding primers are included in the 'Timber and binding primers' category.

The maximum TVOC content of ready-to-use paint for walls and ceilings, interior gloss is 75 g/l.

Technical Clarification: Adhesives & Sealants - Scope of Products and additional guidance for defining and documenting product types and associated TVOC.

(Replaces IEQ13-T-OB1-0055 issued 2010-02-12, IEQ13-T-OB1-0057 issued 2010-02-12, and IEQ13-T-OB1-0338 issued 2011-11-10)

Technical Clarification Number: IEQ13-T-OB1-0424

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Guidance: 2012-02-15

The following uses for sealants and adhesives are considered to represent the most significant portion of these products within buildings and are included within the scope of the IEQ-13 Volatile Organic Compound credit:

- Floor coverings – including carpet and tile adhesives
- Wall coverings – including wallpaper and tile adhesives
- Ceiling and soffit coverings – including adhesives for laminated ceiling tiles or bonded insulation and;
- Skirting board applications.

Adhesive and sealant applications specified for use in/on miscellaneous applications OTHER than those listed above are EXCLUDED from the IEQ-13 Volatile Organic Compound credit scope and are not required to comply with the credit criteria. These include, but are not limited to, piping glues/sealants, window and/or expansion joint sealant.

For compliance with the credit criteria, project teams must demonstrate that 95% of adhesive and sealant products used to fix floor, wall, ceiling and soffit coverings and skirting boards (measured in surface area of use), meet the VOC levels in Table IEQ-13.2: Maximum TVOC Content Limits for Adhesives & Sealants.

“Adhesives”, “sealants” and “paints” for the purposes of Green Star SA, are defined as follows:

Adhesive: A substance capable of holding materials together by bonding the surfaces that are in contact.

Sealant: A material or device used to prevent the passage of liquid or gas across a joint or opening; a sealer.

Paint: A liquid solution of pigment in a suitable vehicle of oil, organic solvent, or water; liquid when applied but dries to form an adherent, protective, and decorative coating.

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’.

Acoustic Sealants and Waterproofing membranes are categorised under the Product Type ‘Architectural Sealants’ in table IEQ-13.2 and must not exceed a Max TVOC content of 250 g/litre.

Technical Clarification: Excluded Products, Applications and Spaces

(Replaces IEQ13-T-OB1-0054 issued 2010-02-12, IEQ13-T-OB1-0056 issued 2010-02-12, and IEQ13-T-OB1-0336 issued 2011-10-18)

Technical Clarification Number: IEQ13-T-OB1-0425

Guidance: 2012-02-15

Reused items/products are not addressed by this credit and do not need to demonstrate compliance with the Credit Criteria.

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Temporary formwork - Adhesives and mastics that are used for temporary formwork are not required to comply with Green Star SA VOC credit criteria. Such materials are not commonly used within enclosed spaces, and as such, the impact on the indoor environment quality of the completed project is negligible.

Non-habitable rooms that open directly to outside or into internal car parking areas may be excluded from the IEQ-13 credit and thus are not required to comply with the credit criteria. Non-habitable rooms that open directly into internal spaces other than internal car parking areas must however be included in the scope of the credit. Examples of non-habitable rooms that may be excluded include store rooms and plant rooms opening directly to outside or into internal car parking areas. 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. See SANS 10400 definition for 'habitable room' for further guidance.

Technical Clarification: Are skimming products exempted from this credit IEQ-13

Technical Clarification Number: IEQ13-T-OB1-0825

Guidance: 2014-11-05

Project's request: the filler is specifically defined as cement-based and would qualify for below rational,

"This product is not defined as a paint as it is cement based and acts as a quick drying filler for construction surfaces to which the paint is then applied."

The quantity of skimming product typically would only be a fraction of the quantity of paint area. It would fall in the 80/20 rule. There will be some fillers that DO have VOCs, especially for wood/board, but the overall scale of magnitude is insignificant.

Project team would need to submit the datasheet reflecting Total Calculated VOC even if it is equal to 0.

Technical Clarification: Volatile Organic Compounds and 'Shell & Core' spaces

Technical Clarification Number: IEQ13-T-OB1-0365: **Guidance:** 2012-01-11

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

Paints

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to those paints applied base building, excluding paints used in internal car parks and for exterior applications.

Adhesives & Sealants

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Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to those adhesives and sealants applied to the base building, excluding adhesives and sealants used in internal car parks and for exterior applications.

Carpets & Floor Coverings

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to those carpets and flooring installed within the base building, excluding carpets and flooring used in internal car parks and for exterior applications.

Technical Clarification: Scope of delivery – ‘Conventional’, ‘Integrated’ and ‘Shell & Core’ (REPLACES IEQ13-T-OB1-0051 issued 20 Nov 2009)

Technical Clarification Number: IEQ13-T-OB1-0379

Guidance: 2012-01-11

The following provides guidance as to the scope of delivery for Conventional, Integrated and Shell & Core:

Conventional Delivery:

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with ceilings, finishes (e.g. floor coverings and paint), generic mechanical services (e.g. ducts from air supply and return risers, or other HVAC equipment, with generic control zone/diffuser/return layouts), generic electrical services (e.g. generic lighting layout) and complete wet services. The fitout to tenant areas is intended to be generic and non-tenant specific.

For the purposes of IEQ-13 and a conventional delivery in accordance with the above scope, all applicable paints, adhesives, sealants, carpets and flooring within common areas and tenant areas must comply.

Integrated Fitout:

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with ceilings, finishes (e.g. floor coverings and paint), specific mechanical services (e.g. ducts from air supply and return risers, or other HVAC equipment, with fitout specific control zone/diffuser/return layouts), specific electrical services (e.g. fitout specific lighting layout) and complete wet services. The fitout to tenant areas are tenant specific.

For the purposes of IEQ-13 and an integrated fitout in accordance with the above scope, all applicable paints, adhesives, sealants, carpets and flooring within common areas and tenant areas must comply. Loose furniture is not within the scope of IEQ-13.

Shell & Core:

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with no ceilings, floor coverings, lighting systems nor partition walls. Mechanical services are not installed within tenant areas, with ducts from air supply and return risers finishing within 1m of the face of the riser (for central air systems), or no other tenant-side systems installed (e.g. indoor units). A raised floor or underfloor air distribution (UFAD) system may

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be installed in a Shell & Core scenario provided floor coverings are not installed. No fitout is provided in a Shell & Core scenario.

For the purposes of IEQ-13 and a Shell & Core delivery in accordance with the above scope, only applicable paints, adhesives, sealants, carpets and flooring within common areas must comply.

Technical Clarification: Internal walls in office areas

Technical Clarification Number: IEQ13-T-OB1-0276

Guidance: 2011-06-01

Where internal walls within office areas are provided as part of the 'base building provision' (i.e. will not change based on tenant requirements), project teams may include these within the Green Star SA submission, but should ensure they are included consistently across the submission. (E.g. finishes to these walls may need to be included in the IEQ-13 credit.)

Technical Clarification: Carpet underlay

Technical Clarification Number: IEQ13-T-OB1-0053

Guidance: 2010-02-12

Underlay must be included in the carpet product VOC calculations for this credit. Carpet underlay products are to comply with the emission limits stated in 'Table IEQ-13.3; Carpet TVOC emissions limits' of the Green Star SA - Office v1 Technical Manual.

Technical Clarification: Exempt compounds

Technical Clarification Number: IEQ13-T-OB1-0058

Guidance: 2010-02-12

Exempt compounds (based on ASTM D3960 as well as SCAQMD Rule 1168) must be included in TVOC calculations. The exemption for those compounds in the Standards is based on the impact that they have on air pollution, not indoor environment quality (i.e. if the VOC compound did not participate in air pollution reactions, it was exempted from the VOC content). A practice in the industry exists to replace non-exempt compounds (e.g. methyl ethyl ketone) with "exempt compounds" (e.g. acetone) in formulations of paints, coatings and adhesives. While this lowers the TVOC content of the product, it will still have an indoor environment impact. For this reason exempt compounds must be included in TVOC calculations submitted.

The following errata have been incorporated:

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IEQ13-E-OB1-0132 Green Star SA - Office v1 Technical Manual: Page 108 (2011-01-06)

IEQ13-E-OB1-0133 Green Star SA - Office v1 Technical Manual: Page 113 (2011-01-06)

IEQ13-E-OB1-0134 Green Star SA - Office v1 Technical Manual: Page 110 (2011-01-06)

IEQ13-E-OB1-0135 Green Star SA - Office v1 Technical Manual: Page 110 (2011-01-06)

IEQ-14 Formaldehyde MinimisationPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise the specification of products with low formaldehyde emission levels.

CREDIT CRITERIA

One point is awarded where all composite wood products (including exposed and concealed applications) either:

- Have low formaldehyde emissions; OR
- Contain no formaldehyde.

If no composite wood products are used within the project, this credit is 'Not Applicable' and excluded from the total number of Points Available, used calculate the IEQ Category Score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance. • Short report • Extract(s) from specification(s) Where the credit is being claimed as 'Not Applicable': • Extract(s) from the specification(s)	Submit all the evidence and ensure it readily confirms compliance. • Short report • Confirmation from contractor For every product nominated, the following must be provided: • Product Datasheet(s) Where the credit is being claimed as 'Not Applicable': • Confirmation form contractor

Short report prepared by a suitable professional that describes how Credit Criteria have been met by:

- Summarising how the products used meet the Credit Criteria;
- Listing and referencing all the composite wood products used in the project; and
- Nominating the ones that meet the Credit Criteria; and
- For As built compliance: Referencing the appropriate manufacturers formaldehyde emissions report or datasheet with the compliant emissions values highlighted in the test report.

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Extract(s) from the specification(s) stipulating:

- The formaldehyde content or emissions standard for all composite wood products used in the project (excepting excluded applications);
- The contractor is required to obtain the approval of the design team or client before substituting the composite wood products listed in the schedule; and
- Where no composite wood products are being used, an extract from the specifications must be provided showing that no composite wood products (excepting excluded applications) are to be used in the project.

Confirmation from the contractor:

- Describing the application, amount, type and supplier of composite wood products used throughout the project;
- Demonstrating that compliant low-formaldehyde products were used wherever specified, to meet the Credit Criteria; and
- Where the point for formaldehyde minimisation is claimed as 'Not Applicable', stating that no composite wood products were used in the project (excepting excluded applications); and
- For As Built compliance: Confirmation from the contractor that the materials installed were as per the short report.

Product Datasheet(s) provided by manufacturer:

- Quoting the formaldehyde emission level of each composite wood product used in the project (excepting excluded applications); and
- Highlighting the compliant emission values in the test results for clarity of submission purposes.

ADDITIONAL GUIDANCE

Composite wood products include, but are not limited to, particleboard, plywood, veneer, MDF and decorative overlaid wood panels. It must be clearly demonstrated that all composite wood products (including both 'raw' unfinished & finished products) used in the project (except excluded applications) have low formaldehyde emissions.

The emission levels must be established by a NATA or ISO/IEC 17025 registered laboratory as per the testing methodologies provided in Table IEQ-14.1.

The following applications are excluded from this credit and do not require documentation:

- Any composite wood products used in exterior applications (e.g. decorative façade);
- Formwork;
- Internal car park applications;
- Reused composite wood products; and
- Raw timber.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria

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regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.

- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

Emission Requirements

Products made from wood and other natural products that contain formaldehyde-based additives, shall be subject to the following air emission limits for formaldehyde as measured using the Air Chamber, Desiccator or Perforator test methods.

Composite wood products, (e.g. particleboard, MDF, decorative overlaid wood panels) must conform to formaldehyde testing outlined in AS 4266.16 (2004) *Method 16: Formaldehyde emission-Desiccator method*. Composite wood products shall demonstrate a level equivalent to or below E1 limit values provided in Table IEQ-14.1.

Veneer and plywood must conform to formaldehyde testing outlined in Australian Standard – AS/NZS 2098.11 (2005) *Method 11: Methods of test for veneer and plywood – Determination of formaldehyde emissions for plywood*. These panels shall demonstrate a level equivalent to or below E1 limit values provided in Table IEQ-14.1.

Other internationally accepted test methods may be accepted as outlined in Table IEQ-14.1.

Test method	Limit Value ^{1,2,3}		
	E1	E0	Super E0
AS 4266.16 for particle board for MDF	< 1.0 mg/L <1.5 mg/L	< 0.5 mg/L	< 0.3 mg/L
JIS A1460 not applicable to plywood	< 1.0 mg/L	< 0.5 mg/L	< 0.3 mg/L
JAS 233 for plywood	< 1.0 mg/L	< 0.5 mg/L	< 1.0 mg/L
EN 120 for particle board and MDF	< 9 mg/(100g)	< 6 mg/(100g)	< 2.8 mg/(100g)
For plywood	< 6 mg/(100g)	< 9mg/L	< 2.4 mg/(100g)

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DIN EN 717-1	< 0.12 mg/m ³ h	< 0.08 mg/m ³ h	< 0.04 mg/m ³ h
DIN EN 717-2 not applicable to MDF	< 0.12 mg/m ³ h	< 0.08 mg/m ³ h	< 0.12 mg/m ³ h

Note 1: Values from Good Environmental Choice Australia Standard No: GECA 04-2007 Panel Boards section 3.2.1.5 Emissions Requirements

Note 2: Values from Good Environmental Choice Australia Standard No: GECA 41-2007 Toys and Childcare Products section 3.2.1.5 Formaldehyde Emissions

Note 3: Values from Good Environmental Choice Australia Guidance Note October 2007 – Formaldehyde Testing v0.1 Table 1

Table IEQ-14.1: Formaldehyde emission limit values for different testing methods

The comparability Table IEQ-14.1 should not be misunderstood to mean that 'E1 board according to EN 120' allows more formaldehyde than 'E1 board according to AS 4266.16'. This is not the case as the levels provided in the table are equivalent results for the same board tested with different procedures. Refer to 'Background' for more information on the comparisons and differences between testing methodologies.

BACKGROUND

Formaldehyde is a widely used industrial chemical (generally as a solution in water) and it is a gas at room temperature. Formaldehyde resins are used to bond the constituent parts together in some particleboards and all fibreboards, and have been reported to:

- Be an irritant at low levels to eyes, mucous membranes, nose and throat;
- Lead to sensitise skin (dermatitis) and respiratory system (asthma and rhinitis);
- Cause an increased risk of cancer;
- Lead to reproductive hazards with the ability to damage a foetus; and
- Emit vapour even after it has hardened, in the case of formaldehyde resin.

There is an ongoing debate within the industry regarding the approach of testing for formaldehyde emissions in products, with the principle approaches being industrial production testing and performance testing, outlined below. The distinction between these two opinions is based on how formaldehyde emissions are considered in green building situations and addresses two key issues; the indoor environmental quality (IEQ) and the toxicity of materials.

Industrial Production Testing reports on the content of formaldehyde as an ingredient in a product (a materials/toxicity issue). It is usually tested by 'concentration-based' methods and might be deemed to better reflect the proof of best-practice minimisation of formaldehyde in a product. The logic associated with support of this method overlaps on IEQ implications because, in theory, minimal inclusion of formaldehyde (stipulated at < 1 mg/L) will deliver a low rate of formaldehyde emission into the indoor environment.

Performance Testing uses 'rate-based' testing methods to report the 'rate' of formaldehyde emitted over the lifetime of a finished product which might be deemed to be a better reflection of realistic calculable net best air quality for human exposure (IEQ). It is typically reported by mg/m²/h.

The GBCSA recognises the merits of both the 'rate-based' and 'concentration-based' testing methodologies. There is sufficient consensus from a range of internationally-accepted standards,

IEQ-14 Formaldehyde Minimisation

POINTS
AVAILABLE

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which define both low formaldehyde 'rate' and 'concentration' emission limit values, to warrant recognition in Green Star SA rating tools of both methodologies. The emission limit values prescribed in the 'Additional Guidance' section is adopted from Good Environmental Choice Australia's (GECA) Guidance Note on Formaldehyde Testing v0.1. The acceptable emission levels quoted in this document are founded on independent comparability research of inter-laboratory formaldehyde emission testing undertaken by GECA. The limit values have also passed through an industry stakeholder engagement process, which is required by the GECA standards development protocol and are referenced in the Emissions Requirement sections of two GECA standards.

The GBCSA supports recognition of internationally accepted test methods as a means to remove technical barriers to trade, thereby ensuring that both imported and domestically produced products have equally accessible opportunities for recognition in Green Star SA rating tools, provided that the products can demonstrate compliance with emission levels as per one of the respective testing methods provided in table IEQ-14.1.

REFERENCES & FURTHER INFORMATION

Australian Safety and Compensation Council (1994), *Guidance Note for the Assessment of Health Risks Arising from Hazardous Substances in the Workplace* [NOHSC:3017(1994)]. Commonwealth of Australia, Canberra.

Australian Safety and Compensation (1995), *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:3008(1995)] 3rd Edition. Commonwealth of Australia, Canberra

European Standard (2001), EN 13986, 2001 *Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking*.

Good Environmental Choice Australia (2007), *Good Environmental Choice Australia Standard No: GECA 04-2007 Panel Boards section 3.2.1.5 Emissions Requirements*

South African National Occupational Health and Safety Act, 1993: various chapters.
<http://www.acts.co.za/ohs/index.htm>

Japanese Standard (2003), JIS A 5905:2003 : Fiberboards. The official translated version (into English) is available from Standards Australia

Australia Green Procurement database (search for low-VOC paints, carpets and adhesives),
<http://www.greenprocurement.org/database/main.jsf> (Accessed November 2007)

Ecospecifier, Materials database search for low formaldehyde engineered wood products.
<http://www.ecospecifier.org>

Nordic Swan Ecolabelling, *Ecolabelling of Panels for the Building, Decorating and Furniture Industry*.
<http://www.svanen.nu/en>

Alternative Resin Binders for Particleboard, MDF and Wheatboard, Global Health and Safety Initiative. <http://www.healthybuilding.net/healthcare/Alternative%20Resin%20Binders.pdf>

IEQ-14 Formaldehyde Minimisation

POINTS
AVAILABLE**1**

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Formaldehyde minimisation and 'Shell & Core' spaces

Technical Clarification Number: IEQ14-T-OB1-0366

Guidance: 2013-07-22

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office Design v1 Technical Manual.

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to those applications of composite wood products within the base building, except excluded applications as stated in the technical manual.

Technical Clarification: Formaldehyde Emission Testing Guidance Document Supplementary Documentation – Formaldehyde Emission Limit Values for Different Testing Methods (This TC replaces IEQ14-T-OB1-0422)

Technical Clarification Number: IEQ14-T-OB1-0534

Guidance: 2012-07-13

The Formaldehyde Emission Testing Guidance Document on Formaldehyde Emission Limit Values for Different Testing Methods provides detailed guidance on acceptable formaldehyde emission limits as well as broader recognition of international testing methods than the guidance in Table IEQ-14.1 found in the Green Star - Office v1 Technical Manual.

Supplementary Information

[Formaldehyde Emission Testing Guidance Document version 1.1.pdf](#)

Technical Clarification: Formaldehyde Minimisation Guidance Document Supplementary Documentation – Formaldehyde Emission Limit Values for Different Testing Methods (SUPERCEDED by IEQ14-T-OB1-534 issued on 2012-07-13)

Technical Clarification Number: IEQ14-T-OB1-0422

IEQ-14 Formaldehyde Minimisation

POINTS
AVAILABLE**1**

Guidance: 2012-06-12

Technical Clarification: Formaldehyde minimisation and 'Shell & Core' spaces

Technical Clarification Number: IEQ14-T-OB1-0366

Guidance: 2012-01-11

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to those applications of composite wood products within common areas (e.g. lobbies, foyers etc.) and within the usable area (UA).

Technical Clarification: Documentation - test methods

Technical Clarification Number: IEQ14-T-OB1-0260

Guidance: 2011-03-10

In addition to the 'Documentation Requirements' stipulated in the Green Star SA Office (Version 1) Technical Manual, product datasheet(s) for composite wood product(s) must clearly nominate the test method to which the stated emission limit(s) and/or emission rate(s) have been determined.

Technical Clarification: Documentation - Test reports/emissions values

Technical Clarification Number: IEQ14-T-OB1-0040

Guidance: 2009-06-29

Actual test reports and emissions values are required in the documentation for this credit. A simple statement of 'E1 compliance' is not acceptable.

The following errata have been included: Erratum

IEQ14-E-OB1-0254 Green Star SA - Office v1 Technical Manual: Page 115 (2011-08-08)

IEQ14-E-OB1-0255 Green Star SA - Office v1 Technical Manual: Page 116 (2011-08-08)

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IEQ14-E-OB1-0137 Green Star SA - Office v1 Technical Manual: Page 118 (2011-01-06)

IEQ14-E-OB1-0131 Green Star SA - Office v1 Technical Manual: Page 115 -116 (2011-01-06)

IEQ-15 Mould Prevention

POINTS
AVAILABLE**1**

AIM OF CREDIT

To encourage and recognise the design of services that eliminate the risk of mould growth and its associated detrimental impact on occupant health.

CREDIT CRITERIA

One point is awarded where it is demonstrated that:

- 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;

OR

- The building is fully naturally ventilated.

DOCUMENT REQUIREMENTS

Systems that rely on humidity monitoring only or humidity control by virtue of coil selection only do not satisfy the Credit Criteria.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Naturally ventilated spaces

The areas nominated as naturally ventilated must be designed to meet the requirements of SANS10400-O.

Mechanically air conditioned spaces

Humidity sensors must be provided in the ductwork and linked to the BMS 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 duct work and in the office space for all modes of operation.

Mixed-mode ventilated space

Mixed-mode ventilated spaces must comply with the criteria for mechanically air conditioned spaces.

IEQ-15 Mould PreventionPOINTS
AVAILABLE**1**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated spaces: • Short report • Opening Area Schedule • Tender drawings For mechanically air conditioned spaces: • Short report • Extract(s) from the specification(s) • Tender mechanical drawings	For naturally ventilated spaces: • Short report • Opening Area Schedule • As built drawings For mechanically air conditioned spaces: • Short report • As built mechanical drawings • BMS point schedules • Extract(s) from the Commissioning Records

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 demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

Short report prepared by a mechanical engineer that describes how the Credit Criteria have been met:

- For naturally ventilated buildings, showing that the entire building is naturally ventilated
- For mechanically air conditioned spaces, describing the active humidity control system.

Tender drawings for naturally ventilated spaces showing openings and ventilation inlets and outlets.

Extract(s) from the specification(s) where the system design parameters in terms of design conditions, humidity and temperature, and humidity control parameters are stipulated.

Tender mechanical drawings for each mechanically ventilated space highlighting and showing the active humidity control systems.

As built drawings for each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly indicated and dimensioned.

As built mechanical drawings showing humidity sensors installed in the ductwork.

BMS point schedules showing humidity sensors installed in the ductwork.

Extract(s) from the Commissioning Records showing the humidity levels in the ducts and in the office space for all modes of operation.

IEQ-15 Mould Prevention

POINTS
AVAILABLE

1

ADDITIONAL GUIDANCE

ASHRAE Standard 62-2001 recommends maintaining indoor relative humidity levels between 30 percent and 60 percent. Humidity levels less than 30 percent trigger respiratory discomfort in some people while humidity levels over 70 percent near surfaces for extended periods of time promote the growth of some forms of mould and fungi.

This can be achieved through specific HVAC system design and by including dehumidifying components such as desiccants.

Controlling indoor moisture levels is one way to control propagation of fungi and dust mites inside buildings: in the carpets, wall coverings, and furnishings, as well as within the HVAC system itself.

The ducts should also be constructed from a material which is not susceptible to mould growth. Internal duct linings should be avoided or else selected with regard to avoiding mould growth and with provision for easy access for maintenance.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

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 however problems may arise when quantities of mould grow beyond usual limits or when particular species are introduced into a building. In these situations, mould can cause irritation, allergic responses and infections particularly in the eyes and respiratory system. Also of concern are mould toxins, which can potentially affect the skin immune system, respiratory system and nervous system.

Ultra-violet systems located in 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 place for mould to grow. Controlling humidity and moisture problems is the main way to prevent unhealthy mould growth and build up. This must be combined with an effective maintenance programme.

Recently, litigation for mould related illnesses has increased substantially in the US. Most insurance firms now specifically exclude mould from policies covering building owners and building industry practitioners. Alexander Robertson, Erin Brockovich's attorney, recently commented that "mould is where asbestos was thirty years ago".

IEQ-15 Mould PreventionPOINTS
AVAILABLE**1****REFERENCES & FURTHER INFORMATION**

ASHRAE – *Minimizing Indoor Mold Problems Through Management of Moisture in Building Systems*

<http://tc112.ashraetcs.org/content.html>

ASHRAE - The ASHRAE Guide for Buildings in Hot and Humid Climates 2008

<http://www.ashrae.org/publications/>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

NIL

IEQ-16 Tenant Exhaust Riser

POINTS
AVAILABLE**1**

AIM OF CREDIT

To encourage and recognise the design of buildings with a general exhaust riser that can be used by tenants to remove indoor pollutants from printing and photocopy areas.

CREDIT CRITERIA

One point is awarded where the building either:

- Includes a dedicated tenant's exhaust riser with the following characteristics:
 - Provides no less than 0.2 L/s/m² for 100% of the UA; AND
 - Has a capacity of 0.35 L/s/m² for 100% of UA on any individual floor; AND
 - The exhaust system is not recycled to other enclosures of different use.
- OR
- Provides an exhaust louvre for tenant extract in each tenanted area of a size equivalent to 1.75cm²/m² of UA and with an exhaust point at least 7m away from any openable window or air intake.

DOCUMENT REQUIREMENTS

It is a requirement of this credit that the exhaust facility is a dedicated exhaust facility and that air exhausted cannot be recycled to other enclosures. In addition, the tenant exhaust riser must NOT serve the kitchenette or tearoom areas.

If providing an exhaust riser, the exhaust fans must be installed as part of the base building – provision for future installation (e.g. by the tenant) does not meet the Credit Criteria.

If providing an exhaust louvre for each tenant, it must be located such that the tenant can install an extract fan within their unit without affecting other tenants.

It must be clear that the project's exhaust riser is externally exhausted, meets the flow rate, the percentage of UA, and the requirements for all tenancy printing/photocopy rooms/areas.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

IEQ-16 Tenant Exhaust RiserPOINTS
AVAILABLE**1**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report If providing a tenant exhaust riser: • Tender exhaust riser drawings If providing tenant exhaust louvres: • Tender exhaust louvre drawings	• Short report If providing a tenant exhaust riser: • As built exhaust riser drawings If providing tenant exhaust louvres: • As built exhaust louvre drawings

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- If providing a tenant exhaust riser:
 - Describing how the tenant's exhaust riser is controlled and operated;
 - Demonstrating that the risers have the capacity to serve all floors as required by the credit;
 - Describing how it meets the requirements of the credit and referring to design drawings and specifications; and
 - Providing clear calculations correlating per-floor air rates to the UA, specifications and the drawings.
- If providing exhaust louvres on each floor:
 - Providing clear calculations correlating louvre sizes and tenancy floor areas

Tender exhaust riser drawings showing the location of the tenants' exhaust risers. These drawings can be in the form of architectural drawings or reflected ceiling plans, and must contain the information required to clearly demonstrate compliance with the credit criteria.

Tender exhaust louvre drawings

- Clear plan and elevation drawings showing the louvres in each tenancy. These drawings should also indicate any openable windows and demonstrate that the distance criteria have been met.

As built exhaust riser drawings showing the location of the tenant's exhaust risers. These drawings can be in the form of architectural drawings or reflected ceiling plans, and must contain the information required to clearly demonstrate compliance with the credit criteria.

As built exhaust louvre drawings

- Clear plan and elevation drawings showing the louvres in each tenancy. These drawings should also indicate any openable windows and demonstrate that the distance criteria have been met.

IEQ-16 Tenant Exhaust Riser

POINTS
AVAILABLE

1

ADDITIONAL GUIDANCE

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

We spend over 90% of our lives indoors and our exposure to air pollutants is far greater from breathing indoor air than outdoor air. It is commonly found for most air pollutants that indoor air concentrations are far in excess of those outdoors. Consequently there is considerable research underway concerning:

- Eliminating or controlling sources of indoor pollutants; and
- Ensuring building ventilation rates are sufficient to remove pollutants for which source control is limited.

This credit (along with IEQ-1 'Ventilation Rates') addresses copying equipment ventilation concerns. A tenant exhaust riser can assist in removing pollutants from the office environment.

The typical copying/printing process can produce emissions such as volatile organic compounds (VOCs), ozone and particulates, particularly as the machines age. Volatile organic compounds are produced when toner is baked onto the paper during photocopying, whilst the black pigment is generally the source of particulate pollution from these machines.

Toner dust may irritate the respiratory tract, resulting in coughing and sneezing. Some toners contain carcinogenic chemicals. Copier pollutants have been known to be the cause of headache; mucous membrane irritation; and dryness of eyes, nose and throat.

Ozone is an unstable form of oxygen, which may be formed during the printing or photocopying. Ozone is a reactive, unstable gas with a half-life of six minutes in office environments. It is a highly toxic gas and is the most serious health risk from photocopiers. Ozone is also produced by ultraviolet emission from the photocopier lamp.

Ozone has a sweet smell and can be detected at concentrations of 0.01 to 0.02 parts per million (ppm). The permissible exposure level currently accepted in Australia for ozone is 0.1 ppm as a time-weighted average over the working day. Prolonged inhalation of ozone levels of a few parts per million is known to damage the lungs. Some authorities suggest that a concentration of 0.1 ppm might cause premature ageing and shortened life span.

Some photocopiers and printers use a drum impregnated with selenium and cadmium sulphide. The gas these chemicals emit, especially when hot, can cause throat irritation and sensitisation to exposed workers.

IEQ-16 Tenant Exhaust RiserPOINTS
AVAILABLE**1**

Nitrogen oxide gas may be produced when there is a spark in electrostatic photocopiers. Carbon monoxide is produced when toner (containing Carbon Black) is heated in an inadequate air supply. In an insufficiently ventilated environment this can induce headaches, drowsiness, faintness and increased pulse rate and carbon monoxide can cross the placenta and affect the foetus.

REFERENCES & FURTHER INFORMATION

Australian Safety and Compensation Council (1994), *Guidance Note for the Assessment of Health Risks Arising from Hazardous Substances in the Workplace* [NOHSC:3017(1994). Commonwealth of Australia, Canberra.

Australian Safety and Compensation (1995), *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:3008(1995)] 3rd Edition. Commonwealth of Australia, Canberra.

London Hazards Centre (2002). *Photocopier and Laser Printer Hazards*.
<http://www.lhc.org.uk/members/pubs/factsht/76fact.pdf>

The Union for People in Transport & Travel (UK).
<http://www.tssa.org.uk>

Workers Health Centre, Photocopiers,
<http://www.workershealth.com.au/facts011.html>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Tenant exhaust riser and 'Shell & Core' spaces

Technical Clarification Number: IEQ16-T-OB1-0367

Guidance: 2012-01-11

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the Credit Criteria is applicable regardless as delivery type does not prohibit the installation of tenant exhaust riser(s).

IEQ-16 Tenant Exhaust Riser

POINTS
AVAILABLE **1**

The following Erratum has been included:

IEQ16-E-OB1-0252 Green Star SA - Office v1 Technical Manual: Page 125 (2011-02-08)

IEQ-17 Environmental Tobacco Smoke Avoid.POINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognize the air quality benefits to occupants by prohibiting smoking inside the building.

CREDIT CRITERIA

One point is awarded where:

- Smoking is not allowed inside the building; AND
- No provision is made for smoking areas inside the building (e.g. separately exhausted smoking rooms); AND
- There is clear signage indicating that smoking indoors is prohibited and identifying the location of outside smoking areas if provided.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Statement from building owner or manager • Extract(s) from the tenant handbook or design report(s)	• Statement from building owner or manager • Evidence that signage is in place • Extract(s) from the tenant handbook or design report(s)

Statement from building owner or manager confirming a no smoking policy in the building.

Extract(s) from the tenant handbook or design report(s) confirming that smoking is not allowed and that no designated smoking areas provided in the building

Evidence that signage is in place such as a photograph showing 'no smoking' signs and/or signs to outside smoking areas if provided.

ADDITIONAL GUIDANCE

Current South African regulations (Tobacco Products Control Act).require that if smoking is permitted inside a building, it must be in a designated smoking area with direct exhaust to

IEQ-17 Environmental Tobacco Smoke Avoid.POINTS
AVAILABLE**1**

outside. While this provides non smoking occupants with some protection, it is subject to maintenance and correct use of the facility. The most effective way to avoid the health problems associated with ETS is to prohibit smoking indoors.

The Green Star SA Office credit prohibits all indoor smoking areas.

BACKGROUND

The relationship between smoking and various health risks including lung disease, cancer and heart disease has been well documented. A strong link between Environmental Tobacco Smoke (ETS), or 'passive smoking' and health risks has also been demonstrated.

A smoke-free policy has advantages for smoking and non-smoking employees, including:

- Improved work environment: A healthier, cleaner, safer and more pleasant working environment is created.
- Better health: Non-smokers are no longer exposed to the harmful effects of second-hand smoking. It also provides an opportunity for smokers to cut down or quit smoking.
- Increased health awareness: Awareness of the health risks of smoking is raised.

A move into a new building or a major retrofit is a good opportunity to change behavioural patterns of staff and is therefore a time when enforcing a no smoking policy should be considered.

REFERENCES & FURTHER INFORMATION

Tobacco Products Control Act 1993 and subsequent Amendments Act no. 12 of 1999 and Act no 23 of 2007

South Africa Department of Health – *A guide on how to create a smoke free workplace*
<http://www.doh.gov.za/issues/tobacco-f.html>

IEQ-17 Environmental Tobacco Smoke Avoid.POINTS
AVAILABLE**1****TECHNICAL CLARIFICATIONS AND ERRATUM**

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Documentation Requirements

Technical Clarification Number: IEQ17-T-OB1-0581

Guidance: 2012-10-03

It is approved for a project team to submit the building users guide instead of the tenant handbook or design reports to demonstrate that smoking will be prohibited and no designated areas will be allocated for smoking within the building.

Ene- Conditional Requirement

AIM OF CREDIT

To encourage and recognise designs that minimise the greenhouse gas emissions associated with operational energy consumption, and maximise potential operational energy efficiency of the base building.

CONDITIONAL REQUIREMENT CRITERIA

To meet the conditional requirement the building must demonstrate energy performance equal to or better than a notional building constructed to the 'deemed to comply' fabric and building services clauses of *SANS 204:2008 Energy Efficiency in Buildings*.

Three compliance routes are available:

Compliance Route 1 – Energy modelling

The Green Star SA energy calculator must be completed to show that the actual building has lower carbon emissions than the notional building.

Compliance Route 2 – ASHRAE guide

The design must fully comply with ASHRAE *Advanced Energy Design Guide for Small Office Buildings*. This route is only available for offices < 2,000m² UA.

Compliance Route 3 – Following SANS 204 deemed to comply clauses

The design must comply with all of the SANS 204:2008 'deemed to comply' clauses regarding building fabric and building services.

DOCUMENTATION REQUIREMENTS

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Ene- Conditional Requirement

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Compliance Route 1 – Energy modelling - Documentation required as for Ene-1 credit, compliance route 1 Compliance Route 2 – ASHRAE guide - Documentation required as for Ene-1 credit, compliance route 2 Compliance Route 3 – following SANS 204 deemed to comply clauses - Short report	Compliance Route 1 – Energy modelling - Documentation required as for Ene-1 credit, compliance route 1 Compliance Route 2 – ASHRAE guide - Documentation required as for Ene-1 credit, compliance route 2 Compliance Route 3 – following SANS 204 deemed to comply clauses - Short report - Confirmation from the contractor

Short report prepared by architect and mechanical engineer that describes how the SANS 204:2008 deemed to comply clauses have been complied with.

This report must demonstrate that:

- Glazing areas and performance satisfy the minimum requirements of SANS 204:2008;
- Insulation levels satisfy the minimum requirements of SANS 204:2008; and
- Mechanical and electrical systems comply with the minimum requirements of SANS 204:2008.

Confirmation from the contractor

- Signed confirmation that the systems installed are as described in the short report.

ADDITIONAL GUIDANCE

Modelling and supporting documentation

Refer to the Green Star SA – Office v1 Energy Calculator & Modelling Protocol Guide for more information.

For Shell and Core or Integrated Fit-Out Projects

- Design** – The documented design must demonstrate compliance with the Conditional Requirement Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out. If any component of the project is delivered as shell and core, all assumptions must be conservative and documented clearly and consistently throughout the submission.

Ene- Conditional Requirement

- **As Built** – The as built/as installed evidence must demonstrate compliance with the Conditional Requirement Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

As noted in the introduction to this Energy chapter, emissions from buildings total 20% of global greenhouse gas emissions. At the same time, a Working Group of the Intergovernmental Panel on Climate Change (IPCC) in 2007 noted that the built environment provides a significant amount of cost-effective greenhouse gas mitigation potential; more than any other industry.

Building shell performance has a large impact on the heating, cooling and illumination requirements for commercial buildings. Improvements in the thermal, daylight and natural ventilation performance of commercial building shells will reduce greenhouse gas emissions. Increasing the efficiency of artificial lighting will reduce emissions directly by lowering energy consumption (refer to Energy Credit Ene-2 'Energy Sub-metering'), and indirectly through lower cooling requirements.

Commercial & Public Services account for around 7% of overall energy usage in South Africa, but around 14% of electrical use (data from 2005 source IEA at <http://www.iea.org>).

In 2005, 93% of South African electricity was generated from coal, which is one of the most polluting forms of electrical generation in terms of carbon, sulphur (SO_x) and nitrous oxide (NO_x) emissions. Only approximately 2% came from renewable sources such as hydroelectric and solar.

The South African Government has targeted a final energy demand reduction of 15% by 2015 for the commercial and public building sector.

SANS 204 (*Energy Efficiency In Buildings*) is due to be published in October 2008. The SANS will not be mandatory until new legislation is enacted. Compliance with the standard is included within the Green Star SA – Office rating tool with the aim of increasing knowledge and use of the standard and also to encourage adoption of the legislation to make compliance mandatory for all new buildings.

Typical operational energy applications within office buildings are cooling (28%), air handling (22%), lighting (21%), heating (13%) and miscellaneous (computer equipment etc.) (16%). These are Australian data but are similar to measurements taken in 2007 by *Danish Energy Management* at Edenvale. Studies have shown that very significant amounts of energy are wasted in many South African buildings during out-of-hours periods. For example the Edenvale study showed 51% of electricity was being consumed outside of standard working hours, due to some lighting, mechanical plant and equipment such as computers being left on all night.

In addition to addressing operational greenhouse gas emissions, the overall reduction in a building's contribution to climate change depends on the efficiency and embodied energy of its systems. When effectively designed and operated, centralised energy systems can deliver such a reduction and optimise energy, resource and maintenance efficiency.

Ene- Conditional Requirement

REFERENCES & FURTHER INFORMATION

South African National Standard *SANS 204:2008 Energy Efficiency in Buildings*
<http://www.sabs.co.za/>

Part 1: General Requirements.

Part 2: The application of the general requirements of energy efficiency in buildings with natural environmental control.

Part 3: The application of the general requirements of energy efficiency in buildings with artificial environmental control.

Energy Efficiency Strategy of the Republic of South Africa, 2005, Dept of Minerals & Energy
Energy Consumption Guide ECON19 – Energy Use in Offices, BRECSU (UK)

Southern African Association for Energy Efficiency (SAEE)
<http://www.sae.org.za>

International Energy Agency
<http://www.iea.org>

Council for Scientific & Industrial Research (CSIR)
http://www.csir.co.za/Built_environment

Carbon Dioxide Information Analysis Center
<http://cdiac.ornl.gov>

UN Millennium Development Goals Indicators
<http://mdgs.un.org/unsd/mdg/Default.aspx>

Promoting Renewable Energy in Africa (PREA)
<http://prea.ises.org>

Sustainable Energy Society of Southern Africa
<http://www.sessa.org.za>

South African Cities Network
<http://www.sacities.co.za>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

NIL

ENE-1 Greenhouse Gas EmissionsPOINTS
AVAILABLE**20****AIM OF CREDIT**

To encourage and recognise designs that minimise greenhouse gas emissions associated with operational energy consumption.

CREDIT CRITERIA

Up to twenty points are awarded where it is demonstrated that the building's predicted greenhouse gas emissions have been reduced below the Conditional Requirement.

Compliance Route 1 – Energy Modelling

The office is to be modelled using the GBCSA protocol, and the predicted carbon emissions compared with a baseline office in the same location constructed to the requirements of the SANS 204:2011 'deemed to satisfy' clauses. Points are then awarded on a linear scale with 0 points for the baseline building and 20 points for a net zero operating emissions building.

The points are determined by the Green Star SA Energy Calculator.

<i>% improvement in Carbon Emissions over SANS 204 Notional Building</i>	<i>Number of Points Obtained</i>
< 5% (less than 5% improvement)	0
5%	1
10%	2
15%	3
20%	4
25%	5
30%	6
35%	7
40%	8
45%	9
50%	10
55%	11
60%	12
65%	13
70%	14
75%	15
80%	16
85%	17
90%	18
95%	19
100% (net zero operating emissions base building)	20

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Compliance Route 2 – ASHRAE guide

As an alternative to the energy modelling route, 4 points are awarded for offices < 2,000m² UA if the design complies with ASHRAE *Advanced Energy Design Guide for Small Office Buildings*.

DOCUMENTATION REQUIREMENTS

Compliance Route 1 – Energy Modelling

The energy modelling must be carried out in accordance with the latest available version of the Green Star SA – Office v1.1 Energy Calculator & Modelling Protocol Guide.

Each variable in the Energy Modelling Report (e.g. building form, materials or air conditioning system(s)) must be referenced consistently throughout the rest of the submission (i.e. in related credits such as IEQ-1 'Ventilation Rates' or Ene-7 'Peak Energy Demand Reduction') and should be clearly justified by the documented design (for Green Star SA – Office Design v1.1 assessment) or by the as built evidence (for Green Star SA – Office As Built v1.1 assessment).

Software must comply with the requirements and verification methods detailed in the Energy Calculator & Modelling Protocol Guide.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Energy modelling report	Energy modelling report
Copy of the completed Green Star SA Energy Calculator	Copy of the completed Green Star SA Energy Calculator
Extract(s) from the specification(s)	Extract(s) from the Commissioning Report
Tender drawings	As built drawings
Additionally for naturally ventilated spaces:	Additionally for naturally ventilated spaces:
Natural ventilation report	Natural ventilation report

Energy modelling report in accordance with the Green Star SA – Office v1.1 Energy Calculator & Modelling Protocol Guide.

- Following the structure defined in the Green Star SA – Office v1.1 Energy Calculator & Modelling Protocol Guide; and
- Clearly identifying all assumptions made for tenant and other loads (e.g. occupant density); and
- 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.

If the same report is submitted for the As Built rating as was submitted for the Design rating, then the

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same points will not be guaranteed unless it is clearly evident that it accurately reflects the as built/as installed design. The project team may wish to provide a short report correlating the original report to the as built design.

Copy of the completed Green Star SA Energy Calculator to show what energy values have been entered for the actual and notional building.

Extract(s) from the specification(s) demonstrating that all the inputs used in the energy simulation are reflected in the current design.

Tender drawings demonstrating that all the inputs used in the energy simulation are reflected in the current design.

Extract(s) from the Commissioning Report demonstrating (through supporting evidence) that the building has been commissioned and operates as intended by the design (i.e. as described in the energy modelling report).

As built drawings demonstrating that the façade details and materials are the same as described in the energy modelling report.

Natural Ventilation Report prepared by a mechanical engineer that describes how the building has been designed to be naturally ventilated and confirms that analysis has been carried out to check that internal conditions will be acceptable to the occupants. This is to avoid rewarding buildings which will overheat or be uncomfortable and require air conditioning to be retrofitted.

The report should include:

- 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).
- Thermal Analysis of all typical office spaces in the building, using hourly weather data to show that internal conditions meet the following criteria:

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.

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 – Office v1.1 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-9 for more details of calculation method.

Note that if a naturally ventilated building fails to achieve the above criteria, it can still be entered for Green Star SA – Office assessment, but the energy modelling must include a notional air conditioning system in the actual building (refer to Green Star SA – Office v1.1 Energy Calculator & Modelling Protocol Guide for more details). This is because with such a building there is a significant risk that future occupants will retrofit air conditioning systems).

Compliance Route 2 – ASHRAE Guide

The building UA must be under 2,000m² to use this compliance route.

To achieve this credit, the project must comply with ALL recommendations established in the Advanced Energy Design Guide for the climate zone in which the building is located. Points are not awarded for partial compliance.

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Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Report Tender architectural drawings Extract(s) from the mechanical and electrical specification(s)	Report As built architectural drawings Confirmation(s) from the contractor

Report written in the same format as the ASHRAE guide *Climate Zone X Recommendation Table* detailing each component (e.g. roof insulation), the ASHRAE recommendation, and the achieved performance level in the design.

Tender architectural drawings (plans, elevations and typical details) demonstrating that the wall, roof and window constructions meet the thermal insulation and solar performance as described in the ASHRAE guide.

Extract(s) from mechanical and electrical specifications demonstrating that the mechanical and electrical systems meet the efficiency and other requirements of the ASHRAE guide.

Confirmation(s) from the contractor that the insulation, glazing and other thermal envelope components supplied to the project are as per the specification on which the above report is based. Additionally, confirmation that the HVAC and electrical installations are as per the specification on which the above report is based.

As built architectural drawings (plans, elevations and typical details) demonstrating that the wall, roof and window constructions meet the thermal insulation and solar performance as described in the ASHRAE guide.

ADDITIONAL GUIDANCE

ASHRAE Advanced Energy Design Guide for Small Office Buildings

This guide provides an effective means of limiting building energy usage and documenting improved building energy performance without the need for a building energy simulation. The recommendations in the guide must be incorporated into the project early in the building design in order to optimise building performance with minimum impact on capital cost.

The project team must identify which of the eight US climate zones is appropriate for the project location in South Africa and use the corresponding criteria from the guide. This is using the method explained in the 2006 *International Energy Conservation Code* (IECC) by firstly establishing whether it is a 'Marine' climate or not and then calculating the number of heating degree days HDD (relative to 18°C) and cooling degree days CDD (relative to 10°C):

Zone	Criteria	Example in South Africa
Zone 1	CDD > 5000	Beitbridge
Zone 2	CDD between 3500 - 5000	Upington, Durban
	CDD between 2500 - 3500 and HDD < 3000	Pretoria
Zone 3C (Marine)	HDD < 2000	Cape Town
Zone 4AB	CDD < 2500 and HDD < 3000	Johannesburg

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Zone 4C (Marine)	HDD between 2000 and 3000	-
Zone 5	HDD between 3000 and 4000	-
Zone 6	HDD between 4000 and 5000	-
Zone 7	HDD between 5000 and 7000	-
Zone 8	HDD > 7000	-

Table Ene-1.1: Classification of Climate Zones for use with ASHRAE design guide

The guide includes recommendations for roofs, walls, floors, slabs, vertical glazing, skylights, interior lighting, ventilation ducts, energy recovery and service water heating. The measures in the guide are expected to reduce a building's energy consumption significantly compared to a baseline ASHRAE 90.1-1999 standard office.

Modelling and supporting documentation

Refer to the Green Star SA – Office v1.1 Energy Calculator & Modelling Protocol Guide (at the end of this document) for details of how to carry out the modelling.

Renewable energy, off-sets and carbon credits

Where the building produces its own energy on site, this production can be included within the energy modelling; any greenhouse gas-neutral energy will directly reduce the building's predicted greenhouse gas emissions.

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.

Tenant lighting

Tenancy lighting is usually installed as part of the base building works but is metered and paid for by the tenants. Lighting is not included in the energy modelling methodologies outlined above.

The energy efficiency of the lighting is assessed in Ene-3 'Lighting Power Density' and Ene-4 'Lighting Zoning'. Note that both the energy efficiency and the design lighting levels (refer to Indoor Environment Quality credit IEQ-7 'Electric Lighting Levels') will impact on the heating/cooling loads used in the energy modelling to predict the base building HVAC performance.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out. If any component of the project is delivered as shell and core, all assumptions must be conservative and documented clearly and consistently throughout the submission.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

Refer to Ene-0 Conditional Requirement.

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REFERENCES & FURTHER INFORMATION

ASHRAE *Advanced Energy Design Guide for Small Office Buildings*, 2004

ANSI-ASHRAE 104:2004 *Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs*

CIBSE TM33:2006 *Tests for Software Accreditation and Verification*

Energy Efficiency Strategy of the Republic of South Africa – Department of Minerals and Energy, March 2005

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>

International Energy Conservation Code, 2006 edition

<http://www.iccsafe.org>

TECHNICAL CLARIFICATIONS AND ERRATUM

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Credit Interpretation Request: Energy Modelling Protocol Guide - set criteria central plant

Credit Interpretation Request Number: ENE1-C-OB1-0831

Ruling: 2014-10-28

The project team's proposal for allowing compliance based on set standard criteria of section 5.4 for central plant as per Energy Modelling Protocol Guide is approved.

The GBCSA provides guidance relating to this issue:

Where a project team has shown compliance and submitted Energy Calculator & Modelling Protocol Guide v1.1 under section 5.4 HVAC System Simulation

- The size of the central plant used for the energy calculations in this rating tool must be assumed as equivalent to the peak demand of the development pursuing certification
- The part load curves for the actual central plant shall be applied proportionally to the central plant used for the energy calculations.
- Submitting a CIR will only be required when different methods of apportionment within the guide is proposed.

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Credit Interpretation Request Number: ENE1-T-OB1-768

Ruling: 2014-02-27

Accounting for VRF systems in Ene-1 model

1) VRF: Outdoor unit energy consumption

The energy consumption of any outdoor unit shall be determined using the 'interpolated COP data' as described in item (3) below and the thermal loads as derived from thermal modeling software.

2) VRF: Indoor unit energy consumption

The energy consumption of any indoor unit shall be determined using the 'specific fan power' as described in item (4) below and the supply air rates as described in 5) as proposed by the Project Team.

3) Interpolated COP data (outdoor units)

The interpolated COP data for the outdoor VRF units used for the calculation of the annual energy consumption of all the outdoor VRF units included in the project is to be derived from the manufacturer's product data for –

- All outdoor unit models or types included in the project such that each outdoor unit model or type has a unique interpolated COP data set based on the manufacturer's product data for that unit;

4) Derived Specific Fan Power (indoor units)

The derived specific fan power for the indoor VRF units used for the calculation of the annual energy consumption of all the indoor VRF units included in the project is to be derived from the manufacturer's product data for –

- All indoor unit models or types included in the project such that each indoor unit model or type has a unique specific fan power based on the manufacturer's product data for that unit;

5) Derivation of zone supply air rates

The derivation of zone supply air rates, to which the specific fan power, as outlined in item (4) above, is applied to determine the fan energy consumption of the indoor VRF units, must be determined through modeling the HVAC system as a Constant Volume (CV) system.

6) Treatment of sub-systems

As part-load conditions, thus part-load performance, will vary depending on each sub-system required to serve the different parts of the building that have been connected to that sub-system, it is an unacceptable methodology to aggregate the thermal loads of all zones within the thermal modeling. As each sub-system will have a different installed heating/cooling capacity and the thermal loads within each space will not be equal, each sub-system will have different part load conditions, it is required that each sub-system be post-processed using the methodology approved in item (1) above, individually to account for this. This post-processing method approved in item (1) above must clearly reference the part-load conditions derived from the peak load within the sub-system and the thermal loads of the zones within the sub-system.

Credit Interpretation Request Number: ENE1-C-OB1-708

Ruling: 2013-09-26

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Shell & Core compliance, ENE-1.

The GBCSA note that where buildings are delivered as ‘Shell & Core’ or where tenant layout designs are not yet defined, the following proposed methodology for the modelling of HVAC under the ENE-1 credit, is deemed acceptable for buildings to claim savings for load reductions via improved building fabric and for selection of a higher efficiency chiller.

As per Technical Manual guidance for Ene-1 modelling, “all assumptions must be conservative and documented clearly and consistently”.

Heating and Cooling Setpoints

These can be entered as per the notional building. The modelling protocol guide already allows this for buildings where no client brief exists.

Zoning

IEQ-09 zoning requirements may be applied to both the notional and actual buildings.

Supply Air Fan Energy Use

Two alternative methodologies can be used;

Use the notional building fan system as the air side HVAC component. This is conservative since the notional building is considered to represent the minimum system requirement as per SANS.

OR

Where a central chiller is installed, and tenants are contractually required to install Fan Coil Units linked to this central chiller, documentation from the developer outlining the system must be provided as well as the contractual requirement to install Fan Coil Units. The GBCSA understand that research exists that shows that the specific fan power of fan coil units typically never exceeds 0.8w/l/s, this specific fan power along with the air delivered to provide the required cooling can thus be used to calculate annual energy use.

Cooling and Heat Rejection

Where a chiller has been selected for the building, the as-designed / installed chiller must be used with all its attributes to calculate savings in ENE-01.

In summary, using the methodology above, the building will be able to claim savings for load reductions via improved building fabric and for the selection of a higher efficiency chiller.

Technical Clarification Number: ENE1-T-OB1-0710

Guidance: 2013-06-14

Proposed methodology for modelling VRF/VRV systems (This TC supersedes ENE1-T-OB1-0097 issued on 2010/08/18)

Projects that make use of modelling software which includes a simulation for variable refrigerant flow (VRF) or variable refrigerant volume (VRV) systems do not need to submit a Technical Clarification to the GBCSA prior to submittal when modelling these systems in the actual building energy model, provided that the following are met:

- The modelling package is compliant with the ‘simulation package’ requirements of the Green Star SA – Office v1.1 Energy Calculator and Modelling Protocol Guide.
- The modelling report clearly indicates all the inputs used within the model and demonstrates through contract documentation and product datasheets that these inputs accurately represent the system

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installed.

Projects using methodologies for modelling of VRV/VFR systems that are not integral to the simulation package must submit a Technical Clarification to the GBCSA prior to submittal, outlining the proposed modelling methodology for approval.

Technical Clarification Number: ENE1-T-OB1-700

Guidance: 2013-06-13

Proposed methodology for modelling VRF system

The technical clarification seeking approval to use the Daiken VRV Systems Plug in tool as the proposed methodology for modelling the VRV and VRF system is approved on condition that the modelling report clearly indicates all the inputs used within the plugin and demonstrates through contract documentation or product datasheets that these inputs accurately represent the system installed.

Technical Clarification Number: ENE1-T-OB1-0636

Guidance: 2013-02-13

Carbon Monoxide (CO) monitoring on basement fans

Where CO monitoring is used to control the air flow of basement fans, the calculation of the required air flow rates and associated energy savings must be based strictly in accordance with a recognised best practise standard or guideline, e.g. '2011 ASHRAE Handbook – HVAC Applications'.

The calculation methodology must at a minimum be based on the following inputs:

- Acceptable level of contaminants in the parking facility
- Number of cars in operation at various times over a 24 hour period
- Length of travel and operation time for cars within the car-park
- CO emission rate for a typical car under various conditions
- Total volume of the parking facility

Documentation Requirements:

Within the Energy Modelling Report, the project team must;

- Clearly state the source of the calculation methodology used (recognised best practise standard or guideline).
- Describe the calculation inputs used for each of the items above.
- Provide a description of how the 'number of cars in operation at various times over a 24 hour period' and the 'length of travel and operation time for cars within the car-park' are a representative or conservative representation of the expected traffic profile for the building.

In addition, the project team must state in the Energy Modelling Report how the following issues have been taken into account within the calculations:

- Accounting for the contaminant level of outside air drawn into the basement;
- Accounting for building form and position of sensors and the effect this may have on operation of the system; and
- Providing efficient, adequate airflow throughout the structure.

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The project team must demonstrate with supporting contract documentation (Design rating) or commissioning records (As Built rating) that the CO sensors are set according to the levels used within the calculations.

Note that the project team need not submit the full calculations within the Energy Modelling Report, but simply the confirmations and inputs requested above.

Technical Clarification Number: ENE1-T-OB1-0597

Guidance: 2012-11-05

HVAC plant operating schedules

Should operating schedules of HVAC equipment be used as part of the energy performance or thermal comfort strategy, e.g. night flushing or early start-up of HVAC plant, the actual HVAC plant operating schedules for the related equipment as supported by tender documentation (Design) or commissioning data (As Built) may be used for the Ene-1 actual building modelling and IEQ-9 credit modelling.

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 modelling protocol should be used.

Note that for the Ene-1 notional building, the HVAC plant operating schedules in the energy modelling protocol should be used.

Technical Clarification Number: ENE1-T-OB1-585

Guidance: 2012-10-01

Supply air Fans and Fresh air Fans (Note this TC replaces ENE1-T-OB1-0374)

This TC has been superceded by the new requirements of the revised energy modelling protocol.

Credit Interpretation Request Number: ENE1-T-OB1-0420

Ruling: 2012-06-18

The CIR Review Panel has assessed the Credit Interpretation Request (CIR) relating to the occupancy sensor provision for lighting in external areas and parking areas and has provided the following ruling back to the GBCSA:

The CIR Review Panel notes that for external areas and car parks, in order to make use of the “Internal lighting with presence controls” schedule in Table 17, Appendix C of the Green Star SA – Office v1.1 Energy Calculator & Modelling Protocol guide, presence detectors need no longer be

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provided to a specific density, but the project team must show that presence detectors have been installed, and at least 70% of the car park lighting and/or external lighting (by installed power not number of fixtures) is linked to presence detectors. Please note that enclosed spaces such as storeroom need not be connected to occupancy sensors. The project team should also demonstrate that each floor is separately controlled and that external lighting is controlled separately to that of the car park.

Documentation Requirements:

The project team is required to submit contract documentation (drawings and/or specifications) confirming that lighting controls have been specified / installed in compliance with the requirements listed above i.e. indicating that each floor is individually controlled and that the required % of lighting is linked to occupancy sensors. The project team must also clearly show in the Energy Report the detailed calculations showing that 70% of their total wattage is controlled by presence detectors.

Technical Clarification Number: ENE1-T-OB1-437

Guidance: 2012-05-23

Should new SANS 204:2011 standard apply for Ene-1 compliance or is SANS 204:2008 acceptable?

This TC has been superseded by the new requirements of the revised energy modelling protocol.

Technical Clarification Number: ENE01-T-OB1-462

Guidance: 2012-03-27

ENE-01: Weather Data - Weather Analytics (WxA)

This TC has been superseded by the new requirements of the revised energy modelling protocol.

Technical Clarification Number: ENE1-T-OB1-0352

Guidance: 2012-01-12

Energy modelling - Calculation of total U-values of windows/glazing assemblies

For the purposes of energy modelling for the Green Star SA - Office v1 Ene-1 credit, for the actual building, where an overall window (whole glazing) U-value is not known, but the project team does have glazing U-values from the manufacturer, calculations may be performed to take account of the thermal conductance of the frame and thus ascertain the overall window U-value. Industry standard U-values for various frame materials such as those published by the CSIRO (Commonwealth Scientific and Industrial Research Organisation - Australia) may be used for this purpose. Where calculations of the overall window U-values are performed, the following must be clearly shown in the Energy Modelling Report.

- Details of composite U-value calculations.

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- Individual element U-values used in the calculation and their source.
- Justification of glazing and frame areas used in the calculations.

Where the manufacturer U-value for the glazing is not known, the U-values from the table on 'Worst-case whole glazing element performance values' given in SANS 204:2011 should be used in the model.

Credit Interpretation Request Number: ENE1-C-OB1-0353

Ruling: 2012-01-12

Intellectual property - trigeneration system design documentation

The Credit Interpretation Request (CIR) seeking approval to substitute extracts of tender documentation with a statement of confirmation from the design engineers to protect the intellectual property of the tri-generation system is conditionally approved.

The CIR Review Panel notes that the Project Team is permitted to request alternative forms of documentation where they wish to protect intellectual property, however sufficient documentation must be submitted to satisfy the GBCSA of inclusion within the design. A statement of confirmation, prepared and signed by a suitably qualified professional responsible for the design of the tri-generation system, may be submitted provided the following information is confirmed:

- Estimated hourly electrical energy produced by the plant;
- Estimated electrical energy consumption of plant itself;
- Estimated hourly heat supply to the absorption chiller;
- Estimated hourly heat supply for DHW;
- Estimated hourly heat supply for tempering of fresh air;
- Size of auxiliary pumps in system and energy consumed
- Estimated amount and type of primary fuel consumed;

In addition;

- Size/capacity of major components of the system, including the generators, the absorption chillers and heat exchangers (i.e. kW).

In addition to the statement of confirmation, extracts of tender documentation must be submitted to confirm the inclusion of the tri-generation system within the design. This must be of the form of;

- Tender architectural plan drawings showing the location/space allocation of the trigeneration system;
- OR
- Tender mechanical services plan drawings showing the location/space allocation of the trigeneration system.

The CIR Review Panel notes that as the project is registered for a Design certification, information contained on the statement of confirmation must be based on calculated estimates. It is not acceptable to use actual measured performance data from the tri-generation system (if operational).

Credit Interpretation Request Number: ENE1-C-OB1-0383

Ruling: 2012-01-12

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Automated daylight control for daylight dimming or switching - approved methodology.

The Credit Interpretation Request (CIR) seeking approval for the proposed methodology for the control of light fittings via automated daylight control, for daylight dimming or switching is conditionally approved. The CIR Review Panel notes that proposed methodology is robust and well researched to predict energy savings from an automated control system. However within the submission, the Project Team must clearly identify the correlation between the lighting zoning and the HVAC zoning in the model.

The CIR Review Panel confirms that the Documentation Requirements which must be demonstrated within the submission are;

- Daylight modelling report in strict compliance with IEQ-4 Daylight (to demonstrate the daylight model);
- Tender / As Built Drawings (to demonstrate sensor positions and control zones);
- Extract(s) from specifications (to correlate the control methodology with the actual design);
- Energy modelling report (to demonstrate that the modelling accurately reflects the design).

Approval is conditional on the following methodology only:

- 1) The daylight model is established using software that can export to Daysim;
- 2) Daysim (driving the Radiance simulation engine) is used to establish the hourly daylight availability per grid point on an analysis grid with grid points a maximum of 1m x 1m apart with the first measurement point within half a meter from the façade. The resulting output file contains lux levels for each hour of the year for each grid point. The weather data file used must be compliant with ENE-1 and be the same file used for the ENE-1 modelling so that the daylight results and weather conditions related to the rest of the heat loads are correlated;
- 3) The data is analysed to establish when daylight levels at 1.5m in from the centre of the glazing or greater, exceeds 2000lux;
- 4) The same analysis process is then used to establish the hourly daylight availability with the blinds closed with any daylight penetration according to the design features (e.g. light shelves, daylight redirecting blinds etc.);
- 5) A single daylight availability file is created from the two scenarios of (a) no glare and blinds up and (b) glare and blinds down;
- 6) The results of this hourly file are then zoned according to the lighting controls. The control point used is the grid point that is reflective of the daylight sensor position;
- 7) The response of the light system within these different zones (including parasitic power where applicable) is determined according to the power consumption at the differing illumination contribution made by the electric lighting system to the space to make up for what the daylight cannot provide. Control is performed as per the design – either dimming or stepped;
- 8) It may be assumed that all electric energy consumed by the lighting system is given off as a heat load to the space and an hourly lighting schedule for the entire year for each zone is created and exported into the file format that can be used by the thermal modelling software.

All prescribed documentation requirements must be met as outlined above.

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AVAILABLE**20****Credit Interpretation Request Number: ENE1-C-OB1-0384****Ruling:** 2012-01-12**Control of light fittings via informed user control**

The Credit Interpretation Request (CIR) seeking approval for the proposed methodology for the control of light fittings via informed users control is denied.

Although the CIR Review Panel supports design attention to the interface between occupants and control systems within buildings and the potential for resource savings, for the purposes of base-building benchmarking within Green Star SA, the proposed methodology is not deemed acceptable.

The CIR Review Panel notes that “clear and user friendly” instruction signage cannot be considered as an attribute of the base-building (although are to be commended for best practice) and unlike other aspects of Green Star SA where occupant behaviour is assumed based on necessary human physiology drivers (i.e. frequency of amenity use), assumptions pertaining to occupant interaction with control systems (e.g. lighting or HVAC) are highly variable and influenced by multiple factors. On this basis it is not possible to reliably determine to any extent the benefit gained of continuous and on-going informed users interface with a particular control system for the purposes of benchmarking in Green Star SA further than what is already permitted as per Appendix C of the Green Star SA Office v1 Energy Calculator Guide.

Technical Clarification Number: ENE01-T-OB1-0374**Guidance:** 2012-01-03**Supply air fans to be modelled as variable air volume**

Replaced by TC ENE01-T-OB1-585

Technical Clarification Number: ENE1-T-OB1-0314**Guidance:** 2011-08-23**Post-processing of systems modelling**

“The Green Star SA – Office v1 Energy Calculator & Modelling Protocol Guide (Version 1.1.) permits “post-processing” of systems modelling, completed in a spreadsheet program or by hand, provided “full details are submitted”. The GBCSA wishes to clarify that where post-processing methodologies are developed and applied by hand, using common spreadsheet programs, or proprietary software programs, in acknowledgement of intellectual property, “full details” constitute a brief explanation of the concept of the methodology only. It is not required that Project Teams explicitly detail the methodology such to communicate their intellectual property.

Where Project Teams have specifically developed proprietary software to complete post processing, this is deemed equivalent to the use of a “spreadsheet program” as per the Energy Calculator & Modelling Protocol Guide (Version 1.1), and is therefore deemed acceptable. Please note however,

Ene-1 Greenhouse Gas Emissions

POINTS
AVAILABLE**20**

the derivation of thermal loads for the building(s) must be completed using simulation software compliant with Section 5.1 of the Energy Calculator & Modelling Protocol Guide (Version 1.1.).

Technical Clarification Number: ENE1-T-OB1-0276

Guidance: 2011-06-01

Internal walls in Office areas

Where internal walls within Office areas are provided as part of the 'base building provision' (i.e. will not change based on tenant requirements), project teams may include these within the Green Star SA submission, but should ensure they are included consistently across the submission. (E.g. finishes to these walls may need to be included in the IEQ-13 credit.)

Technical Clarification Number: ENE1-T-OB1-0118

Guidance: 2010-11-23

Car Park Ventilation

This TC has been superceded by the new requirements of the revised energy modelling protocol.

Technical Clarification Number: ENE1-T-OB1-0096

Guidance
2010-08-18

Modelling Software

DesignBuilder software interface for the BESTEST-certified Energy Plus modelling software is acceptable for Green Star SA purposes.

Technical Clarification

VRF/VRV Modelling (SUPERCEDED by TC ENE1-T-OB1-0710 issued on 2013-06-14)

Technical Clarification Number
ENE1-T-OB1-0097

Guidance
2010-08-18

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Technical Clarification

Occupied space below ground

Technical Clarification Number
ENE1-T-OB1-0089

Guidance
2010-07-07

If the actual building contains regularly occupied space below ground, the notional building must still be modelled as above-ground, with the properties laid out in the Green Star SA - Office v1 Energy Calculator and Modelling Protocol Guide (the Energy Guide). In the case that the actual building contains both occupied and parking floors below ground, the notional building must be modelled with the lowest regularly occupied floor at ground level, and the first basement parking level modelled as naturally ventilated per the Energy Guide. For example, if the actual building contains two regularly occupied floors on B1 and B2, with three levels of parking below (B3 to B5), then the notional building will have the occupied floors as ground and 1st floor, with the parking as B1 (naturally ventilated), B2 (mechanically ventilated) and B3 (mechanically ventilated).

Technical Clarification

Shading for notional building

Technical Clarification Number
ENE1-T-OB1-0036

Guidance
2009-05-21

When modelling the notional building, the effects of shading from neighbouring buildings must be included, but the model should not incorporate any shading devices on the building itself. Glazing area for the notional building is then determined as per SANS 204.

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Green Star SA

ENE-1: ENERGY MODELLING PROTOCOL

OFFICE VERSION 1.1

Last update: November 2014

1 Executive Summary

The Green Star SA – Office rating tool has been developed to evaluate the predicted performance of buildings based on a variety of environmental criteria. The Energy Calculator within this tool compares the predicted 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 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 energy consumption of both the actual building and the notional building must be calculated. Important components of this calculation are the heating and cooling energy consumption of the building, which must be determined using computer modelling. 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 buildings.

The predicted ancillary load energy consumption, such as that from lighting, mechanical ventilation, domestic hot water and lifts, must also be calculated. This guide includes details on how to calculate these loads in such a way that they can be fairly compared to the benchmark. HVAC, lighting and tenant equipment energy must be included for any project following the modeled route to compliance.

Finally, this guide includes information on how to enter the simulation outputs and the ancillary load calculations into the Green Star SA – Office rating tool Energy Calculator. The calculator converts the energy use into carbon emissions and indicates the percentage improvement of the actual building compared to the notional building (base building). Points are awarded based on 0 points for no improvement; up to a maximum of 20 points for a building with net zero operating emissions for the base building.

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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 – Office v1.1 rating tool.

SPONSORSHIP

The revision to Office v1.1 did not receive any sponsorship funding.

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 reviewing and revising the Energy Modelling Protocol for the Green Star SA – Office v1.1 rating tool, as well as various professionals who acted as Technical Advisory Group (TAG) who were consulted in the review of this protocol.

3 Introduction

The Green Building Council of South Africa (GBCSA) is developing a suite of rating tools to assess the environmental performance of buildings and tenants in South Africa. As part of this package, the Green Star SA – Office rating tool assesses the environmental performance of office buildings by measuring their environmental impact. Part of this assessment includes determining the predicted energy consumption of the office building.

The building must be simulated using computer modelling software in order to determine the predicted energy consumption of its Heating, Ventilation and Cooling (HVAC) system. In addition, the predicted energy consumption of the ancillary loads in the building must be calculated. Thermal modelling must be done using software that complies with the requirements in this guide.

This protocol must be used as the set of instructions on how to undertake the modelling and how the data must be entered into the Energy Calculator to produce the project's 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.

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All energy modelling undertaken for Green Star SA certification purposes (Design/As Built tools) 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 Design and As Built 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.

CHANGE LOG (from Office v1 to v1.1)

The following changes have been made to the Office v1 protocol in v1.1 based on improvements made to the protocol in other rating tools such as PEB v1 and Interiors v1, to ensure it aligns with current practices in industry.

Notional building system type	Two system types have been selected; this is to allow smaller projects to use a more realistic baseline.
Heating	Clarification in the modelling guide: No heating coils are to be included in the air handling unit, should outdoor temperature be less than 12, heating will be at reheaters only.
Internal Loads	Internal loads for equipment and occupancy will be as per actual building. Air temperature control will also be identical in both models.
Cooling and Heat Rejection	Notional building chiller performance curve updated to be more representative of a standard chiller used in industry.
Notional building glazing	Notional building vertical glazing updated to clear double glazing. Window to wall calculation table provided within modelling guide. The roof glazing requirements clarified: Notional building to only have roof glazing if the reference building has got

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	skylights.
Supply air fans	A part load power curve introduced to standardize off design energy performance for variable air volume fans. Specific fan power updated to 1.8W/l/s. This includes all the fans used to supply, return and extract air for the notional building. No additional fresh air fan energy use is to be included. Toilet extract fans are not to be included as miscellaneous fans for the notional building.
Extract and miscellaneous fans	Notional and actual building miscellaneous fan energy use to be the same. Projects can take 50% credit on energy use for performance based car park ventilation via carbon monoxide sensors. Project teams are to note that the day to day ventilation requirement and not the smoke extract condition is to be used for car park ventilation calculations.
Lighting	Notional building lighting benchmarks updated for all areas.
External lighting	Notional building external lighting calculation updated. Calculation is no longer based on external area
Schedules	Schedules as per PEB tool have been provided. Project teams are now allowed to motivate their own schedules where they feel the standard schedules do not reflect the specific operation of their building.
Vertical transport	A methodology that requires the same annual energy for both buildings, based on the actual building systems has been provided. Projects can claim a standardised energy savings regenerative braking. A calculation spreadsheet for the updated methodology has been provided with the GBCSA calculators for the Office v1.1 tool.
Domestic hot water	The new SANS10400-XA regulations require 50% DHW heating to be from a non-resistive heating source. An update of the calculation methodology to include 50% heating by a heat-pump with minimum efficiency as per SANS has been provided. Energy calculations will now be as per the installed capacity of the system and a schedule of operation.

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4 General Methodology

4.1 Model Notional SANS204 Building

A building in the same location and with the same geometry as the actual building is modelled, with defined areas of glazing and fixed fabric performance and M&E (mechanical & electrical) systems performance. The building is generally 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. The building is modelled in four orientations (at actual orientation, orientation + 90°, orientation +180°, orientation +270°), and an average taken. This approach is to allow benefit to be taken for optimum orientation of the actual building.

4.2 Model Actual Building

The actual building is modelled, using exactly the same simulation software, weather data and tenant assumptions as the model of the notional building, but with the actual building fabric and HVAC systems.

4.3 Enter energy use into Green Star SA – Office energy calculator

The HVAC energy uses predicted by the models above for the notional building and the actual building are entered into the calculator. The other remaining energy uses (e.g. lifts, hot water, car park ventilation, external lighting etc) are calculated using this protocol. Once the total is obtained, any renewable energy sources and on-site generation are taken into account. The calculator produces an estimate of the carbon emissions/m²/year for both the notional base building and the actual base building.

The final Ene-1 point score is awarded based on the percentage improvement of the actual base building compared to the notional base building in terms of “base building” carbon emissions, on a linear scale with 0 points representing no improvement and 20 points

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representing a base building with net zero operating emissions. The carbon emissions include energy used for heating, cooling, ventilation, lifts, tenant lighting, non tenant (common area) lighting, external lighting and tenant equipment. (The base building typically excludes tenant specific equipment and appliances.)

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5 General Modelling Parameters

This section pertains to both the notional and actual buildings.

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	Statement in modeling report. Where weather file sources as per the list below are used, no description of the weather files is required; the modeling report should merely state the origin of the files. • IWECC (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.

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	simulation and are based on at least 5 years of measured data.	
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 drawing. 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.

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6 Building Envelope

6.1 Building Fabric – Opaque Elements

All notional building fabric elements to reflect deemed to satisfy requirements as per SANS 204:2011 and SANS 10400-XA:2011 as per table below:

Table 2 Opaque building fabric elements

	Notional Building	Actual Building
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 actual building shall be modeled as per design documents. Where assumptions are made they must be shown to be conservative.
Internal floors*	10mm Ceiling tile, 300mm air gap, 100mm concrete slab, 150mm air gap, 10mm wooden floor	
Ground floor/adjacent to basement parking	Standard Expanded Expanded Polystyrene (EPS) Insulation, 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	

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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	0.7mm clay roof tile, EPS insulation, 300mm air gap, 10mm ceiling tile. Insulation to achieve total R-value as per climate requirement Climate zone 1 and 4 – R=3.7 (± 130mm EPS) Climate Zone 2 – R=3.2 (± 110mm EPS) Climate Zone 3 and 5– R=2.7 (± 80mm EPS) Climate zone 6 – R=3.5 (± 120mm EPS) All roof types to have an outer layer reflectivity of 30%	
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 in four orientations (actual, actual +90°, actual +180°, actual +270°) and take average.	Model as per actual orientation

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*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.

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6.2 Building Fabric – Glazing

	Notional Building								Proposed	
Vertical glazing window to wall ratio*	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.								As per building design. All elements of the actual 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	
	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%
Vertical glazing performance	Performance as per SANS 204-2011 Table 6 – Tinted double glazing in aluminium/steel frame.								Manual shading devices such as blinds are not to be included in the energy model.	
	U-Value: 4.23									
	SHGC: 0.59									

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Skylight glazing area	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.	
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 design	As per design

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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.

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Table 4 Notional building lighting inputs

Building Code Classification	Occupancy	Notional Building Input (W/m ²)
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)		2

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lighting	
Sub-basement Vehicle Parking Area (B2 and below) lighting	2

Figures are as per SANS 204 and ASHRAE 90.1, (lower of the two)

A saving of 15% on the peak lighting installed power for occupancy sensing can be claimed for projects that have occupancy sensing installed for at least 75% of a particular space type. Savings from day light harvesting must be motivated to the GBCSA via a CIR prior to the projects submission for a rating.

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6.4 Actual Building – HVAC Systems

All components of the HVAC system 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.

<i>Modelling Parameter</i>	<i>Requirements</i>	<i>Documentation</i>
HVAC System design	Demonstrate that the HVAC system modelled represents the system design for each part of the building.	<u>Verification Documents:</u> - Design or as-installed (where appropriate) relevant pages from mechanical specification and mechanical drawings which accurately and thoroughly describe the basic HVAC system design. <u>Energy Report:</u> - 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.	<u>Energy Report:</u> 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.

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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. • <u>Water cooled equipment:</u> Demonstrate that chiller data is specified under conditions that reflect the intended condenser water temperature controls. • <u>Air cooled equipment:</u> Demonstrate that the air cooled chiller COP profiles have been accurately modelled with regard to loading and ambient conditions	<u>Verification Documents:</u> • 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). <u>Energy Report:</u> • 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.	<u>Verification Documents:</u> • 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. <u>Energy Report:</u> • Details of how the boiler has been modelled.
Supply Air and Exhaust Fans	• Demonstrate that fan performance curves are accurately represented in the model.	<u>Verification Documents:</u> • Design or as-installed (where appropriate) pages from the mechanical specification showing fan performance curves and fan size. <u>Energy Report:</u> • 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.

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Cooling Tower Fans	Demonstrate that allowance for energy consumption from cooling tower fans has been made, based upon the annual cooling load of the building and the supplementary cooling load for tenancy air conditioning.	<u>Energy Report:</u> 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 building.	<u>Energy Report:</u> 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.	<u>Verification Documents:</u> - Design or as-installed (where appropriate) relevant pages from mechanical specification, giving details on the correct minimum outside air flow <u>Energy Report:</u> - 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.	<u>Verification Documents:</u> - Design or as-installed (where appropriate) relevant pages from mechanical specification giving details on the economy cycle of the system <u>Energy Report:</u> - Detail of how the economy cycle has been modelled
Controls - Primary duct temperature control	<u>Constant Volume Systems:</u> Demonstrate that modelling has allowed supply air temperatures to vary to meet loads in the space <u>Variable Volume Systems:</u> 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.	<u>Verification Documents:</u> - Design or as-installed (where appropriate) relevant pages from mechanical specification giving details of the design temperature and HVAC cooling and heating setpoints <u>Energy Report:</u> - Detail of how design temperatures and setpoints have been modelled

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Controls - Airflow	• 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 modeled 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 power</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>	Fraction of full load power	Fraction of full load power	1	1	0.9	0.83	0.8	0.68	0.7	0.54	0.6	0.41	0.5	0.3	0.4	0.21	0.3	0.13	<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
Fraction of full load power	Fraction of full load power																			
1	1																			
0.9	0.83																			
0.8	0.68																			
0.7	0.54																			
0.6	0.41																			
0.5	0.3																			
0.4	0.21																			
0.3	0.13																			
Controls - Minimum turndown	• Demonstrate, where relevant, that the minimum turndown airflow of each air supply is accurately reflected in the model.	<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																		

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		each air supply
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.	<u>Verification Documents:</u> - Design or as-installed (where appropriate) relevant pages from the mechanical specification giving details of the chiller staging strategy <u>Energy Report:</u> - 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.	<u>Verification Documents:</u> - Design or as-installed (where appropriate) relevant pages from the mechanical specification giving details of the design specification for the thermal model <u>Energy Report:</u> - Details of how the temperature control bands have been modelled

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6.5 Notional Building - HVAC System 1

For non-residential buildings 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 below
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

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System Component	Performance Parameter																		
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 6 VAV fan part load power <table> <tr> <th>Fraction of full load power</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>	Fraction of full load power	Fraction of full load power	1	1	0.9	0.83	0.8	0.68	0.7	0.54	0.6	0.41	0.5	0.3	0.4	0.21	0.3	0.13
Fraction of full load power	Fraction of full load power																		
1	1																		
0.9	0.83																		
0.8	0.68																		
0.7	0.54																		
0.6	0.41																		
0.5	0.3																		
0.4	0.21																		
0.3	0.13																		
Zoning	Thermal zones as per proposed building with one air handling unit object per floor.																		

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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	

ENE-Energy Modelling Protocol

6.6 HVAC System 2

For residential and buildings that are less than 3500m² a unitary heat pump system shall be modeled for the notional building.

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.

ENE-Energy Modelling Protocol

6.7 Extract and miscellaneous fans

The same specific fan power is to be used for both the notional and actual buildings for all extract and miscellaneous fans. Project teams can claim a 50% energy saving for carbon monoxide sensors in the basement provided that the information below is provided;

Calculation of the required air flow rates and associated energy savings must be based strictly in accordance with a recognised best practice standard or guideline, e.g. '2011 ASHRAE Handbook – HVAC Applications'.

The calculation methodology must at a minimum be based on the following inputs:

- Acceptable level of contaminants in the parking facility
- Number of cars in operation at various times over a 24 hour period
- Length of travel and operation time for cars within the car-park
- CO emission rate for a typical car under various conditions
- Total volume of the parking facility

Within the Energy Modelling Report, the project team must;

- Clearly state the source of the calculation methodology used (recognised best practice standard or guideline).
- Describe the calculation inputs used for each of the items above.
- Provide a description of how the 'number of cars in operation at various times over a 24 hour period' and the 'length of travel and operation time for cars within the car-park' are a representative or conservative representation of the expected traffic profile for the building.

In addition, the project team must state in the Energy Modelling Report how the following issues have been taken into account within the calculations:

- Accounting for the contaminant level of outside air drawn into the basement;
- Accounting for building form and position of sensors and the effect this may have on operation of the system; and
- Providing efficient, adequate airflow throughout the structure.

The project team must demonstrate with supporting contract documentation (Design rating) or commissioning records (As Built rating) that the CO sensors are set according to the levels used within the calculations. Note that the project team need not submit the full calculations within the Energy Modelling Report, but simply the confirmations and inputs requested above.

ENE-Energy Modelling Protocol

6.8 External Lighting

Notional building external lighting is to be as per the actual building. Project teams may claim a 15% saving on annual energy use for the use of photocell sensors to control lighting.

ENE-Energy Modelling Protocol

6.9 Domestic Hot Water

Actual building hot water heating will be calculated based on the installed capacity of the system and a schedule of operation as determined by the building type. Where schedules of operation are not known, schedules as provided by the GBCSA can be used.

Notional building hot water will be calculated as per SANS-10400-XA2. 50% Hot water to be supplied by electric resistance heating and 50% by heatpump with COP 3. The total installed capacity and schedule of operation is to be as per the actual building.

The table below shows an example calculation for a building with a 10kW heatpump (COP 4) installed.

Table 8 DHW annual consumption

Space Name	Notional Building	Actual Building
Installed Heating Capacity (kW)	10	10
Electrical input	6.6	2.5
Schedule hours (GBCSA Table)	1 592	1 592
Annual energy use kWh	10 507	3 980

6.10 Vertical Transport

The same calculations shall be performed for the notional and actual buildings. Should project teams wish to achieve further savings, 20% saving on annual energy use can be claimed for regenerative braking. Calculation methodology is to be based on the European standard VDI 4707 E, this standard is used to rate lifts in terms of their energy use characteristics. Project teams shall use the table below to characterize the usage patterns of their elevators.

Utilisation Category	1	2	3	4
Use intensity/frequency	Low Seldom	Medium	High	Very High
Average travel time in hours per day	0.5	1.5	3	6
Average stand-by time in hours per day	23.5	22.5	21	18
Typical types of buildings and use	Building with 2 to 5 stories	Building with 2 to 10 stories	Building with more than 10 stories	Building more than 100m tall

Escalators are to use an average travel time of 10 hours a day for both the notional and actual building. Where the actual building is fitted with a proximity sensor to only run when someone approaches the escalator, 8 hours may be used.

1. Determine Utilisation Category

- Average travel time in hours per day - **Tu** (read from table above)

2. Document Design Parameters

- Nominal load **Qn** - kg
- Velocity **Vn** - m/s
- Ascent Height **AH** - m
- Lift travel energy demand **Etravel/spec** - mWh/(m.kg) (where this figure is not known a default value of 2.7mWh/(m.kg) will be used. This correlates to a 'D' rating for travel demand as per VDI 4707E.
- Standby Demand **Psb** - W (Total of individual demand values for various components such as lighting and electronics. (where this figure is not known a default value of 400W will be used. This correlates to a 'D' rating for standby demand as per VDI 4707E.
- Days of operation a year - **N**

3. Calculated Parameters

- Average Travel Distance = (Ascent Height * 0.5)
- Average Trip Time = Avg Travel Distance / Velocity
- Number of trips - (avg travel time in hours per day x 3600) / avg trip time
- Distance travelled per day (Snom) = Number of trips x average travel distance
- Utilization Category - Table 1

4. Calculate Standby Demand

$$Esb = Psb * (24h - Tu)$$

5. Calculate Daily Travel Demand

$$Etravel = Etravel/spec * Snom * Qn$$

This figure will be reduced by 20% for elevators with regenerative breaking

6. Calculate Annual Energy Demand

$$Ey = (Esb + Etravel) * N$$

7. Report Template to be used for project submissions

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 *7*
- Location *Johannesburg*
- Simulation Software used *DesignBuilder v3.1*
- Weather Data Used *International Weather For Energy Calculations (IWECC) file for Johannesburg*
- Space Breakdown:

Table 9 Space break down

Space	Included in simulation	Area (m ²)	Comments
Office UA	yes	13,000	
Non-Tenant Area	yes	2,501	<i>Lighting energy use calculated manually</i>
Parking Area	yes	53,000	<i>Lighting and extract fan energy use excluded manually</i>
External area	no	5 640	<i>Lighting energy use calculated manually</i>

[Justification for any areas of the project excluded from the model]

[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 Building Envelope

2.1 Geometry

Geometry was as per architect's drawings, the images below show the simulation models created for both the actual and notional buildings.

[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]

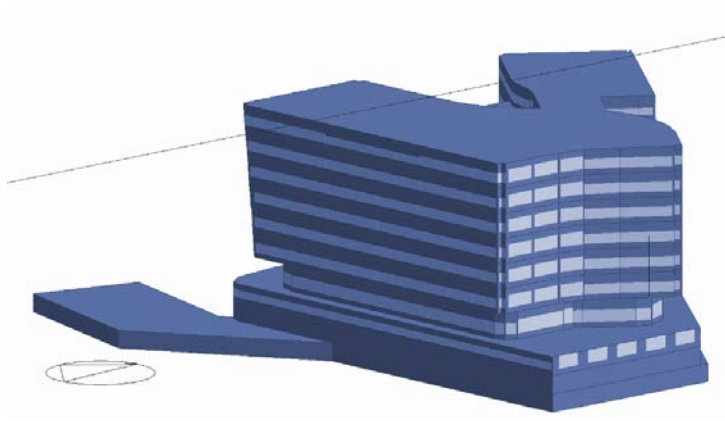


Figure 1 Notional building model

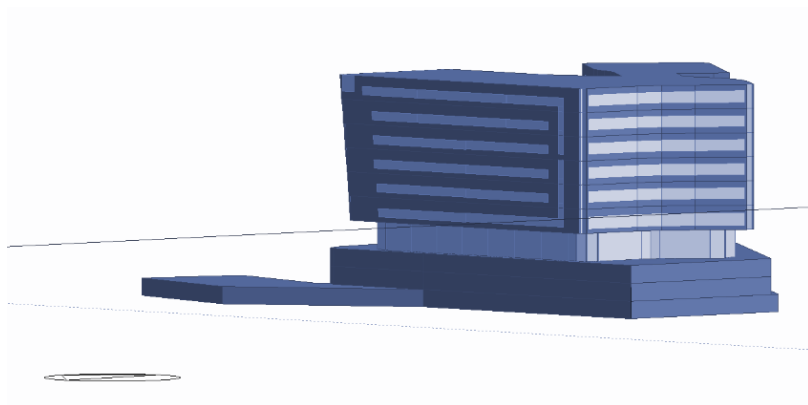


Figure 2 Actual building model

2.2 Fabric

2.2.1 Opaque building fabric

Table 10 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	Carpet tile,150mm concrete slab,500mm air gap,10mm ceiling tile R= 1

2.2.2 Glazing

Table 11 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	0.3

*Aluminium frames are drawn geometrically in the model as per glazing schedules, total U-value is calculated by the modeling software.

Table 12 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%

Notional building glazing was as per the requirements for climate zone 1 in the table above.

2.2.3 Roof lights

Table 13 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

2.2.4 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 14 Actual building shading summary

Location	Description
North facing glass	0.5m overhang placed 100mm above glazing.

2.3 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.

2.4 Infiltration

Infiltration for perimeter zones was set as below;

Table 15 Infiltration

	Notional Building	Actual Building
Infiltration rate	0.5ach	0.5ach

2.5 Internal Loads

	Notional Building	Actual Building
Summer Design temperature	23°C	23°C
Winter Design Temperature	21°C	21°C
Occupancy	9 m ² /person	9 m ² /person
Tenant lighting	11 W/m ²	6 W/m ²
Tenant equipment	11 W/m ²	11 W/m ²
Fresh air rate	7.5 litres/sec/person	10 litres/sec/person

3 HVAC Systems

3.1.1 Zoning

The same zoning was used for both the notional and actual building. This zoning was exactly as per the mechanical engineers design.

[provide image showing typical correlation between zoning used in model with mechanical engineers design]

3.1.2 Notional building HVAC

HVAC system 1 was used for the notional building since the building is more than 3 500m². Notional building system inputs were as per the table below

System Component	Performance Parameter
Chiller	As per table 7 below
Number of chillers	Based on peak building load reported during the simulation. Chillers were simulated sequentially with no chiller staging performed. The peak load reported was 1300 kW for the building. 3 450 kW chillers with performance as per table 7 in the modelling guide were used to calculate cooling and heat rejection energy use
Chilled Water Temperatures	6°C supply water temperature
Chilled Water pump power	Constant speed primary pump with a specific pumping power of 349 W/l/s was used. A secondary pump with a variable speed drive and specific pumping power of 349 W/l/s was also included in the simulation. A variable speed curve as per

System Component	Performance Parameter																		
	the fan variable speed motor characteristics was used to model part load energy consumption for the variable speed pump.																		
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 was modeled. Table 16 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>	Fraction of full load volume	Fraction of full load power	1	1	0.9	0.83	0.8	0.68	0.7	0.54	0.6	0.41	0.5	0.3	0.4	0.21	0.3	0.13
Fraction of full load volume	Fraction of full load power																		
1	1																		
0.9	0.83																		
0.8	0.68																		
0.7	0.54																		
0.6	0.41																		
0.5	0.3																		
0.4	0.21																		
0.3	0.13																		
Zoning	Thermal zones as per proposed building with one air handling unit object per floor.																		

3.1.3 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]

The actual building makes use of a four pipe fan coil unit system utilizing a heat pump chiller to provide chilled water for cooling and hot water for heating. Fresh air is distributed to all parts of the building by means of a ducted reticulation system that supplies fresh air directly into the in-ceiling fan-coil units.

3.1.3.1 Cooling and heat rejection

This was calculated post process on excel using the total load experienced by each chiller, the ambient outdoor temperature and a COP calculated from the manufacturers product data sheets. The tables below show the design chiller capacities used in the model and the part load performance curve used.

Table 17 Design chiller capacities

Chiller	Rated Capacity (kW)	Note
Chiller 1	400	The actual design capacity is used
Chiller 2+3	500	

Table 18 Chiller performance data

ABAD CHL 1000X										
		Outdoor Temperature								
		18	20	21	23	25	27	29	30	35
Part Load %	25	4.3	4.3	4.3	4.3	4.3	4.8	4.8	4.8	4.2
	30	4.3	4.3	4.3	4.3	4.3	4.7	4.7	4.7	4.1
	40	4.2	4.2	4.2	4.2	4.2	4.4	4.4	4.4	3.9
	50	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.7
	60	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.6
	70	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.9	3.4
	75	4.0	4.0	4.0	4.0	4.0	3.8	3.8	3.8	3.4
	80	3.9	3.9	3.9	3.9	3.9	3.7	3.7	3.7	3.3
	90	3.8	3.8	3.8	3.8	3.8	3.5	3.5	3.5	3.1
	100	3.7	3.7	3.7	3.7	3.7	3.3	3.3	3.3	2.9
Calculated COP										

3.1.3.2 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. Fan power as per the product data sheets provided for each specified fan is given below. Flow rate was entered as per the design flow rate indicated on the mechanical engineers drawings.

Table 19 Fan power of installed indoor units

Model Reference	Design Flow Rate (m ³ /s)	Fan Power (w)	Quantity	Total Fan Power (kW)
SA1	0.25	130	70	9.1
SA2	0.25	130	80	10.4
SA3	0.15	80	100	8
SA4	0.15	80	65	5.2
SA5	0.4	200	30	6
Fresh Air Fan	2	2000	3	6
Total installed fan power (kW)				44.7

Fresh air is delivered by a constant volume fresh air fan and is included in the table above.

4 Extract and Miscellaneous Fans

All extract and miscellaneous fans were calculated as per the technical manual. The same installed fan power and running hours were used for both the notional and actual building. A 50% energy saving for basement ventilation fans is claimed as the project makes use of carbon monoxide control for basement ventilation fans. The design was based on ASHRAE 2011 – HVAC Applications methodology.

Table 20 Miscellaneous fans calculations

MISCELLANEOUS FANS							
	DESIGN PARAMETERS			Notional Building		ACTUAL BUILDING FANS	
Drawing Reference	Duty	Quantity	Flow Rate (m ³ /s)	Fan Motor Power (kW)	Yearly Energy Usage (kWh/year)	Fan Motor Power (kW)	Yearly Energy Usage (kWh/year)
EF-1+2	Toilet Extract	2	3	1.10	6,659	1.1	6,659
BF1-4	Basement Ventilation Fans	4	13.5	12.1	146,506	12.1	73,253
Total Yearly Consumption (kWh/year)				153,166		79,913	

[Within the Energy Modelling Report, the project team must;

- Clearly state the source of the calculation methodology used (recognised best practice standard or guideline).*
- Describe the calculation inputs used for each of the items above.*
- Provide a description of how the 'number of cars in operation at various times over a 24 hour period' and the 'length of travel and operation time for cars within the car-park' are a representative or conservative representation of the expected traffic profile for the building.*

In addition, the project team must state how the following issues have been taken into account within the calculations:

- Accounting for the contaminant level of outside air drawn into the basement;*
- Accounting for building form and position of sensors and the effect this may have on operation of the system; and*
- Providing efficient, adequate airflow throughout the structure.*

demonstrate with supporting contract documentation (Design rating) or commissioning records (As Built rating) that the CO sensors are set according to the levels used within the calculations. Note that the project team need not submit the full calculations within the Energy Modelling Report, but simply the confirmations and inputs requested above.]

5 Lighting

Notional building lighting was calculated according to the total area for each relevant space, its associated lighting power density and a schedule of hours as per schedules provided by the GBCSA. Actual building lighting was calculated using the total installed lighting power for each space and schedule of hours as per standard schedules provided. A 15 % saving on the lighting power density for each space was claimed for the inclusion of occupancy sensors for all areas of the building. Lighting calculations are summarized in the tables below;

Table 21 Non-tenant area lighting calculations

Non-Tenant Area Lighting					
NOTIONAL		ACTUAL			
Total Non-Tenant Area (m²)	2,501	Type	Light Fitting Total W	Quantity	Total W
		A	72	14	1008
		A3	116	8	928
		BE	36	55	1980
		C	36	14	504
		D	10	420	4200
Total Installed Lighting @ 6W/m² (kW)	15.0	Total Installed Lighting (kW)			7.3
Total Annual Energy Consumption (kWh/year)	58,981	Total Annual Energy Consumption (kWh/year)			28,799

Table 22 Car park lighting calculations

Car Park Lighting					
Notional		Actual			
Total Car Park Area (m²)	53,000	Type	Light fitting total W	Quantity	Total W
		A	72	832	59904
		AE	72	150	10800
		BE	36	55	1980
		C	36	14	504
		D	10	72	720

Total Installed Lighting @ 2W/m ² (kW)	106	Total Installed Lighting (kW)	63
Total Annual Energy Consumption (kWh/year)	253,552	Total Annual Energy Consumption (kWh/year)	150,270

Table 23 External lighting calculations

External Lighting					
Notional		Actual			
Total Installed Lighting (kW)	1.9	Type	Light fitting total W	Quantity	total W
		UD	26	20	520
		PT	70	20	1400
		Total Installed Lighting (kW)			1.6
Total Annual Energy Consumption (kWh/year)	8,409	Total Annual Energy Consumption (kWh/year)			7,148

6 Domestic Hot Water

Actual building hot water heating was calculated based on the installed capacity of the system and a schedule of operation as per the GBCSA schedule for the building type. Notional building hot water was calculated as per SANS-10400-XA2. 50% Hot water supplied by electric resistance heating and 50% by heatpump with COP 3. The total installed capacity and schedule of operation is to be as per the actual building.

Table 24 DHW annual consumption

	Notional Building	Actual Building
Installed Heating Capacity (kW)	10	10
Electrical input	6.6	2.5
Schedule hours (GBCSA Table)	1 592	1 592
Annual energy use kWh	10 507	3 980

7 Lifts and Escalators

Lift energy calculation inputs were filled into the VDI calculator provided by the GBCSA with results as per the excerpt below. No regenerative braking is included for the project therefore no energy savings were claimed. The building is 7 stories and therefore falls into the medium use utilization category. Default values for standby demand and lift travel demand. All other inputs were as per the lift specification document.

Table 25 Lift energy calculator

Elevator/Lift	Passenger 1	Passenger 2				
Duty	Office Lift	Office Lift				
Use intensity/frequency	Medium	Medium	Escalator - No	Low Seldom	Low Seldom	Low Seldom
Avg Travel Time (hours/day) - Tu	1.5	1.5	12.0	0.5	0.5	0.5
Avg Standby Time (hours/day) - 24h-Tu	22.5	22.5	12.0	23.5	23.5	23.5
Nominal load (kg) - On	1,500	1,500				
Velocity (m/s) - Vn	1.0	1.5				
Ascend Height (m) - AH	31.5	31.5				
Lift travel energy demand (mWh/m.kg) - Etravel/spec	2.7	2.7				
Standby Demand (W) - Psb	400	400				
Days of Operation a year - N	260	260				
Regenerative braking	no	no	no	no	no	no
Number of lifts	4	1	3	6	7	8
Average travel distance (m)	15.8	15.8	-	-	-	-
Average trip time (s)	15.8	10.5	-	-	-	-
Trips per day	343	514	-	-	-	-
Distance travelled per day (m) - Snom	5,400	8,100	-	-	-	-
Standby Demand (Wh/day)	9,000	9,000	-	-	-	-
Etravel (Wh/day)	21,870	32,805	-	-	-	-
Annual energy demand per lift (kWh) - Ey	8,026	10,869	-	-	-	-
Annual energy demand per lift (kWh), including regenerative braking - Ey	8,026	10,869	-	-	-	-
Annual energy demand (kWh)	32,105	10,869	-	-	-	-
Annual Energy Usage (kWh/annum)						42,974.1

8 Renewable Energy & Cogeneration

None included for this project.

9 Simulation Results

Results from the procedures outline above are presented below. Six points are claimed for ENE-1.

Table 26 Simulation Results

Building Component [kWh/annum]	Notional Building	Actual Building
Heating	59,982	11,700
Cooling and Heat Rejection	243,760	165,694
Pumps	46,131	22,116
Fans	113,206	142,074
Miscellaneous Fans	153,166	79,913
Non-Tenant Area Lighting	58,981	28,799
Car Park Lighting	253,552	150,270
External Lighting	8,410	6,076
Vertical Transport	42,974	42,974
Domestic Hot Water	10,507	3,980
Miscellaneous Equipment	-	-
Tenant Lighting	631,487	631,487
Tenant Equipment	891,229	891,229
Total	2,513,385	2,176,311
Total Building kWh/m ² /annum	186	161
Base Building kWh/m ² /annum	72	48
Base Building (kgCO ₂ m ² /annum)	87	58
Percentage Saving Over Notional		33.72%
Green Star Points		6

9.1 Sign Off

I believe the results above to be accurate to my knowledge

Asim Ulator *[modelling consultant]*

ENE-2 Energy Sub-metering

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise the installation of energy sub-metering to facilitate ongoing management of energy consumption.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- It is demonstrated that sub-metering is provided for substantive energy uses within the building (i.e. all energy uses of 100kVa or greater); AND
- There is an effective mechanism for monitoring energy consumption data.

An additional point is awarded where:

- The first point is achieved; AND
- It is demonstrated that sub-metering is provided separately for lighting and separately for power for each floor for 95% of the total UA; AND
- There is an effective mechanism for monitoring energy consumption data from all energy sub-meters.

DOCUMENTATION REQUIREMENTS

The documentation must account for all of the energy consumption loads in the building, and clearly identify (through highlighting or similar means) the location, number and respective loads of all sub-meters.

There must be an effective system for collecting, recording and monitoring data from the sub-meters, and for alerting the facility management of any change in energy consumption trends during the building's operation. In most cases, the requirement for an effective system will lead to the design of automated monitoring systems, such as Building Management Systems (BMS). Wherever such systems are present to monitor the energy consumption data, the energy sub-meters must be linked to them.

It must be clear that the sub-metering is provided by the base building owner/developer.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

ENE-2 Energy Sub-meteringPOINTS
AVAILABLE**2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Short report	Short report
Extract(s) from the specification(s)	Extract(s) from the commissioning report
Tender schematic electrical drawings	As built schematic electrical drawings
	Additionally where BMS provided:
	As built BMS / monitoring system point schedule

Short report prepared by a relevant project team member describing how the Credit Criteria have been met by:

- Providing a summary table of all separately metered spaces in the building;
- Describing how the energy consumption data will be effectively monitored during the building's operation; and
- Where the additional point is claimed, describing how sub-metering is provided separately for lighting and separately for power for each floor or tenancy, whichever is smaller; and the effective mechanism for monitoring energy consumption data.

Extract(s) from the specification(s) describing the installation requirements for electrical sub-meters that meet the Credit Criteria (see 'Additional Guidance').

Extract(s) from the Commissioning Report showing that all the meters and the monitoring system have been commissioned and are operating as intended by the design

Tender schematic electrical drawings with all uses and with the location of all sub-meters clearly marked.

As built schematic electrical drawings with all uses and with the location of all sub-meters clearly marked.

As built BMS / monitoring system point schedule showing inputs from the sub-meters and that they are duly connected.

ADDITIONAL GUIDANCE

If there is a Building Management System (BMS) that can provide a breakdown of the energy use by building system and location, this will also comply with the Credit Criteria. However, relevant details of the BMS and data must be provided to confirm the metering capability of the system.

Note that supplementary equipment can also be installed on the same measured circuit as the substantive energy use item. However, it must not contribute more than 10kVA.

ENE-2 Energy Sub-meteringPOINTS
AVAILABLE **2****Ene-2 Energy Sub-metering**POINTS
AVAILABLE **2**

This credit acknowledges the common existence of minor areas of office UA on predominantly non-office UA floors (i.e. parking or plant floors). Where such areas exist and are cumulatively less than 5% of the office UA, these floors may be excluded from the Credit Criteria.

For a typical office building, the following will have loads of 100kVA or greater and must be sub-metered:

- Car parks;
- Chillers;
- Air handling fans;
- Lifts;
- Common area lighting;
- Common area power; and
- Any additional item that carries an energy use greater than 100kVA.

Whenever lifts, individually or collectively, carry an energy use greater than 100kVA, they must be sub-metered. If individual lifts carry an energy use under 100kVA, they can be sub-metered individually or as a group; if individually they carry an energy use greater than 100kVA, they must be sub-metered separately unless they are monitored by an intelligent control system.

Speculative office buildings

In speculative buildings, compliance with Green Star SA – Office Design v1 can be demonstrated by a commitment to install sub-meters to the smallest available tenancy areas, and with Green Star SA – Office As Built v1, by their installation.

Owner-occupier buildings

In buildings where the owner is the sole, dedicated and long-term tenant, compliance with Green Star SA – Office Design v1 can be demonstrated by a commitment to install sub-meters on each floor of the office to allow for monitoring of different departments or sections of an organisation, and with Green Star SA – Office As Built v1, by their installation.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

ENE-2 Energy Sub-metering

POINTS
AVAILABLE**2**

BACKGROUND

Consumption of electricity is the biggest contributor of greenhouse gas emissions arising from office buildings. In successfully managing energy consumption it is important that sufficient data is available to building managers to allow them to monitor consumption and compare historical records. Sub-metering allows building managers to fine tune operational procedures to minimise consumption and to detect any operational problems early.

Lighting is one of the biggest single consumers of electrical energy in an office building.

Metering can assist in the measurement and management of lighting usage.

Measuring the energy use by all tenants within a building can highlight differences in energy use and allow facilities charges to be linked to levels of energy consumption, thus providing a financial incentive for organisations to reduce energy consumption.

REFERENCES & FURTHER INFORMATION

CIBSE TM39:2006 *Building Energy Metering – A Guide to Energy Sub-metering in Non- domestic Buildings*

International Performance Measurement & Verification Protocol.

<http://www.ipmvp.org>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

ENE-2 Energy Sub-metering

POINTS
AVAILABLE**2**

Technical Clarification: Allowing alternative compliance for Design rating building, where buildings with a total connected load of less than 100 kVA (maximum demand), metered as a whole and not individually per floor.

Technical Clarification Number: ENE2-T-OB1-0839

Guidance: 2014-10-31

Where buildings with a total connected load of less than 100 kVA (maximum demand), separate metering of power and lighting and HVAC is adequate and no further split per floor will be required, the Short report should reflect the following:

- Summary table of the separate metered components
- Describes how energy consumption is effectively monitored during operation
- Where additional point is claimed – project team describe separate metering for power, lighting and HVAC effectively monitoring energy consumption
- Tender schematic electrical drawings are provided reflecting all sub-metering.

Technical Clarification: Sub meter requirements

Technical Clarification Number: ENE2-T-OB1-0013

Guidance: 2009-02-06

Sub meters must measure energy in kWh and need not measure kVA.

The following errata have been incorporated:

ENE2-E-OB1-0652 Green Star SA - Office v1 Technical Manual: Page 146 (2013-03-14)

ENE2-E-OB1-0454 Green Star SA - Office v1 Technical Manual: Page 146 (2012-03-14)

ENE2-E-OB1-0300 Green Star SA - Office v1 Technical Manual: Page 145 (2011-08-08)

ENE2-T-OB1-0299 Amendment of Credit Criteria (2011-07-25)

ENE2-E-OB1-0242 Green Star SA - Office v1 Technical Manual: Page 146 (2011-02-08)

ENE2-E-OB1-0243 Green Star SA - Office v1 Technical Manual: Page 147 (2011-02-08)

ENE 3 Lighting Power Density

POINTS
AVAILABLE

4

AIM OF CREDIT

To encourage and recognise designs that provide artificial lighting with minimal energy consumption.

CREDIT CRITERIA

Up to four points are awarded where it is demonstrated that the lighting power densities for 95% of the UA meets the following criteria at 720mm above FFL with the default maintenance factor of 0.8:

- One point for energy use of 3.0W/m² per 100 Lux;
- Two points for energy use of 2.5W/m² per 100 Lux;
- Three points for energy use of 2.0W/m² per 100 Lux; or
- Four points for energy use of 1.5W/m² per 100 Lux.

DOCUMENTATION REQUIREMENTS

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Tender lighting drawings	• Short report • As built lighting drawings • Confirmation from the contractor

Short report prepared by a relevant project team member describing how the Credit Criteria have been met by:

- Providing a summary table that lists all layouts and their area, demonstrating that compliant areas jointly account for at least 95% of the UA;

Ene 3 Lighting Power Density

POINTS
AVAILABLE

4

- Stating the working plane used in the calculations; and
- Outlining the lighting power density calculations for each of the typical layouts.

Extract(s) from the specification(s) showing the tender light fittings schedule, confirming luminaire and lamp types and quantities

Tender Lighting Drawings indicating the location and area of each typical lighting layout and the luminaries used.

As Built Lighting Drawings indicating the location and area of each typical lighting layout and the luminaries used.

Confirmation from the contractor of the type and quantity of luminaire and lamp types installed in the building.

ADDITIONAL GUIDANCE

This credit rewards the efficiency of the luminaires and lighting system, independent of the design lighting levels. Appropriate design lighting levels are rewarded in credit IEQ-7.

Lighting power density is calculated on an area-weighted average over each typical lighting layout.

Full, rather than dimmed, lighting capacity must be assessed as it is an inherent building attribute.

If task lights are supplied as part of the base building works, they should also be included in the calculation.

Related credits

If IEQ-7 'Electric Lighting Levels' is claimed, the lighting levels referenced in both credits must be consistent.

Should both IEQ-7 'Electric Lighting Levels' and Ene-5 'Lighting Power Density' credits be claimed, the same software, values for the design lighting levels and inputs must be used for both credits.

Design strategies

The provision of energy efficient lighting systems is achievable through:

- Use of electronic ballasts (refer also to IEQ-6 'High Frequency Ballasts');
- New generation fluorescent and metal halide lamps;
- Efficient luminaires;
- Correct spacing of light fittings;
- Designing to a reasonable light level (refer to IEQ-7 'Electric Lighting levels');
- Lighting control zoning (refer to Ene-4 'Lighting Zoning'); and/or
- Maximising use of daylight with perimeter dimming (refer also to IEQ-4 'Daylight').

Ene 3 Lighting Power Density

POINTS
AVAILABLE**4**

Example calculation

General Office = 400 Lux at 11W/m² over 10,000m²

Meeting Rooms = 360 Lux at 15W/m² over 500m²

Therefore:

General Office = 2.75W/m² per 100 Lux over 10,000m²

Meeting Rooms = 4.15W/m² per 100 Lux over 500m²

Average = 2.8W/m² per 100 Lux = 1 point

The energy efficiency of a lighting system is gauged by the 'lighting power density' (watts per square metre) for a given lighting level, and the flexibility and effectiveness of lighting controls (switches, dimmers, etc.), addressed in Ene-4 'Lighting Zoning'.

The lighting power for a luminaire assembly must include lamp power and ballast losses.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

Tenancy lighting is not included in the base building greenhouse gas emissions (refer to Ene-1: Greenhouse Gas Emissions). Office lighting, however, is one of the biggest users of electricity in commercial office buildings and the building owner and lighting designer usually provide office-standard lighting before the office space has a tenant and the usage of the space is known. This credit is to reward the use of high efficiency lighting for this purpose.

For guidance in lamp selection, typical lamp efficiencies are as follows. (Note that for the Green Star SA submission, the actual specified luminaire, achieved Lux levels and circuit watts must be used in calculations.)

Ene 3 Lighting Power Density

POINTS
AVAILABLE**4**

Lamp	Typical lumen/Watt
GLS (General Lighting Service) traditional light bulbs	12
Halogen (e.g. 12V Dichroic)	18
Compact Fluorescent	50 - 80
Linear Fluorescent (triphosphor)	65 - 95
Metal halide	70 - 95
High pressure sodium	50 - 130

source: LTS Luminaire Information

Table Ene-3.1: Typical lamp efficiencies

In addition to brightness, factors such as, but not limited to, vertical illuminance, luminance contrasts, lamp obscuration and light distribution (direct vs. indirect) will affect the visual comfort of building occupants. For example, a lower level of illumination may be comfortable if the walls are well lit. Designers should take all these factors into account when generating the best design for the space.

REFERENCES & FURTHER INFORMATION

SANS 10400 *Application of the National Building Regulations – Part O – Lighting & Ventilation*

SANS 10114-1:2005 *Interior Lighting – Part1: Artificial Lighting of Interiors*

SANS 10142-1:2003. *Code of Practice: The Wiring of Premises*

SANS 204:2008 *Energy Efficiency in Buildings*

Occupational Health & Safety Act (OHS) 1993

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Ene 3 Lighting Power Density

POINTS
AVAILABLE**4**

Technical Clarification: Integrated fitout

Technical Clarification Number: ENE3-T-OB1-0095

Guidance: 2010-08-17

If a project, or part thereof, is delivered as an integrated fitout, it must still be demonstrated that 95% of the Usable Area (UA) meets the credit criteria for the number of points pursued. Meeting rooms, boardrooms and other enclosed spaces which are part of the UA must be included within the area used to demonstrate compliance with the credit criteria. For different spaces with different lighting systems/layouts and therefore different lighting power densities, an area-weighted averaging method, as detailed in the Green Star SA – Office v1 Technical Manual section for this credit, must be used to determine the overall UA compliance with the credit criteria. It is not permissible to exclude areas of the UA on the basis of an integrated fitout.

The following errata have been incorporated:

ENE3-E-OB1-0440 Green Star SA - Office v1 Technical Manual: Page 149 & 150 (2012-03-14)

ENE3-E-OB1-0247 Green Star SA - Office v1 Technical Manual: Page 149 (2011-08-08)

ENE-4 Lighting Zoning

POINTS
AVAILABLE

2

AIM OF CREDIT

To encourage and recognise lighting design practices that offer greater flexibility for light switching, making it easier to light only occupied areas.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where it is demonstrated that:

- All individual or enclosed spaces are individually switched; AND
- The size of individually switched lighting zones does not exceed 100m² for 95% of the UA; AND
- Switching is clearly labelled and easily accessible by building occupants.

An additional point is awarded where:

- The point above is achieved; AND
- It is demonstrated that an individually addressable lighting system is provided for 90% of the UA.

DOCUMENTATION REQUIREMENTS

In order to be deemed 'easily accessible', switching (wired for each zone of 100m² or any part thereof) must be located as follows:

- Within the 100m² zone AND at every entry (two or three-way switches may need to be provided) to the floor or tenancy (if known), whichever is smaller;

OR

- At the entry point to the tenancy or floor (whichever is smaller) if the area controlled by the switching does not exceed 500m².

To be considered 'individually addressable', the lighting fixtures must be able to be readdressed/regrouped without rewiring.

If any component of the project is delivered as shell and core or integrated fit-out, please refer to the Additional Guidance section for applicable submission requirements.

ENE-4 Lighting ZoningPOINTS
AVAILABLE**2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Short report	Short report
Tender floor plan drawings	As built floor plan drawings
Tender schematic electrical drawings	As built electrical drawings
Extract(s) from the specification(s)	Confirmation(s) from the contractor
	Extract(s) from the Commissioning Report

Short report prepared by a suitable professional that describes how the Credit Criteria have been met and providing a summary table that lists all separately switched zones and their area, demonstrating that compliant areas jointly account for the stipulated proportion of the UA.

Tender floor plan drawings clearly indicating the location of the switches, each individually switched lighting zone and its area.

Tender schematic electrical drawings clearly indicating the locations of, and the area controlled by, each switch.

Extract(s) from the specification(s) where the requirements for switching and zoning are stipulated.

As built floor plan drawings clearly indicating the location of the switches, each individually switched lighting zone and its area.

As built electrical drawings clearly indicating the locations of, and the area controlled by, each switch.

Confirmation from the contractor that the system has been installed and wired as designed.

Extract(s) from the Commissioning Report demonstrating (through supporting evidence) that the lighting system has been commissioned and operates as intended by the design.

ADDITIONAL GUIDANCE

As this credit rewards the base building owner/developer for facilitating lighting control, switching and sensors must be provided by the building owner to demonstrate compliance with the Credit Criteria. It is understood that in the case of a shell-and-core delivery, this installation would be deferred until the tenants are secured.

Controlling alternate rows by separate switches in a lighting zone that exceeds 100m² does not meet the intent of the credit to minimise energy consumption necessary for performing a task in a specific area, as it is likely that both switches will be on simultaneously to provide the desired lighting level.

Motion occupancy sensors (presence/absence detection)

Motion occupancy sensors are treated the same way as manual switching, thus zones controlled by occupancy sensors that do not exceed 100m² may contribute to the compliant Useable Area provided that the occupancy sensor is located within the 100m² zone that it controls.

ENE-4 Lighting Zoning

POINTS
AVAILABLE

2

Daylight sensors

Daylight sensing linked to automatic dimming of lighting is to be encouraged, but these controls cannot be treated as manual switches when claiming this credit. Daylight sensing and presence/absence detection can be incorporated in the energy modelling which will result in reduced cooling load on the HVAC systems and hence energy savings in the Ene-1 credit.

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

BACKGROUND

For tenancies, lighting expenditures can represent two-thirds of total energy costs. Decreasing the size of lighting zones allows for greater control over lighting, giving tenants the ability to reduce energy consumption and costs by only lighting those areas or zones that are occupied.

REFERENCES & FURTHER INFORMATION

Refer to Ene-3.

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Typical lighting layouts

Credit Interpretation Request Number: ENE4-C-OB1-0519

Ruling: 2014-01-31

The representation of all separately switched lighting zones and their area within the Short Report through marked up typical layouts is acceptable in place of a summary table. Note that all typical layouts must be presented in the short report. The provision of a summary table listing only typical lighting layouts would also be acceptable in this regard.

Note that while it is acceptable to only mark-up typical lighting layouts / floor plans as opposed to all lighting zones in the building, actual floor plan drawings of all typical lighting layouts / floors must be included in the documentation.

ENE-4 Lighting Zoning

POINTS
AVAILABLE**2**

While it is acceptable to mark up the location of switches, each individually switched zone and its area within the Short Report, the mark-ups are to be shown on the actual Tender floor plan drawings, clearly referencing the drawing revision and legend applicable to lighting control symbols.

Technical Clarification: Override switches - guidance
(REPLACES ENE4-T-OB1-0268 issued 30 Aug 2011)

Technical Clarification Number : ENE4-T-OB1-0381

Guidance 2012-01-12

Duplicate override switches: projects are required to provide a switch for every 100m² zone within every 100m² zone, and may choose to provide one or more additional overall override switches for all 100m² zones at the entrance to that floor/building. The project does not need to duplicate all the override switches at the entrance to the floor/building that are already provided within each 100m² zone. A project is only required to provide additional override switches per entrance of a 100m² zone where a partitioned 100m² zone has more than one entrance – in this case every entrance to that 100m² requires an override switch for that 100m² zone.

Technical Clarification: Internal walls in Office areas

Technical Clarification Number: ENE4-T-OB1-0276

Guidance: 2011-06-01

Where internal walls within Office areas are provided as part of the 'base building provision' (i.e. will not change based on tenant requirements), project teams may include these within the Green Star SA submission, but should ensure they are included consistently across the submission. (E.g. these walls may need to be taken account of in the ENE-4 credit.)

Technical Clarification: Documentation for addressable systems

Technical Clarification Number: ENE4-T-OB1-0033

Guidance: 2009-04-20

Where projects have installed an addressable lighting control system, the following must be shown in the documentation provided:

- Provide a Short Report prepared by a suitable professional that describes how the credit criteria for both points have been met and how the addressable lighting control system operates.
- Provide tender drawings (Design) or as built drawings (As Built) with all switches highlighted and identified and include an electrical services legend that identifies the various symbols on the drawings relate to the system. (Soft switch is an addressable switching mechanism such as a light level detector, motion detector or light switch which is connected to an addressable lighting control system). Ensure that the drawings provided represent each typical floor/lighting layout (i.e. the drawing must be a typical lighting layout); where lighting layouts are different on each floor, then drawings for each floor must be provided

ENE-4 Lighting Zoning

POINTS
AVAILABLE**2**

- Provide a statement from the electrical or lighting designers (Design) or contractor (As Built) stating that no zone exceeds 100m².
- For As Built only: Extracts from the Commissioning Report demonstrating (through supporting evidence) that the lighting system has been commissioned and operates as intended by the design
-

The following erratum has been incorporated:

ENE4-E-OB1-0489 (2012-05-23): Occupancy sensors

TRA-1 Provision of Car Parking

POINTS
AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise developments that facilitate the use of alternative modes of transportation for commuting to work.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where the number of car parking spaces is:

- At least 25% lower than the maximum local planning allowances applicable to the project;
OR
- Not exceeding the minimum DOT guidelines by more than 10% or not exceeding the local planning minimum allowances by more than 10%, whichever is lower.

Two points are awarded where the number of car parking spaces is:

- At least 50% lower than the maximum local planning allowances applicable to the project;
OR
- Not exceeding the minimum DOT guidelines or not exceeding the local planning minimum allowances, whichever is lower.

Where car parking is not permitted in the local planning scheme, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Transport Category Score.

DOCUMENTATION REQUIREMENTS

This credit is applicable regardless of the location of the project or the presence of local planning allowances, as neither of those factors lessens the environmental impact of automotive commuting.

Only mandatory local, provincial or national planning allowances can be used. Whenever such allowances do not exist at all, or are optional, please refer to the Additional Guidance section.

TRA-1 Provision of Car Parking

POINTS
AVAILABLE **2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the local, provincial or national authority planning allowances • Tender drawings Where the credit is claimed as 'Not Applicable': • Extract(s) from the local, provincial or national authority planning allowances - OR • Development Approval certificate	• Short report • Extract(s) from the local, provincial or national authority planning allowances • As built drawings Where the credit is claimed as 'Not Applicable': • Extract(s) from the local, provincial or national authority planning allowances - OR • Development Approval certificate

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by stating how the development satisfies the Credit Criteria, including a comparison between the total number of car parking spaces provided by the project against the total maximum or minimum number of car parking spaces allowed.

Extract(s) from the local, provincial or national authority planning allowances where:

- The car parking allowances for the site or region are nominated;
- It is indicated where the allowances are mandatory or otherwise; and
- The date and issuing authority are identified.

Tender drawings of all car parking provisions for the site showing the number of car parking spaces in the project.

As built drawings of all car parking provisions for the site showing the number of car parking spaces in the project.

Development Approval certificate from the relevant authorities stating that no car parking is permitted in the project.

ADDITIONAL GUIDANCE

Car parking spaces dedicated for use by disabled users can be excluded from the total number of car parking spaces provided by the project. All other car parking that forms part of the development must be included.

Alternative requirements

Whenever mandatory car parking requirements exist, either within the planning allowances or Development Approval requirements for the project, they must be used. A number of South African municipalities do not have their own parking requirements, and defer to DOT

TRA-1 Provision of Car Parking

POINTS
AVAILABLE **2**

standards. Most that do have standards specify a minimum number of spaces; but the City of Johannesburg, for example, recently prepared a set of parking maximums. However, when the mandatory requirements do not exist at all or are optional (or recommended), the project has the following two options:

- Clearly demonstrate that car parking is not provided in excess of one car parking space per 100m² of UA to achieve one point or one parking space per 200m² to achieve two points
- OR
- Submit a Credit Interpretation Request (CIR) to substantiate an argument for equivalent yet alternative compliance with the Credit Criteria.

External car parks

If any part of the car parking provisions for the building occupants are met through external means (e.g. car park spaces are leased in another building), then it is necessary to:

- Include them in the number of parking spaces provided for the project; and
- Ensure that energy modelling addresses the external car parks in accordance with the relevant methodology (refer to Ene-1 'Greenhouse Gas Emissions').

Note that if parking for the office occupants is not provided external to the subject site, external spaces do not need to be included for the credit.

BACKGROUND

The proportion of a country's greenhouse gas emissions that can be attributed to transport activity varies from country to country. According to the Australian State of the Environment Report 2006, the transport sector is the third largest contributor to Australia's greenhouse gas emissions. This accounts for 79.7 million tonnes of Australia's total net greenhouse gas emissions, and represents 13.5% of Australia's total emissions. 90% of these transport emissions come from road transport, including cars, trucks and buses.

Greenhouse gas emissions from the entire transport sector rose by 11% between 1990 and 2003, with the road transport proportion of the sector increasing by 29 per cent during this period. The Bureau of Transport Economics (Australia) predicts that without suitable reduction measures, emissions from the transport sector will rise by 38 per cent between 1990 and 2010.

Atmospheric emissions are derived from a wide variety of anthropogenic and natural sources, and have effects on both human health and the environment. Fossil fuel combustion, particularly by motor vehicles, has been identified as the single largest contributor to the air pollutants as detailed in the table below.

Carbon Monoxide (CO)	Hydrocarbons (HC)	Oxides of Nitrogen (NOx)	Particulates (PM)
70-95%	40-50%	70-80%	10-50%

Table Tra-1.1: Contribution (%) of Motor Vehicles to Air Emissions in Major Australian Cities (source: Coffey Partners 1996)

The NSW EPA State of the Environment Report (2000) states that motor vehicles contribute over half of the volatile organic compounds (VOCs) in Sydney's air and are by far the biggest

TRA-1 Provision of Car Parking

POINTS
AVAILABLE **2**

contributors of carbon monoxide.

Reducing the number of car parking spaces will not only encourage building occupants to use mass transport but also to car-share, walk or cycle to work.

REFERENCES AND FURTHER INFORMATION

Western Cape Sustainable Energy Policy

<http://www.wcapeenergy.net>

National Greenhouse Gas Emissions Profile

<http://soer.deat.gov.za/themes.aspx?m=172>

City of Johannesburg Transportation Dept Parking Policy, October 2007

Australian Greenhouse Office, Sustainable Transport

<http://www.greenhouse.gov.au/transport>

Department of Transport and Regional Services (DOTARS), Motor Vehicles and the Environment

http://www.dotars.gov.au/departments/statements/2005_2006/paes/part_c.aspx,

Nature Conservation Council, Smogbusters

<http://www.nccnsw.org.au>

Travel Smart Schemes:

Queensland - <http://www.transport.qld.gov.au/travelsmart>

South Australia - <http://www.transport.sa.gov.au/environment/travelsmartsa>

Victoria - <http://www.travelsmart.vic.gov.au>

Western Australia - <http://www.dpi.wa.gov.au/travelsmart>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Tandem Parking Bays

Technical Clarification Number: TRA1-T-OB1-0678

Guidance: 2013-05-28

Considering the aim of the credit and related credits, Green Star SA considers a tandem parking bay as 2 car parking bays.

TRA-1 Provision of Car Parking

POINTS
AVAILABLE **2**

Technical Clarification: Non-Office areas

Technical Clarification Number: TRA1-T-OB1-0049

Guidance: 2009-10-16

A portion of a building that is not office usage may be excluded from the calculations for car parking spaces provided it can be demonstrated in the submission that office occupants can not park in the parking area(s) dedicated to the other usage(s).

The following errata have been incorporated:

TRA1-E-OB1-0198 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 165 – 168

TRA1-E-OB1-0199 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 165

TRA1-E-OB1-0200 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 167

TRA-2 Fuel Efficient Transport

POINTS
AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise developments that facilitate the use of more fuel efficient vehicles for work commuting.

CREDIT CRITERIA

Two points are awarded where:

- A minimum of 5% of all parking spaces are dedicated solely for use by car-pool vehicles, car share vehicles, hybrid or other alternative fuel vehicles. All qualifying spaces must be located in preferred parking locations and be designed and labelled for the intended vehicle types; and
- A minimum of 5% or 5 parking spaces (whichever is the greater) are designed and labelled for mopeds, scooters and/or motorbikes, and all of these must be located in preferred parking locations.

If no parking spaces are to be provided, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Transport Category Score.

DOCUMENTATION REQUIREMENTS

This credit is applicable regardless of location or presence of local planning allowances, as neither of those factors lessens the environmental impact of automotive commuting.

For the purpose of this credit, car parking spaces dedicated for use by disabled users can be excluded from the total number of car parking spaces.

TRA-2 Fuel Efficient TransportPOINTS
AVAILABLE**2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where car parking is provided: • Short report • Tender drawings Where car pool vehicle parking spaces are used to meet the credit criteria, the following additional evidence is required: • Green travel plan documentation Where car share vehicle parking spaces are used to meet the credit criteria, the following additional evidence is required: • Car share contractual agreement If the credit is claimed as 'Not Applicable': • Tender drawings - OR • Extract(s) from the local authority planning allowances - OR • Development Approval • Confirmation from the building owner	Where car parking is provided: • Short report • As built drawings Where car pool vehicle parking spaces are used to meet the credit criteria, the following additional evidence is required: • Green travel plan documentation Where car share vehicle parking spaces are used to meet the credit criteria, the following additional evidence is required: • Car share contractual agreement If the credit is claimed as 'Not Applicable': • As built drawings - OR • Extract(s) from the local authority planning allowances - OR • Development Approval • Confirmation from the building owner

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Indicating the number of car-pool, car-share, motorbike, hybrid (or other alternative fuel) vehicles, and total number of parking spaces being provided, and referencing the site plans when necessary; and
- Where alternative compliance is claimed, providing calculations that relate the number of parking spaces provided to the project UA.

Tender drawings indicating the total number (or lack thereof, if the credit is claimed as 'Not Applicable') of designated parking spaces for mopeds/scooters/motorbikes, car-share vehicles, car pooling participants, and hybrid and other alternative fuel vehicles.

As built drawings indicating the total number (or lack thereof, if the credit is claimed as 'Not Applicable') of designated parking spaces for mopeds/scooters/motorbikes, car-share vehicles, car pooling participants, and hybrid and other alternative fuel vehicles.

Green travel plan documentation that includes provision for a driver and passenger matching programme (car pooling) and allocation of responsibility for implementation of such a programme to a specific staff position.

Car-share contractual agreement between building owner or tenant and an independent car-

TRA-2 Fuel Efficient Transport

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AVAILABLE

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share company, including specification of the number of car-share vehicles to be accommodated on the site. Other car-share arrangements involving tenants and/or owners may be considered.

Extract(s) from the local authority planning allowances indicating that no car parking is permitted in the project.

Development Approval from the relevant authorities stating that no car parking is permitted in the project.

Confirmation from the building owner stating that no car parking spaces are provided in the project.

ADDITIONAL GUIDANCE

Preferred parking spaces

Preferred parking spaces are defined as those located closest to the facility entrance or lift core. These spots must be clearly signposted and marked with a separate colour from other spots. They must not be double or tandem spaces.

Car pooling

In South Africa, there is no existing process for car pool participants to be registered as part of a car pooling programme, for which documentary evidence or preparatory registration must be submitted. The requirement for this credit is to demonstrate commitment to a green travel plan that is supported by an employee of the building owner (or tenant) or the body corporate in the case of a multi-building development with independent owners.

Car sharing

The concept of car sharing is that individuals can hire cars from a pool that is distributed throughout a city, on an hourly basis rather than daily, making them a more cost-effective and efficient form of transport than owning a vehicle or renting on a daily basis. (ZipCar is a North American example, and there are others in Europe.) This credit allows for the possibility that building owners or tenants may set up formal car-sharing arrangements for the use of the building tenants and potentially for other office workers in the vicinity. To claim credit for such an arrangement, it must be shown that parking space(s) is provided.

BACKGROUND

According to the Australian State of the Environment Report 2006, passenger vehicles account for 45% of all road transport emissions, and these emissions increased progressively between 1990 and 2003. According to the Australian Bureau of Statistics, in 1998 each registered motor vehicle averaged 14,900 kilometers and consumed an average 13.8 litres of fuel per 100 kilometers during the year. The Australia Greenhouse Office (AGO) Greenhouse Gas Emissions Calculator states that every litre of petrol used release about 2.4 kilograms of carbon dioxide through tailpipe emissions into the atmosphere.

Choosing a two-wheeled vehicle or an alternative-fuel vehicle can help to reduce air pollution, as well as minimise greenhouse gas emissions, thereby helping to combat the overall effects of climate change.

TRA-2 Fuel Efficient TransportPOINTS
AVAILABLE**2****REFERENCES AND FURTHER INFORMATION**

Pedestrian and Bicycle Facility Guidelines, Engineering Manual to Plan and Design Safe Pedestrian and Bicycle Facilities, NDOT, June 2002

Australian Bureau of Statistics
www.abs.gov.au

Australian Greenhouse Office, *Fuel Consumption Guide*
www.greenhouse.gov.au/fuelguide

Greenhouse Gas Emissions Calculator
www.greenhouse.gov.au/fuelguide/environment.html

Department of Transport and Regional Services (DOTARS), *Motor Vehicles and the Environment*
www.dotars.gov.au/departments/statements/2005_2006/paes/part_c.aspx

Standards Australia, AS2890.1-1993 *Parking Facilities – Off-street Car Parking*
www.standards.org.au

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Tandem Parking Bays

Credit Interpretation Request Number: TRA2-T-OB1-0678

Ruling: 2013-05-28

Considering the aim of the credit and related credits, Green Star SA considers a tandem parking bay as 2 car parking bays.

Technical Clarification: Preferred Parking Space Markings

Technical Clarification Number: TRA2-T-OB1-0644

Guidance: 2013-02-12

With reference to the statement on page 171 that states that preferred parking spaces "...must be clearly signposted and marked with a separate colour from other spots...", note that the requirement for colour markings apply only if the spots are signposted so that it is clear which parking spaces the signposting applies to. If preferred parking bay markings are provided in the actual parking bays, then these markings need not be in a separate colour to other spots as it is clear which parking spots are marked as preferred.

TRA-2 Fuel Efficient Transport

POINTS
AVAILABLE**2**

Technical Clarification: Calculations

Technical Clarification Number: TRA2-T-OB1-0021

Guidance: 2009-02-06

The number of moped/scooter/motorbike spaces must be at least 5 motorbike spaces or 5% of the total number of vehicle spaces on the site (whichever is greater). The size of size 'parking space' is equal to the size of a motor bike parking space. For example, a site with 190 car parking spaces and 10 small motorbike spaces would qualify.

The following errata have been incorporated:

TRA2-E-OB1-0324 (2012-01-16): Green Star SA - Office v1 Technical Manual: Page 170

TRA2-E-OB1-0201 (2011-01-06) : Green Star SA - Office v1 Technical Manual: Page 170

TRA-3 Cyclist FacilitiesPOINTS
AVAILABLE**3****AIM OF CREDIT**

To encourage and recognise developments that facilitate the use of bicycles by occupants and visitors.

CREDIT CRITERIA

Provided it can be demonstrated that safe, convenient cycling routes are provided between the office development and the adjacent street network, up to three points are awarded as follows:

- One point is awarded where the following are provided:
 - Secure bicycle storage for 3% of building staff (based on one person per 15m² of UA);
 - Accessible showers (based on one per 10 bicycle spaces provided or part thereof);
 - Changing facilities adjacent to showers; and
 - One secure locker per bicycle space in the changing facilities.
- Two points are awarded where the following are provided:
 - Secure bicycle storage for 6% of building staff (based on one person per 15m² of UA);
 - Accessible showers (based on one per 10 bicycle spaces provided or part thereof);
 - Changing facilities adjacent to showers; and
 - One secure locker per bicycle space in the changing facilities.
- An additional point is awarded where:
 - The requirements for either one or two points have been met; and
 - Visitor bicycle parking is provided and meets the following criteria:
 - One space per 750m² UA or part thereof; and
 - Provided in an accessible location, signposted and close to, or adjacent to, a major public entrance to the building.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specifications • Tender drawings	• Short report • As built drawings • Confirmation from the contractor

TRA-3 Cyclist FacilitiesPOINTS
AVAILABLE**3**

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Describing the location and provision of the cyclist facilities and referencing the cyclist facilities drawings;
- Demonstrating that the spaces are weather protected and have good natural surveillance (or are in a secured area);
- Stating what proportion of UA is assigned, and how access is provided, to each bicycle space, shower and locker facilities; and
- Where the additional point is being claimed:
 - Describing the number and location of visitor cyclist facilities;
 - Showing that the spaces provided are signposted in an accessible location near a major public entrance; and
 - Demonstrating that the visitor spaces are provided with good natural surveillance.

Tender drawing(s) of the cyclist facilities showing:

- The number and location of bicycle racks/rails/storage facilities;
- The number and location of shower and locker facilities;
- The route(s) provided for cyclists across the development site, including surface treatment, surface markings, and traffic signage for both motorists and cyclists indicating traffic control for both; and
- Where the additional point is being claimed, the number and location of visitor bicycle parking.

As built drawing(s) of the cyclist facilities showing:

- The number and location of bicycle racks/rails/storage facilities;
- The number and location of shower and locker facilities;
- The route(s) provided for cyclists across the development site, including surface treatment, surface markings, and traffic signage for both motorists and cyclists indicating traffic control for both; and
- Where the additional point is being claimed, the number and location of visitor bicycle parking.

Extract(s) from the specification(s) stipulating:

- The number of showers, lockers and storage/parking spaces provided;
- That storage/parking spaces must comply with SABS, municipal or other relevant design standards and with Documentation Requirements for this credit; and
- The criteria that the showers, lockers and changing facilities must meet.

Confirmation from the contractor of

- The location, type and number of the secure bicycle storage spaces installed; and
- Where the additional point is being claimed, confirmation of the location, type and number of the visitor bicycle parking units installed.

TRA-3 Cyclist Facilities

POINTS
AVAILABLE

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ADDITIONAL GUIDANCE

For the purpose of the Transport Credits, a major public entrance is defined as a public entrance to the building that is accessible from a public plaza, main street or avenue (e.g. not the entrance from a side street unless the side street entrance is the only public entrance to the building). Furthermore, the entrance to a multi-storey carpark will also be considered to be a major public entrance if the visitor's cyclist facilities are clearly signposted at the entry to the carpark and the designated parking is no more than one split level away (in either direction).

Bicycle storage

Secure bicycle storage for staff is to be protected from the elements and provided in close proximity to the entrance to the car park or office area, in a location that is highly visible, well lit, well signposted and with good passive surveillance.

Secure tenant 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 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 to lock bikes in this case are not required.

Visitor bicycle parking

Visitor racks must be located near a major public entrance (they are not intended for sole or primary use by couriers) if the additional point is claimed. Railings, lampposts and other non-purposeful bike parking facilities do not comply. Visitor spaces must be signposted and provided with good natural surveillance.

Showers and changing facilities

Showers and changing facilities must be protected from the elements and available for both male and female users. These facilities can be available for non-cycling users of the building.

The total required number of showers and lockers does not have to be provided in one area. However, all cyclist facilities must be accessible to all staff, i.e. they cannot be located within tenancies or require access through a tenancy.

Secure lockers must be adequately sized to accommodate normal office clothing, i.e. should not be significantly smaller than 180cm tall by 25cm wide (for box lockers) or 180cm tall by 40cm wide (for 'L-shaped' double lockers).

Toilets do not count as changing facilities unless there is sufficient private space and lockers. Even if toilets are fitted out as changing rooms, the minimum number of disabled toilets mandated by statutory requirements cannot contribute to the total number of changing facilities provided, as doing so may detract from their availability for use by disabled persons. Disabled showers do 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.

TRA-3 Cyclist Facilities

POINTS
AVAILABLE

3

Access routes

The requirement for safe and convenient cycling routes across the development property, between the building and an adjacent street, is intended to ensure that cyclists have access to the building that is at least as convenient as vehicular access. This includes clear markings of cyclist routes/paths from the development entrance/exit to the bicycle storage areas. This does not necessarily require a dedicated right-of-way for cyclists, but it does require deliberate designing of the route (whether on-street or off-street) to ensure safe passage across the property boundary, and through parking areas (if applicable).

External cyclist facilities

Although Green Star SA assesses inherent attributes of buildings, external amenities are critical to the success of attempts to encourage alternative forms of mobility. Consequently, while the developer does not have direct control over amenities beyond the assessed property, the absence of certain amenities would reduce the effectiveness of on-site amenities. It would therefore be beneficial to encourage the local municipality to implement cycle network plans.

It is noted that there are sometimes opportunities to influence the development of facilities off-site, and this is to be encouraged, for the reason just mentioned. For example, a multi-owner development that has a strong body corporate provides an opportunity to coordinate cycling links. Even in the case of individual owner developments such as a high-rise office in a CBD, approval authorities sometimes require off-site transportation improvements to mitigate impacts. If these impacts are extended to consider cyclists, then it might not be unreasonable for provision of off-site cyclist facilities to be negotiated between the developer and the approving agency to complete cycling routes.

Where external amenities are planned or implemented, it would be beneficial to provide connections from the on-site cycle route to the nearest off-site designated route.

BACKGROUND

The practice of cycling to work benefits the environment by reducing levels of potential pollutants from other means of transport, provides substantial health and economic benefits to the cyclist, and helps reduce road congestion.

According to the Australian Bureau of Transport and Regional Economics' *Greenhouse Policy Options for Transport* report (2002) an estimated one-third of day-to-day car trips are 3km or less in length, which usually represents an easy cycling distance. The average length of each bicycle trip is 2.5km.

A cold car motor produces more pollutants than a hot one, especially when equipped with a catalytic converter. It can take 5km or more before pollution control devices such as catalytic converters start to become effective.

Short trips in cars are therefore seen as relatively more environmentally damaging whilst being the length of journey most attractive for walking and bicycling. Bicycling and walking are promoted as efficient, low-cost and low-impact modes of travel that can be particularly effective in maximising the effective use of local roads and mass transport services.

Statistics South Africa (2001) reports that approximately 60% of all trips are made by non-motorised transport, but less than 1% of all trips are made by bicycle. A number of South African cities are developing, or have developed, NMT plans with cycle networks, and are adopting support programs to encourage increased use of non-motorised transport.

Over time, and with the development of supporting facilities at offices and other buildings, these initiatives should make it easier to cycle. Research in Australia and elsewhere has

TRA-3 Cyclist FacilitiesPOINTS
AVAILABLE **3**

consistently found that people are more willing to cycle when the appropriate facilities are provided at the destination.

REFERENCES AND FURTHER INFORMATION

Australian Bicycle Council, 1999-2004 Australia Cycling: The National Strategy
www.austroads.com.au/abc/

Bicycle Federation of Australia
www.bfa.asn.au/

Bureau of Transport and Regional Economics (2002), Greenhouse Policy Options for Transport
www.btre.gov.au

VicRoads, Bicycle Parking: Providing Bicycle Parking Facilities brochure
www.vicroads.vic.gov.au

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Alternative locker sizes

Technical Clarification Number: TRA3-T-OB1-769

Guidance: 2014-02-27

The project team's proposal for making use of cyclist lockers with alternative dimensions (640mm h x 435mm w x 285mm d) is approved given that the lockers in question are of adequate size to accommodate typical work clothing on a hanger.

Credit Interpretation Request: Bicycle Visitor Bays

Credit Interpretation Request Number: TRA3-T-OB1-767

Ruling: 2014-02-17

The GBCSA does note that although the lower ground level entrance may not be considered to be a major entrance to the building as per the GSSA Office v1 Technical Manual documentation requirements, the information provided by the project team indicates that this entrance will be used by building occupants parking on lower ground level and visitors that will arrive on bicycles have a choice of using either this entrance or the main building entrance which is located approximately 50 meters away from the visitors' bicycles parking.

TRA-3 Cyclist Facilities

POINTS
AVAILABLE**3**

Technical Clarification: Non-Office areas

Technical Clarification Number: TRA3-T-OB1-0050

Guidance: 2009-10-16

A portion of a building that is not Office usage may be excluded from the calculations for cyclist facilities if it can be demonstrated in the submission that these cyclist facilities are only accessible to the office occupants. If the cyclist facilities are accessible to everyone, the facilities must be sized for all users, and projects must justify the amount provided to meet the needs of the non-Office components.

The following errata have been incorporated into the document:

TRA3-E-OB1-0456: Cycle paths/markings within Project Site

TRA3-E-OB1-0339: Green Star SA - Office v1 Technical Manual: Page 174 – 176

(REPLACES errata TRA3-T-OB1-0202)

TRA-4 Commuting Mass Transport

POINTS
AVAILABLE**5**

AIM OF CREDIT

To encourage and recognise developments that facilitate the use of mass transport for work commuting.

CREDIT CRITERIA

Up to five points are awarded for the quality of mass transport options available to building occupants. The points are determined using the Green Star SA Mass Transport Calculator based on:

- The type of mass transport services available within 1,000m of the site;
- The number of routes served; and
- The average interval between services during weekday peak hours.

DOCUMENTATION REQUIREMENTS

It must be demonstrated that:

- All the inputs into the Mass Transport Calculator have been justified clearly and in accordance with the Mass Transport Calculator Guide provided within the Additional Guidance section for this credit;
- The distance of stops from the public entrance to the building is clearly indicated on a legible scale plan; and
- The routes which serve that stop are clearly listed and supported by identifiable timetable information, where applicable.

Where minibus taxi services are included for credit, the following must also be provided:

- In the case of non-contract taxi services, proof of a survey of taxi services, showing the frequency of service on the routes to be included in the calculator;
- In the case of contract services (e.g. for taxis that are contracted to provide feeder services to bus or train routes), proof of such contract; and
- In the case of taxi services that are negotiated as part of the site development process, proof of an agreement.

TRA-4 Commuting Mass TransportPOINTS
AVAILABLE**5**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
- Completed Green Star SA Mass Transport Calculator - Short report - Site plan extending to surrounding areas - Extract(s) from timetables - Service frequency of minibus taxis, where applicable	- Completed Green Star SA Mass Transport Calculator - Short report - As built site plan extending to surrounding areas - Extract(s) from timetables - Service frequency of minibus taxis, where applicable

Completed Green Star SA Mass Transport Calculator

- A copy of the completed Mass Transport Calculator.

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Summarising the services using each transport stop showing the route of the bus service for each stop and/or tram or train line servicing the nearest station. The timetables used for the calculations must be included as an appendix (in the case of minibus taxi services not operating on a schedule, the surveyed service headway must be provided).

Site plan extending to surrounding areas:

The site plan must clearly justify the 'Distance to Site' inputs in the Calculator. It must be legible and to scale. The major public entrances to the building must be marked. The mass transport stops must be clearly indicated and labelled with the associated services.

As built site plan extending to surrounding areas:

The site plan must clearly justify the 'Distance to Site' inputs in the Calculator. It must be legible and to scale. The major public entrances to the building must be marked. The mass transport stops must be clearly indicated and labelled with the associated services.

Extract(s) from timetables for each route showing service frequency during peak periods. The timetable provided must not be more than one year old from the date of submission.

Service frequency of minibus taxis must be based on survey results of observed minibus taxi operations during peak periods, and included in the Mass Transport Calculator. In cases where a Current Public Transport Record (CPTR) has been completed in accordance with national requirements, and such record is based on data collected less than one year prior to the date of the Green Star SA submission, the CPTR data may be deemed to be satisfactory documentation of taxi routes and headways.

MASS TRANSPORT CALCULATOR GUIDE

Using the Transport Calculator involves three steps:

TRA-4 Commuting Mass Transport

POINTS
AVAILABLE**5**

- 1) Determine the number and type of public transport services stopping within 1,000m walking distance of the building;
- 2) Determine the frequency (average interval in minutes) of each service between 7.30am and 9.30am and between 4.30pm and 6.30pm on Monday to Friday from current timetables; and
- 3) Enter the number of services in each category in the tables above based on type, distance and frequency.

If the site is within 15 minutes of a public transport interchange via a public transport connecting service, with the connecting service having a frequency of no more than 30 minutes, then the services available from the interchange can be included in the calculator with the following modifications:

- The number of services going to the interchange for each type and frequency is to be halved;
- The distance to be entered for interchange services is equal to the distance from the site to the connecting service plus 250m; and
- Any connecting service from the interchange that terminates within 1,000m of the site only as half of one service (e.g. enter 0.5 instead of 1 for that service).

The instructions below will enable the project team to complete the Mass Transport Calculator. The Calculator determines the number of points achieved based on the following:

- Type of mass transport (bus/taxi/ferry or train);
- Walking distance from building to stop; and
- Frequency of service during peak commuting periods.

The following three diagrams illustrate how the Mass Transport Calculator determines the number of points achieved by the project. The calculations will be executed automatically once the number of available services is entered into the relevant cells.

Tables Tra-4.2 and Tra-4.3 provide the relative weighting of cells within the Calculator. These weightings will be automatically reflected in the number of points achieved.

Score for bus or taxi services

Walking distance from entrance to mass transport (m)		Contract services*		Uncontracted services*	
		Frequency of peak period service		Frequency of peak period service	
		≤ 15 min	≤ 30 min	≤ 15 min	≤ 30 min
0m-250m	6		4	3	1
250m-500m	5		3	2	0
500m-750m	4		2	1	0
750m-1,000m	3		1	0	0

Table Tra-4.2: Relative Cell Weightings for Bus/Midibus/Minibus Services within the Mass Transport Calculator

TRA-4 Commuting Mass TransportPOINTS
AVAILABLE**5****Score for train services**

Walking distance from entrance to mass transport (m)	≤ 15 min	≤ 30 min

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AVAILABLE**5**

0-250m	7	5
250-500m	6	4
500-750m	5	3
750m-1,000m	4	2

Table Tra-4.3: Relative Cell Weightings for Train Services within the Mass Transport Calculator

The Mass Transport Calculator multiplies the number of services entered for each of the above categories and adds all the scores together to give a single Mass Transport Calculator Score. For example, two train routes at a station 300m from the building with a peak frequency of less than 15 minutes would achieve $2 \times 6 =$ score of 12.

The number of points is then determined, based on the total score achieved, in accordance with the table below:

Total Mass Transport Calculator Score	Number of points for Tra-4
10	1
20	2
40	3
60	4
80	5

Table Tra-4.4: The Conversion of the total Mass Transport Calculator Score to Points Achieve

Number of services

The project team needs to determine the type of mass transport services available within 1,000m of the site. Available bus, midibus, minibus or train services can be counted. Airplane travel is not considered a form of mass transport.

The project team also needs to determine the number of mass transport services stopping at each stop within 1,000m walking distance of the building. If a transport route provides services in two directions for more than 2km, it is to be counted as two services. Please note that in some locations the services in each direction may not have the same frequencies. However, any route that terminates within 2km of the site is to be counted as half of one service; enter 0.5 instead of 1 into the Calculator.

Only the services which arrive at the stop can be used to calculate the average interval for the morning peak period; conversely only the services that depart from the site can be used to calculate the afternoon peak period. In addition, only one stop per route can contribute to calculations.

Even if a service stops at more than one stop within 1,000m from the site, it is to be counted once as the building occupants are most likely to catch this service closest to the site.

If a bus or taxi stop that is on the adjacent road is included in the calculator, there must be a road crossing opportunity for pedestrians within 50m of the site entrance. Should this requirement be in contravention of any requirements of the approving municipal authority, a crossing opportunity must be provided at the closest location that can be arranged with the approval of the municipal authority.

Any bus or taxi stops to be included in the calculator must be designed with a vehicle stopping area that allows for safe and convenient passenger waiting, boarding and

Tra-4 Commuting Mass Transport

POINTS
AVAILABLE**5**

alighting.

Distance to site

The distance to a mass transport stop is to be measured as actual pedestrian walking distance (not bird's eye view) from a major building entrance. It must be demonstrated that safe, well-lit, dedicated pedestrian facilities are provided between the office development and the adjacent street network. These should conform to SANS 10246.

Frequency of service

The project team needs to determine the average interval (in minutes) of each service during weekday peak hours from current timetables (in the case of contract services) and from surveys (in the case of uncontracted minibuss services).

The Calculator does not assess frequency of services outside of peak periods as there is generally a good correlation between peak and off-peak services, indicating the overall quality of the available mass transport. The morning peak period is 7.30am to 9.30am and the afternoon peak period is 4.30pm to 6.30pm.

The average interval of services during the peak periods for a route is calculated as shown in the example below:

Time	Time between services (minutes)	Time	Time between services (minutes)
7.25am		4.20pm	
7.45am	20	4.40pm	20
8.00am	15	4.55pm	15
8.15am	15	5.05pm	10
8.25am	10	5.15pm	10
8.35am	10	5.25pm	10
8.50am	15	5.35pm	10
9.05am	15	5.45pm	10
9.25am	20	6.00pm	15
9.40am	15	6.15pm	15
		6.30pm	15
Total	135mins	Total	130mins

Table Tra-4.5: Example of time between services

The average interval in a peak period EQUALS the SUM of Time Between Services DIVIDED BY the Effective Number of Services during peak period.

The Effective Number of Services is calculated by counting the number of Time Between Services in the tables above.

Number of morning peak services = 9

Number of afternoon peak services = 10

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POINTS
AVAILABLE**5**

Average morning peak frequency = $135 \div 9 = 15\text{mins}$

Average afternoon peak frequency = $130 \div 10 = 13\text{mins}$

The Average Service Frequency is $(15 + 13) \div 2 = 14\text{mins}$

Proximity to a public transport interchange

The services available to building occupants at an interchange that is further than 1,000m away from the site can be entered into the Calculator if the interchange is accessible by mass transport with service intervals of no greater than 30 minutes and stop(s) within 1,000m from the site. The services available at that interchange must be entered with the following modifications:

- The number of services available at the interchange is to be halved; and
- The distance to be entered for interchange services is equal to the distance from site to the connecting service plus 250m.

BACKGROUND

When a development is poorly located, in relation to the proximity of transport nodes and their frequency of service, then it is unlikely that building occupants will use mass transport to travel to work. Conversely, developments that are within close proximity of good transport nodes with frequent service can encourage building occupants to use mass transport.

Of all urban work trips made in South Africa by public, private and non-motorised transport in 1998, just under 40% are made on bus, minibus and train services. (StatsSA household surveys: <http://www.transport.gov.za/library/docs/stats/2001/statistics.html>) This is a significant share for public transport, but there has been a shift away from public to private transport, with a resultant increase in greenhouse gas emissions and air pollution. According to the 2001 Census, South Africa at that time had 129 vehicles per 1,000 people – higher than the world average of 120 – and more than 7 million vehicles were on South African roads. The number of vehicles was growing at a rate of 2% a year. (Dept. of Environmental Affairs and Tourism *State of the Environment Report* <http://soer.deat.gov.za/themes.aspx?m=361>)

Private transport trips are often undertaken over longer distances than public transport trips, with a corresponding increase in environmental impact. In Australia, where 64% of residents travel to work by car, motor vehicles account for approximately 93% of passenger kilometers. (Bureau of Transport and Regional Economics' *Greenhouse Policy Options for Transport Report* (2002), Australia)

REFERENCES AND FURTHER INFORMATION

Australian Greenhouse Office, Sustainable Transport,
www.greenhouse.gov.au/transport/index.html

Bureau of Transport and Regional Economics, (2002), *Greenhouse Policy Options for Transport*
www.greenhouse.gov.au/ago/annual-report/2001-02/performance_agenda.html

Ecotransit Sydney
www.ecotransit.org.au

Tra-4 Commuting Mass Transport

POINTS
AVAILABLE**5**

NSW Government – Ministry of Transport
www.transport.nsw.gov.au/abouttrans

Public Transport Users Association
www.ptua.org.au

Travelsmart
www.travelsmart.gov.au

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Alternative documentation for contract requirements

Credit Interpretation Request Number: TRA4-C-OB1-629

Ruling: 2013-01-13

The Credit Interpretation Request (CIR) seeking approval to submit alternative documentation in lieu of the contracts for the Tra-4 Commuting mass transport is conditionally approved.

The approval of this CIR is thus contingent on the project team submitting a sample contract and a signed letter of confirmation from the relevant contracting body (i.e. Relevant Precinct Property Owners' Association body representative) with a tabulated list of all the contracted services and routes. The letter should also state that signed contracts exist for all service providers included in the table and that the signed sample contract provided is an example of a standard contract that exists between the contracting body and each individual service provider listed. Additionally, extracts from each contract showing the signatures (i.e. page 14 of the sample contract) of both representatives must be submitted. Please note that the other documentation requirements stipulated in the Green Star SA – Office v1 Technical Manual must still be adhered to.

Credit Interpretation Request: Future Services for MyCiti bus services in Cape Town

Credit Interpretation Request Number: TRA4-T-OB1-0580

Ruling: 2012-10-01

Future MyCiti bus services may be included in calculations for Tra-4 Commuting Mass Transport. Where bus services are included for credit (as mainline, feeder or connecting services) but not operational at the time of the Green Star SA submission.

The most recent schedules, maps and other relevant information from the MyCiti website may be used and is acceptable evidence towards your Green Star SA submission.

Tra-4 Commuting Mass Transport

POINTS
AVAILABLE**5**

For future routes and information not available on the MyCiti website, a confirmation from the relevant transport authority of the planned service frequency, hours of operation and route applicable to the project site is required.

Do note that all other documentation requirements/TC's and CIR's remain unchanged.

Credit Interpretation Request: Interpolating stop-times from timetables

Credit Interpretation Request Number: TRA4-T-OB1-0313

Ruling: 2011-08-23

Where timetables available for a public transport route do not show stop-times for all stops along the route, interpolated times may be used. The following methodology should be used for interpolating the required stop-time:

Stop-time = [Time at start point (or nearest published stop-time before required stop)] + [Average Speed x distance travelled from start point (or nearest published stop-time before required stop)].

Where:

Average Speed = d/t

d = Distance travelled between start and finish of route (or time between closest published time before required stop and closest published time after required stop)

t = Time between start and finish times of route (or time between closest published time before required stop and closest published time after required stop).

Credit Interpretation Request: Bus schedule documentation

Credit Interpretation Request Number: TRA4-C-OB1-0044

Ruling: 2009-09-04

The Credit Interpretation Request (CIR) seeking approval of survey results in place of timetables for bus services is approved. For bus services, projects may submit either extract(s) from current timetables less than one year old from the date of Green Star SA submission (revision from Technical Manual, issued via Technical Manual Errata), survey results of observed bus operations during peak periods, or Current Public Transport Record (CPTR) data collected less than one year prior to the date of Green Star SA submission.

Credit Interpretation Request: Service interval calculation

Credit Interpretation Request Number: TRA4-C-OB1-0032

Tra-4 Commuting Mass Transport

POINTS
AVAILABLE**5****Ruling:** 2009-03-31

The Credit Interpretation Request (CIR) seeking approval for an alternative calculation methodology for Average Service Frequency is approved. Projects may either use the calculation methodology defined in the Green Star SA - Office v1 Technical Manual or use the following formula: Average Service Frequency = 120 minutes / (actual number of services in the peak 2 hour window).

Technical Clarification: Peak periods**Technical Clarification Number:** TRA4-T-OB1-0026**Guidance:** 2009-03-26

For peak travel hours to be used in determining the frequency of service, projects are permitted to select any two-hour window between 6:30 and 9:30 for the morning peak period and any two hour period between 15:30 and 18:30 for the afternoon peak period. The same two hour windows must be used for all transit modes.

Technical Clarification: Private buses**Technical Clarification Number:** TRA4-T-OB1-0022**Guidance:** 2009-02-06

Private bus transport systems with established routes and timetables equivalent to public transport may be included in the calculations for Tra-4 Commuting Mass Transport contingent upon the project's ability to demonstrate that the future operation of these services is as certain as public transport (i.e. demonstrates alternative but equivalent compliance in respect to longevity, publicity, etc.). Please enter the number and frequency of services into the Public Transport Calculator and provide the evidence stipulated in the Documentation Requirements.

Technical Clarification: Future services**Technical Clarification Number:** TRA4-T-OB1-0008**Guidance:** 2009-02-05

Future public transport services may be included in calculations for Tra-4 Commuting Mass Transport. Where train, bus, midibus or taxi services are included for credit (as mainline, feeder or connecting services) but not operational at the time of the Green Star SA submission, the following documentation must be provided:

- Proof of a contract signed by the relevant transport authority and the service provider, and the planned service frequency, hours of operation and route; and
- Proof of an undertaking to have the necessary transport stops constructed, whether on a public road or the development site.

Tra-4 Commuting Mass Transport

POINTS
AVAILABLE**5**

The following errata have been incorporated into the body of the credit:

TRA4-E-OB1-0203: Green Star SA - Office v1 Technical Manual: Page 180

TRA4-E-OB1-0406: Green Star SA - Office v1 Technical Manual: Page 181



Green Star SA

COMMUTING MASS TRANSPORT GUIDE

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1 Introduction

The Green Building Council of South Africa (GBCSA) has developed a Commuting Mass Transport Calculator (the Calculator), which is used in Green Star SA rating tools to determine how well a building is located in relation to public mass transport networks and to reward points accordingly. The Calculator determines the number of points earned out of the five available points for the Green Star SA credit Tra-4 'Commuting Mass Transport'. This Guide should be used in conjunction with the Calculator in the Green Star SA rating tools.

The Calculator allows projects to be compared using a common standard benchmark. The Calculator determines the number of points awarded based on the type of mass transport, the 'average interval between services during peak periods', and the proximity of the mass transport stops to the development.

2 Acknowledgements

The Commuting Mass Transport Calculator and Guide are based on the versions produced by the Green Building Council of Australia for the Australian Green Star rating tools. The Green Building Council of South Africa acknowledges technical consultant WSP for the work in adapting these documents for the South African Green Star SA rating tools.

3 Differences between Green Star SA rating tools

In each Green Star SA rating tool, there are slight differences in the Calculator because it is designed to assess the specific transport needs for different building types and market sectors. The following issues have been changed from the Green Star SA - Office v1 Calculator to reflect the specific conditions of the market sector:

- Green Star SA - Retail Centre v1: data for Saturdays need to be included

4 About the Calculator

The Calculator determines the number of Green Star SA points achieved based on scores representing the type and 'average interval between services during peak periods' of mass transport routes, as well as their proximity to the development. Points are awarded in proportion to the proximity of a development to mass transport stops and the frequency of the mass transport services.

5 How to Use the Calculator

The Calculator is embedded in the Green Star SA rating tools, which are located on the GBCSA website, www.gbcsa.org.za. The Calculator can be found on a tab in the rating tool spreadsheet after the Transport Category.

5.1 Step 1: Determine Mass Transport Stops

Identify the number and type of mass transport modes stopping within 0-250 metres, 250-500 metres, 500-750 metres and 750-1,000 metres of the development, measured as actual pedestrian walking distances, not 'as the crow flies'.

Documentation must be provided as per the relevant Technical Manual.

Mass Transport

- Mass transport includes publicly accessible buses, midibuses, minibuses and trains.
- Hired taxis and airplanes are not considered modes of mass transport.

- Future transport, private mass transport and public transport interchanges may be considered if they meet the criteria in section 6.

Mass Transport Route

- The route is considered the course followed by a mode of transport.
- A service is a mass transport vehicle travelling along a given route.
- Routes with an 'average frequency between services during peak periods' of more than 30 minutes cannot be inserted into the Calculator.
- Any route that terminates within 2 km of the development entrance is counted as half a route, therefore insert 0.5 instead of 1 in the Calculator.
- If a route goes from A to B via C, and another route goes from A to B via D, these are considered two different routes with distinct services.
- A route with services for two directions (e.g. northbound and southbound) is considered two separate routes (refer to Example 2).
- A route with services for two directions (e.g. northbound and southbound) where one direction only has services in the morning and the other direction only has services in the afternoon is considered one route (refer to Example 3).

Mass Transport Stops

- Mass transport stops are considered only if vehicle stopping areas allow for safe and convenient passenger waiting, boarding and alighting.
- Only one stop per route can contribute to the calculations. Even if services on a route stop at more than one stop within 1,000 m from the development entrance, only one stop is considered because building occupants are likely to use the nearest one.
- It must be demonstrated that safe, well-lit, dedicated pedestrian facilities are provided between the development and the adjacent street network. These must conform to *SANS 10246:2003 Edition 1 - Accessibility of buildings to disabled persons* which sets minimum design requirements for access to and circulation in buildings and related facilities to permit general use by disabled people.
- If a stop on an adjacent road is included in the calculations, there must be a road crossing opportunity for pedestrians within 50 m of the development entrance. If this is not in accordance to municipal authority requirements, a crossing opportunity must be planned with the approval of municipal authority at the closest location possible to the development entrance.

5.2 Step 2: Weekday Frequency of Services

Determine the peak travel hours for the frequency of services by selecting any two-hour window between 06h30 and 09h30 for the morning peak period and any two-hour period between 15h30 and 18h30 for the afternoon peak period. The same two-hour windows must be used for all transit modes for regular weekdays. Public holidays are excluded from this calculation.

Determine the average interval, in minutes, of services on each route during the peak hours from timetables, surveys or Current Public Transport Records (CPTR). Only one source may be used for each route.

The 'average service frequency' during the peak periods for a route can be calculated by either of the following two methodologies.

1. Time between services

The project team needs to determine the average interval (in minutes) of each service during weekday peak hours from current timetables, surveys or CPTR.

The average interval of services during the peak periods for a route is calculated as shown in the example below.

Example 1:

Route A: Northbound Morning Peak Service 07h30 - 09h30		Route A: Northbound Afternoon Peak Service 16h00 - 18h00	
Time	Time between services (minutes)	Time	Time between services (minutes)
7h25		16h20	
7h45	20	16h40	20
8h00	15	16h55	15
8h15	15	17h05	10
8h25	10	17h15	10
8h35	10	17h25	10
8h50	15	17h35	10
9h05	15	17h45	10
9h25	20	18h00	15
9h40	15	18h15	15
		18h30	15
Total	135mins	Total	130mins

Table Tra-4.4: Example of time between services

The average interval in a peak period EQUALS the SUM of Time Between Services DIVIDED BY the Effective Number of Services during peak period.

The Effective Number of Services is calculated by counting the number of "Time between services" in the tables above.

Number of morning peak services = 9

Number of afternoon peak services = 10

Average morning peak frequency = $135 \div 9 = 15\text{mins}$

Average afternoon peak frequency = $130 \div 10 = 13\text{mins}$

The Average Service Frequency is $(15 + 13) \div 2 = 14\text{mins}$

2. Number of services in two-hour period

Average Service Frequency = 120 minutes / actual number of services in the peak two-hour period

The average of the morning and afternoon frequencies is then calculated.

Calculations are required for each route servicing the stop. Only services which arrive at the stop can be used to calculate the average interval for the morning peak period; conversely only services that depart from the stop can be used to calculate the afternoon peak period.

Two examples (Examples 2 & 3) are provided.

Example 2:

53 m from the development entrance is a bus route with northbound and southbound services in the morning and afternoon, therefore the northbound is considered one route (A) and the southbound is considered one route (B).

Route A: Northbound Morning Peak Service 07h30 - 09h30		Route A: Northbound Afternoon Peak Service 16h00 – 18h00	
Time		Time	
07h00		15h30	
07h25		15h45	
07h45		16h00	
08h00		16h20	
08h15		16h50	
08h25		17h20	
08h35		17h20	
08h50		17h50	
09h05		18h20	
09h25		18h50	
09h40		-	
Total Services	8	Total Services	6

Route B: Southbound Morning Peak Service 07h30 - 09h30		Route B: Southbound Afternoon Peak Service 16h00 – 18h00	
Time		Time	
06h45		-	
07h15		15h45	
07h30		16h10	
07h45		16h15	
08h00		16h45	
08h15		17h00	
08h30		17h20	
08h15		17h15	
08h30		17h30	
08h45		17h40	
09h00		18h00	
09h15		18h15	
10h00		-	
Total Services	10	Total Services	9

The Average Service Frequency is calculated as follows:

Route A: Northbound

Average Service Frequency = 120 minutes / number of services during peak period

Number of morning peak services = 8

Number of afternoon peak services = 6

Average frequency morning peak = $120 \div 8 = 15$ minutes

Average frequency afternoon peak = $120 \div 6 = 20$ minutes

The Average Service Frequency is $(15 + 20) \div 2 = \mathbf{17.5 \text{ minutes}}$

Route B: Southbound

Average Service Frequency = 120 minutes / number of services during peak period

Number of morning peak services = 10

Number of afternoon peak services = 9

Average frequency morning peak = $120 \div 10 = 12$ minutes

Average frequency afternoon peak = $120 \div 9 = 13.3$ minutes

The Average Service Frequency is $(12 + 13.3) \div 2 = \mathbf{12.6 \text{ minutes}}$

Example 3:

622 m from the development entrance is a bus route with northbound services only in the morning and southbound services only in the afternoon. Therefore, together these services comprise only one route.

Route C: Northbound		Route C: Southbound	
Morning Peak Service 07h30 - 09h30		Afternoon Peak Service 16h00 – 18h00	
Time		Time	
3:30pm		6:45am	
3:45pm		7:15am	
4:00pm		7:30am	
4:20pm		7:45am	
4:50pm		8:00am	
5:20pm		8:15am	
5:20pm		8:30am	
5:50pm		8:15am	
6:20pm		8:30am	
6:50pm		9:00am	
-		9:30 am	
-		9:45am	
-		10:00am	
Total Services	6	Total Services	9

The Average Service Frequency can be calculated as follows:

Route C: Northbound & Southbound

Average Service Frequency = 120 minutes / number of services during peak period

Number of morning peak services = 6

Number of afternoon peak services = 9

Average frequency morning peak = $120 \div 6 = 20$ minutes

Average frequency afternoon peak = $120 \div 9 = 13.3$ minutes

The Average Service Frequency is $(20 + 13.3) \div 2 = \mathbf{16.6 \text{ minutes}}$

5.3 Step 3: Saturday Service Frequency (Green Star SA - Retail Centre Only)

The Mass Transport Calculator for retail centre developments includes Saturdays, and the same process is to be followed as in Step 2 above. Saturday peak period is defined as any two-hour window between 09h00 and 17h00. The same two-hour window must be used for all transit modes on Saturdays, and public holidays are excluded.

5.4 Step 4: Populate Transport Calculator

Enter the number of routes (NOT individual services or vehicles passing by) into the Mass Transport Calculator, based on distance and frequency.

The results from Examples 2 and 3 are included in the Mass Transport Calculator as follows:

WEEKDAY SERVICES				
No. of Bus, Midibus or Minibus Services				
	Contracted		Uncontracted	
Walking Distance from Building Entrance to Public Transport	Frequency of Service During Peak Periods		Frequency of Service During Peak Periods	
	15 min	30 min	15 min	30 min
0-250m	1	1		
250-500m				
500-750m		1		
750m-1km				

Route A

Route B

Route C

6 Additional Guidance

6.1 Supporting Evidence

For all mass transport modes the following documentation is considered valid for submission:

- **Timetables**
- **Surveys**
- **Current Public Transport Records (CPTRs)**

A timetable, survey or Current Public Transport Record (CPTR) may be used for each route. The services of any one route cannot be proved with more than one type of evidence.

Surveys need to be carried out by a qualified professional. Survey of observed mass transport routes (contracted and un-contracted) must identify the location of the stops and frequency of services during peak periods. Routes must also be identified for the different transport modes (e.g. route names, numbers). The CPTR data is satisfactory documentation to determine routes.

Where surveys are provided for contracted transport, confirmation is required from the transport operator that the routes are contracted by the local, provincial or national authority, or if the transport is part of a site development process, proof of an agreement is required.

The above documentation cannot be older than one year prior to the date of the first round of the Green Star SA submission.

6.2 Contracted/un-contracted operations

In general, contracted transport modes are considered transport routes operating under contract to the municipality, operating on a fixed route and schedule. In some cases in South Africa the contracted operations do not have timetables or the timetables are outdated (older than 1 year). The project can then decide to carry out a traffic survey for the transport mode in order to include the calculations under contracted operations; the project must provide confirmation from the transport operator stating that the routes are contracted by a local, provincial or national authority.

6.3 Future Services

Future public transport services may be included in calculations for the TRA-04 Commuting Mass Transport credit. Where train, bus, midibus or taxi services are included for credit (as mainline, feeder or connecting service) but not operational at the time of the Green Star SA submission, the following documentation must be provided:

- Proof of a contract signed by the relevant transport authority and the service provider, and the planned service frequency, hours of operation and route; and
- Proof of an undertaking to have the necessary transport stops constructed, whether on a public road or the development site.

6.4 Private Bus Transport

Private bus transport with established routes and timetables equivalent to public transport may be included in the Calculator contingent upon the project's ability to demonstrate that the future operations of these services are as certain as public transport. The project must provide documentation demonstrating alternative but equivalent compliance in respect to longevity of the service, available timetables, etc. in addition to the other required

documentation in the Documentation Requirements section for this credit in the relevant Technical Manual.

6.5 Public Transport Interchange

A public transport interchange is a location where passengers move between services of the same or different transport mode. If the site is within 15 minutes of a public transport interchange via a public transport connecting service, with the connecting service having a frequency of no more than 30 minutes, then the routes available from the interchange can be included in the Calculator with the following modifications:

- Only connecting services operating under contract to the municipality on a fixed route and schedule may be included.
- The number of routes at the interchange is halved.
- The distance to be entered for routes at the interchange is equal to the distance from the development to the connecting service, plus 250m.
- Any connecting service from the interchange that terminates within 1,000m of the interchange only counts as half of one service, which is then halved again because it is from the interchange (e.g. enter 0.25).

Example 4:

The train route that stops 600m from the building services a Transport Interchange within a travel time of 12 minutes AND six additional bus routes service the Transport Interchange; three arriving routes and three departing.

Morning Peak Period Services 'To' and 'From' Transport Interchange					
Bus A		Bus B		Bus C	
Route 1 To Transport Interchange	Route 2 From Transport Interchange	Route 3 To Transport Interchange	Route 4 From Transport Interchange	Route 5 To Transport Interchange	Route 6 From Transport Interchange
Time	Time	Time	Time	Time	Time
7h25	7h20	7h18	7h45	7h15	-
7h45	7h40	7h48	8h30	8h00	6h25
8h00	8h00	8h18	9h15	8h10	7h45
8h15	8h20	8h48	10h00	8h20	8h45
8h30	8h40	9h18	-	8h30	9h45
8h45	9h00	9h48	-	8h40	-
9h00	9h20	-	-	8h50	-
9h15	9h40	-	-	9h00	-
9h35	-	-	-	9h45	-
Number of services Route 1	7	Number of services Route 3	4	Number of services Route 5	7
Number of services Route 2	6	Number of services Route 4	3	Number of services Route 6	2
Average Interval Between Services Route 1	17.14 min	Average Interval Between Services Route 3	30 min	Average Interval Between Services Route 5	17.14min
Average Interval Between Services Route 2	20 min	Average Interval Between Services Route 4	40min	Average Interval Between Services Route 6	60 min

Afternoon Peak Period Services 'To' and 'From' Transport Interchange					
Bus A		Bus B		Bus C	
Route 1 To Transport Interchange	Route 2 From Transport Interchange	Route 3 To Transport Interchange	Route 4 From Transport Interchange	Route 5 To Transport Interchange	Route 6 From Transport Interchange
Time	Time	Time	Time	Time	Time
16h25	16h30	16h50	16h40	16h15	16h29
16h45	16h50	17h20	16h55	16h45	16h32
17h00	17h10	17h50	17h10	17h15	16h35
17h05	17h20	18h20	17h25	17h20	16h58
17h10	17h30	18h50	17h40	17h25	17h13
17h15	17h40	-	17h55	17h30	17h22
17h20	18h00	-	18h10	17h35	17h30
17h30	18h20	-	18h25	17h40	17h43
18h00	18h40	-	18h40	17h45	17h59
18h15	-	-	-	18h00	18h22
18h30	-	-	-	18h30	18h28
18h45	-	-	-	19h00	18h43
Number of services Route 1	10	Number of services Route 3	4	Number of services Route 5	10
Number of services Route 2	8	Number of services Route 4	8	Number of services Route 6	10
Average interval Between services Route 1	12 min	Average interval Between services Route 3	30 min	Average interval Between services Route 5	12 min
Average interval Between services Route 2	15 min	Average interval Between services Route 4	15 min	Average interval Between services Route 6	12 min

Summary of the Average Interval between Services:

Average Interval Between Services During Peak Periods for Bus A Route 1 = 14.57 minutes = 15 minutes	Average Interval Between Services During Peak Periods for Bus B Route 3 = 30 minutes	Average Interval Between Services During Peak Periods for Bus C Route 5 = 14.57 minutes= 15 minutes
Average Interval Between Services During Peak Periods for Bus A Route 2 = 17.50 minutes= 18 minutes	Average Interval Between Services During Peak Periods for Bus B Route 4 = 27.50 minutes= 28 minutes	Average Interval Between Services During Peak Periods for Bus C Route 6 = 36 minutes

The "Average Interval Between Services" for each route can be entered into the Calculator as follows. The distance is 600m to the train station + 250m = 850m. Note that Route 6 can not be entered as the frequency is greater than 30 min.

WEEKDAY SERVICES				
No. of Bus, Midibus or Minibus Services				
Walking Distance from Building Entrance to Public Transport	Contracted		Uncontracted	
	Frequency of Service During Peak Periods		Frequency of Service During Peak Periods	
	15 min	30 min	15 min	30 min
0-250m				
250-500m				
500-750m				
750m-1km	1	1.5		

Route 1 and Route 5 should be entered in this cell as '0.5' each

Route 2, 3, 4 should be entered in this cell as "0.5" each

7 Mass Transport Calculator

The Calculator determines the number of points achieved based on the following criteria:

- Type of mass transport; and
- Walking distance from the development to the stop/station; and
- Frequency of service during peak commuting periods.

The following tables provide the relative weighting of cells within the Calculator by indicating the score per route in each category. These weightings are automatically reflected in the number of points achieved.

WEEKDAY/SATURDAY WEIGHTINGS				
for Bus, Midibus or Minibus Routes				
Walking Distance from Building Entrance to Public Transport	Contracted		Uncontracted	
	Frequency of Service During Peak Periods		Frequency of Service During Peak Periods	
	15 min	30 min	15 min	30 min
0-250m	6	4	3	1
250-500m	5	3	2	
500-750m	4	2	1	
750m-1km	3	1		

WEEKDAY/SATURDAY WEIGHTINGS		
For Train Routes		
Walking Distance from Building Entrance to Public Transport	Frequency of Service During Peak Periods	
	15 min	30 min
0-250m	7	5
250-500m	6	4
500-750m	5	3
750m-1km	4	1

The Mass Transport Calculator multiplies the number of routes entered for each of the above categories and adds all the scores together to give a single Mass Transport Calculator Score. Weekday and Saturday scores are added together and are not weighted differently.

The number of points is then determined, based on the total score achieved, in accordance with the table below:

For **office** developments:

Total Mass Transport Calculator Score	Number of Points for Tra-4
10	1
20	2
40	3
60	4
80	5

For **retail centre** developments:

Total Mass Transport Calculator Score	Number of Points for Tra-4
Weekday services	Weekday services
10	1
20	2
40	3
60	4
Saturday services	Saturday services
20	1

For example, based on Examples 2 and 3 previously:

No. of Bus, Midibus or Minibus Routes				
Walking Distance from Building Entrance to Public Transport	Contracted		Uncontracted	
	Frequency of Service During Peak Periods		Frequency of Service During Peak Periods	
	15 min	30 min	15 min	30 min
0-250m	1 x 6	1 x 4		
250-500m				
500-750m		1 x 2		
750m-1km				

Total Mass Transport Calculator Score = 6 + 4 + 2 = 12, and $10 \leq 12 \leq 20$, therefore **1 point for Tra-4 is achieved.**

Public Transport Calculator Example

PUBLIC TRANSPORT CALCULATOR EXAMPLE

Transport services to the project site during peak periods include:

- One bus service with a stop 50m from the project site, with a service frequency of 15 minutes, to a major railway station (the travel time to the major railway station is 12 minutes);
- The station has two train services with a frequency of 12 minutes;
- The station also has four bus routes, one with a frequency of 15 minutes and the remainder with a frequency of 25 minutes (not including the one from the site); and
- One minibus taxi route has a stop 50m from the project site, with an observed frequency of 10 minutes in both directions of travel.

Data to enter into the Public Transport Calculator

1) Bus service terminating 50m from the site

- Type = Bus
- Frequency = 15 min
- Services = 0.5 (service between station and site = $\frac{1}{2} = 0.5$)
- Distance = 0-250m

2) Train services

The train interchange is within 15 minutes travel time and the connecting service's (the bus above) frequency is less than 30 minutes, therefore, services at the railway interchange can be included in the calculator provided they are modified as follows:

- Trains with 12 minute frequency
 - Type = Train
 - Frequency = 12 min
 - Services = 1 (No. of services halved = $\frac{2}{2} = 1$)
 - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)

3) Bus services from train interchange

- Bus with 15 minutes frequency
 - Type = Bus
 - Frequency = 15 min
 - Services = 0.5 (No. of services halved = $\frac{1}{2} = 0.5$)
 - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)

Public Transport Calculator Example

- Buses with 25 minute frequency
 - Type = Bus
 - Frequency = 30 min
 - Services = 1.5 (No. of services halved = $\frac{3}{2} = 1.5$)
 - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)

4) Minibus taxi services

- Type = Taxi
- Frequency = 10 min
- Services = 2 (each direction counts as one service)
- Distance = 0-250m

No. of bus, midibus or minibus services

Walking dist from building to public transport	Contracted		Uncontracted	
	Frequency of service during peak periods		Frequency of service during peak periods	
	15 min	30 min	15 min	30 min
0 – 250m	0.5		2	
250 – 500m	0.5	1.5		
500 – 750m				
750 – 1,000m				

No. of train services

Walking dist from building to public transport	Frequency of service during peak periods	
	15 min	30 min
0 – 250m		
250 – 500m	1	
500 – 750m		
750 – 1,000m		

No. of points from Calculator = 2

Table App-B.1: Example values entered into Public Transport Calculator

TRA-5 Local ConnectivityPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise office buildings that are integrated with or built adjacent to community amenities and/or dwellings in order to reduce the overall number of automobile trips taken by building users.

CREDIT CRITERIA

Up to two points are awarded, provided that it is demonstrated that safe, well-lit, dedicated pedestrian facilities are provided between the office development and the adjacent street network, conforming to SANS 10246.

One point is awarded where:

- Any four of the following are located within 400m of a public entrance to the building:
 - Bank/ATM, convenience grocery/supermarket, day care, cleaners/laundry, medical/dental offices, pharmacy, post office, restaurant/canteen/cafeteria, fitness centre/gym, library, school.

One point is awarded where:

- There is a minimum average gross density of 35 du/ha (dwellings units per hectare) for the entire area within 400m of the office development.

DOCUMENTATION REQUIREMENTS

It must be demonstrated that the claimed land uses are in existence or under construction. In cases where the applicable land uses are part of the development to which the Green Star SA submission applies, they must be indicated in the development plans that are to be (or have been) submitted to the government approving agency.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender drawings • Confirmation from the building owner	• Short report • As built drawings

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Describing and mapping the location and nature of the public amenities to be claimed within 400m of the proposed development, if applicable; and

TRA-5 Local Connectivity

POINTS
AVAILABLE

2

- Mapping the residential areas within 400m of the proposed development, and identifying the number of units in each area, if applicable.

Tender drawing(s) of the site showing:

- The pedestrian route(s) between the public entrance of the proposed building and the public street, including any gates or other facilities for crossing barriers along the route(s);
- Design elements required to comply with SANS 10246 within the development site; and
- Provision for night time lighting.

As built drawing(s) of the site showing:

- The pedestrian route(s) between the public entrance of the proposed building and the public street, including any gates or other facilities for crossing barriers along the route(s);
- Compliance with SANS 10246 within the development site; and
- Provision for night time lighting.

Confirmation from the building owner stipulating:

- That any gates on routes used in the calculation of pedestrian distances will be accessible by users of the proposed development.

ADDITIONAL GUIDANCE

Public amenities

The general intent of this credit is to discourage car trips made from the office while employees are at work. Walking distance must be based on actual routes that allow for pedestrian movement on paved surfaces removed from vehicular travel lanes. Crow-fly distances are not acceptable as an indication of walking distances.

Drawings must be submitted, indicating the location of the applicable land uses (including the points of public access to these land uses) in relation to the public entrance of the proposed development. Where pedestrian routes cross barriers such as rivers, canals or roads, crossing opportunities must be indicated on the drawings submitted for the purpose of this credit. This may include bridges over canals, and pedestrian traffic crossings or road intersections (it may not be assumed that pedestrians will cross mid-block where there is no pedestrian crossing facility). Where the development is within a fenced area, if it is assumed that pedestrians use a gate that is separate from the vehicular entrance, then such gate must be shown on the development drawings.

Residential density

The general intent of this credit is to discourage car trips for commuting to and from work. For the purpose of this credit, a crow-fly distance is acceptable for identifying the number of residential units within a 400 m radius of the proposed development. It is not essential to show pedestrian routes to all residential units included in the calculation of average density; however the development drawings must show that there is a clear, safe pedestrian route to the public entrance of the development building from an adjacent public street.

The configuration and density of individual residential developments is not important for this credit, as long as the average gross density is achieved within the specified radius.

External pedestrian facilities

Although Green Star SA assesses inherent attributes of buildings, external amenities are critical to the success of attempts to encourage alternative forms of mobility. Consequently,

TRA-5 Local ConnectivityPOINTS
AVAILABLE**2**

while the developer does not have direct control over amenities beyond the assessed property, the absence of certain amenities would render on-site amenities meaningless. It would therefore not be appropriate to award credits for mixed-use developments if it were difficult to walk between land uses.

It is noted that there are sometimes opportunities to influence the development of facilities off-site, and this is to be encouraged. For example, a multi-owner development that has a strong body corporate provides an opportunity to coordinate pedestrian links (examples are Century City in Cape Town and Melrose Arch in Johannesburg). Even in the case of individual owner developments such as a high-rise office in a CBD, approval authorities sometimes require off-site transportation improvements to mitigate impacts. If these impacts are extended to consider pedestrians – as they should – then it might not be unreasonable for provision of off-site pedestrian facilities to be negotiated between the developer and the approving agency.

Amenities that are planned, but not completed at the time of the Green Star SA submission, may be included if they are substantially complete by the date of practical completion of the assessed building.

BACKGROUND

The practice of walking to work benefits the South African environment by reducing levels of potential pollutants from other means of transport, provides substantial health and economic benefits to the pedestrian, and helps reduce road congestion.

For people who do drive to work, there are still benefits from walking from the office to carry out errands during the day (or before or after work).

Single-use zoning discourages walking, so this credit is intended to encourage the location of offices where other land uses are within walking distance. The promotion of office locations within higher density residential areas is based on the concept that there will be a greater probability of people living close to their office. Some people who could use public transport to commute to work do not do so because they wish to run errands during the day, and the credit for proximity to public amenities is intended to reduce the need for errands to be carried out by car.

REFERENCES AND FURTHER INFORMATION

City of Cape Town NMT Strategy – Oct 2005

Mobility Strategy – Dept of Transport and Public Works

NMT Masterplan for Eden District Municipality – July 2007

Public Transport Infrastructure Plan – Dept of Transport & Public Works

DOT Draft National Scholar Transport Policy – Nov 2007

Rural Transport Strategy for South Africa – National DOT Nov 2003

Draft Final City of Johannesburg Planning Framework for NMT in JHB – June 2007

TRA-5 Local ConnectivityPOINTS
AVAILABLE**2****TECHNICAL CLARIFICATIONS AND ERRATUM**

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Services within building

Technical Clarification Number: TRA5-T-OB1-0062

Guidance: 2010-02-26

For the first point of the credit, for community services within 400m of a public entrance to the building, any services within the building itself may be included regardless of distance to an entrance.

The following errata have been incorporated into the body of the credit:

TRA-5-OB1-445: Green Star SA - Office v1 Technical Manual: Page 187 & 188

TRA5-E-OB1-0204: Green Star SA - Office v1 Technical Manual: Page 187

WAT-1 Occupant Amenity WaterPOINTS
AVAILABLE**5****AIM OF CREDIT**

To encourage and recognise designs that reduce potable water consumption by building occupants.

CREDIT CRITERIA

Up to five points are awarded where the predicted potable water consumption for sanitary use within the building has been reduced against a 'best practice' benchmark.

The points are determined by the Green Star SA Potable Water Calculator.

DOCUMENTATION REQUIREMENTS

All base building fittings must be included in the Potable Water Calculator for this credit, including common area fittings and base building fittings in any non-office usage areas.

Green Star SA – Office Design	Green Star SA – Office As Built
<i>Submit all the evidence and ensure it readily confirms compliance.</i> • Short report • Extract(s) from the specification(s) • Tender schematic hydraulic drawings • Completed Potable Water Calculator	<i>Submit all the evidence and ensure it readily confirms compliance.</i> • Short report • Technical data sheets from the contractor • Completed Potable Water Calculator <i>If rainwater collection or water reuse systems are installed, the following is also required:</i> • As built schematic hydraulic drawings • Extract(s) from Commissioning Report

Short report prepared by a suitable professional that describes how the Credit Criteria have been met, and including:

- Descriptions of all the water-efficient features in the building;
- Justifications of the predicted water savings, wherever not solely achieved by fittings/fixtures; and calculations undertaken for the Potable Water Calculator, including the

WAT-1 Occupant Amenity Water

POINTS
AVAILABLE

5

capacity of all the water reuse, collection and storage systems; and

- *Where greywater, blackwater or rainwater systems are to be installed, and the contribution determined by the design team rather than using calculators in the Green Star SA – Office tool, then calculations demonstrating the reduction in potable water consumption must be submitted by a qualified and experienced consultant who has been involved in the design of such systems.*

Extract(s) from the specification(s) listing and describing:

- *All hydraulic fixtures and fittings in the project including water usage rates;*
- *All water reuse systems; and*
- *All water collection systems with a specific mention of the capacity of the system.*

Tender schematic hydraulic drawings showing the location of all water reuse, collection and storage systems.

Completed Potable Water Calculator referencing the short report and including supporting evidence.

Technical data sheets from the contractor indicating the water usage rates of all fixtures and fittings installed in the building along with confirmation that they were installed.

As built schematic hydraulics drawings showing the location of all water reuse, collection and storage systems.

Extract(s) from Commissioning Report demonstrating that the relevant systems have been commissioned and operate as intended by the design; and referencing the Operations and Maintenance (O&M) Manual, clearly indicating that all the intended hydraulic fixtures and fittings and all water reuse, collection and storage systems have been installed.

ADDITIONAL GUIDANCE

This credit addresses the entire building gross floor area (GFA) and must include all base building fixtures and fittings, including common area fittings and base building fittings in any non-office usage areas.

The number of points achieved is determined by using the Potable Water Calculator. The Potable Water Calculator must be used in accordance with the Potable Water and Sewage Calculators Guide available from the GBCSA website (<http://www.gbcsa.org.za>). All teams claiming this credit are required to comply with the requirements outlined in this guide.

In most cases, off-setting demand with rainwater or reused water will be necessary to achieve more than two points in the Potable Water Calculator.

The GBCSA strongly supports the use of shared/centralised water treatment facilities. When the amenity is within the project, but other uses (for base building projects) or tenants (for fit-out projects) are present in the building, this credit requires evidence that the use of such facilities by the project being assessed is not compromised (e.g. that a proportion of facilities is dedicated for exclusive use of the project).

For Shell and Core or Integrated Fit-Out Projects

- **Design** – The documented design must demonstrate compliance with the Credit Criteria regardless of whether any component of the project is delivered as shell and core or an integrated fit-out.
- **As Built** – The as built/as installed evidence must demonstrate compliance with the Credit Criteria regardless of whether any component of the project was delivered as shell and core or an integrated fit-out.

WAT-1 Occupant Amenity Water

POINTS
AVAILABLE**5**

BACKGROUND

Rainwater, greywater & blackwater

Collecting rainwater from roofs and other impervious surfaces can add to the amount of non-potable water available for use in buildings.

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 or toilet flushing use but needs to be used within a short time after collection to avoid extensive water treatment.

In locations where on-site black water 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 and Forestry, 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.

REFERENCES & FURTHER INFORMATION

South African Weather Service

<http://www.weathersa.co.za/Menus/WXandClimate.jsp>

South Africa Rain Atlas

<http://134.76.173.220/rainfall/index.html>

South Africa Department of Water Affairs & Forestry

<http://www.dwaf.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*

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: WAT-01 Occupant Amenity Water: Exclusion of external taps

WAT-1 Occupant Amenity Water

POINTS
AVAILABLE**5****Technical Clarification Number: WAT01-T-OB1-438****Guidance:** 2012-03-19

Note that external taps can be excluded from the Potable Water Calculator in terms of the WAT-01 Occupant Amenity Water credit.

The aim of the Wat-1 credit is to encourage and recognise designs that reduce potable water consumption by building occupants. As such, the intent is to minimise potable water consumption in occupant amenity fixtures and fittings (toilets, all internal taps, urinals and showers) through the use of efficient fixtures and fittings, reused / harvested water or a combination of these initiatives.

Credit Interpretation Request: Statement of confirmation - manufacturer

Credit Interpretation Request Number: WAT1-C-OB1-0321

Ruling: 2012-01-16

The Credit Interpretation Request (CIR) seeking approval for the use of a letter from the manufacturer confirming fixture flow/flush rates where product datasheets do not confirm these flow/flush rates is approved.

Technical Clarification: Evidence of approval from the local authority

Technical Clarification Number: WAT1-T-OB1-0279

Guidance: 2011-06-09

Where rainwater collection or water reuse systems are installed, project teams are no longer required to provide 'evidence of approval from the relevant authority' within their documentation submitted for a Green Star SA Design / As Built rating.

Whilst this documentation is no longer required to be included within the submission for Green Star SA certification, the GBCSA would expect that project teams adhere to all relevant authority regulations and requirements (including approval of such systems where required).

Credit Interpretation Request: Off-site reclaimed water - alternative documentation can be provided as per 29 April 2014 see *

Credit Interpretation Request Number: WAT1-C-OB1-0266

Ruling: 2011-06-09

WAT-1 Occupant Amenity Water

POINTS
AVAILABLE**5**

The use of reticulated off-site reclaimed water is an acceptable way to reduce potable water consumption within the Green Star SA rating system. Although off-site harvesting and recycling systems are not specific attributes of the building seeking Green Star SA certification (as would be the case of an on-site water harvesting and recycling system), the fact that the building has chosen to incorporate the necessary infrastructure to connect their building services to the off-site service is, in this scenario, viewed as a building attribute.

The following additional documentation requirements apply where reticulated off-site reclaimed water is used:

For Green Star SA Design ratings;

- Evidence that the reclaimed water system is operational at the time of practical completion of the building.
- Confirmation from the off-site non-potable water supply vendor that the required supply is available to the project.

For Green Star SA As Built ratings;

- Evidence that the reclaimed water system is operational at the time of practical completion of the building.
- An extract from the contract between the off-site non-potable water supply vendor and the building owner must be provided.

* 29 April 2014 TC788

The project team's proposal for providing alternative evidence to that requested in the WAT1/3/4-C-OB1-0266 CIR's (evidence that reclaimed water system is operational and confirmation of supply from water vendor) is hereby approved.

We note that the following alternative documentation has been proposed and approved:

- 1) Site plans of the precinct illustrating;
 - The current As Built stormwater reticulation, and attenuation facilities, and
 - Construction plans for the stormwater reticulation of the registered project
 - Water Schematic for registered project, illustrating connection to off-site non-potable water source, and usage of water source
- 2) A signed short report from system design consultant describing and quantifying the volume of off-site non-potable water that will be available for the registered project each day, and why.

Technical Clarification: Potable Water Calculator - 'intrinsic' flow controlling devices

Technical Clarification Number: WAT1-T-OB1-0112

Guidance: 2010-11-09

WAT-1 Occupant Amenity Water

POINTS
AVAILABLE

5

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.

Technical Clarification: Groundwater

Technical Clarification Number: WAT1-T-OB1-0087

Guidance: 2010-07-06

Previously unused groundwater seeping into building basements cannot be used in this credit as ‘non-potable’ or recycled water for amenities, unless it is used and then recycled within the building. See Technical Clarification WAT3-T-OB1-0385 under Wat-3 regarding use in irrigation.

Technical Clarification: Potable water calculator - non-roof area harvesting

Technical Clarification Number: WAT1-T-OB1-0083

Guidance: 2010-06-14

In the potable water calculator, projects may include rainwater/stormwater harvested from surfaces other than those given in the run-off coefficient list. However, the run-off coefficient of 0.65 for ‘Flat gravel or turf roof (<30 pitch)’ must be used. Project teams wishing to use an alternative rainwater run-off coefficient for such surfaces may submit a Credit Interpretation Request (CIR) clearly justifying the alternative run-off coefficient.

Credit Interpretation Request: Approval of blackwater systems

Credit Interpretation Request Number: WAT1-C-OB1-0047

Ruling: 2009-09-14

The Credit Interpretation Request (CIR) seeking approval for exempting the project from approval from the relevant authority for a blackwater treatment system is granted for this specific project at this point in time. The project must demonstrate in the submission for certification that the project team has worked with the local authority to pursue approval of the system, has designed the system to all applicable SABS, SANS and DWAF standards, and must provide assurance that the system will be installed and used once authority approval is granted. Note that any future requests from other projects for exemption from approval from the

WAT-1 Occupant Amenity Water

POINTS
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relevant authority for a blackwater treatment system will be considered on their merits on a project-by-project basis. Such projects must submit a CIR

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The following errata have been included in the body of the credit:

WAT1-E-OB1-0280 (2011-08-08): Green Star SA - Office v1 Technical Manual: Page 193

WAT1-E-OB1-0281(2011-08-08): Green Star SA - Office v1 Technical Manual: Page 194

WAT1-E-OB1-0282 (2011-08-08): Green Star SA - Office v1 Technical Manual: Page 195

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Green Star SA – Office v1

POTABLE WATER & SEWAGE CALCULATORS GUIDE – VERSION 1.1

Last Update: 23 June, 2010

1 Executive Summary

The Potable Water Calculator (the Calculator) estimates the potable water consumption based on efficiency of fittings (such as WCs, urinals, taps, and showers) and the reduction in potable water consumption achieved through rainwater, greywater or blackwater harvesting.

The Potable Water Calculator is used in Green Star SA - Office to estimate the consumption of potable water by office developments, and forms the basis for points awarded in the Water category. The Calculator allows development projects to be compared on an equal basis, which is essential for equitable Green Star SA – Office assessment. The Calculator is built for Green Star SA – Office assessment purposes and should not be used for sizing sanitary fittings and water reticulation systems.

The estimated potable water consumption of each office development is compared to benchmarks to determine the efficient use of water and hence the points achieved. The benchmarks used in this credit are based on fittings that are, for the most part, currently available in South Africa.

If all WCs, manually operated wash hand basin (WHB) taps, urinals and showerheads achieve the Category 3 flow rates listed in Table 2 of this guide, and no rainwater or recycled water systems are installed, then the Calculator awards one (1) point. To achieve a greater number of points, further reduction in water consumption through the use of more efficient fittings and rainwater collection and/or water recycling systems is necessary.

The Calculator is divided into three sections. The first section establishes the predicted water consumption based on specified fittings and fixtures. The second section calculates the predicted water savings in the building due to water recycling. The third section reports results of the above calculations and identifies the number of points achieved in the credit Wat-1 'Occupant Amenity Water'. These points are automatically inserted in the Water tab on the Green Star SA – Office v1 spreadsheet tool.

2 Acknowledgements

The Green Star SA – Office v1 Potable Water and Sewage Calculators and this guidance document are based on those of the Australian Green Star – Office v3 rating tool. The Green Building Council of South Africa acknowledges the work of technical consultant Arup in adapting these items to the South African Green Star SA – Office v1 tool.

3 Predicted Water Consumption

The calculated potable water consumption is based on the average water consumption of fixtures specified in the project. The average usage data is based on studies undertaken in the U.K. by the Water Centre at the Building Research Establishment (BRE) for typical office buildings.

The usage per person per day is based on equal numbers of male and female occupants, outlined in Table 1. Male and female WCs are treated separately where urinals are installed. If there are no urinals then an average WC use of 2.3 times per person per day is assumed for all occupants. The Calculator assumes the frequency of use of kitchen sinks to be the same as wash hand basins (WHB) for the Indoor Tap calculation. All base building WCs, WHB and sink taps, urinals and showers must be included in the calculations.

Type	No. of uses per day per person		Duration per use
	Male	Female	
WC	0.3	2.3	1 flush
Urinal	2	0	1 flush
Shower	Varies	Varies	5 minutes
Manual WHB/Sink tap	2.5	2.5	9 seconds
Timed WHB/Sink tap	2.5	2.5	7 seconds
PIR* WHB/Sink tap	2.5	2.5	6 seconds

*PIR- Passive Infra Red

Table 1 : Data for average usage of water consuming facilities in offices used in the Potable Water Calculator.

3.1 Occupancy

The number of occupants used in the Calculator is based on one person per 15m² of Usable Area. The Calculator is designed to produce a benchmark for equitable comparison of office buildings. The Green Star SA - Office tool assesses base building features, so hours of operation within the occupancy are not considered and no adjustment is made where the hours of occupancy may exceed normal hours of operation. Occupancy is calculated automatically based on the UA entered into the 'Building Input' sheet.

3.2 Fittings and Fixtures

The actual flow rate of the fixture or fitting should be entered manually into the calculator.

PREDICTED POTABLE WATER CONSUMPTION		
WCs		
Type	Avg L/flush	% of WCs
dual flush toilet - standard	4	100%
<enter description here>		0%
<enter description here>		0%
<enter description here>		0%
		100%
Predicted Normalised WC Water Consumption Sub-Total (L/day/m ²)		0.35

Flow controlling devices can only be considered for this credit if they are an intrinsic attribute of the fitting or fixture, and cannot be removed or adjusted by maintenance staff without specialist equipment.

Up to four different types of fittings can be inserted and described in the Calculator for WCs, WHB/sink taps, urinals and showers. For each fitting type, the water consumption must be

entered, together with the percentage of each type of fitting in the building, as a percentage of the total number of fixtures of that type.

The average litres used for flushing a dual flush WC should be calculated as per the methodology provided in AS/NZS6400 i.e. averaging 1 full flush and 4 half flushes. For example a 6/3 litre WC should be entered as $(6 \times 1 + 3 \times 4) / 5 = 3.6$ litres. For WCs with flush valves, the valve flow rate (in litres/sec) must be multiplied by the flush duration (in seconds) to find the litres/flush. A minimum flush duration of 7 seconds should be assumed.

If a number of urinals or a length of trough feature a timed automatic flush (as may be found in refurbishment projects) rather than a manual or sensor flush, then the actual details of cisterns are to be inserted, together with number of cisterns and the percentage for each fixture (urinal, trough length or stall) as a percentage of all urinals, measured by urinal 'stalls' (600mm of trough or the number of individual urinal stalls) throughout the project. Insert the flush capacity for timed flush cisterns or the average flush capacity where multiple timed automatic flush cisterns are installed. The number of flushes entered must be for a 24 hour period.

For refurbishment projects only, urinals can be converted and deemed to be 'waterless' without completely removing existing plumbing if the water supply to them has been permanently disabled (i.e. physically dismantled in such a way that reconnecting the water supply for flushing is NOT possible without additional construction work). For new buildings, in order to qualify as "waterless," urinals must be specified as being designed to function without the use of water. The specification of standard water-based urinals with cartridges to negate the need for water does not qualify as 'waterless'.

A system for labelling efficiency of water fittings is still under development in South Africa and inclusion of relative performance of fittings in Table 2 below is for guidance only.

Water Fittings Consumption - for Guidance:

Type	Usage unit	Flow Rate Category						
		0 Worst	1	2	3	4	5	6 Best
WC	L(Average flush volume)/flush	6	5.5	4.5	4.0	3.5	3.0	2.5
Flush valves	L/min	65	-	-	-	-	-	-
Urinal flushing	L/flush per stall or 600mm width of trough	2.5	2.5	2.5	2.0	1.5	1.0	1.0
Indoor taps & flow controls	L/min	20.0	15.0	12.0	9.0	8.0	6.0	4.5
Showers	L/min	16.0	16.0	12.0	10.0	9.0	9.0	9.0

Table 2- Water Consumption for Fittings (FOR GUIDANCE ONLY)

3.3 Shower Use

Enter the fixture description and the applicable flow rate, followed by the percentage of fixtures as a percentage of all shower fixtures. Once shower usage is entered in the calculator, the benchmark is automatically adjusted so that shower usage is not unduly penalised. Shower usage is assumed for 3% of the occupants.

3.4 Other Predicted Consumption

Other water demands within the project can be entered into the 'Other Predicted Recycled/Harvested Water Demand/Consumption' section of the Calculator. These values are used to calculate the quantity of recycled water which will be available to reduce demand for

potable water. Annual demands should be calculated and converted to values in litres per day and entered into these fields.

OTHER PREDICTED RECYCLED/HARVESTED WATER DEMANDS/CONSUMPTION	
Are there any other recycled/harvested water demands in the project? Enter recycled water demand only, disregard potable water use. This is to determine the availability of recycled/reused/harvested water for occupant amenity (i.e. fixtures and fittings) purposes.	Yes v
RECYCLED/HARVESTED WATER DEMAND FOR IRRIGATION (L/day)	3000
RECYCLED/HARVESTED WATER DEMAND FOR COOLING TOWERS (L/day)	0
RECYCLED/HARVESTED WATER DEMAND FOR FIRE SYSTEM TESTING (L/day)	120
RECYCLED/HARVESTED WATER DEMAND FOR OTHER (L/day)	30

Please note that all 'other' daily demands must be calculated based on work days (i.e. 260 days per year), with the exception of irrigation recycled water demands which must be calculated on total days (i.e. 365 days per year).

4 Predicted Reduction in Potable Water Consumption

The results from the Potable Water Calculator are based on default values for occupancy and usage, and these results may not be accurate representations of the actual potable water consumption. The results for reduction of water use from the Potable Water Calculator are only intended for benchmarking purposes in Green Star SA – Office and **should not be used to size and specify rainwater, greywater or blackwater recycling systems.**

4.1 Rainwater Recycling

The Calculator produces an estimate of the amount of rainwater that could be collected and used to replace part or all of the potable water demands entered elsewhere in the calculator, based on:

- monthly rainfall;
- collection area;
- run-off coefficient;
- annual number of rainy days;
- storage capacity; and
- volume of rainwater collected used for irrigation or other purposes.

Table 3 displays the run-off coefficients for rainwater collection systems used in the Calculator:

Roof Type	Run-off Coefficient
Steel roof (>30° angle)	0.9
Non-absorbent roof (>30° angle)	0.9
Flat non-absorbent roof (<30° angle)	0.8
Flat gravel or turf roof (<30° angle)=0.8-0.15 evaporation/transpiration	0.65

Table 3 Run-off coefficients used in the Potable Water Calculator

Projects may include rainwater harvested from surfaces other than those given in the run-off coefficient table above. However, the run-off coefficient of 0.65 for 'Flat gravel or turf roof (<30 pitch)' must be used. Project teams wishing to use an alternative rainwater run-off coefficient

for such surfaces may submit a Credit Interpretation Request (CIR) clearly justifying the alternative run-off coefficient.

To complete the rainwater component of the Calculator, systematically answer the question below:

- **Are there any rainwater systems proposed for the project?**

If **NO** then this section of the Calculator is now complete. Go to the greywater and blackwater sections of the Calculator.

If **YES** then select the type of demands that the rainwater supplies, by checking any or all of the check boxes in the fields "Rainwater collected is used for" area. Note that these fields can be selected in rain, grey or black water sections of the calculator. Where demand(s) are met via multiple sources, for the purposes of benchmarking, the potable water calculator prioritises the consumption of recycled/harvested water based on environmental preference (i.e. blackwater and greywater are prioritised before rainwater, with potable water used to supplement where recycled/harvested water is deficient). Recycled/harvested water from the prioritised sources is supplied to different demands (e.g. irrigation, WCs & urinals, showers & taps etc.) proportionally based on the demand breakdown.

RAINWATER/STORMWATER HARVESTING						
Are there any rainwater/stormwater harvesting systems, and if so, do they comply with Local Authority requirements?						Yes v
Harvested water collected is used for (please tick appropriate box(es)):						
☒	Irrigation	☒	WC & Urinal Flushing			
☐	Cooling Tower	☐	Shower & Taps (treated to potable)			
☐	Fire System Testing	☐	Other			
Total water harvesting collection area (drained to storage tank(s))				1300.0m2		
Total storage capacity of harvested water tank(s) (kL)				50.0 kL		
Collection Area Types		Rainwater Run-off Coefficient	Steel roof (> 30 pitch)	0.9	1300.0m2	
				0	0.0m2	
				0	0.0m2	
Average monthly rainfall for the building location (mm):						
Location	Jan.	Feb.	March	April	May	June
Cape Town	15	17	20	41	69	93
	July	August	Sept.	Oct.	Nov.	Dec.
	82	77	40	30	14	17
Annual number of rain days > 1mm:						103
Predicted amenity potable(mains) water reduction due to rainwater harvesting (L/day/m ²)				0.00		

Other daily demands such as Irrigation, Cooling Tower, Fire System Test and 'Other' water have been entered previously and do not need to be re-entered.

Enter the collection area(s), total storage tank capacity and runoff co-efficient(s).

Monthly rainfall and number of rain days data is automatically populated within the potable water calculator by selecting the location from the drop-down menu.

This section of the calculator is now complete and the quantity of potable water that is replaced by the rainwater system is shown in litres per work day (i.e. non-weekend days) per m².

The calculator computes the potable water reduction on a per work day basis. The calculator also assumes a 20 litre/100m² "first flush" volume of water is lost for each rain day. The first flush volume is the volume of water diverted from the storage tank at the beginning of a rain event, due to the large quantity of initial debris and pollutants.

4.2 Greywater Harvesting

To complete the greywater component of the Calculator, answer the question below:

- **Are there any greywater systems proposed for the project?**

If **NO** then this section of the Calculator is now complete. Go to the blackwater section of the Calculator.

If **YES** then select the type of demands that the rainwater supplies, by checking any or all of the check boxes in the fields "Greywater harvested is used for" area. Where demand(s) are met via multiple sources, for the purposes of benchmarking, the potable water calculator prioritises the consumption of recycled/harvested water based on environmental preference (i.e. blackwater and greywater are prioritised before rainwater, with potable water used to supplement where recycled/harvested water is deficient). Recycled/harvested water from the prioritised sources is supplied to different demands (e.g. irrigation, WCs & urinals, showers & taps etc.) proportionally based on the demand breakdown.

GREYWATER HARVESTING	
Are there any greywater harvesting systems, and if so, do they comply with Local Authority requirements?	Yes
Greywater harvested is used for (please tick appropriate box(es)):	
☒ Irrigation	☒ WC & Urinal Flushing
☐ Cooling Tower	☐ Shower & Taps (treated to potable)
☐ Fire System Testing	☐ Other
Percentage of indoor taps used for greywater collection	100%
Percentage of showers used for greywater collection	100%
Storage capacity of greywater tank(s) (kL)	7.00 kL
Other greywater Collection Sources	L/day
<enter description here>	0
<enter description here>	0
<enter description here>	0
<enter description here>	0
Predicted amenity potable(mains) water replacement due to greywater harvesting (L/day/m ²):	0.14

Enter the percentage of each type of fixture used for collection and the storage volume of the greywater tank. Enter any other sources of collection of water for greywater processing such as fire test water.

The potable water calculator completes a check on the capacity of the greywater storage tank(s) and the predicted greywater inflow. For the purposes of benchmarking, if the daily greywater inflow exceeds the total capacity of the nominated storage tank, then the excess is assumed not available for reuse (i.e. diverted to sewer).

This section of the calculator is now complete and the quantity of potable water that is recycled by the greywater process is shown in litres per work day (i.e. non-weekend days) per m².

4.3 Blackwater Harvesting

In locations where on-site black water treatment is generally not permitted, projects are encouraged to contact local authorities to discuss the benefits of on site water treatment for the project and local infrastructure.

To complete the Blackwater component of the Calculator, answer the question below:

- **Are there any blackwater systems proposed for the project?**

If **NO** then this section of the Calculator is now complete.

If **YES** then select the type of demands that the blackwater supplies, by checking any or all of the check boxes in the fields "Blackwater harvested is used for" area. Where demand(s) are met via multiple sources, for the purposes of benchmarking, the potable water calculator prioritises the consumption of recycled/harvested water based on environmental preference (i.e. blackwater and greywater are prioritised before rainwater, with potable water used to supplement where recycled/harvested water is deficient). Recycled/harvested water from the prioritised sources is supplied to different demands (e.g. irrigation, WCs & urinals, showers & taps etc.) proportionally based on the demand breakdown.

BLACKWATER HARVESTING	
Are there any blackwater harvesting systems, and if so, do they comply with Local Authority requirements?	Yes v
Blackwater harvested is used for (please tick appropriate box(es)):	
☒ Irrigation	☒ WC & Urinal Flushing
☐ Cooling Tower	☐ Shower & Taps (treated to potable)
☐ Fire System Testing	☐ Other
Percentage of WC's used for blackwater collection	100%
Percentage of urinals used for blackwater collection	100%
Percentage of indoor taps used for blackwater collection	100%
Percentage of showers used for blackwater collection	100%
Storage capacity of Blackwater tank (kL)	13.00 kL
Other blackwater collection sources	L/day
<enter description here>	0
<enter description here>	0
<enter description here>	0
<enter description here>	0
Predicted amenity potable(mains) water replacement due to blackwater harvesting (L/day/m ²):	0.31

Enter the percentage of each type of fixture used for collection and the storage volume of the blackwater tank. Enter any other sources of collection of water for blackwater processing such as fire test water.

The potable water calculator completes a check on the capacity of the blackwater storage tank(s) and the predicted blackwater inflow. For the purposes of benchmarking, if the daily blackwater inflow exceeds the total capacity of the nominated storage tank, then the excess is assumed not available for reuse (i.e. diverted to sewer).

This section of the calculator is now complete and the quantity of potable water that is recycled by the blackwater process is shown in litres per work day (i.e. non-weekend days) per m².

5 Net Potable Water Consumption

The resulting predicted potable water consumption is calculated by subtracting the predicted reduction in potable water consumption from the predicted consumption of fixtures. The result is then compared to consumption benchmarks, and a Green Star SA – Office v1 Wat-1 score is generated.

TOTAL REDUCED POTABLE WATER USE		
Predicted Water Consumption from Fixtures	0.69	L/day/m ²
Predicted Recycled/Harvested Water available to Fixtures	0.57	L/day/m ²
NET POTABLE (MAINS) WATER CONSUMPTION	0.12	L/day/m ²
POINTS ACHIEVED:	5	
Back to Water Credits		

6 Sewage Calculator

The Sewage Calculator is a reporting tool. Data entered to the Potable Water Calculator is used to report on expected flow to the sewerage system. The flow is then compared to flow reduction benchmarks that are set against a standard case. If shower usage is entered, the benchmark is adjusted so that showers are not unduly penalised. Efficient fittings, as well as grey water and blackwater recycling systems, reduce flow to sewerage.

REDUCED SEWER DISCHARGE	
The following estimated discharge to sewer is based on the data entered above and does not represent actual discharge to the sewer in the building.	
	L/day/m ²
Predicted Water Consumption by Fixtures	0.69
Less predicted Greywater and Blackwater treated	0.20
Estimated discharge to sewer (L/day/m ²)	0.49
Points Achieved	2

WAT-2 Water MetersPOINTS
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:

One point is awarded where:

- Water meters are installed for all major water uses in the project.

An additional point is awarded where:

- The above is achieved; AND
- An automated effective mechanism for monitoring water consumption data is installed.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Tender schematic hydraulic drawings Where an automated monitoring system is present, the following additional documentation is required: • Extract(s) from the specification(s) • BMS Point Schedule	• Short report • As built schematic hydraulics drawings Where an automated monitoring system is present, the following additional documentation is required: • As installed BMS point schedule • Extract(s) from the Commissioning Report

Short report on water management prepared by the relevant qualified project team member to describe how the Credit Criteria have been met:

- Identifying the major water uses in the building; and
- Describing how the water consumption data will be effectively monitored during the building's operation, including the function of the alert and leak detection systems.

WAT-2 Water Meters

POINTS
AVAILABLE

2

Extract(s) from the specification(s) listing the major water uses within the project and stipulating their sub-metering requirements; where an automated monitoring system is present, showing that the water meters are to be connected to the automated monitoring system (e.g. BMS) and describing the functionality of the monitoring system (including the alert function).

Tender schematic hydraulics drawings showing the location of all water meters in the project, and the associated water uses.

BMS Point Schedule showing the connection of water meters to the automated monitoring system (e.g. BMS).

As built schematic hydraulics drawings clearly showing the locations of all water meters in the project, and the associated water uses.

As installed BMS point schedule showing the connection of water meters to the automated monitoring system (e.g. BMS), and confirming that all of them have been correctly installed.

Extract(s) from the Commissioning Report showing that all the meters and the monitoring system have been commissioned and are operating as intended by the design.

ADDITIONAL GUIDANCE

Major water uses are considered to include the following as a minimum (where installed):

- Amenities (e.g. bathrooms, showers, kitchenettes etc) Evaporative heat rejection systems;
- Irrigation systems;
- Wash-down systems;
- Recycled water supply;
- Rainwater supply; and
- Humidifiers.

It may be necessary to provide separate sub-metering on other water uses within the building if they are deemed equally substantial.

Award of the second point requires an effective system for collecting, recording and monitoring data from the sub-meters, and for alerting the facility management of any change in water consumption trends (which may indicate problems such as leaks) during the building's operation. In most cases, effectiveness will necessitate the design of automated monitoring systems, as part of a Building Management System (BMS). Wherever such a system is present to monitor water data, water sub-meters must be linked to them. The BMS or equivalent system must provide a leak detection system and include an alarm that is triggered in the event of a new trend in water consumption.

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

WAT-2 Water Meters

POINTS
AVAILABLE **2**

equates to bathroom water consumption, it is not necessary to have a separate bathroom meter.

Separate metering of rainwater supply is not required if rainwater is used solely for manual irrigation.

BACKGROUND

To help reduce water consumption, accurate information on usage is required at the building management level. The inclusion of water meters or sub-meters to major water users in the building is a simple and effective way of carrying this out. When water users know how much water they use, and the cost associated with that particular use, behaviour and usage pattern changes accordingly. A water management device that replaces the traditional water meter installed in some areas of Cape Town is saving 5,000 litres of water per household per month. (Source: *The Good News*)

Leaks and wastage on the site of the development and in the building itself can result in significant water losses and costs, as well as having the potential to cause major damage.

REFERENCE & FURTHER INFORMATION

South Africa, *The Good News*

http://www.sagoodnews.co.za/environment/water_saving_device_cuts_losses_for_cape_s_poor_.html

Water Efficiency South Africa

<http://www.waterefficiencysa.co.za>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

The following errata have been incorporated into the body of the credit:

WAT2-E-OB1-0432 (2012-03-14): Green Star SA - Office v1 Technical Manual: Page 198

WAT2-E-OB1-0261 (2011-08-08) : Green Star SA - Office v1 Technical Manual: Page 198

WAT-3 Landscape Irrigation

POINTS
AVAILABLE**3**

AIM OF CREDIT

To encourage and recognise the design of systems that aim to reduce the consumption of potable water for landscape irrigation.

CREDIT CRITERIA

Up to three points are awarded as follows:

One point is awarded where:

- Potable water consumption for landscape irrigation has been reduced by 50%;

Two points are awarded where:

- Potable water consumption for landscape irrigation has been reduced by 90% OR
- Plants chosen require no additional watering once established (i.e. xeriscaping).
If there is no landscaping, or the total landscaping represents less than 1% of the site area, these two points are 'Not Applicable' and are excluded from the Points Available, used to calculate the Water Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

An additional point is awarded where 30% or more of the site is landscaped and the above criteria for 90% reduction of potable water consumption for landscape irrigation has been met.

If there is no landscaping, or the total landscaped area represents less than 30% of the site area, this third point is 'Not Applicable' and is excluded from the Points Available, used to calculate the Water Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

WAT-3 Landscape IrrigationPOINTS
AVAILABLE**3****DOCUMENTATION REQUIREMENTS**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where irrigation systems are installed: • Short report • Extract(s) from the specification(s) • Tender schematic hydraulic drawings • Tender site plans OR Where a xeriscape garden is installed: • Tender site plans • Landscape report • Confirmation of xeriscape garden installation Where the credit is claimed as 'Not Applicable': • Tender site plans • Confirmation from the architect Where the additional point is claimed: • Tender Site Plans • Confirmation from the Architect(2) Where the additional point is claimed as 'Not Applicable' • Tender Site Plans • Confirmation from the Architect(3)	Where irrigation systems are installed: • Short report • Extract(s) from the Commissioning Report • As built hydraulics drawings • As built site plans OR Where a xeriscape garden is installed: • As built site plans • Landscape report • Evidence that there is no provision of irrigation systems Where the credit is claimed as 'Not Applicable': • As built site plans • Confirmation from the architect Where the additional point is claimed: • Tender Site Plans • Confirmation from the Architect(2) Where the additional point is claimed as 'Not Applicable' • Tender Site Plans • Confirmation from the Architect(3)

Short report by a suitably qualified engineer detailing:

- The proposed landscape irrigation system, its water sources and operation;
- Calculations (with justification of values used) for the reference case; and
- Demonstration of how the proposed system meets the Credit Criteria against the reference case; and referencing:
 - Hydraulics drawings; and

WAT-3 Landscape Irrigation

POINTS
AVAILABLE

3

- The design or commissioning report extracts and compliance with Department of Environment, Agriculture & Tourism requirements when necessary.

Extract(s) from the specification(s) identifying the proposed landscape irrigation system, its water sources and operation requirements.

Extract(s) from the Commissioning Report demonstrating that the system has been commissioned and operates as intended by the design, and expressed in the hydraulics report.

Tender or as built schematic hydraulic drawings indicating the design, location and water supply of the irrigation system; and specifically showing that the tank size is consistent with calculations.

As built site plans for the entire site showing the use for all areas (including roofs) and demonstrating that landscaping is or is not provided.

Tender site plans of the entire site showing the use of each area (including roofs) and clearly indicating the location, or lack of landscaped area.

Landscape Report justifying why the design can be classified as 'xeriscaping'.

Confirmation of xeriscape garden installation from the owner indicating that the provision of irrigation systems for the xeriscape garden will be removed within twelve months of landscaping installation and that the landscape will not receive watering after this time.

Evidence that there is no provision of irrigation systems e.g. a letter by the building owner that the irrigation system has been removed.

Confirmation from the architect (1) that landscaping (including roof, vertical and planter gardens) is either not present or jointly accounts for less than 1% of the project site area (calculations are required in the latter case).

Confirmation from the architect (2) that landscaping (including roof, vertical and planter gardens) jointly accounts for 30% or more of the project site area (calculations are required).

Confirmation from Architect (3) that landscaping (including roof, vertical and planter gardens) jointly accounts for less than 30% of the project (calculations are required).

ADDITIONAL GUIDANCE

The credit requires that the solution(s) described in this credit correlate with the other relevant credits claimed, e.g. Wat-1 'Occupant Amenity Water' and Eco-4 'Change in Ecological Value'.

If a xeriscape garden is proposed, it must be evident that it will not require irrigation during the building's operation.

If reduction in the demand of potable water is proposed, the reduction must be demonstrated clearly against a robust reference case (see Additional Guidance).

The first two points of this credit will only be considered to be 'Not Applicable' if it is clearly demonstrated that landscaping (including roof, vertical and planter gardens) is either not present or jointly accounts for less than 1% of the project site area.

The additional one point of this credit will only be considered to be 'Not Applicable' if it is clearly demonstrated that there is no landscaping (including roof, vertical and planter gardens), or the total landscaped area represents less than 30% of the site area.

Reduction in potable water demand

Potable water demand can be reduced through the installation of water-efficient irrigation

WAT-3 Landscape Irrigation

POINTS
AVAILABLE**3**

systems (such as sub-soil or drip irrigation) or through the use of non-potable water for landscape irrigation. If rainwater harvesting or greywater collection is also used for toilet flushing then to avoid double-counting, the volume of water provided for the irrigation credit must be entered into the Potable Water Calculator. The Potable Water Calculator does not undertake detailed calculations of water storage efficiency.

Non-potable 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 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 provincial level.

Establishing the reference case

The reduction in potable water consumption is to be estimated against the amount of potable water that would be used in the most common solution permitted by regulation. At the time of the publication of this Technical Manual, most projects would assume above-ground sprinkler systems. However, should these become prohibited, it would not be acceptable to assume such a system for the reference case.

Xeriscape garden

A 'xeriscape garden' is defined as a water-conserving garden, or garden requiring no additional watering. Where a xeriscape garden has been installed, provisions must be made to remove any irrigation system within twelve months 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.

Relevant authority approval

Where greywater and/or blackwater treatment and reuse systems are present, evidence of approval from the relevant authority(s), such as government agencies, local council, the water utility and the department of public health, must be provided.

BACKGROUND

Irrigation demand is not included in the Potable Water Calculator (Wat-1 'Occupant Amenity Water') due to difficulties in setting a benchmark for use in commercial buildings (including area and type of plants).

In South Africa the quantity of water used for landscape irrigation in some instances accounts for as much as 50% of the total water consumed on office premises.

REFERENCE & FURTHER INFORMATION

Landscape Irrigation Association of S.A.
<http://www.liasa.co.za>

Water Conservation & use in Agriculture
<http://www.wca-infonet.org>

Water Efficiency South Africa

WAT-3 Landscape Irrigation

POINTS
AVAILABLE

3

<http://www.waterefficiencysa.co.za>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Off-site reclaimed water - Alternative documentation as per 29 April 2014 see *

Credit Interpretation Request Number: WAT3-C-OB1-0266

Ruling: 2011-06-09

The use of reticulated off-site reclaimed water is an acceptable way to reduce potable water consumption within the Green Star SA rating system. Although off-site harvesting and recycling systems are not specific attributes of the building seeking Green Star SA certification (as would be the case of an on-site water harvesting and recycling system), the fact that the building has chosen to incorporate the necessary infrastructure to connect their building services to the off-site service is, in this scenario, viewed as a building attribute.

The following additional documentation requirements apply where reticulated off-site reclaimed water is used:

For Green Star SA Design ratings;

- Evidence that the reclaimed water system is operational at the time of practical completion of the building.
- Confirmation from the off-site non-potable water supply vendor that the required supply is available to the project.

For Green Star SA As Built ratings;

- Evidence that the reclaimed water system is operational at the time of practical completion of the building.
- An extract from the contract between the off-site non-potable water supply vendor and the building owner must be provided.

*29 April 2014 TC788

The project team's proposal for providing alternative evidence to that requested in the WAT1/3/4-C-OB1-0266 CIR's (evidence that reclaimed water system is operational and confirmation of supply from water vendor) is hereby approved.

We note that the following alternative documentation has been proposed and approved:

WAT-3 Landscape Irrigation

POINTS
AVAILABLE**3**

- 1) Site plans of the precinct illustrating;
 - The current As Built stormwater reticulation, and attenuation facilities, and
 - Construction plans for the stormwater reticulation of the registered project
- Water Schematic for registered project, illustrating connection to off-site non-potable water source, and usage of water source

- 2) A signed short report from system design consultant describing and quantifying the volume of off-site non-potable water that will be available for the registered project each day, and why.

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Technical Clarification: Non-permanent landscape

Technical Clarification Number: WAT3-T-OB1-0101

Guidance 2010-09-07

Non-permanent landscape, such as potted plants, planter boxes, or other non-insitu landscape features, either internally or externally located, which can be removed or relocated, are not considered part of the 'base building' and are therefore not within the scope of the Wat-3 credit. Irrigation demands for such non-permanent landscape are to be excluded from calculations to demonstrate compliance with the Credit Criteria.

.....

Technical Clarification: Combined initiatives

Technical Clarification Number: WAT3-T-OB1-0102

Guidance: 2010-09-07

It is an acceptable method to meet the Credit Criteria through a combination of some or all of the design initiatives noted in the Wat-3 Additional Guidance (i.e. xeriscape, water-efficient irrigation systems and non-potable water for landscape irrigation). If Project teams elect to meet the Credit Criteria using a combination of initiatives, the established reference case, the proposed savings of each initiative and the overall savings must be clearly communicated in the documentation.

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Technical Clarification: Groundwater

Technical Clarification Number: WAT3-T-OB1-0385

Guidance: 2010-07-06

Groundwater seeping into building basements may be included as non-potable water in calculations for this credit. 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.

WAT-3 Landscape Irrigation

POINTS
AVAILABLE

3

The following errata have been incorporated into the body of the email:

WAT3-E-OB1-0404 (2012-02-03): Green Star SA - Office v1 Technical Manual: Page 202-203

WAT3-E-OB1-0292 (2011-08-08) : Green Star SA - Office v1 Technical Manual: Page 204

WAT3-E-OB1-0207 (2011-01-06): Green Star SA - Office v1 Technical Manual: Page 201

WAT3-E-OB1-0208 (2011-01-06): Green Star SA - Office v1 Technical Manual: Page 201

WAT-4 Heat Rejection Water

POINTS
AVAILABLE**4**

AIM OF CREDIT

To encourage and recognise design that reduces potable water consumption from heat rejection systems.

CREDIT CRITERIA

Up to four points are awarded as follows:

Two points are awarded where:

- Potable water consumption of water consuming heat rejection systems is reduced by 50%.

Four points are awarded where:

- Potable water consumption of water consuming heat rejection systems is reduced by 90%;
OR
- No water consuming heat rejection systems are provided.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For mechanically air conditioned spaces: • Short report • Extract(s) from the specification(s) • Tender schematic hydraulic drawings For naturally ventilated and mechanically assisted naturally ventilated spaces: • Short report • Extract(s) from the specification(s) • Tender architectural drawings	For mechanically air conditioned spaces: • Short report • Extract(s) from the Commissioning Report • As built hydraulics drawings For naturally ventilated and mechanically assisted naturally ventilated spaces: • Short Report • As built architectural drawings • Extracts(s) from the Commissioning Report

Short report on the heat rejection system(s) in the project, prepared by a suitably qualified project team member, referencing drawings and detailing:

- The heat rejection requirements of the building;

WAT-4 Heat Rejection Water

POINTS
AVAILABLE

4

- Any proposed water-based heat rejection system;
- Calculations (and justification of values used) for the reference case; and
- How the proposed system meets the Credit Criteria against the reference case.
- Where no water-based heat rejection systems are installed, the report must describe the heat rejection system installed in the project (such as air cooled chillers, etc).
- For naturally ventilated spaces and mechanically assisted naturally ventilated spaces, demonstrating that the building operates as a naturally ventilated office space in accordance with SANS 10400-O and requires no mechanical air conditioning for occupancy.

Extract(s) from the specification(s) identifying and detailing the proposed heat rejection system, its water sources and operation requirements. For mechanically assisted naturally ventilated spaces, identifying and detailing the proposed mechanically assisted system and operation requirements, for naturally ventilated buildings, no extract(s) from the specification(s) are required.

Extract(s) from the Commissioning Report demonstrating that the installed system has been fully commissioned and operates as intended by the design.

Tender or as built schematic hydraulic drawings highlighting:

- The location and water supply of the water-based heat rejection systems; and
- Any supplementary equipment that may be required to achieve the specified reduction in potable water consumption.

Tender architectural drawings for each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly indicated and dimensioned.

As built architectural drawings for each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly indicated and dimensioned.

ADDITIONAL GUIDANCE

Points under this credit will not be awarded unless the solution(s) described in this credit correlate with the other relevant credits claimed, e.g. Ene-1 'Greenhouse Gas Emissions'.

If reduction in the demand for potable water is proposed, the credit requires that the reduction has been demonstrated and justified clearly and against a robust reference case.

No evidence need be submitted within this credit to demonstrate the absence of water-based heat rejection systems in the project. However, this claim will only be accepted if throughout the submission it has been clearly demonstrated that the air conditioning needs of the project will be effectively met by means other than water-based heat rejection, and that there are no water-based heat rejection systems installed.

For the purposes of this credit, non-potable 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 non-potable water used. In addition to the surface water table dropping, there is a global deficit of groundwater each year, and extracting water from any neighbourhood fresh-water sources merely localises what otherwise would take place on the municipal or provincial level.

Establishing the reference case

WAT-4 Heat Rejection Water

POINTS
AVAILABLE**4**

Potable water demand of water-based heat rejection systems can be reduced through mixed-mode air conditioning, efficient use of conventional systems (e.g. cooling towers) or through the use of alternative technologies.

The reduction in potable water consumption is to be estimated against the amount of potable water that would be used in the reference case specific to this project.

The reference case is to be established as follows:

- To reflect water consumption for evaporation, bleed and draining required by Eurovent 9/5, 2nd Edition, 2002, for full cleaning;
- The cooling demand must be based on the thermal model used for Ene-1 'Greenhouse Gas Emissions';
- An hour-by-hour calculation must be completed for an average day in January, April, July and October; and
- Six cycles of concentration are to be assumed.

Mixed-mode

Mixed-mode buildings must demonstrate that the predicted reduction in the operation hours of the mechanically air conditioned system does in fact equate to the stipulated reduction in potable water consumption. Note that 50% reduction in operation hours does not usually equate to a 50% reduction in water consumption by water-based heat rejection systems.

Mixed-mode projects can assume that water consumption savings due to the mixed-mode system are proportional to the cooling energy savings. For example, if the cooling energy consumption is reduced by 30% per annum due to the natural ventilation mode of operation, compared to full HVAC mode of operation, then for the purpose of this credit, the cooling tower water consumption can be considered to be reduced by 30%.

BACKGROUND

The use of water based heat rejection systems that consume huge amounts 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.

REFERENCES & FURTHER INFORMATION

CIBSE, AM 10:1997, *Natural Ventilation in Non-domestic Buildings*

Eurovent, 9/5, 2nd Edition:2002, *Recommended Code of Practice to Keep Your Cooling System Efficient & Safe*

WAT-4 Heat Rejection Water

POINTS
AVAILABLE

4

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Off-site reclaimed water - Alternative documentation as per 29 April 2014 see *

Credit Interpretation Request Number: WAT4-C-OB1-0266

Ruling: 2011-06-09

The use of reticulated off-site reclaimed water is an acceptable way to reduce potable water consumption within the Green Star SA rating system. Although off-site harvesting and recycling systems are not specific attributes of the building seeking Green Star SA certification (as would be the case of an on-site water harvesting and recycling system), the fact that the building has chosen to incorporate the necessary infrastructure to connect their building services to the off-site service is, in this scenario, viewed as a building attribute.

The following additional documentation requirements apply where reticulated off-site reclaimed water is used:

For Green Star SA Design ratings;

- Evidence that the reclaimed water system is operational at the time of practical completion of the building.
- Confirmation from the off-site non-potable water supply vendor that the required supply is available to the project.

For Green Star SA As Built ratings;

- Evidence that the reclaimed water system is operational at the time of practical completion of the building.
- An extract from the contract between the off-site non-potable water supply vendor and the building owner must be provided.

*29 April 2014 TC788

The project team's proposal for providing alternative evidence to that requested in the WAT1/3/4-C-OB1-0266 CIR's (evidence that reclaimed water system is operational and confirmation of supply from water vendor) is hereby approved.

We note that the following alternative documentation has been proposed and approved:

- 1) Site plans of the precinct illustrating;
 - The current As Built stormwater reticulation, and attenuation facilities, and
 - Construction plans for the stormwater reticulation of the registered project
- Water Schematic for registered project, illustrating connection to off-site non-potable water source, and usage of water source

WAT-4 Heat Rejection WaterPOINTS
AVAILABLE**4**

2) A signed short report from system design consultant describing and quantifying the volume of off-site non-potable water that will be available for the registered project each day, and why.

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Technical Clarification: Evaporative cooling

Technical Clarification Number: WAT4-T-OB1-0061

Guidance: 2010-02-15

Evaporative cooling is considered a water consuming heat rejection system for purposes of this credit.

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The following erratum has been incorporated into the body of the email:

WAT4-E-OB1-0402 (2012-01-27) : Green Star SA - Office v1 Technical Manual: Page 208

.....

ENE-5 Peak Energy Demand Reduction

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise designs that reduce peak demand on energy supply infrastructure.

CREDIT CRITERIA

Up to two points are awarded where it is demonstrated that the building has reduced its peak electrical demand load on electricity infrastructure as follows:

One point is awarded where:

- Peak electrical demand is actively reduced by 15%; OR
- The difference between the peak and average demand does not exceed 40%.

Two points are awarded where:

- Peak electrical demand is actively reduced by 30%; OR
- The difference between the peak and average demand does not exceed 20%.

DOCUMENTATION REQUIREMENTS

Passive design can be claimed to meet the Credit Criteria for the flatter overall electrical demand curve (i.e. the difference between the peak and average demand), but not for active peak energy demand reduction.

The following is required to claim the points:

a) Active peak electrical demand reduction

- Peak electrical demand must be calculated for the actual building; and
- Peak electrical demand must be calculated for a notional building of the same size without the peak energy demand measures

b) Flatter electrical demand curve

- Peak electrical demand must be calculated for the actual building; and
- Average electrical demand must be calculated for the actual building.

The proposed system must be incorporated accurately and consistently throughout the submission wherever it may affect compliance with other claimed credits (e.g. Ene-1 'Greenhouse Gas Emissions').

Compliance may NOT be achieved by 'load lopping' using the Building Management System (BMS) or equivalent. 'Load Lopping' is when chillers or other large pieces of equipment are turned off automatically if the building exceeds a certain power usage. This is excluded since it will affect the comfort of the occupants and is easy to reset or override.

Peak energy demand calculations

Peak energy demand is the predicted annual peak to be calculated as the sum of all loads (to include all miscellaneous loads) relevant to the base building in electrical schematics.

Peak energy demand must be calculated as follows:

ENE-5 Peak Energy Demand Reduction

POINTS
AVAILABLE

2

- In accordance with SANS 10142;
- As the absolute design capacity of the system, after the application of diversity factors but prior to the application of contingency factors as required for utility agreements;
- Mixed-mode ventilated buildings must be calculated as per the mechanically air conditioned mode; and
- Everything except tenant light and power must be included in assessing peak demand.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where credit claimed for reduction in peak electrical demand: • Short report • Extract(s) from the specification(s) • Tender schematic electrical drawings	Where credit claimed for reduction in peak electrical demand: • Short report • Extract(s) from the Commissioning Report • As built schematic electrical drawings
Where credit claimed for flatter electrical demand curve: • Short report • Evidence of system viability	Where credit claimed for flatter electrical demand curve: • Short report • Evidence of system viability

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Where compliance is demonstrated through reduction of peak electrical demand:
 - Justifying, with supporting calculations, the building's peak demand value;
 - Detailing, with supporting calculations, the design, operation, and sufficient capacity of the intended system;
 - Appropriately referencing drawings and SANS 10142; and
 - Clearly identifying what active mechanisms will ensure that the demand on the infrastructure will at no point exceed the stipulated percentage of the building's demand.
- Where compliance is demonstrated through a flatter electrical demand curve:
 - Describing building attributes that result in a flatter overall electrical demand curve; and
 - Providing calculations supporting compliance with the Credit Criteria.

Extract(s) from the specification(s) where the proposed solution(s) are described.

Extract(s) from the Commissioning Report demonstrating that the solution(s) have been commissioned and operate as intended by the design, appending relevant test data, and referencing the Operations and Maintenance (O&M) Manual.

Tender schematic electrical drawings clearly indicating the type, location and details of the proposed solution(s).

As built schematic electrical drawings of the installed solution(s).

ENE-5 Peak Energy Demand Reduction

POINTS
AVAILABLE

2

Evidence of system viability showing any evidence that may be necessary to demonstrate that the intended solution(s) meets the Credit Criteria.

ADDITIONAL GUIDANCE

Peak energy demand

The peak demand is expected to occur during regular occupancy hours. The typical peak energy demand occurs during hot summer afternoons when the HVAC system is providing maximum cooling.

Mixed-mode ventilated buildings must provide calculations for the mechanically air conditioned mode.

Design strategies

Peak energy demand reduction systems that could comply with the credit's requirements include, but are not limited to:

- Distributed energy systems;
- Cogeneration;
- Micro-turbines;
- Photovoltaics (with battery storage);
- Fuel cells;
- Energy and thermal storage systems;
- Batteries;
- Ice storage; and
- Phase change materials.

It is expected that where compliance is achieved using an active, rather than a passive, system, a significant amount of time and detail would be required to ensure the correct design and commissioning of such a system.

Energy storage systems may also be useful in combination with intermittent energy sources, a common trait of many renewable energy sources. The most common example of this is a system that utilises the excess electricity from a photovoltaic array to charge a battery during daylight hours, then draws off the battery during the night.

Unless they are designed and integrated into the base building for the purpose of peak energy demand reduction and can be activated automatically and without causing a blackout, stand-by generators do not qualify for this credit.

Where the building produces its own energy on site, such energy can be included in modelling.

BACKGROUND

Lessening the peak demand is one strategy for reducing the energy infrastructure required to meet the needs of buildings and industry.

The electrical generation capacity in South Africa is currently unable to meet peak demands, leading to regular load shedding and disruption. Reducing peak loads will reduce the pressure on the utility to provide short term solutions (often involving older 'dirtier' plant and carbon intensive generation) and allow the utility to concentrate on longer term cleaner forms of electrical energy generation.

ENE-5 Peak Energy Demand Reduction

POINTS
AVAILABLE**2**

REFERENCES & FURTHER INFORMATION

SANS 10142-1:2003 *Code of Practice: The Wiring of Premises*

ESKOM Annual Report 2007

<http://www.eskom.co.za>

National Response To South Africa's Electricity Shortage (Jan 2008)

http://www.info.gov.za/otherdocs/2008/nationalresponse_sa_electricity1.pdf

Eskom Demand Side Management

<http://www.eskomdsm.co.za/>

CSIRO, Demand-Side Response and the Electricity Network

http://www.det.csiro.au/science/de_s/de_dsm.htm

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Use of actual measured data

Credit Interpretation Request Number: ENE5-C-OB1-0271

Ruling: 2012-01-12

The Credit Interpretation Request to use actual measured energy consumption data to calculate the peak demand reduction is denied.

The CIR Review Panel notes that the project must use documentation requirements as set out in the Green Star SA - Office v1 Technical Manual. The CIR Review Panel also wishes to note that the CIR also proposes the use of extrapolated measured energy data to estimate the building electrical demand (even though this was not the request raised in the CIR), which is also not an acceptable proof of compliance with credit criteria.

Technical Clarification: Notional building clarification

Technical Clarification Number: ENE5-T-OB1-0265

Guidance: 2011-04-13

In determining the active Peak Electrical Demand Reduction for Ene-5 credit, the "notional building" referenced, refers to the actual building (with geometry, orientation, fabric, services etc. as per the actual design) but without the inclusion of the benefit of the active peak energy demand reduction

ENE-5 Peak Energy Demand Reduction

POINTS
AVAILABLE**2**

systems.

Thus as an example, in the case of a building using onsite electrical generation (renewable or otherwise) as an active peak electrical demand reduction intervention, the active peak electrical demand reduction is determined by comparing the maximum electrical peak power of the "notional building" (i.e. without the onsite generation contribution) and the maximum electrical peak power of the "actual building" (i.e. including the onsite generation contribution).

Technical Clarification: Photovoltaics without battery storage

Technical Clarification Number: ENE5-T-OB1-0103

Guidance: 2010-09-07

The Technical Manual states that "Peak energy demand reduction systems that could comply with the credit's requirements include but are not limited to:... Photovoltaics (with battery storage)". The Technical Manual does not prevent the use of photovoltaic (PV) systems being connected to the building's electrical network as opposed to a battery storage system. Should PV systems be used in such a scenario without battery storage and the project wishes to claim points under this credit, the peak electrical demand reduction claimed must be calculated using the building's 24 hour load profile containing the highest expected annual peak (without the PV supply), determined via modelling or from first principles, and the project's PV electrical supply curve/profile determined using the performance specifications of the proposed PV system and using the appropriate climatic data for that same day. Projects are required to submit the documentation as per the Technical Manual and ensure that the proposed maximum electrical demand reduction system meets the Credit Criteria. The Certified Assessors will look for evidence that an appropriate peak baseline is determined and that the PV system supply curve/profile has been determined using the specifications of the proposed PV system.

Technical Clarification: Passive design

Technical Clarification Number: ENE5-T-OB1-0014

Guidance: 2009-02-06

Per the Green Star SA - Office v1 Technical Manual, page 157, passive designs can claim the credit for the flatter overall demand curve, but not for the active peak energy demand reduction. This credit deals with active reduction of peak electrical demand of the as-designed building, or achievement of a flatter electrical demand curve. Decreased demand through efficient design is rewarded in Ene-1 Greenhouse Gas Emissions.

Technical Clarification: Demand curve

Technical Clarification Number: ENE5-T-OB1-0003

Guidance: 2009-02-05

ENE-5 Peak Energy Demand Reduction

POINTS
AVAILABLE

2

Projects must look at the peak energy demand over the 24 hour demand curve, not just the regularly occupied hours.

The following erratum has been incorporated:

ENE5-E-OB1-0264 (2011-08-08)

WAT-5 Fire System Water ConsumptionPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise building design which reduces consumption of potable water for the building's fire protection and essential water storage systems.

CREDIT CRITERIA

One point is awarded where:

- There is sufficient temporary storage for a minimum of 80% of the routine fire protection system test water and maintenance drain-downs, for reuse on-site; and
- Each floor fitted with a sprinkler system has isolation valves or shut-off points for floor-by-floor testing;

OR

- The fire protection system does not expel water for testing.

If the building does not have a sprinkler system, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Water Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short Report • Extract(s) from the specification(s) • Tender schematic fire suppression drawings Where the credit is claimed as 'Not Applicable': • Extracts from the Fire Engineering report	• Short report • Extract(s) from the Commissioning Report • As built schematic fire suppression drawings

WAT-5 Fire System Water Consumption

POINTS
AVAILABLE

1

Short report from the suitable professional that describes how the Credit Criteria has been met, including:

- The proposed fire protection system, its operation and testing requirements, and justifying how the system design meets the Credit Criteria and how the collected water will be reused on site.

Extract(s) from the specification(s) identifying the fire protection system components and their properties that enable the system to meet the Credit Criteria.

Extract(s) from the Commissioning Report demonstrating that the fire protection system has been commissioned and operates as intended by the design.

Tender or as built schematic fire suppression drawings for each typical floor and drawings of the water storage and reuse system(s).

Extracts from the Fire Engineering report where it states that the building's fire suppression system has no sprinklers.

ADDITIONAL GUIDANCE

It must be clearly demonstrated that no less than 80% of the water from testing and maintenance drain-downs will be reused on site. If the proposed fire protection system expels water for testing, this will require an effective collection and reuse system, as well as sufficient storage capacity.

The fire protection system is deemed to include:

- Hydrants;
- Fire hose reel;
- Storage and sprinkler-test tanks; and
- Sprinkler-test and drain-down points.

As sprinkler water may not be suitable for reuse, sprinklers and sprinkler pipe drain-down water can be excluded from this credit.

Collected test water can be reused within the fire protection system or other water recycling functions, but it must be reused on site.

Temporary water storage facilities for fire systems must have the capacity to store test water at any time of the year and cannot share any component of the rainwater tank capacity that is used in any calculations for other water credits. If the storage tank designated for collection and storage of fire system water is simultaneously used for rainwater or recycled water storage, it must be designed (e.g. sized sufficiently) to avoid overflow of collected water into the sewerage system or the watercourse.

BACKGROUND

To comply with statutory requirements, fire protection systems are regularly tested and maintained to ensure that, in the event of a fire, the system will operate and deliver water flow rates to meet required design standards. In most instances sprinkler and hydrant testing requires that the system pressure is reduced to simulate a fire condition and start the booster pumps, usually by opening a valve and draining this water to a drainage system. Due to the

WAT-5 Fire System Water Consumption

POINTS
AVAILABLE

1

frequency of maintenance this volume of water can be considerable.

Additionally, fire services tanks often serve a dual function as storage for potable water. To maintain cleanliness and structural integrity these tanks are often drained to allow maintenance activities to be carried out (maybe once every two years). The volume of such tanks can be up to 50,000-100,000 litres and it is not unusual for leaks to occur after maintenance, requiring further draining and repair.

Fitting each floor with a sprinkler system with isolation valves or shut-off points ensures that draining of a floor's sprinkler system for works, alterations or maintenance can be carried out independently of the sprinkler system on other floors of the same building. However, all isolation valves fitted should be in accordance to the requirements of the fire fighting regulations.

REFERENCE & FURTHER INFORMATION

South African National Standards, SANS 10400: 1990, Part T and W, *Code of Practice for the Application of the National Building Regulations*

South African National Standards, SANS 10287:2000, *Code of Practice for Automatic Sprinkler Installation for Fire Fighting Purposes*

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Documentation Requirements - "Not Applicable" claim

Technical Clarification Number: WAT05-T-OB1-470

Guidance: 2012-04-10

In demonstrating that the project does not have a fire protection sprinkler system, the following documentation is required to claim this credit as "Not Applicable":

- Short Report prepared by a suitably qualified professional:

1. Confirming that the development does not incorporate fire protection sprinkler systems; and
2. Confirming that the development meets the required fire safety standards outlined in SANS 10400 Part T:1990

WAT-5 Fire System Water Consumption

POINTS
AVAILABLE**1**

The following errata have been incorporated into the credit body:

Erratum Number

WAT5-E-OB1-0405: (2012-02-03) : Green Star SA - Office v1 Technical Manual: Page 212

WAT5-E-OB1-0401: (2012-01-27) : Green Star SA - Office v1 Technical Manual: Page 211-212

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MAT-1-Recycling Waste StoragePOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise the inclusion of storage space that facilitates the recycling of resources used within buildings to reduce waste going to disposal.

CREDIT CRITERIA

Two points are awarded where a dedicated storage area is provided for the separation and collection of office consumables with good access for all building occupants and for collection by recycling companies.

The storage area shall be adequately sized, in accordance with Table Mat-1.1 to allow for the collection and eventual recycling of, as a minimum: cardboard, paper products, glass, plastics, and metals.

The space needs to be placed within easy access of all office areas. This can be achieved by positioning it within 20m of the base of the lift core/principal vertical circulation core serving all floors; or within 20m of the exit used for recycling pick-up; or within 3m of the shortest route connecting the lift core serving all floors and the exit used for recycling pick-up. The location and layout of the storage and collection area must be safely and easily accessible by recycling collection people and vehicles.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender drawings	• Short report • As built drawings

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Providing calculations demonstrating compliance with the sizing requirements for the recycling storage area outlined in Table Mat-1.1; and
- Demonstrating that at least one of the distance requirements is met.

MAT-1-Recycling Waste Storage

POINTS
AVAILABLE

2

Tender drawing(s) marked up to show:

- The location of the recycling storage area(s), with dimensions indicated; and
- The route connecting the recycling storage area(s) with either the exit and/or the lift core, with dimensions indicated.

As built drawing(s) marked up to show:

- The location of the recycling storage area(s), with dimensions indicated; and
- The route connecting the recycling storage area(s) with either the exit and/or the lift core, with dimensions indicated.

ADDITIONAL GUIDANCE

The recycling waste storage must effectively serve all building uses and occupants and be sufficiently sized to accommodate the storage of the following recyclables, as a minimum: cardboard, paper products, glass, plastics and metals. Other products that require appropriate disposal and/or recycling include printer and toner cartridges, organics, CFL and other light bulbs, computer and electronic equipment.

The recycling storage area must be sized in accordance with Table Mat-1.1. Where the GFA of the building falls between the figures outlined in Table Mat-1.1, linear interpolation must be used to determine an appropriate percentage area for the recyclable storage space.

For GFA less than 500m² the minimum area required is 7.5m². For projects with a GFA above 20,000m² use 0.15%.

Gross Floor Area (m ²)	Min area of recyclable storage space (% of GFA)
500	1.5%
1,000	0.80%
5,000	0.35%
10,000	0.25%
20,000	0.15%

Table Mat-1.1: Compliance requirements for different GFA for waste storage

Lifts

If a building has multiple lifts, and no lift serves all floors, then the storage area(s) must be located within near equal proximity of all the lifts.

MAT-1-Recycling Waste Storage

POINTS
AVAILABLE

2

Storage area

Table Mat-1.1 provides sizing requirements for recycling waste storage only; the area must be increased by a minimum of 25% should general waste be stored in the same location.

The prescribed amount of recycling waste storage area can be provided by more than one dedicated space, but no more than one area can serve any 1,000m² of GFA (or 500m² of GFA for refurbishment projects), and each storage area must be functional and separately meet all the Credit Criteria.

If multiple uses (e.g. retail and multiple tenancies) are present within the building, this cannot compromise the value of the amenity for any of the uses.

External recycling waste storage

As Green Star SA assesses inherent 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.

BACKGROUND

Waste generation in the developed world grew by 20% between 1980-2000, and is expected to increase by a further 30% by 2020. Offices are known to produce enormous waste streams, including those of plastics, cardboards, glass bottles, aluminium cans, and of course large amounts of paper waste. Studies have found that most often, the paper waste generated in offices is recyclable paper, and usually printed only on one side. Even in offices with paper recycling systems, large amounts of recyclable paper was found to still end up in the general rubbish.

MAT-1-Recycling Waste StoragePOINTS
AVAILABLE**2**

To make recycling schemes more economic, it is beneficial for waste to be collected quickly and efficiently. A convenient, purpose-designed storage space ensures that sufficient waste is accumulated before it is collected, and helps occupants to store material. The purpose of this credit is to encourage and recognise the inclusion of storage space in the physical attributes of the building, regardless of the tenant operational policies such as contracting another company to segregate waste off-site.

According to the Paper Recycling Association of South Africa the recyclable paper recovery rate in 2006 for South Africa, as a percentage of paper consumption, was approximately 44%. When segmented, 'Offices' were performing at a recovery rate of 42%, whereas 'Homes' at only 14%. World total recovery levels showed slightly higher than the SA average at approx 47%, with countries like Switzerland, The Netherlands and Germany at the top of the list with levels between 70% and 80%.

SustainableChoice, an Australian based organization, states that producing paper from recovered fibres consumes 60% less energy and 55% less water than manufacturing paper from virgin pulp. Each recycled steel or aluminium can, and each glass bottle, keeps valuable non-renewable resources such as bauxite, iron-ore and sand in the ground, and saves energy that would normally be used in mining, manufacturing and transporting.

REFERENCES & FURTHER INFORMATION

Department of Environment and Tourism (South African Government Department)

<http://www.environment.gov.za>

<http://www.environment.gov.za/ProjProg/WasteMgmt/recycling/an-a.htm>

National Waste Management Strategy Implementation Project, April 2005

<http://www.sawic.org.za/documents/235.pdf>

Greenworks

<http://www.greenworks.co.za>

Paper Recycling Association of South Africa

<http://www.prasa.co.za>

Earthlife Africa

<http://www.earthlife.org.za>

Inform Inc. (U.S.), Waste at Work: Prevention Strategies for the Bottom Line

<http://www.informinc.org/wasteatwork.php>

New South Wales Department of Environment and Conservation, *Waste Reduction in Office Buildings: A Guide for Building Managers* (2002); *Better Practice Guide for Waste Management in Multi-Unit Dwellings* (2002).

<http://www.environment.nsw.gov.au/education/recyclingandwaste.htm>

SustainableChoice

<http://www.sustainablechoice.com.au/>

MAT-1-Recycling Waste Storage

POINTS
AVAILABLE**2**

Mondi Paper
<http://www.mpsa.co.za>

Collect-a-Can
<http://www.collectacan.co.za>

Institute of Waste Management of Southern Africa
<http://www.iwmsa.co.za/>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Alternative compliance for recycling waste storage on a precinct level

Credit Interpretation Request Number: MAT1-T-OB1-0667

Ruling: 2013-04-23

The project team must demonstrate that the size of the dedicated storage area provided within the building is sufficiently sized to accommodate the storage recyclable waste generated between collection intervals as per TC MAT1-T-OB1-0593.

The project team must further demonstrate that the centralised waste facility has sufficient space to store all the waste from the buildings (and any future buildings) within the precinct as per the credit guidance in allocating space size, page 218. Alternatively, this can be demonstrated as per the methodology stipulated in TC MAT1-T-OB1-0593. The project team must also provide a signed letter of confirmation from the relevant governing body (i.e. the precinct Property Owners Association representative) stating that that the waste recycling centre is operational at the time of practical completion of the building and that all tenants (including the project) are authorised to make use of this centralised facility. The extracts from the tenant guidelines must be provided to show the requirements for waste collection and frequency of collection.

Do note that all other credit criteria remains and the project must comply in order to be recognised for their effort.

MAT-1-Recycling Waste StoragePOINTS
AVAILABLE**2**

Technical Clarification: Waste professional sizes your waste storage area

Technical Clarification Number: MAT1-T-OB1-0593

Guidance: 2013-04-16

If a waste management professional has established that the allocated size of the space for recycled waste (including general waste) is sufficient for the development, this is acceptable as an alternative to the table Mat-1.1 sizing requirements, however the project team will need to provide the following as part (not solely, unless it includes all documents types/information requested by the technical manual) of the credit submission:

- Waste and Recycling Management Plan (Signed by the building owner)

The Waste and Recycling Management Plan must address all waste (recyclable and non-recyclable) generated in the building (occupants, common areas and visitors) and the dedicated storage area for the separation and collection of recyclables must be sufficiently sized (as per the technical manual or waste professional advice) to handle the collection and sorting of all waste streams for the following recyclables as a minimum:

- Cardboard;
- Paper Products;
- Glass;
- Plastics; and
- Metals

The Waste and Recycling Management Plan must describe, at a minimum:

- Estimation of waste generation and justification of the size of the recycling area. This justification must be made by the waste management professional and must be based on calculations of the estimated waste generation quantities. All calculations must be well explained in the WMP and clearly conclude that based on these calculations and the proposed frequency of collection, that the size of the recycling waste storage area is in fact sufficient;
- Description of the waste storage areas, in terms of location, size, accessibility, easy access for manoeuvring bins and cleaning storage areas;
- Proposed waste recycling strategy; what waste is separated and recycled; and how;
- Transfer of waste bins to storage areas; in terms of surface (free of steps, kerbs), distances;
- Description of the collection points, ease of collection, access for collection vehicles;
- Frequency of collection.

Credit Interpretation Request: Recycling waste storage

Credit Interpretation Request Number: MAT1-T-OB1-0623

Ruling: 2013-01-28

It is acceptable to meet the Credit Criteria of Mat-1: Recycling Waste Storage with more than one dedicated storage area. However, all storage areas dedicated to recycling must meet all the Credit Criteria and Additional Guidance requirements (such as location within 20m of a lift core) and be sufficiently sized, functional, safely and easily accessible.

An area dedicated exclusively to storage of rubbish (non-recycling waste) should be excluded from the calculations of the recycling waste storage area. Note that if general (non-recycling) waste is stored in the same location as the recycling waste, the area must be increased by a minimum of 25%.

MAT-1-Recycling Waste Storage

POINTS
AVAILABLE**2**

In addition, where other uses (retail or multiple tenancies) are present in the building, it must be clearly demonstrated that the office use of the recycling waste storage facilities is not compromised (e.g., how a proportion of facilities is dedicated for exclusive use of the project).

Technical Clarification: Multiple GFA space types

Technical Clarification Number: MAT1-T-OB1-0409

Guidance: 2012-02-10

As per the Green Star SA – Office v1 Technical Manual (Page 219), “if multiple uses (e.g. retail and multiple tenancies) are present within the building, this cannot compromise the value of the amenity for any of the uses”. This statement is to be interpreted that recycling waste storage area(s) sized in accordance with Table Mat-1.1 using the commercial office GFA only (i.e. other space type GFA excluded), would only be deemed to meet the Credit Criteria if additional area(s) is provided for waste generated from the non-commercial office GFA (e.g. retail, restaurant etc.). Where no additional area(s) is provided and only the minimum as per Table Mat-1.1 is provided, it is reasonably assumed that waste generated from the non-commercial GFA would be stored within the area(s) and “compromise the value of the amenity” for the commercial office GFA recycling waste management.

The GBCSA does not prescribe guidelines for area of recycling waste storage (per m2 GFA) for non-commercial office GFA (e.g. retail, restaurant etc.) and Project Teams are permitted to use their professional and informed discretion as to the additional area provided for waste streams from these space types. It is suggested that the figures presented in Table Mat-1.1 are used as a guide, but are not compulsory.

The requirement to increase waste storage area(s) by 25% should general waste be stored in the same location as recycling waste, as per the Green Star SA – Office v1 Technical Manual, is applicable to commercial office waste storage area(s) only.

MAT-2-Building Reuse

POINTS
AVAILABLE**5**

AIM OF CREDIT

To encourage and recognise developments that reuse existing buildings to minimise materials consumption.

CREDIT CRITERIA

Five points are available as follows:

Up to two points are awarded where a proportion of the total existing façade of the building, by vertical area, is reused:

- One point for reuse of 60%; OR
- Two points for reuse of 90%.

Up to three points are awarded where a proportion of the existing major structure, by gross building volume, is reused:

- One point for 30% reuse; OR
- Two points for 60% reuse; OR
- Three points for 90%.

Where the site contained no buildings at the time of purchase or the total GFA of the original building(s) is less than 20% of the GFA of the new building that replaces it, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Materials Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

MAT-2-Building ReusePOINTS
AVAILABLE**5****DOCUMENTATION REQUIREMENTS**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where façade or structure is being used: • Short report • As built drawing(s) of original building(s) • Tender drawing(s) of new building Where the credit is being claimed as 'Not Applicable': • Short report • Site Documentation OR • As built drawing(s) of original building(s)	Where façade or structure is being used: • Short report • As built drawing(s) of original building(s) • As built drawing(s) of new building Where the credit is being claimed as 'Not Applicable': • Short report • Site Documentation OR • As built drawing(s) of original building(s)

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Providing calculations and a complete area schedule that demonstrate that the GFA of the original building(s) is less than 20% of the GFA of the building replacing them, referencing documentation from original buildings;
- OR
- Describing what elements of the façade/structure are being retained, and providing calculations and a complete area/volume schedule for both the original and new buildings that demonstrate that the total area (for façade calculations) or volume (for structure calculations) retained from the original building(s) is sufficient to meet the Credit Criteria. All of the original façade/structure must be accounted for;
- OR
- Stating that the site contained no building(s) at the time of purchase.

Site documentation:

Scaled site plans (with built area and GFA quantified) or aerial photographs generated at, or prior to, site purchase, showing the built area on the site.

As built drawing(s) of the original building(s):

- Elevation drawings marked up to show the location and area of the reused façade; and
- Floor plan drawings marked up to show the location and associated building volume of the reused structure and indicating the building(s)' GFA.

MAT-2-Building ReusePOINTS
AVAILABLE**5****Tender drawing(s) of the new building:**

- Elevation drawings marked up to show the location and area of the reused façade; and
- Floor plan drawings marked up to show the location and associated building volume of the reused structure and indicating the building(s)' GFA.

As built drawing(s) of the new building:

- Elevation drawings marked up to show the location and area of the reused façade; and
- Floor plan drawings marked up to show the location and associated building volume of the reused structure and indicating the building(s)' GFA.

ADDITIONAL GUIDANCE

The documentation must clearly demonstrate that the stipulated proportion of the façade/structure has been retained, regardless of how much additional material has been added.

This credit will only be deemed 'Not Applicable' if the calculations account for all of the building(s) that existed on the site.

In addition to conservation of materials, land and water, as well as reduced embodied energy, factors such as energy performance determine whether conservation of an existing building is the best environmental outcome. The design team should consider this in determining to what extent the existing building should be retained and refurbished.

This credit addresses the retaining of existing materials, not the final design; therefore, it is irrelevant whether the retained elements are clad in, or otherwise refurbished with, additional material.

If the building(s) that are being demolished, as a consequence of the development that seeks Green Star SA assessment, extend beyond the site boundary, their total area must be used in the calculations for these credits. If the development comprises both a refurbishment and a new addition, the Credit Criteria are to be read as pertaining to the refurbishment only.

Refurbishment projects are likely to achieve this credit without difficulty unless the building is entirely re-clad. Externally affixed elements such as fixed shading devices are excluded from the calculation of façade.

Structure

A major structure is defined as floors, columns, beams and load bearing walls and where these are required for structural use by the new building foundations. The allocation of the points for reuse of structure is based on gross building volume and not material volume, as the latter would be difficult to calculate. The credit requires that the existing major structure is reused without significant strengthening or alteration works (where mass of new material is equal to or greater than 50% of the total mass for the reused structure).

It is not necessary for the reused structure to correspond to a similar proportion of the new building for this credit to be awarded.

MAT-2-Building ReusePOINTS
AVAILABLE**5****BACKGROUND**

At present, construction and demolition waste within the developed world makes up approximately one third of all waste generated, and approximately 40% of all waste disposed to landfill.

Reuse of buildings and parts of buildings can significantly reduce the demand for new construction materials and thus lessen environmental burdens resulting from the development. The reuse of building façades is commonly required for other reasons, such as heritage considerations, but can also lead to a direct environmental benefit.

Repairing a structure saves natural resources, including raw materials, water and energy, and decreases the negative impact that are byproducts of extraction, manufacturing and transportation of new materials. It also minimises the amount of demolition waste sent to landfill. Indirect economic benefits include reduced demolition and transportation costs.

REFERENCES & FURTHER INFORMATION

Deconstruction as an Essential Component of Sustainable Construction, by Charles J. Kibert, University of Florida, USA

<http://www.sustainablesettlement.co.za/event/SSBE/Proceedings/kibert.pdf>

eThekweni Municipality website

<http://www.durban.gov.za/durban/services/services/cleansing/recycling/construction>

South African Greenbuilding website

<http://www.greenbuilding.co.za/>

Sustainable Built Environment

<http://www.sustainablebuiltenvironments.com>

Smart Growth Online (U.S.), Green Building Case Studies

http://www.smartgrowth.org/casestudies/casestudy_index.html

National State of the Environment Report, South Africa

<http://www.environment.gov.za/soer/index.html>

Concrete Thinker: Concrete Thinking for a Sustainable World <http://www.concretethinker.com>

<http://www.concretethinker.com/Papers.aspx?DocId=36>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects' discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Demolition drawings

Technical Clarification Number: MAT2-T-OB1-0312

MAT-2-Building ReusePOINTS
AVAILABLE**5****Guidance:** 2011-08-22

Demolition drawings may be provided in lieu of As Built Drawings of the Original Buildings, provided that the same information is indicated. If demolition elevations are not available, then floor plans must indicate the locations of reused and demolished facades, which can then be correlated with the tender elevations.

Technical Clarification: 'Not Applicable' Clause**Technical Clarification Number:** MAT2-T-OB1-0042**Guidance:** 2009-08-20

The Credit Criteria states that if “the total GFA of the original building(s) is less than 20% of the GFA of the new building that replaces it, this credit is ‘Not Applicable.’” The ‘new’ building GFA is considered to be the final GFA of the building, including both the original building GFA and any new GFA added to it through the development.

The following erratum have been incorporated:**MAT2-E-OB1-0333** (2012-01-17) Green Star SA - Office v1 Technical Manual: Page 224

MAT-3 Reused MaterialsPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise designs that prolong the useful life of existing products and materials.

CREDIT CRITERIA

One point is awarded where:

At least 1% of the project's total contract value is represented by reused products/materials.

This credit excludes materials specifically addressed by other credits (i.e. steel, concrete, PVC and timber); neither does it address the reuse of the original building(s) on the site (addressed in Mat-2 'Building Reuse').

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Quantity Surveyor report • Extract(s) from specification(s)	• Short report • Confirmation from contractor • Evidence of reuse

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by documenting all separate uses of reused products and materials in the project.

Quantity Surveyor report estimating the total material value of the reused materials as a proportion of the project's total value.

Extract(s) from specification(s) where the reused products and materials in the project as well as the associated quantities of these materials are stipulated.

Confirmation from the contractor that all reused items have been installed.

Evidence of reuse of products/materials, such as purchase receipts of items purchased from a second-hand retailer or removal list/inventory to confirm previous location of the item.

"Extract(s) from the issued contract that includes the project's total contract value."

MAT-3 Reused MaterialsPOINTS
AVAILABLE**1****ADDITIONAL GUIDANCE**

It must be demonstrated that:

- The actual or estimated total monetary value of reused products/materials is reasonably justified (It is acceptable to substitute the actual amount paid with the fair market value of a reused material, as long as it is justified in the submission.);
- The claimed monetary value of the project reflects the entire project scope; and
- At least 80% of each product/material claimed towards this credit has been retained.

Examples of reused materials include, but are not limited to, bricks, windows, cladding, pre-cast concrete panels (as their reuse is not rewarded in the 'Recycled Content of Concrete' credit), flooring and doors.

For a product/material to be classified as 'reused' at least 80% (by area, length, volume or mass, whichever is more appropriate, and metric chosen must be justified) of the item must be retained; the rest can be refurbished or new (as in the case of new upholstery). Painting or coating is inconsequential to determining whether a product is reused.

BACKGROUND

At present, construction and demolition waste in the developed world makes up around one third of all waste generated. Implementation of appropriate strategies during the construction phase of a building can significantly reduce this figure, helping the transition towards a more sustainable industry. Reusing products and materials is another definite approach towards ensuring that the useful life of products is extended and hence diverted from landfill.

REFERENCES & FURTHER INFORMATION

Deconstruction as an Essential Component of Sustainable Construction, by Charles J. Kibert, University of Florida, USA

<http://www.sustainablesettlement.co.za/event/SSBE/Proceedings/kibert.pdf>

National State of the Environment Report, South Africa

<http://www.environment.gov.za/soer/index.html>

eThekweni Municipality website

<http://www.durban.gov.za/durban/services/services/cleansing/recycling/construction>

South African Greenbuilding website

<http://www.greenbuilding.co.za/>

Sustainable Built Environment

<http://www.sustainablebultenvironments.com>

Smart Growth Online (U.S.), Green Building Case Studies

http://www.smartgrowth.org/casestudies/casestudy_index.html

Department of Environment and Tourism, South African Government

MAT-3 Reused MaterialsPOINTS
AVAILABLE**1**<http://www.environment.gov.za>**TECHNICAL CLARIFICATIONS AND ERRATUM**

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Technical Clarification: Quantity surveyor report and short report

Technical Clarification Number: MAT3-T-OB1-0357

Guidance: 2012-01-06

This Technical Clarification is applicable to Mat-3 Reused Materials, Mat-6 Steel, Mat-7 PVC Minimisation, Mat-8 Sustainable Timber, Mat-9 Design for Disassembly, Mat-10 Dematerialisation and Mat-11 Local Sourcing.

Where the 'Documentation Requirements' (for Design and As Built) request a 'Short report' and a 'Quantity Surveyor report', if the 'Short report' is prepared by the Quantity Surveyor, it is permitted that one consolidated report satisfying both 'Documentation Requirements' be submitted instead of two separate documents.

Where the 'Short report' is not prepared by the Quantity Surveyor (e.g. green building consultant, Accredited Professional, structural engineer etc.), both the 'Short report' and 'Quantity Surveyor report' must be submitted independently.

The purpose of the 'Quantity Surveyor report' is to validate data (e.g. quantities, costs, Project's contract value etc.) referenced within the 'Short report'.

The following errata have been incorporated:

MAT3-E-OB1-0244 (2011-02-08) Green Star SA - Office v1 Technical Manual: Page 227

MAT3-E-OB1-0245 (2011-02-08) Green Star SA - Office v1 Technical Manual: Page 227

MAT3-E-OB1-0192 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 228

MAT-4 Shell and Core or Integrated Fit-outPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise base building delivery mechanisms that eliminate the need for immediate tenant refits.

CREDIT CRITERIA

One point is awarded where:

90% of the UA (Usable Area) of the project is delivered as any combination of shell and core or integrated fit-out.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the project has shell and core elements: • Short report • Extract(s) from specification(s) or tender document(s) • Tender drawings Where the project has integrated fit-out elements: • Short report • Tender drawings • Confirmation from building owner • Confirmation from tenant(s) (1)	Where the project has shell and core elements: • Short report • As built drawings Where the project has integrated fit-out elements: • Short report • As built drawings • Confirmation from contractor • Confirmation from tenant(s) (2)

MAT-4 Shell and Core or Integrated Fit-outPOINTS
AVAILABLE**1**

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by providing a tabulated summary that:

- Identifies all UA spaces in the building, and their areas;
- Nominates whether they are delivered as shell and core, integrated fit-out or neither; and
- Confirms that compliant spaces jointly account for at least the stipulated proportion of the UA.

Extract(s) from the specification(s) demonstrating compliance with the shell and core criteria and the area of the UA claimed.

Tender documents demonstrating compliance with the shell and core criteria and the area of the UA claimed.

Tender drawings for all areas:

- Indicating whether they are delivered as integrated fit-out(s) or shell and core; and
- Where shell and core is claimed, demonstrating that no ceilings, floor coverings, lighting systems and partitions walls are installed, and that ducts from the air supply and return risers finish within 1m of the face of the riser.

Confirmation from the building owner or designated representative, stating that the fit-out design is being coordinated with the base building design and construction. This communication must also indicate the area of the integrated fit-out.

Confirmation(s) from the tenant(s) (1) that the fit-out design is being coordinated with the base building design and construction. This communication must also indicate the area of the integrated fit-out.

Confirmation(s) from the tenant(s) (2) for an integrated fit-out, indicating:

- The proportion of UA that is an integrated fit-out;
- That the as built fit-out has been designed to satisfy the requirements of those tenants; and
- That no significant alterations will be carried out on the fit-out provided prior to occupation.

As built drawings for all areas:

- Indicating whether they are delivered as integrated fit-out(s) or shell and core; and
- Where shell and core is claimed, demonstrating that no ceilings, floor coverings, lighting systems and partitions walls were installed, and that ducts from the air supply and return risers finish within 1m of the face of the riser.

Confirmation from contractor stating the extent of works (shell and core or integrated fit-out) performed within the building.

MAT-4 Shell and Core or Integrated Fit-outPOINTS
AVAILABLE**1****ADDITIONAL GUIDANCE****Shell and core**

A shell and core office includes finishes and fit-out to common areas only, with services capped off within 1m of the face of the riser at each floor. The definition of shell and core for purposes of this credit is a tenancy space where:

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

To determine the mechanical and electrical loadings and the Indoor Environmental Quality objectives for each floor of a building, the base building design team must make assumptions about the systems, floor and lighting layout and document the design. The assessment will be based on this design, and these assumptions must be clearly stated for each relevant credit in the submission. In this way, shell and core delivery does not impede assessment of the development.

Delivering any portion of the base building as shell and core or integrated fit-out will affect other elements of the submission so please take note of Additional Guidance provided.

Any space within a project delivered as a shell and core or integrated fit-out will be assessed on the basis of:

- The traditional scope of fit-out provided by the base building (e.g. not furniture);
- The fully documented design for Green Star SA – Office Design v1; and
- The as built/as installed design for Green Star SA – Office As Built v1.

Where any component of the project is delivered as shell and core or integrated fit-out, the General Section of the submission must include an area summary listing each area within the project and indicating whether it is delivered as a standard fit-out, integrated fit-out, or shell and core. In addition, the mode of delivery must be clearly indicated on all documentation.

For Green Star SA – Office Design v1 Rating, the fully documented design will be assessed regardless of how it is delivered. Where an integrated fit-out is designed into the project all documentation submitted for assessment, including tender drawings, must reflect the changes requested by the tenant(s).

For Green Star SA – Office As Built v1 Rating, the fit-out (to the extent designed or provided by the base building) must demonstrate compliance with the Credit Criteria regardless of how it is delivered. Any areas that remain as shell and core (i.e. have not been fitted out by the tenant) at the time of the submission cannot contribute towards compliance for this credit as an integrated fit-out.

MAT-4 Shell and Core or Integrated Fit-outPOINTS
AVAILABLE**1****BACKGROUND**

The Building Research Establishment's *Green Guide to Specification* (3rd edition) outlines the relative environmental impact of different elements of a commercial building in the UK. A typical wool/nylon mix carpet with foam backing/underlay accounts for approximately 40% of the total building impact (assuming replacement every 5 years over a 60 year life). This is similar to the combined environmental impact of the structure (floors, substructure, roof, walls and glazing) measured over the same period.

It is not uncommon for speculatively developed buildings to include finishes such as floorings and ceilings as part of the base building, only to have some of these finishes removed to suit tenant needs and aesthetics. This practice can lead to increased resource use and material consumption, and unnecessarily adds to the strain on landfill sites from construction and demolition waste.

The delivery of buildings as shell and core is a common practice in the SA commercial market.

REFERENCES & FURTHER INFORMATION

Building Research Establishment (2002), *The Green Guide to Specification*, 3rd edition by Jane Anderson and David Shiers, Blackwell 2002.

<http://www.bre.co.uk/greenguide/section.jsp?id=499>

TECHNICAL CLARIFICATIONS AND ERRATUM

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Technical Clarification: Scope of delivery – 'Conventional', 'Integrated' and 'Shell & Core'

Technical Clarification Number: MAT4-T-OB1-0386

Guidance: 2012-01-17

The following provides guidance as to the scope of delivery for Conventional, Integrated and Shell & Core:

Conventional Delivery:

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with ceilings, finishes (e.g. floor coverings and paint), generic mechanical services (e.g. ducts from air supply and return risers, or other HVAC equipment, with generic control zone/diffuser/return layouts), generic electrical services (e.g. generic lighting layout) and complete wet services. The fitout to tenant areas is intended to be generic and non-tenant specific.

MAT-4 Shell and Core or Integrated Fit-outPOINTS
AVAILABLE**1****Integrated Fitout:**

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with ceilings, finishes (e.g. floor coverings and paint), specific mechanical services (e.g. ducts from air supply and return risers, or other HVAC equipment, with fitout specific control zone/diffuser/return layouts), specific electrical services (e.g. fitout specific lighting layout) and complete wet services. The fitout to tenant areas are tenant specific.

Shell & Core:

Common Areas - Finishes (e.g. floor coverings and paint) and services are applied to common areas (as applicable).

Tenant Areas - Tenancies are delivered with no ceilings, floor coverings, lighting systems nor partition walls. Mechanical services are not installed within tenant areas, with ducts from air supply and return risers finishing within 1m of the face of the riser (for central air systems), or no other tenant-side systems installed (e.g. indoor units). A raised floor or underfloor air distribution (UFAD) system may be installed in a Shell & Core scenario provided floor coverings are not installed. No fitout is provided in a Shell & Core scenario.

Credit Interpretation Request: Partial fit-outs**Credit Interpretation Request Number: MAT4-C-OB1-0351****Ruling: 2011-11-17**

The Credit Interpretation Request (CIR) seeking partial fit-outs with modular ceilings, HVAC and lighting systems in conjunction with lease agreement requirements/restrictions for tenant fit-outs, to be defined as 'integrated fit-out' for the purpose of the credit is denied. Such partial fit-out delivery scenarios do not meet the aim of credit as tenant re-fit can occur as per conventional fit-out delivery, regardless of the initial fit-out being retained in entirety or removed (i.e. original fit-out materials stored).

The following erratum has been incorporated:

MAT4-E-OB1-0193 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 233

MAT-5 ConcretePOINTS
AVAILABLE**3****AIM OF CREDIT**

To encourage and recognise the reduction of embodied energy and resource depletion occurring through use of concrete.

CREDIT CRITERIA

Three points are available as follows:

Up to two points are available where the project has reduced the absolute quantity of Portland cement, as an average across all concrete mixes, by substituting it with industrial waste product(s) or oversized aggregate as follows:

- For 1 point, 30% for in-situ concrete, 20% for precast concrete and 15% for stressed concrete;

OR

- For 2 points, 60% for in-situ concrete, 40% for precast concrete and 30% for stressed concrete.

An additional point is awarded where:

- At least one of the above points is achieved; AND
- 10% of all aggregate used for structural purposes is recycled (Class 1 RCA in accordance with Australian standard HB155-2002) or slag aggregate;

AND

- No virgin aggregates are used in non-structural concrete uses (e.g. footpaths, backfilling to service trenches). Note that this requirement applies to non-structural concrete aggregate applied on site and not to pre-cast non-structural concrete uses.

If the material cost of new concrete represents less than 1% of the project's contract value, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Materials Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

MAT-5 ConcretePOINTS
AVAILABLE**3****DOCUMENTATION REQUIREMENTS**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
To demonstrate replacement of Portland cement:	To demonstrate replacement of Portland cement:
- Concrete Technologist/Structural Engineer's report - Quantity Surveyor report - Extract(s) from specification(s)	- Concrete Technologist/Structural Engineer's report - Quantity Surveyor report - Confirmation(s) from supplier(s) - Confirmation from contractor
Where the additional point is claimed, the following evidence is also required:	Where the additional point is claimed, the following evidence is also required:
Concrete Technologist/Structural Engineer's report	Concrete Technologist/Structural Engineer's report
Where the credit is claimed as 'Not Applicable':	Where the credit is claimed as 'Not Applicable':
Quantity Surveyor report	Quantity Surveyor report

Concrete Technologist/Structural Engineer's report that describes how the Credit Criteria have been met by:

- Providing a breakdown of all concrete uses in the project, with the description, volume, composition and proportions of components clearly identified for each mix and use;
- Clearly indicating the volume of Portland cement replaced by the industrial waste product or oversize aggregate;
- Correlating with the specification;
- If oversized aggregate is used, calculations that demonstrate that this approach is equivalent to reducing the amount of cement used in a project by replacing it with industrial waste products; and
- Where the additional point is claimed, identifying all aggregate uses in the project, describing where recycled or natural aggregate is used, and demonstrating that the Credit Criteria has been met.

Quantity Surveyor report estimating the total material value of the new concrete as a proportion of the project's total value.

MAT-5 ConcretePOINTS
AVAILABLE**3****Extract(s) from the specification(s):**

- Nominating how the Credit Criteria will be met, accounting for all concrete in the project;
- Stating that no industrial waste product came from industrial facilities co-fired with hazardous waste;
- Where industrial waste product is being used for cement replacement, identifying the proportion of industrial waste product to be used in place of cement;
- Where oversized aggregate is being used for cement replacement, identifying the use of oversize aggregate in order to reduce the amount of cement required in a project; and
- Where the additional point is claimed, nominating the proportion of recycled aggregate to be used and stipulating that the recycled aggregate be classified as Class 1 RCA, in accordance with the Australian code HB 155-2002. (Currently, no equivalent South African code exists.)

Confirmation(s) from supplier(s):

- Of the quantities of Portland cement, industrial waste product ;
- Where the additional point is claimed, confirmation of the quantities of aggregate (both recycled and non-recycled) supplied to site
- That no industrial waste product came from industrial facilities co-fired with hazardous waste; and
- Where the additional point is claimed, nominating the proportion of recycled aggregate to be used and stipulating that the recycled aggregate be classified as Class 1 RCA, in accordance with the Australian code HB 155-2002. (Currently, no equivalent South African code exists.)

Confirmation from the contractor that all of the concrete used on site complies with the Credit Criteria by identifying all concrete uses in the project and describing the mix and product used.

ADDITIONAL GUIDANCE

This credit addresses all concrete, including non-structural uses such as paving, footpaths, kerbs, channels and gutters; it must be clear that all of the concrete in the project has been accounted for.

Supplementary cementitious materials

It must be clearly demonstrated that the amount of Portland cement has been reduced in all mixes used throughout the project. Points are awarded on the basis of reductions in Portland cement use, rather than the quantity of industrial waste product used. The reference case must have the same structural and functional requirements, and apply to the same location and season.

Alternative assessment for oversized aggregate

Reduction in the amount of Portland cement can be achieved through the use of oversized aggregate. Points will only be awarded if it is demonstrated that the amount of cement is reduced due to replacement of standard aggregate with oversized aggregate.

Note that any pre-existing concrete that is retained in a refurbished project cannot be included in the calculation of this credit; it is addressed in Mat-2 'Building Reuse' and Mat-3 'Reused Materials'.

MAT-5 ConcretePOINTS
AVAILABLE**3****Aggregates**

It is a prerequisite to claim at least one point for cement replacement in order to claim the additional point for aggregate. Recycled aggregate may affect the engineering properties of structural concrete, and this should be considered as it is not a desired environmental outcome that projects increase the amount of concrete used to counteract this.

HB 155-2002 *Guide to the Use of Recycled Concrete and Masonry Materials* presents an overview of material and processing requirements of recycled concrete and provides general guidelines for the specification and use of Class 1 and Class 2 recycled concrete aggregate products. Class 1 products can be used in structural concrete, Class 2 as fill or granular sub-base.

Industrial waste product

The industrial waste product can be slag or fly ash but must not come from industrial facilities co-fired with hazardous waste. Kilns have been identified in the US EPA Dioxin Inventory as one of the top ten sources of dioxin to the environment (more than 22-fold increase over standard cement, per kilogram of cement fired). Slag (a waste product from steel manufacturing using a blast furnace), whether as an aggregate or cement replacement, is appropriate for meeting the Credit Criteria.

The quality and properties of concrete can actually be improved by replacing a portion of the Portland cement with industrial by-products such as fly ash, blast furnace slag and silica fume.

BACKGROUND

Concrete is a significant element in most commercial buildings for floors, columns, cores, footings and sometimes façades. Reinforced concrete can readily utilise both post-consumer and post-industrial waste, thus reducing waste, consumption of natural resources and greenhouse gas emissions.

Cement replacement (post-industrial)

The production of cement is responsible for approximately 90% of the greenhouse gas emissions associated with concrete production. Replacing a portion of the Portland cement with industrial by-products such as fly ash, blast furnace slag and silica fume reduces the mining of natural resources and greenhouse gas emissions associated with cement production while disposing of a waste material previously destined for landfill. In South Africa fly ash, blast furnace slag, and silica fume are commonly used, in varying levels, to replace Portland cement. In KZN, blast furnace slag typically replaces around 30% of Portland cement in common cement products – this is largely due to its availability and the lower cost of slag. In other South African regions, where only fly ash or silica fume are readily available, such high replacement levels are not common practice.

Recycled concrete aggregate (RCA)

Concrete waste can be processed to produce roadbase/fill material, recycled concrete aggregate and recycled concrete fines. Extensive research has and is being undertaken to increase the use of recycled concrete worldwide. In the UK, Wessex Water used recycled concrete (from old railway sleepers) to replace approximately 40% of natural aggregates in the structural concrete of their new headquarters.

The primary use of recycled concrete aggregate in South Africa is for general fill and roadbase material, which reduces the need for natural fill. Further research and concrete mix design

MAT-5 ConcretePOINTS
AVAILABLE**3**

optimisation will lead to wider adoption of RCA in structural concrete mixes.

REFERENCES & FURTHER INFORMATION

Cement and Concrete Institute of South Africa (CNCI)
<http://www.cnci.org.za>

AggRegain, Sustainable aggregate information service from Waste and Resources Action Programme (WRAP)

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Proprietary mixes

Credit Interpretation Request Number: MAT5-C-OB1-683

Ruling: 2013-06-13

The Project team's proposal to demonstrate compliance by complying with the 15% threshold of Portland cement reduction for stressed concrete, and an average cement reduction of 30% across pre-cast and in-situ mixes is approved for the first point of the credit only.

Alternatively, please note that the GBCSA also provide the following guidance to the project team with respect to proprietary concrete mixes:

Where suppliers are not able to divulge the exact composition and proportions of components of their proprietary concrete mixes, the project team may submit a statement of confirmation from the supplier clearly stating the resulting reduction of Portland cement content in the mix compared to a base case scenario with the same structural and functional requirements, and applying to the same location and conditions.

Note that concrete technologist report is thus not required to state the proportions of components for these proprietary mixes. However, the report must show how the cement reduction achieved by these proprietary mixes along with the cement reduction calculated for all other mixes is taken into account in confirming compliance with the credit criteria

MAT-5 ConcretePOINTS
AVAILABLE**3**

Credit Interpretation Request: Approval of published mix design ratios

Credit Interpretation Request Number: MAT5-T-OB1-0660

Ruling: 2013-03-13

It is left up to the Concrete Technologist's professional discretion to put forward a reference case that has the same structural and functional requirements, and apply to the same location and season.

Should the Concrete Technologist believe that the mix design ratios published by the Cement and Concrete Institute (CNCI) or any other reputable source/authority is an acceptable reference to calculate the reference case mix design for their specific project, this will be deemed acceptable. It is neither the GBCSA's nor Assessors' prerogative to question this.

The determined reference case must be stated in the Concrete Technologist report as per the documentation requirements stipulated in the Green Star SA Office v1 Technical Manual.

Technical Clarification: Minor ancillary concrete applications

Technical Clarification Number: MAT5-T-OB1-646

Guidance: 2013-02-22

The GBCSA acknowledge that for small, inconsequential concrete uses, the sourcing of mix designs for these applications may be unnecessarily onerous given their impact in terms of credit compliance. As such, please note that it is acceptable for marginal and ancillary applications to be included in calculations for this credit as a conservative generic mix rather than having to source a mix design for each and every low volume concrete component. For example, the project team could structure the calculations for the Mat-5 credit so that items such as kerbs, pipes, lintels, paving blocks, sills and similar items are included as a conservative generic 100% OPC mix. No further documentation would be required for the proposed approach, but the project team needs to provide calculations for the specific project to demonstrate that these applications have been included."

In addition, please note that it is not the intent of the Credit Criteria to encompass minor miscellaneous concrete applications such as small statues, benches, landscaping steps, concrete filled manhole covers, etc. Although noted as concrete applications within buildings, these are excluded from the scope of the Mat-5 credit due to the general quantity of concrete represented and the practicalities of quantification. It is also noted that in some projects, the credit criteria benchmarks may be comfortably achieved for all major concrete applications and minor applications such as paving, kerbs, channels, gutters, lintels and stormwater piping will represent a small fraction of the project's concrete use and as such will not affect compliance. In such cases the project team may justify this within the 'Concrete Technologist / Structural Engineer's Report' with a simple calculation using conservative estimates of quantities as well as a conservative 100% OPC concrete mix. This conservative calculation must clearly show that these items combined do not significantly impact compliance with the criteria benchmarks and as such can be regarded as negligible.

MAT-5 ConcretePOINTS
AVAILABLE**3**

Credit Interpretation Request: Minor ancillary concrete applications

Credit Interpretation Request Number: MAT5-C-OB1-647

Ruling: 2013-02-22

The proposal to alter the credit criteria wording from “all concrete mixes” to “95% (volume) of concrete mixes”, as well as provide a list of concrete uses that make up that 95%, is denied.

The Technical Advisory Group and GBCSA do not necessarily disagree that the proposed approach would for the most part achieve the same aim as the current credit, and in fact recommend that this approach is reviewed for inclusion in Green Star SA – Office v2 of the rating tool. However it is felt that within version 1 of the tool, the following clarifications would address the main issues raised (listed below) adequately until the credit is reviewed in entirety for Green Star SA – Office v2.

- 1) The burden of sourcing mix designs for small, inconsequential concrete uses:

See TC MAT5-T-OB1-646

- 2) The burden of sourcing mix designs for small, inconsequential concrete uses:

See TC MAT5-T-OB1-646

Technical Clarification: Technologist Report, quantity of cement and additional point

Technical Clarification Number: MAT5-T-OB1-0631

Guidance: 2013-02-07

To demonstrate compliance with the credit criteria, within the Concrete Technologist Report, project teams need not provide the full breakdown of composition and proportions of components for each mix.

In order to demonstrate compliance with the credit criteria, only the quantity of cement per cubic meter of mix and total cement for each mix need be presented against a reference case for the first 2 points.

For projects pursuing the additional (aggregate) point: only the total mass of aggregates per cubic meter, mass of recycled aggregates per cubic meter and total mass of aggregates need be presented in order to demonstrate that concrete mixes are compliant. Non-structural aggregates used (for example as fill, sub-grades and building base course) must clearly be accounted for separately and demonstrate that 100% of the aggregate was not from virgin sources.

Credit Interpretation Request: Alternative percentage reduction metrics

Credit Interpretation Request Number: MAT5-C-OB1-0355

MAT-5 ConcretePOINTS
AVAILABLE**3****Ruling:** 2012-01-27

For the purpose of compliance with the credit criteria, it is acceptable to demonstrate that the project has reduced the absolute quantity of Portland cement by a minimum percentage as an average across all concrete mixes (in situ, precast and stressed). One point shall be awarded for 30% reduction OR two points awarded for 40% reduction.

Where the average percentage reduction of Portland cement across all concrete uses is demonstrated, individual evidence of Portland cement reductions for in-situ, pre-cast or stressed concrete types is not required.

Credit Criteria of the additional point remains unchanged.

Technical Clarification: Portland cement content in concrete reference cases

Technical Clarification Number: MAT5-T-OB1-356

Guidance: 2012-01-27

A concrete reference case is typically provided in Mat-5 Concrete credit submissions to demonstrate the percentage of total Portland cement replaced in all concrete uses by supplementary cementitious materials (SCM).

To ensure consistency in Green Star project submissions and the assessments of this credit, the GBCSA deems it acceptable for project teams to present concrete reference cases that assume the use of baseline concrete mixes with 100% Portland cement content (i.e. use no SCM).

Projects may still provide concrete reference cases with more realistic mix designs that do contain some percentage of SCM, which is common industry practice, however this is not mandatory.

Technical Clarification: Percentage reduction metrics

Technical Clarification Number: MAT5-T-OB1-0329

Guidance: 2011-10-13

For the purposes of demonstrating the percentage reduction of Portland cement from the reference case, it is acceptable that calculations are presented in volume or mass.

Technical Clarification: Alternative documentation requirements - Concrete Technologist report

Technical Clarification Number: MAT5-T-OB1-0111

MAT-5 ConcretePOINTS
AVAILABLE**3****Guidance:** 2010-11-02

The 'Concrete Technologist report' may be substituted with a report from either the Structural Engineer or Civil Engineer where the report demonstrates the exact same requirements as outlined in the Technical Manual. This report must reference Concrete Technologist report(s) and/or product manufacturer data sheet(s) and/or statement(s) of confirmation from product manufacturers to substantiate compliance with the credit criteria where applicable.

The following erratum have been incorporated:

MAT5-E-OB1-721 (2013-08-20) Green Star SA - Office v1 Technical Manual: Page 235

MAT5-E-OB1-0631 (2013-02-07) Green Star SA – Office v1 Technical Manual: Page 237

MAT5-E-OB1-0277 (2011-08-08) Green Star SA - Office v1 Technical Manual: Page 235

MAT5-E-OB1-0194 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 236

MAT5-E-OB1-0195 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 236

MAT-6 SteelPOINTS
AVAILABLE**3****AIM OF CREDIT**

To encourage and recognise the reduction in embodied energy and resource depletion associated with reduced use of virgin steel.

CREDIT CRITERIA

Up to three points are awarded as follows: One point is awarded for:

- A building predominantly framed in structural steel (>50% by cost compared with the reinforced/precast/stressed concrete framing component), one point is awarded where: 60% of all structural steel, by mass, in the project either has a post-consumer recycled content greater than 40%, or is reused;

OR

- A building predominantly framed in reinforced/precast/stressed concrete (>50% by cost compared with the structural steel framing component), one point is awarded where: 60% of all reinforcing/stressing steel, by mass, in the project either has a post-consumer recycled content greater than 90%, or is reused.

An additional two points are awarded where: 90% of all steel (total of structural steel, reinforcing/stressing steel and steel products), by mass, in the project either has a post-consumer recycled content greater than 60%, or is reused.

If the material cost of steel 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. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

MAT-6 SteelPOINTS
AVAILABLE**3****DOCUMENTATION REQUIREMENTS**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the project is claiming the use of reused or recycled steel: • Short report • Quantity Surveyor report • Extract(s) from specification(s) Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report	Where the project is claiming the use of reused or recycled steel: • Short report • Quantity Surveyor report • Confirmation(s) from supplier(s) • Confirmation(s) from contractor(s) Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Identifying the total amount (by mass) of steel used within the building structure;
- Identifying all of the applications of steel installed within the building structure;
- Identifying the product used for each type of application;
- Identifying the total amount (by mass) of steel used for each application within the building structure;
- Referencing the quantity surveyor estimation of the total mass of steel in the building's structure, as well as supplier and contractor evidence of the post-consumer content of the steel used; is required in the As Built and not in the Design Short report and
- Demonstrating via a summary table (and calculations wherever relevant) that the steel with confirmed post-consumer content jointly accounts for the stipulated proportion of steel in the project.

If steel was supplied for uses outside the building structure, these uses must be clearly identified and excluded from the calculations.

Quantity Surveyor report that estimates the total mass and material cost of the steel within the building structure as a proportion of the project's total value.

Extract(s) from the specification(s) where the steel requirements are identified, clearly referencing post-consumer content or reuse for the stipulated percentage of all relevant steel in the project.

MAT-6 SteelPOINTS
AVAILABLE**3****Confirmation(s) from the supplier(s) of:**

- The total quantity of steel supplied to the project; and
- The post-consumer recycled content of each steel product supplied to the project (via product-specific evidence such as Materials' Data Sheets).

Confirmation(s) from the contractor(s) of:

- All of the applications of steel installed within the building structure;
- The product used for each type of application; and
- The total amount (by mass) of steel used for each application within the building structure.

ADDITIONAL GUIDANCE

All steel used within the building structure is addressed by this credit, including all concrete reinforcement steel (stressed, in situ or pre-cast) and structural steel. This includes, but may not be limited to, hot rolled beams, columns, angles, mullions and reinforcement as well as cold-formed products such as purlins, girts, cladding and profiled steel decking.

It must be clear that all of the relevant steel uses in the project have been accounted for. The evidence of recycled content refers to average proportions of post-consumer content. It is acceptable to use a weighted average of all steel on the project to meet the credit criteria.

Any pre-existing steel that is retained in a refurbished project cannot be included in the calculation of this credit; it is addressed in Mat-2 'Building Reuse' and Mat-3 'Reused Materials'.

Recycled and reused steel

The impact of steel is best reduced by reducing the total amount of virgin steel required in the building, by reusing existing steel and by recycling steel that cannot be reused, in that order. Using reused steel as well as steel with significant post-consumer content within the building structure is rewarded by this credit.

Post-consumer recycled content refers to the product composition that contains some percentage of material diverted from the product user's waste stream. This excludes re-utilisation of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

BACKGROUND

Over the past decade the international demand for steel has approximately doubled. This demand, coupled with limited natural resources and the high environmental impact of steel production, necessitate making better use of accessible material by re-using and recycling existing steel.

Historically, 50% of the steel produced in South Africa has been exported. However, due to rising local demand in recent years, this figure is currently closer to 25%. As a consequence of South Africa's natural reserves of iron ore and coal, the country is one of the world's primary steel producers. More than 70% of the steel produced locally is completely post-consumer recycled.

Two processes are used in the processing of steel. Arc furnace processing allows for a much

MAT-6 SteelPOINTS
AVAILABLE**3**

higher recycled content than the basic oxygen blast furnace process. Reinforcing steel and smaller structural steel sections are produced by arc furnace manufacturing, which gives a post-consumer recycled content of approximately 40%. Bigger producers and larger steel sections are blast-furnace produced and have recycled content of about 20%.

Types of scrap

'Home scrap' (also known as 'circulating scrap') is the residue left from the steelmaking, rolling and finishing operations and includes croppings, off-cuts and material rejected by quality inspection procedures. The home scrap usually accounts for about 10% of total crude steel production in an integrated steelworks. 'Home scrap' is considered industrial rather than post-consumer waste and does not count towards this credit.

Post-consumer scrap returns to the industry from various sources, partly as manufacturers' off-cuts and defective materials, and partly as obsolete and worn-out goods discarded at the end of their useful lives. Ship-breakers, for example, recover many tonnes of scrap metals, and automobiles are a major source of post-consumer scrap. Locally, there is a very well-established can collecting initiative, Collect-a-Can, which have a current recovery rate (collection for recycling) of approximately 60%.

REFERENCES & FURTHER INFORMATION

South African Institute of Steel Construction
<http://www.saisc.co.za>

One Steel, Information on One Steel – Part 4 (2000)
<http://www.onsteel.com>

Steel Recycling Institute (US).
<http://www.recycle-steel.org>

UK Steel
<http://www.uksteel.org.uk> <http://www.uksteel.org.uk/fact5.htm>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TC/CIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Extent of steel addressed by credit

Credit Interpretation Request Number: MAT6-T-OB1-0323

Ruling: 2011-09-30

The Mat-6 Steel credit in both the Green Star SA Office v1 rating tool is broken down into two parts with a total of 3 un-weighted points available.

MAT-6 SteelPOINTS
AVAILABLE**3****1st Point – Building Structure Steel Applications**

The first part (1 point) addresses 'structural steel' applications in predominantly steel-framed buildings and 'reinforcing steel' applications in buildings predominantly framed in concrete (insitu/precast/stressed). The definition of 'predominant' is the framing method which represents the greater steel cost of the total building's structural cost. The steel applications that are applicable for each structure type include (but are not limited to);

- Steel-framed: hot rolled beams, columns, angles, hollow sections, parallel flange channels, mullions, purlins, girts and light-steel framing systems (i.e. lightweight cold-rolled galvanised steel sections).
- Concrete-framed: reinforcing bar, reinforcing mesh and permanent steel formwork.

For the purpose of demonstrating compliance with the Credit Criteria for this first point, steel applications within the non-predominant framing method are excluded from the calculations. For example, where a building consists of both steel-framed and concrete-framed components (e.g. on different floors or levels) and the steel-framed component is predominant (by cost), then the concrete-framed steel applications (e.g. reinforcing bar/mesh) are neglected from calculations demonstrating compliance with the Credit Criteria.

Additional 2 Points – All 'Major' Steel Applications

The second part (2 additional points) addresses ALL 'major' steel applications in the building regardless of which framing system is more predominant. The 'major' steel applications in a building include;

- Steel-framed structure applications (as above); AND
- Concrete-framed structure applications (as above); AND
- Building envelope applications (e.g. steel wall cladding and steel roof decking).

Please note that it is not the intent of the Credit Criteria to encompass minor miscellaneous steel applications (e.g. door frames, balustrades, railings, fences, UFAD pedestals, architectural features etc.) to be awarded the 2 additional points. Although noted as steel applications within buildings, these are excluded from the scope of the Mat-6 credit due to the general quantity of steel represented and the practicalities of quantification.

Also note that the Mat-6 Steel credit is applicable for base building steel uses as described above. Tenant fit-out steel uses (i.e. steel framed partition walls) are excluded from the scope of the credit.

Technical Clarification: Recycled Content Documentation**Technical Clarification Number: MAT6-T-OB1-0031****Guidance: 2009-03-31**

For documenting recycled content of steel in an As Built submission, it is acceptable to provide evidence stating the overall, manufacturer-wide, recycled content for the particular product or products, rather than the specific batch provided to the project.

MAT-6 Steel

POINTS
AVAILABLE **3**

The following erratum has been incorporated:

MAT6-E-OB1-0620 (2013-01-14) Green Star SA – Office v1 Technical Manual: Page 242

MAT-8 Sustainable TimberPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise the specification of reused timber products or timber that has certified environmentally-responsible forest management practices.

CREDIT CRITERIA

Two points are available as follows:

One point is awarded where 50% (by cost) of all timber products used in the building and construction works have been sourced from any combination of the following:

- Reused timber;
- Post-consumer recycled timber; or
- Forest Stewardship Council (FSC) Certified Timber.

An additional point is awarded where 95% (by cost) of all timber products used in the building and construction works satisfy the abovementioned sourcing criteria.

If the material cost of timber represents less than 0.1% of the project's total contract value then this credit is 'Not Applicable' and is excluded from the Points Available, used calculate the Materials Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

MAT-8 Sustainable TimberPOINTS
AVAILABLE**2****DOCUMENTATION REQUIREMENTS**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the project is claiming use of sustainable timber: • Short report (1) • Quantity Surveyor report (1) • Extract(s) from the specification(s) Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report (1)	Where the project is claiming use of sustainable timber: • Short report (2) • Quantity Surveyor report (2) • Confirmation from supplier(s), including Chain of Custody Certificates • Confirmation from contractor, Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report (2)

Short report (1) prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Providing cost calculations and a summary table to confirm that reused, recycled and FSC timber jointly account for at least 50% or 95% of timber costs in the project.

Short report (2) prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Listing all uses of timber on the project and the timber used.
- Identifying (with supporting receipts) the supplier cost of all timber uses in the project; and
- Providing cost calculations and a summary table to confirm that reused, recycled and FSC timber jointly account for at least 50% or 95% of timber costs in the project.

Quantity Surveyor report (1):

- Estimating the total material cost of timber (including estimated value of the existing timber if part of refurbishment) as a proportion of the project's total value;

Quantity Surveyor report (2) showing:

- The total actual material cost of timber (existing timber if part of refurbishment) as a proportion of the project's total value; and

MAT-8 Sustainable Timber

POINTS
AVAILABLE

2

- For refurbishment projects claiming this credit, the volume and market value of timber material retained within the existing building.

Extract(s) from the specification(s) demonstrating Credit Criteria requirements, stipulating the timber source (i.e. FSC, recycled or reused) for each timber use (i.e. formwork, composite wood products, etc.) used to meet the Credit Criteria and that the evidence confirming compliance with the Credit Criteria (e.g. FSC Certificates) and receipts be kept and logged

Confirmation from supplier(s):

- Indicating the quantity, cost and type of all timber supplied to the project;
- Identifying properties of the timber as they relate to the Credit Criteria, i.e. whether the timber was reused, recycled or FSC Certified; and
- Wherever FSC Certified timber is used, including Chain of Custody Certificates for the last company in the chain of custody of each product or material prior to it being procured for this project.

Confirmation from contractor identifying all timber uses within the project and indicating the quantity and type of timber used.

ADDITIONAL GUIDANCE

This credit addresses all timber within the project, including formwork, temporary works and composite wood products. No distinction is made between applications, temperate or tropical timbers, or between hardwoods and softwoods.

It must be clearly demonstrated that all timber in the project has been accounted for, and that reused, recycled and FSC certified timber jointly accounts for at least 50% or 95% of cost.

For each source that is claimed to satisfy the requirements of this credit, the supplier will be required to certify the credentials of the timber against the Credit Criteria.

Recycled timber

For the purpose of this credit, recycled timber must have a minimum of 50% or 95% post-consumer recycled content; post-industrial content cannot contribute towards this credit.

FSC

FSC Certificates must be presented for all FSC Certified timber. FSC Chain of Custody Certificates must also be provided for the final party in custody of the material or product until it has been procured for the project.

Wood products identified as 'FSC Pure' and 'FSC Mixed Credit' should be valued at 100% of the product cost. Wood products identified as 'FSC Mixed [X]%' should be valued at the indicated percentage of their cost, e.g. a product identified as 'FSC Mixed 50%' should be valued at 50% of the cost. (Wood products identified as 'FSC Recycled' or 'FSC Recycled Credit' do not count toward this credit.)

MAT-8 Sustainable Timber

POINTS
AVAILABLE**2**

Retained timber in refurbishment

Note that any pre-existing timber that is retained in a refurbished project can be included in the calculation of this credit, if its quantification is well justified.

Expected timber uses include, but are not limited to:

- Structural timber including wall, floor and roof structures;
- External and internal cladding;
- Flooring/wall/ceiling finishes;
- Internal and external joinery including windows, doors and other specialist uses of timber such as installed furnishings, joinery fixtures, or balustrades; and
- Structural Formwork.

Chain of Custody

The last 'hands' to supply the FSC Certified piece of timber (e.g. reseller of a finished product) must have a Chain of Custody Certificate; the project itself does not need this Certificate. The current holders of the FSC Chain of Custody and Management Certificate can be found on the following website: <http://www.fsc-info.org>.

It must be clear that the evidence accounts for all uses of the relevant material in the project, i.e. via using 'all' in the specification or, where appropriate, providing a summary table listing all uses and the attributes of the material(s) used.

For a product to receive points within this credit for FSC certification, a full chain of custody must exist. That is, if a board manufacturer who has FSC certification sells the board to a contractor for installation on the building, full chain of custody exists. However, if the board manufacturer provides product to the workstation manufacturer who doesn't have FSC certification, who then sells it to the project, then chain of custody is lost, and points will not be awarded for that workstation. Contractors and subcontractors are considered the end consumers and need not be chain of custody certified. A manufacturer that installs its own product is not required to be chain of custody certified. (Note: These requirements are for Green Star SA and may vary from FSC rules.) A manufacturer that installs its own product (e.g. custom cabinetry) is not required to have chain of custody certification. The following is an extract from the Forest Stewardship Council website (<http://www.fsc.org>):

"Chain-of-custody certification provides a guarantee about the production of FSC-certified products. Chain-of-custody is the path taken by raw materials from the forest to the consumer, including all successive stages of processing, transformation, manufacturing and distribution. Companies or individuals that process, transform, or trade (take ownership of) FSC certified forest products must be CoC certified."

MAT-8 Sustainable TimberPOINTS
AVAILABLE**2**

Industry Type	Process Stage	Chain-of-custody required?
Building & Construction	Sawmills, Lumberyards	YES
	Manufacturers of forest products	YES Timber broker YES
	Building contractors	NO*
	Retailers (i.e. DIY stores)	NO
Printing & Paper	Pulp, paper producer	YES
	Paper merchant	YES
	Broker	YES
	Printers	YES
	Publisher	NO

* The last person in the chain of ownership for materials being supplied to the construction project does NOT need to be CoC certified, but the company those materials are being received from does. The important issue here is ownership.

Table Mat-8.1: Chain of Custody requirements

BACKGROUND

The Forest Stewardship Council certification scheme (FSC) is an international labelling scheme for forest products, which provides a credible guarantee that the product comes from a well-managed forest that has been independently certified for its timber resource sustainability, forest ecosystem maintenance, and financial and socioeconomic viability.

Approximately 80% of plantations in South Africa are FSC certified. The majority of these plantations are for the pulp and paper industry, as trees for paper can be felled sooner resulting in faster turnover. There is not significant demand in the local structural timber industry for FSC certified timber; however a large demand exists internationally. Approximately 25% of the FSC certified timber in SA is exported.

REFERENCES & FURTHER INFORMATION

Forest Stewardship Council

<http://www.fsc.org/> and http://www.fsc.org/resource_center.html

Rainforest Alliance, Sustainable Forestry (SmartWood)

<http://www.rainforest-alliance.org/>

<http://www.rainforest-alliance.org/forestry.cfm?id=certification>

Australian Forestry Standard. Retrieved November, 2007

<http://www.forestrystandard.org.au>

MAT-8 Sustainable TimberPOINTS
AVAILABLE**2****TECHNICAL CLARIFICATIONS AND ERRATUM**

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Chain of Custody - Alternative Documentation

Technical Clarification Number: MAT8-T-OB1-616

Guidance: 2013-01-07

Where a contractor or sub-contractor on a project purchases FSC certified timber bundles intact which originate from an FSC Chain of Custody certified supplier, but have passed hands and ownership through non-FSC CoC certified suppliers, this is acceptable in terms of compliance with Green Star SA Mat-8 credit requirements provided that the following documentation is supplied and conditions are met.

- A full paper-trail of invoices and shipping documents are provided which tracks each bundle from the FSC CoC supplier to the project (contractor / sub-contractor).
- The paper-trail must state for each change of hands the bundle number and volume / number of pieces supplied.
- The bundles must remain intact, with the same volumes / number of pieces from the FSC CoC certified supplier to the project (contractor / sub-contractor).
- Confirmation of the original supplier's FSC CoC certification must be provided for the specific product and specie claimed.

Technical Clarification: Documentation requirement - timber schedule

Technical Clarification Number: MAT8-T-OB1-0354

Guidance: 2012-01-19

Where a timber schedule has been produced as part of the tender documentation for the project, this timber schedule must be submitted as part of the documentation submission for this credit as per the Documentation Requirements set out in the Green Star SA – Office v1 Technical Manual.

Where the project team has not produced a timber schedule as part of the tender documentation, but all timber uses in the project as well as the proposed material for each of those uses is detailed in the Extract(s) from Specification(s), the project team may omit the

MAT-8 Sustainable Timber

POINTS
AVAILABLE**2**

submission of a timber schedule and summarise the timber uses and proposed material for each use within the summary table contained in the Short Report.

Technical Clarification: Internal walls in Office areas

Technical Clarification Number: MAT8-T-OB1-0276

Guidance: 2011-06-01

Where internal walls within Office areas are provided as part of the 'base building provision' (i.e. will not change based on tenant requirements), project teams may include these within the Green Star SA submission, but should ensure they are included consistently across the submission. (E.g. any timber used in these walls may need to be included in the MAT-8 credit.)

Technical Clarification: Formwork

Technical Clarification Number: MAT8-T-OB1-0069

Guidance: 2010-05-14

Projects may not take into account reuse of a product within the same project (unless it is timber retained in a refurbishment), and the applicability to the credit is based upon the first use of the product in the project pursuing certification. The following criteria apply to timber formwork in a project for purposes of this credit:

- New formwork must be post-consumer recycled or have Forest Stewardship Council certification.
- Formwork that has been previously used in another project and has been used in the registered project can be deemed reused.
- Formwork that is sourced new for the project that is not post-consumer recycled or Forest Stewardship Council certified, and was reused within this project cannot contribute to the credit.

Technical Clarification: FSC website

Technical Clarification Number: MAT8-T-OB1-0068

Guidance: 2010-05-13

A current list of holders of the FSC chain-of-custody and management Certificate can be found on the following website:

<http://www.fsc-info.org>

MAT-8 Sustainable TimberPOINTS
AVAILABLE**2**

The following errata have been incorporated into the credit:

MAT8-E-OB1-743 (2013-10-10): Timber schedule and specifications

MAT08-E-OB1-480 (2012-04-10): Green Star SA - Office v1 Technical Manual: Page 252

MAT8-E-OB1-0172 (2011-01-06): Green Star SA - Office v1 Technical Manual: Page 252

MAT8-E-OB1-0196 (2011-01-06): Green Star SA - Office v1 Technical Manual: Page 252

MAT8-E-OB1-0197 (2011-01-06): Green Star SA - Office v1 Technical Manual: Page 252

MAT-9 Design for DisassemblyPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise designs that minimise the embodied energy and resources associated with demolition.

CREDIT CRITERIA

One point is awarded where:

- 50% (by area) of the structural framing, roofing, and façade cladding systems are designed for disassembly.

OR

- 95% of the total façade is designed for disassembly.

If the material cost of the structural framing, roofing, and façade cladding systems represent 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. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Quantity Surveyor report • Tender drawings • Extract(s) from specification(s) • Comprehensive Disassembly Plan Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report	• Short report • As built drawings • Comprehensive Disassembly Plan Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report

MAT-9 Design for Disassembly

POINTS
AVAILABLE

1

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Outlining the overall approach;
- Identifying the elements designed for disassembly; and
- Providing calculations and a summary table confirming that the stipulated proportion of the relevant elements is designed for disassembly.

Quantity Surveyor report estimating the total quantity of new structural framing, roofing and façade cladding systems (including existing elements if part of a refurbishment) that are designed for disassembly as a proportion of the project's total contract value.

Tender drawings/As built drawings:

- Detail drawings of connections demonstrating that the relevant building elements can be disassembled without cutting, material damage, or hindrance from adjacent materials;
- Elevation drawings of façades marked to identify elements designed for disassembly and the elements adjacent or consequential to the disassembly of these elements, as referenced in the Disassembly Plan;
- Floor plan drawings of each typical floor marked to identify elements designed for disassembly and the elements adjacent or consequential to the disassembly of these elements, as referenced in the Disassembly Plan; and
- Roof drawings, sectional drawings or any other relevant drawings marked to identify elements designed for disassembly and the elements adjacent or consequential to the disassembly of these elements, as referenced in the Disassembly Plan.

Extract(s) from the specification(s) that:

- Identify products and materials that demonstrate compliance with the Credit Criteria and describe their requirements; and
- Stipulate that whenever materials/products that enable compliance with the Credit Criteria are fabricated on site, the contractors are required to mark them with their inherent properties and date of fabrication.

Comprehensive Disassembly Plan developed by the design team and provided separately or as a part of the Operations & Maintenance Manual that:

- Identifies which materials are designed to be recovered during building disassembly; and
- 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 building materials/elements.

MAT-9 Design for Disassembly

POINTS
AVAILABLE**1**

ADDITIONAL GUIDANCE

To be designed for disassembly, the relevant building elements must exhibit the following properties:

- Connections allow for disassembly;
- Elements to be recovered are clearly marked, or have a label permanently attached, showing their inherent properties and date of manufacture to enable reuse; and
- A comprehensive Disassembly Plan (provided separately or as a part of the Operations & Maintenance Manual) illustrating how the elements should be recovered.

It must be clearly demonstrated that:

- The stipulated proportion of the specified building elements can be practically extracted for reuse or recycling;
- The extraction of reusable elements will not be prohibited by other and non-reusable elements; and
- The design, the marking of the elements and the Disassembly Plan are sufficient to enable a team different to the installation team to disassemble the building and reuse or recycle the designated elements at a time in the future.

Inherent properties of a material are those that describe the attributes critical for its intended use, such as structural properties, warranty, useful life, width, length, height, mass, composition, etc.

BACKGROUND

This credit facilitates the reduction in consumption of construction materials through reusing, redesigning or reconsidering conventional approaches to building. It is evident that reducing the total amount of new materials used for a given purpose, by reusing the same materials or resources from other parts of the same or similar project is an excellent way of reducing the project's overall impact.

The whole lifecycle of a project including the end-of-life reuse and recycling, and the materials used in its construction, should be considered from the design stage, to examine in detail the materials, elements, resources or parts of the building fabric which might be taken apart and easily used again.

An overall reduction in the embodied energy and resources taken up through the demolition, deconstruction and ultimate recycling of buildings has become more of a priority as more research into waste streams, embodied energy within buildings, and resource lifecycles becomes available. At concept design, designers are accepting the responsibility for the building's (or fit-out's) end of life. By designing individual elements, general parts and sections of developments to be readily disassembled, this can enable better and easier deconstruction, energy savings and more recycling and reuse of construction materials. This becomes even more important as urban fabric becomes denser, as the complications and costs of demolition increase substantially in those circumstances.

MAT-9 Design for Disassembly

POINTS
AVAILABLE**1**

At present, construction and demolition waste in the developed world makes up approximately one third of all waste generated. Implementation of appropriate strategies during the construction phase of a building can significantly reduce this figure, helping the transition towards a more sustainable property industry.

REFERENCES & FURTHER INFORMATION

Deconstruction as an Essential Component of Sustainable Construction, by Charles J. Kibert, University of Florida, USA

<http://www.sustainablesettlement.co.za/event/SSBE/Proceedings/kibert.pdf>

South African Greenbuilding Website
<http://www.greenbuilding.co.za/>

Sustainable Built Environment
<http://www.sustainablebuiltenvironments.com>

Philip Crowther (2005), *Design for Disassembly – Themes and Principles*. BDP Environmental Design Guide 2005

<http://www.architecture.com.au/i-cms?page=60>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Permanent marking or labelling of elements to be disassembled

Technical Clarification Number: MAT9-T-OB1-0573

Guidance: 2012-09-12

In the Additional Guidance, the first bullet point on page 259 reads that "Elements to be recovered are clearly marked, or have a label permanently attached, showing their inherent properties and date of manufacture to enable reuse...". This requirement need not be interpreted as meaning that each and every individual element needs to be marked or labelled with its inherent properties. Key elements or elements where information on the inherent properties is essential in allowing re-use of the item (e.g. bespoke structural beams) should be marked as per the Additional Guidance provided.

It is at the project team's discretion which of these elements require marking, but the project team must detail within the Short Report the approach applied to disassembly and reuse of their specific system and explain and motivate how the marking of key elements in conjunction with the Comprehensive Disassembly Plan will enable disassembly and reuse of the system.

MAT-9 Design for Disassembly

POINTS
AVAILABLE**1**

Technical Clarification: Facade - additional guidance

Technical Clarification Number: MAT9-T-OB1-0342

Guidance: 2011-11-08

For the purposes of Green Star SA, the term “façade” is to be interpreted as the exterior face of a building which is the architectural front, and is to exclude all portions of wall, fabric or envelope constructions which are not visible (i.e. walls shared with adjoining buildings).

Where structural elements are exposed or protrude to appear as part of a façade or exterior face, for the purposes of Green Star SA, only the area of permanent load-bearing structural elements are to be excluded from façade calculations regarding disassembly. Loadbearing structural elements are deemed to include columns, beams and slabs, however in-fill block work is not considered a loadbearing structural element and is considered façade area in the scenario of exposed or protruding structural elements. Pre-cast concrete panels are considered loadbearing structural elements.

MAT-10 Dematerialisation

POINTS
AVAILABLE

1

AIM OF CREDIT

To encourage and recognise designs that produce a net reduction in the total amount of material used.

CREDIT CRITERIA

One point is available where a substantial reduction in materials consumption occurs as follows:

- Where it is demonstrated that the building's structural requirements and integrity have been achieved using 20% less structural steel (by mass) OR 20% less concrete and reinforcing/stressing steel (by mass), OR 20% less timber (by volume) than in a structure with conventional steel, concrete or timber framing, without changing the load path to other structural components.

OR

- Where any two of the initiatives below are demonstrated:

Structure

Where it is demonstrated that the building's structural requirements and integrity have been achieved using 10% less structural steel (by mass) OR 10% less concrete and reinforcing/stressing steel (by mass), OR 10% less timber (by volume) than in a structure with conventional steel, concrete or timber framing, without changing the load path to other structural components.

Ductwork

- The building is fully naturally ventilated; OR
- The requirement for ductwork has been reduced by 95%.

Building Efficiency

For new buildings, where it is demonstrated that Building Efficiency, defined as the ratio of the total UA over the total GFA, is at least 85%.

Finishes

- 95% of all base building floor material is exposed structure with no covering (e.g. exposed sealed concrete floor);

OR

- 95% of all base building ceiling is exposed structure (and services, where relevant) with no cladding (e.g. exposed concrete ceiling).

MAT-10 DematerialisationPOINTS
AVAILABLE**1****Cladding**

- 25% of the roof cladding area has a dual function (e.g. roof garden substrate or photovoltaic shingles serve as cladding);

OR

- 25% of the façade cladding area has a dual function (e.g. photovoltaic panels serve as cladding).

Piping

- No supply piping is used for urinals (i.e. all urinals are waterfree); OR
- No supply piping is used for toilets (i.e. all toilets are waterfree); OR
- Mass of underground piping is reduced by 25% for the same functional requirement and material.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where structure dematerialisation initiatives are undertaken: • Short report from a structural engineer • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required Where ductwork is minimised: • Short report • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required	Where structure dematerialisation initiatives are undertaken: • Short report from a structural engineer • Confirmation from contractor • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required Where ductwork is minimised: • Short report • Confirmation from contractor • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required

MAT-10 DematerialisationPOINTS
AVAILABLE**1**

Where Building Efficiency is achieved: • Short report • Tender drawings Where finishes are minimised: • Short report • Schedules of finishes • Tender Drawings Where dual-function cladding is installed: • Short report • Tender drawings Where piping is minimised: • Short report • Relevant tender schematic hydraulic drawings • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required	Where Building Efficiency is achieved: • Short report • As built drawings Where finishes are minimised: • Short report • As built drawings • As installed schedules of finishes • Confirmation from contractor Where dual-function cladding is installed: • Short report • As built drawings • Extract from the Commissioning Report Where piping is minimised: • Short report • Relevant as built hydraulic system drawings • Confirmation from contractor • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required

MAT-10 Dematerialisation

POINTS
AVAILABLE

1

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Referencing supporting documentation and describing, with calculations and summary tables wherever appropriate, how the Credit Criteria have been achieved; and
- Where the use of structural steel is minimised, a separate short report must be prepared by a qualified structural engineer that:
 - Describes how the amount of steel has been reduced;
 - Includes the calculations of the reduction in the total amount (by mass) of steel necessary for the designed structure against the reference case; and
 - Confirms that the reduction has been achieved without changing the load path to other structural components.

Quantity Surveyor report establishing the reference case against which the reduction in steel, concrete and reinforcing/stressing steel, timber, ductwork or piping will be measured. The report must identify the expected, standard practice scenario for the amount of the relevant material.

Tender/As built drawings:

- Floor plans marked up to demonstrate building efficiency; and
- Floor plans or reflected ceiling plans marked up to show, and quantify associated areas, where finishes are installed; and
- Drawings marked up to show, and quantify associated areas where dual-function cladding is installed

Schedule(s) of finishes that lists all uses of the relevant product/material type in the project.

Tender schematic hydraulic drawings marked up to indicate the underground piping or piping associated with toilets or urinals, whichever initiative is claimed.

Confirmation from contractor indicating the amount and type of product/material installed in accordance with the specifications, e.g. that no piping was installed to serve toilets or urinals.

As installed schedule of finishes that lists all uses of the relevant product/material type in the project.

Extract from the Commissioning Report confirming that the dual-function cladding has been commissioned and performs as intended by the design.

As built hydraulic system drawings marked up to indicate the underground piping or piping associated with toilets or urinals, whichever initiative is claimed.

ADDITIONAL GUIDANCE

The reduction in material must be clearly demonstrated through sufficient supporting documentation. Based on the design, documentation in excess of the outline below may be necessary.

Structure

The percentage of steel structure is measured by the sum of the suspended floor and roof areas. It must be clearly demonstrated, through the use of a reference case, that steel has been used more efficiently rather than replaced with other structural materials.

Ductwork

No additional evidence is required if the building is naturally ventilated as this is expected to be

MAT-10 DematerialisationPOINTS
AVAILABLE**1**

clearly confirmed through the Energy Modelling Report (Ene – Conditional Requirement).

Finishes

As installed final design must require 95% of floor or ceiling with no finish. This initiative is not available to shell and core projects.

Cladding

It must be clearly demonstrated that the dual-function cladding does in fact fulfil both functions and replaces the conventional, single-function cladding.

Piping

If piping for toilets or urinals is present, it will disqualify the submission even if it is capped. Reduction in the mass of underground piping must be demonstrated against a reference case that represents standard practice design.

Reference case for structure

The reduction in the total amount of structural steel (by mass), concrete and reinforcing/stressing steel (by mass) or timber (by volume) in the project must be demonstrated against the reference case. The reference case must assume a conventional steel framed, timber or concrete structure.

BACKGROUND

Reducing the total amount of material used for a given purpose is the best initial step to reducing a project's overall impact. This credit aims to reward such dematerialisation by facilitating the reduction in consumption of construction materials through redesigning or reconsidering conventional approaches to building design and its construction.

Reuse and recycling of materials has been encouraged and recognised by the GBCSA, but now an overall reduction in materials used must also be acknowledged and rewarded in order to reduce the overall amount of materials which go into the construction of commercial developments.

REFERENCES & FURTHER INFORMATION

Tonkinwise, C. (n.d.), *Proposed Asia-Pacific Centre for Dematerialisation Design: Design in less materials-intense societies in North-East and South-East Asia and Australia*, Change Design.

http://www.changedesign.org/DMat/documents/AsiaPacCentreForDMat_Draft.htm

Bibliography of international Dematerialisation and Sustainable Consumption research

<http://www.changedesign.org/DMat/BiblioBody.htm>

MAT-10 DematerialisationPOINTS
AVAILABLE**1****TECHNICAL CLARIFICATIONS AND ERRATUM**

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Concrete and reinforcing steel combination

Technical Clarification Number: MAT10-T-OB1-0799

Guidance: 2014-06-04

The GBCSA can confirm that the 20% less concrete and reinforcing steel (by mass) is a combined reduction and does not mean 20% less Concrete AND 20% less Rebar as separate items.

The GBCSA provide the following clarification relating to this issue: One of the following needs to take place:

- (1) 20% less structural steel
- OR
- (2) 20% less concrete + reinforced steel
- OR
- (3) 20% less timber

Technical Clarification: Roof hardscape

Technical Clarification Number: MAT10-T-OB1-0019

Guidance: 2009-02-06

A roof garden consists of vegetated area. If there is a patio area for use by occupants or serving another purpose, the project team may submit documentation demonstrating a dual purpose. It is important that the roof cladding has not simply been replaced by another material but that the other material serves a second function not typically served by roofing. Assessors will evaluate projects against the credit aim of reducing the total amount of material used.

MAT-10 DematerialisationPOINTS
AVAILABLE**1**

Technical Clarification: Roof gardens

Technical Clarification Number: MAT10-T-OB1-0006

Guidance:2009-02-05

A roof garden serving as cladding meets the definition of ‘dual function.’ The roof garden does not need to be accessible by occupants.

The following erratum have been incorporated:

MAT10-E-OB1-0294 (2011-08-08) Green Star SA - Office v1 Technical Manual: Page 263

MAT10-E-OB1-0173 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 262

MAT10-E-OB1-0175 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 263

MAT10-E-OB1-0176 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 263

MAT10-E-OB1-0191 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 264

MAT-11 Local Sourcing

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise the environmental advantages gained, in the form of reduced transportation emissions, by using materials and products that are sourced within close proximity to the site.

CREDIT CRITERIA

Up to two points are awarded independently as follows: One point is awarded where:

- 20% of the total contract value is represented by materials or products that have been sourced from within 400 km of the site;

One point is awarded where:

- 10% of the project's total contract value is represented by materials or products that have been sourced from within 50 km of the site;

Only materials or products permanently installed on the project site are eligible and must have been extracted, harvested, recovered, as well as manufactured within the above mentioned radii of the site in order to qualify for the credit.

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment are excluded completely from the calculations of this credit - both local materials value and total contract value. The following components, equipment and specialty items must be excluded from the total contract value calculations for MAT-11 Local Sourcing:

- All Heating, Ventilation and Cooling (HVAC) plant components incl. duct work;
- All Electrical equipment and components incl. light fixtures & fittings and distribution boards;
- All Plumbing system components incl. piping, duct work and sanitary fittings & fixtures
- Lifts;
- Building Management System (BMS) components and;
- Generators.

MAT-11 Local SourcingPOINTS
AVAILABLE**2****DOCUMENTATION REQUIREMENTS**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from tender documentation • Quantity Surveyor report • Statement of confirmation (1)	• Short report • Statement of confirmation (1) • Statement of confirmation (2)

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

- Providing a tabulated list of all materials and/or products which are claimed as compliant with the Credit Criteria;
- For each material/product, detailing the manufacturer/supplier, all points of origin, extraction and manufacture with distances to site with reference to supporting documentation
- Providing calculations that demonstrate that the total estimated value (Design) or total actual value (As Built) of the products/materials from within the specified radii account for the percentages required of the Credit Criteria, with reference to supporting documentation.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the sourcing of specified products and/or materials which are demonstrated as compliant with the Credit Criteria, and the associated quantities, as referenced in the short report;

Quantity Surveyor report estimating the total material value of the products/materials from within the specified radii as a percentage of the project's total value

Statement of confirmation (1) from supplier(s) for each material and/or product claimed, in the form of signed correspondence confirming, the location of the material/products' extraction, harvesting, processing and/or manufacturing, and (As Built only), the quantity supplied to the project

Statement of confirmation (2) from the Contractor, in the form of signed correspondence confirming:

- For all materials and/or products claimed compliant, the manufacturer/supplier of the material/product, the quantity installed within the project; and
- The material value of compliant materials/products as a percentage of the project's contract value.

MAT-11 Local Sourcing

POINTS
AVAILABLE**2**

ADDITIONAL GUIDANCE

Sufficient proof must be provided showing all points of extraction, harvesting and processing, and that all these points fall within the allowable radii from the project site.

A suitable professional is to make an informed decision as to when using locally sourced yet higher impact materials are more environmentally beneficial than importing lower impact materials from further afield. This needs to be looked at holistically in the context of the entire project to ensure that the greatest overall benefit is achieved.

If only a fraction of a material or product has been extracted, harvested, recovered and manufactured locally, then only that percentage of the material (by weight) shall contribute to the value of that material for consideration in the local sourcing credit. The cost of the product must be pro-rated based on proportionality of the weight of the various components. For example, the allowable percentage of the cost of concrete containing imported components would be the weight of the locally extracted and manufactured components divided by the total weight of the concrete mix.

In the case of reused or recycled materials or products, the location from where the material was salvaged/recovered for reuse or recycling shall be equivalent to 'point of recovery,' and for reused materials, the location of final vendor shall be considered the 'point of manufacture.'

The material cost is determined as the total cost of materials which must include transport/shipping costs to the site, but must not include installation cost, equipment for installation, contractor fee, contingencies or any other amounts.

Fill material/bulk earthworks sourced on site, or sourced within close proximity to the site, may contribute to the credit. It has been determined that it is common practice to source a non-negligible proportion of fill material from sources not within close proximity to the project site. Furthermore, bulk earthworks sources are highly variable, depending on project type and building typology. Given this, the inclusion of fill material/bulk earthworks satisfies the intent of the credit criteria and project teams are to be encouraged to source these materials locally.

BACKGROUND

It has been well established that in limiting the haulage of materials, and thereby reducing the transportation emissions, one can achieve vast improvement in the environmental impact of a project. Other indirect implications of local sourcing include boosting the local economy by supporting local industries and keeping money in the region, quicker delivery times and reduced transportation costs.

The Beddington Zero Energy Development (BedZed) in the UK put emphasis on sourcing as many products and materials locally as possible. Most of the heavy materials required for construction were sourced locally, whilst lighter more specialist materials came from further afield. 52% of the materials (by weight) were sourced within a 55km radius of the project site.

The results achieved at BedZed were compared, for both distance-by-volume and distance-by-weight measures, to national average haulage figures for similar buildings using the same materials but with average origin distances. The results for BedZed came in at 18% below average for distance-by-volume, and 40% below average for distance-by-weight.

A transport distance saving of 65km per tonne of material was achieved, which equates to a saving of 120 tonnes of CO₂ emissions. This is equivalent to the CO₂ burden of 10 people for a full year.

The choice to source materials and products locally does not in itself lead to any additional

MAT-11 Local Sourcing

POINTS
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costs or staff time, and can therefore be an effective and sustainable policy in reducing a projects footprint.

REFERENCES & FURTHER INFORMATION

Beddington Zero Energy Development: Construction Materials Report Part 1, Nicole Lazarus, Bioregional Development Group.

<http://www.bioregional.com/Materials%20report%20web%20cut%20final%20draft.pdf>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects' discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Nil

Note: Mat-11 November 2014 is based on **MAT11-T-OB1-0439** (2012-12-04) which incorporated all TC's, CIR's and Erratum's to that date

ECO-0 Conditional Requirement

AIM OF CREDIT

To encourage and recognise development on land that has limited ecological value and to discourage development on ecologically valuable sites.

CONDITIONAL REQUIREMENT CRITERIA

The Eco-Conditional Requirement is met where the project development footprint

- Is not located on prime agricultural land. Refurbishments/redevelopments that remain within the existing development footprint are exempt from this criterion;
- Is not located on vegetation of high ecological value or within a 100 metre buffer of vegetation of high ecological value. Refurbishments/redevelopments that remain within the existing development footprint are exempt from this criterion;
- Is not located on land with confirmed presence or high probability of threatened red listed species, or within a defined buffer relevant to the specific threatened red listed species or habitat found. Refurbishments/redevelopments that remain within the existing development footprint are exempt from this criterion; and
- Is not located within the required buffer zones of watercourses:
 - The project development footprint must not fall within the 100 year floodplain.
 - Watercourses of high ecological value. A project's development footprint can be located on land within 100 metres of a watercourse of high ecological value only if the building is a refurbishment that remains within the existing development footprint and the Watercourse Protection Measures (outlined below) have been completed.; or
 - Watercourses NOT of high ecological value. A project's development footprint can be located on land within 100 metres of a watercourse that is NOT of high ecological value only if the Watercourse Protection Measures (outlined below) have been completed.

Watercourse Protection Measures

- A site-specific Watercourse Management Plan has been produced, exhibited and, for an As Built submission, implemented; and
- All points are achieved in Emi-5 watercourse Pollution and in Emi-7 light Pollution.

The project must abide by all measures in the Environmental Impact Assessment for the project if one is required, and the GBCSA reserves the right to provide the final ruling on a project's compliance with this Conditional Requirement.

ECO-0 Conditional Requirement

DOCUMENTATION REQUIREMENTS

The Conditional Requirement requires that there is an official and appropriately dated report from a suitably qualified recognised ecologist confirming that none of the above Conditional Requirement Criteria applies, or applied at the time of purchase, to the site.

Green Star SA ñ Office Design	Green Star SA ñ Office As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• Extract(s) from the environmental impact assessment report (if required for development) • Confirmation from a suitably qualified recognised ecologist if not included with the EIA report or no report is available • Watercourse Management Plan if the development footprint is located within 100 metres of a watercourse. • Letter of confirmation from the building owner if the development footprint falls within 100 metres of a watercourse.	• Extract(s) from the environmental impact assessment report (if required for development) • Confirmation from a suitably qualified recognised ecologist if not included with the EIA report or no report is available • Watercourse Management Plan if the development footprint is located within 100 metres of a watercourse. • Letter of confirmation from the building owner if the development footprint falls within 100 metres of a watercourse.

Extract(s) from the Environmental Impact Assessment report (if required for development) that shows that the site was adequately assessed and that a positive Record of Decision (RoD) was issued for the site. It must also indicate the conditions of the RoD.

The confirmation from a suitably qualified registered ecologist must:

- State whether or not the site is located on or adjacent to any prohibited land types and if so the distance between the development and any vegetation of high ecological value and/or specific threatened red listed species or habitat and/or watercourses
- Where the development is located within 100 metres of a watercourse, describe the watercourse/s, determine the present ecological state or DWAF Ecological Category equivalent of the watercourse/s, confirm whether they are listed as high ecological value or not as defined by this conditional requirement and reference the supporting documentation; and
- Include the curriculum vitae of the ecologist.

A **suitably qualified registered ecologist** is defined as a Professional Natural Scientist currently registered with the South African Council for Natural Scientific Professions (SACNSP) in accordance with the Natural Scientific Professions Act, 2003 (Act 27 of 2003). The SACNSP practitioner may have other specialists produce components of work under his or her guidance, but he/she must sign off the final report.

The Watercourse Management Plan must relate to what can be addressed by the land owner

ECO-0 Conditional Requirement

on his/her own site and be prepared by a suitably qualified and experienced wetland ecologist and include:

- A clearly defined management objective to protect the watercourse;
- A description of the ecological values of the watercourse;
- A list of risks and threats to the conservation of the watercourse values associated with the development;
- The proposed risk-management actions for all construction and operation stages;
- Assumptions and a statement of resources required i.e. budget and specific actions for the management response;
- Requirements for ongoing quarterly monitoring, annual reporting and management of the watercourse ecosystem for a minimum of five years; and
- A statement regarding the operational timeframe of the Watercourse Management Plan (minimum of five years).

The Letter of confirmation from the building owner must state the commitment to the implementation of the Watercourse Management Plan for at least 5 years from project completion (regardless of whether the owner hands over a portion of the project to another entity) and describe the resources that will be allocated over the life of the plan to ensure successful implementation.

ADDITIONAL GUIDANCE

Development footprint

The term development footprint is defined as the extent of all disturbance to the site, including the building footprint, parking areas, roads, landscaping and water detention and treatment areas.

How to determine compliance to conditional requirement

The project team must determine whether an environmental impact assessment was carried out for the site and, if so, refer to the findings of the ecological specialist report. Where there is no such report, the project team must approach a suitably qualified recognised ecologist to undertake an ecological site scan or professional opinion to determine if any of the prohibited land types apply to the site.

Where there is no recent report on watercourses, wetlands and riparian habitats on the site, the project team must approach a suitably qualified wetland specialist to provide a professional opinion to determine whether any watercourses, wetlands or riparian habitats occur on the site.

All specialist ecological assessments must be done by a Professional Natural Scientist currently registered with the South African Council for Natural Scientific Professions (SACNASP) in accordance with the Natural Scientific Professions Act, 2003 (Act 27 of 2003).

Where the project is a building extension it will not automatically meet the Conditional Requirement, as the extension may encroach onto prohibited land types.

Prime agricultural land

Prime agricultural land is synonymous with the term high potential soils for agricultural use. Prime agriculture land is to be assessed in a stepped approach by a registered agricultural/soil scientist (as required by the Natural Scientific Professions Act (No. 27 of 2003) through the South African Council for Natural Scientific Professions (SACNSP));

ECO-0 Conditional Requirement

Step 1:

The specialist is to do a visual inspection of the site and top soil, and prepare a short report of his/her findings that either:

- Describes the findings that highlight that the site is not of high agricultural potential including reasons for this conclusion (in this case projects will not need to continue with step 2 of this assessment),
- or
- Describes the findings that highlight that the inspection and basic assessment was not sufficient to determine whether the site was of high agricultural potential, requiring a more detailed study (in this case the project will need to continue with step 2 of this assessment).

Step 2:

A detailed study and report must be prepared by the registered agricultural scientist to assess whether the site is of prime agricultural potential. The study must address all criteria of the soil classification relevant to the definition of prime agricultural land, as described below. The report must be conclusive in determining the classification of the site in this regard.

Definition of prime agricultural land

Prime agricultural land is classified for the purposes of this Green Star SA conditional requirement as soils of either Class I or II as defined in the Development and Application of a Land Classification for South Africa report dated April 2002 prepared for the National Department of Agriculture, available for download from the AGIS website (www.agis.agric.za under AGIS: Natural Resources: Assessments: Land Capability: e-Library).

Vegetation of high ecological value

Vegetation of high ecological value is defined as indigenous natural vegetation that is in its untransformed state. For the purposes of Green Star SA this would include any vegetation identified as a Critical Biodiversity Area in a fine-scale systematic conservation plan. The project team must secure a recent site-specific vegetation sensitivity study that confirms or refutes the presence of vegetation of high ecological value on the site. Where present, the vegetation of high ecological value is to be delineated on the site plan. Vegetation of high ecological value would typically be included with the environmental impact assessment report. Where there is no such report, a suitably qualified registered ecologist should be commissioned to provide a report.

Threatened red listed/threatened species

Threatened species are any species (including animals, plants, fungi, etc.) which are vulnerable to extinction in the near future. Threatened species are also referred to as a threatened red listed species, as they are listed in the IUCN Red List of Threatened Species. Threatened red listed species are protected through national legislation, the *National Environmental Management: Biodiversity Act 10, 2004* and at a provincial level through policy by the provincial authorities mandated to enforce the *National Environmental Management Act, Act 107 of 1998*.

Threatened and protected species lists may be obtained from the local Provincial and National conservation authorities. More information can be found at <http://www.iucnredlist.org>.

In determining compliance with the Conditional Requirement Criteria, a registered ecologist qualified according to currently accepted standards for the threatened red listed species expected to occur on site should apply relevant methodologies as specified in recent guideline documents and available literature.

Watercourses

The following definitions from the National Water Act, 1998 (Act No. 36 of 1998) (NWA) are to be used to determine the presence of a watercourse on or within 100 metres of the site.

ECO-0 Conditional Requirement

The NWA includes wetlands and rivers into the definition of the term watercourse as follows:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows, and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.

A reference to a watercourse includes, where relevant, its bed and banks.

How to determine the buffer from a watercourse

For the purposes of determining the 100 metre buffer from a watercourse, the edge of a watercourse is defined as the outer edge of the combined footprint encompassing the riparian habitat and/or the temporary zone of a wetland/s on or adjacent to the site.

- The edge of the watercourse must be delineated by a wetland specialist. The 100m buffer is then measured from this line.
- In addition, the development footprint must not fall within the 100 year flood plain.

Riparian habitat is the accepted indicator used to delineate the extent of a river's footprint (DWAF, 2005). The NWA defines a riparian habitat as follows:

Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas'

The temporary zone of a wetland is the outer recognisable edge of a wetland which the National Water Act, 1998 (Act 36 of 1998) defines as:

Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil

Local government policies require that protective river buffer zones be calculated from the outer edge of the riparian zone and that protective wetland buffer zones be calculated from the outer edge of the temporary zone of a wetland (KZN DAEA, 2002; CoCT, 2008; GDACE, 2009).

High Ecological Value Watercourses

For the purposes of this conditional requirement, a watercourse is considered to be a high ecological value watercourse if it is:

- Deemed significant under a local, provincial or national register;
- A listed wetland under the Ramsar Convention on Wetlands; or
- Rated with a Present Ecological State (PES) of 60% or greater.

How to determine the ecological value of a watercourse

The Ecologist's site assessment must be based on:

- Local, provincial and national watercourse mapping where available;
- The Ramsar Convention on Wetlands;

ECO-0 Conditional Requirement

- Aerial photography;
- Topographic mapping (to identify catchment areas and drainage patterns); and
- A site survey including an assessment of the present ecological state of watercourses in terms of the vegetation, soil and hydrological regime, against the definitions of watercourses of high ecological value using recognised South African functional assessment methodologies.

How to determine the Present Ecological State (PES) of a watercourse

A suitably qualified and experienced wetland ecologist must apply the appropriate methodologies to assess the ecological integrity of the watercourse/s on or adjacent to the site to determine their PES or equivalent DWAF ecological category.

Several assessment methodologies have been developed in recent years which describe the relative integrity of wetlands and rivers. In deciding which rating system is the most appropriate at a given time, it is important to take into consideration the following:

- The particular type of wetland or river conditions present on the site will determine which methodology is best suited for an evaluation;
- Methodologies developed for South African biophysical conditions should take preference to non-South African methodologies;
- Where possible, recent, updated methodologies should be followed;
- Methodologies should be generally accepted by specialists in the field; and
- They should be rugged and scientifically defensible.

The following methodologies have been developed for the assessment of the ecological state and by implication the value of watercourses according to their hydro-geomorphic categories:

- The Riparian Vegetation Response Assessment Index (VEGRAI) (Kleynhans et al, 2007);
- The Wetland Index of Habitat Integrity (WETLAND-IHI) developed by DWAF (2007);
- The WET-Health tool designed to assess the health or integrity of a wetland; and
- The WET-EcoServices tool designed to assess the ecological functionality of a wetland.

Watercourse protection measures

The watercourse management plan must be incorporated on the project for the areas within the owner's control. The owner must remain responsible for implementing the watercourse management plan for 5 years from project completion, regardless of whether the land will be donated or handed over to another entity.

All points in Emi-5 Watercourse Pollution and in Emi-7 light Pollution must be achieved, regardless of the areas of the watercourse under the owner's control.

Excluded drainage systems

Man-made drainage features such as stormwater channels and swales are not included in the National Water Act, 1998 (Act No. 36 of 1998) definition of a watercourse and are therefore not considered to qualify as watercourses in terms of the Eco-Conditional Requirement.

However, care should be taken in the interpretation of this definition due to the fact that natural streams, wetlands and rivers may in some instances become transformed so as to resemble artificial features over many years of human disturbance. Similarly, over time, man-made systems may resemble natural systems. A suitably qualified specialist should be approached to determine the status of these systems according to the National Water Act should any doubt arise based on soil moisture, position in the landscape or vegetation characteristics present on

ECO-0 Conditional Requirement

the site.

BACKGROUND

The principal aim of this conditional requirement is to minimise ecological degradation by encouraging the selection of sites for development that have low ecological value. Site selection is one of the easiest ways to gain positive environmental outcomes within the building industry. Following is more information on parameters that are considered to be ecologically sensitive.

Prime agricultural land

Prime agricultural land is potentially a critical ecological resource for food production and must be protected from loss due to development. Schoeman *et al* compiled a report entitled, Development and application of a land capability classification system for South Africa (Schoeman *et al.* 2002) for the National Department of Agriculture. This report is the basis for the categorization of prime agriculture land.

Vegetation of high ecological value

All over South Africa, very little vegetation exists that is in an undisturbed and untransformed state. Where this vegetation does occur, it is often inadequately protected. Mucina and Rutherford (eds) completed a revised study of the vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford, 2006). The book includes descriptions of each vegetation type, including a general introduction to each biome, followed by descriptions for each vegetation type in the Biome. This book is the basis for the calculations contained in the Change of Ecological Value Calculator.

Threatened red listed/threatened species

The World Conservation Union (IUCN) is the foremost authority on threatened species, and treats threatened species not as a single category, but as groups of categories such as vulnerable, endangered, and critically endangered, depending on the degree to which they are threatened.

Watercourses

Watercourses include wetlands and rivers with their associated riparian zones. Wetlands range from springs to seeps, mires and bogs in the mountains, to midland marshes and floodplains, to coastal lakes, mangrove swamps and estuaries. By definition, they are areas of land where saturation with water is the dominant factor determining the nature of soil development and the types of plants and animals living in the soil and on its surface.

The primary task of a wetland is to manage water. It fills with water during floods and releases water during dry periods, thus playing an essential part in the regulation of river flow. It also filters pollutants and fertilizers and provides a habitat for plants, insects and birds.

Maps, photographs or other documentary evidence showing the site's location and past uses may be requested, to confirm proximity to natural wetlands. The South African Wetland

Database contains a list of all wetlands listed under either the Ramsar Convention (<http://ramsar.wetlands.org/>) or the South African National Wetland Inventory Directory of Important Wetlands in South Africa.

REFERENCES & FURTHER INFORMATION

ECO-0 Conditional Requirement

http://www.agis.agric.za/agismap_atlas/

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ECO-0 Conditional Requirement

2009 National Ecosystem Status Document (Driver A, Threatened Ecosystems for Listing under NEM:BA 2009, South African Biodiversity Institute, Pretoria.)

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SACNASP Act (Act 27 of 2003)

<http://www.sacnasp.org.za/sacnaspact.htm>

The Ramsar Convention on Wetlands

<http://www.ramsar.org>

http://www.ngo.grida.no/soesa/nsoer/resource/wetland/inventory_classif.htm

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Ecologist confirmation – exclusions

(Note that ECO0-T-OB1-0290 has been superseded by ECO0-T-OB1-0655)

Technical Clarification Number: ECO0-T-OB1-0655

Guidance: 2013-03-11

If the project is a refurbishment/redevelopment that remains within the existing development footprint (and providing it is outside the required buffers of watercourses), there is no need to include confirmation from a registered ecologist. Confirmation is required and it could simply be included within the Short Report prepared by a suitably qualified professional with reference to supporting evidence (e.g. aerial photos, Google images)

Technical Clarification: Eligibility link with EMI-5 Watercourse Pollution

Technical Clarification Number: ECO0-T-OB1-0611

Guidance: 2012-11-19

Following extensive feedback from the South African market on the issued Emi-05 Watercourse Pollution PILOT Credit, the GBCSA has published the new revised Emi-5 Watercourse Pollution (November 2012) credit for the Green Star SA Office and Retail Centre v1 rating tools (EMI5-E-OB1-0520). The GBCSA is currently reviewing the link between Emi-5 and Eco-00 Eligibility, where it is

ECO-0 Conditional Requirement

required that all 3 points are achieved for project footprints that fall within 100m of a watercourse and until this review has been concluded, please see guidance below for projects that are within 100m of a watercourse

The requirements set out in the revised Emi-5 credit dated November 2012 are intended to represent best practice in South Africa with regards to urban stormwater management. The GBCSA acknowledges however that the applicable stormwater management solutions on each site may vary significantly with regards to site conditions, the extent of the development, off-site infrastructure in place, etc.

Currently, in complying with the Eco-00 Conditional requirement, where a project's development footprint falls within 100m of a watercourse, the Eco-00 Conditional Requirement requires watercourse protection measures to be put in place and the project achieve all points in Emi-5 Watercourse Pollution. Projects may in the interim until the review of the link between Emi-5 and Eco-00 is concluded, propose through an Eligibility Ruling Request sent to the GBCSA, an alternative means of meeting eligibility by showing compliance with recognised best practice urban stormwater management standards. Thus projects are no longer required to meet all 3 points as set out in credit Emi-5 Watercourse Pollution for eligibility purposes until further notice.

Below are examples of urban stormwater management standards that the GBCSA recognise as representing best practice nationally and internationally. Projects teams may also put forward other standards that represent equivalent best practice in this regard.

- City of Johannesburg Metropolitan Municipality Stormwater Management By-Laws – 2009
- City of Cape Town Management of Urban Stormwater Impacts Policy – Version 1.1, 2009
- Georgia Stormwater Management Manual – First Edition, 2001

Please note the following with regards to submission of an Eligibility Ruling Request as per the above:

- The Eligibility Ruling Request must clearly motivate how the stormwater management solutions on site are in line with best practice referencing relevant best practice standards.
- Where standards other than those listed above are referenced, it must be clearly motivated why these standards can be considered as current best practice in relation to other best practice standards such as those listed above.
- Extracts from the relevant standards referenced should be provided along with the submission which correlates with the project team's proposal.

Note that the guidance provided above relates to Eco-00 eligibility compliance only and not to achieving points within the Emi-5 credit. Compliance with the Emi-5 credit must be demonstrated as per the criteria set out in the Emi-5 credit itself. Note that this guidance can be applied by both projects registered before and after the date of issue of this clarification.

Technical Clarification: Applicability of revised Eco-0 Conditional Requirement - project registration date

Technical Clarification Number: ECO0-T-OB1-0396

Guidance: 2012-02-06

ECO-0 Conditional Requirement

The date used to determine the applicability of the revised Eco-0 Conditional Requirement (dated April 2010) published on the GBCSA website is deemed as the date of first full registration of the project for a Green Star SA certification under a particular rating tool, independent of whether it is a Design or As-Built certification.

Technical Clarification: Watercourse Management Plan - exclusions

Technical Clarification Number: ECO0-T-OB1-0368

Guidance: 2012-01-27

The following guidance applies to projects that are required under the Green Star SA – Office v1 Eco-Conditional Requirement of April 2010 to complete the 'Watercourse Protection Measures':

For project sites that are not immediately adjacent to a site on which a watercourse is located, do not have a watercourse located on their site, and are not adjacent to previously undeveloped land adjoining a watercourse, the requirement for a site-specific Watercourse Management Plan need not be satisfied.

All other requirements of the Watercourse Protection Measures outlined in the Green Star SA – Office v1 Eco-Conditional Requirement of April 2010 must still however be complied with (i.e. that all points are achieved for the Emi-5 and Emi-7 credits) and that all measures in any relevant Environmental Impact Assessments must be abided by.

Thus for example, in the case of a project where the development footprint falls within 100m of a watercourse, but the project's site is separated from the watercourse by another fully developed site, a Watercourse Management Plan need not produced, exhibited or implemented, provided that all other requirements under the Green Star SA – Office v1 Eco-Conditional Requirement of April 2010 are satisfied.

Technical Clarification: Threatened red listed species

Technical Clarification Number: ECO0-T-OB1-0099

Guidance: 2010-08-24

The Eco-0 Conditional Requirement (updated 15th April 2010) references "threatened red listed species". For the purposes of Green Star SA, the term "threatened" is as per the IUCN Red List Categories & Criteria (Version 3.1-2000) which defines "threatened" species as those within the subcategories of "Critically Endangered (CR)", "Endangered (EN)" or "Vulnerable (VU)" only. Species which are not included within the afore mentioned subcategories are not considered "threatened" for the purposes of Green Star SA.

Technical Clarification: Floodplain criteria

Technical Clarification Number: ECO0-T-OB1-0079

ECO-0 Conditional Requirement

Guidance: 2010-06-04

Refurbishments/redevelopments that remain within the existing development footprint are exempt from the criterion that the development footprint must not fall within the 100 year floodplain.

Technical Clarification: Development footprint

Technical Clarification Number: ECO0-T-OB1-0077

Guidance: 2010-06-01

Per the Green Star SA - Office v1 Eco-Conditional Requirement revised April 2010, “The development footprint is defined as the extent of all disturbance to the site...” The development footprint thus includes all temporary work or structures erected by the contractor. The intent of restricting the extent of the development footprint is to minimise the disturbance to ecologically valuable land. As temporary site works would still disturb ecologically valuable land, they must be considered as part of the development footprint.

Credit Interpretation Request: Ecologist qualification

Credit Interpretation Request Number: ECO0-C-OB1-0034

Ruling: 2009-05-14

The Credit Interpretation Request (CIR) seeking approval for ecologist registration with the South African Institute of Ecologists and Environmental Scientists (SAIEES) as equal to registration with the South African Council for Natural Scientific Professions (SACNASP) is denied. Registration with SAIEES does not provide an equal qualification as that with SACNASP.

ECO-1 TopsoilPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise construction practices that preserve the ecological integrity of topsoil.

CREDIT CRITERIA

One point is awarded where:

- All topsoil impacted by the construction works is separated and protected from degradation, erosion or mixing with fill or waste;
AND
- Where at project completion:
 - Protected topsoil is spread over impacted areas to a minimum depth of 200mm;
OR
 - 75% of all protected topsoil (by volume) remains on site;
AND
- Where protected topsoil remaining on site is productive.

Where no topsoil was impacted by the construction works, this credit is 'Not Applicable' and is excluded from the Points Available, used calculate the Land Use & Ecology Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• Short report • Extract(s) from contracts Where the credit is claimed as 'Not Applicable': • Short report	• Short report • Extract(s) from contracts Where the credit is claimed as 'Not Applicable': • Short report

ECO-1 Topsoil

POINTS
AVAILABLE

1

Short report prepared by a suitable professional(s) that describes how the Credit Criteria have been met by:

- Quantifying the amount of topsoil on the site at time of purchase; all assumptions must be justified;
- Defining the area that will be impacted by construction activities;
- Where topsoil is present and affected, describing how the integrity of the site's topsoil specifically within the impacted area will be protected throughout construction works in the form of a topsoil management plan or in the case of the as built scenario, describing how the integrity of the site's topsoil has been protected throughout construction works;
- Describing, with calculations and references to drawings, the 'before' and 'after' conditions that account for all topsoil on the site, and clearly confirming that no more than 25% of the site's topsoil by volume will be covered by hard surfaces as a consequence of the design, and that at least 75% of the site's topsoil will remain productive and on site;

Extract(s) from contract(s) clearly demonstrating the requirements for topsoil management that the contractor and sub-contractors must adhere to in order to achieve compliance with the Credit Criteria

ADDITIONAL GUIDANCE

Productive topsoil

Topsoil is defined as the surface layer of soil containing partly decomposed organic debris, which is usually high in nutrients, contains many seeds, and is rich in mycorrhizae. To remain productive, topsoil must not be covered by permanent hard surfaces.

Protected topsoil

The calculation of protected topsoil to remain on site is based on the pre-development volume of topsoil not covered by hard surfaces.

Impacted area

The impacted area includes the total footprint on the site where construction activities including building works, materials handling and traffic occur especially where these activities disturb the existing topsoil cover. The protected topsoil must be spread to a minimum depth of 200mm on all vegetated areas within the impacted area.

Externally sourced topsoil

The importation of topsoil is not rewarded by this credit as it may compromise its ecological integrity. Projects that substitute topsoil from the site with other topsoil and where in situ topsoil has been removed from site forfeit this credit.

Correct topsoil management

- Conduct a site specific soil survey of the project area as a part of baseline investigations. The soil survey will identify the soils suitable for salvaging, their depth and amount prior to disturbance.
- All suitable topsoil occurring within the impact area of construction must be salvaged and stockpiled in a demarcated and protected area for later reapplication.
- Where conditions permit, taking into account project schedules, topsoil must be applied directly to re-contoured areas within the impact area and protected from disturbance by

ECO-1 Topsoil

POINTS
AVAILABLE

1

construction activities.

- A protective vegetation layer must be established to cover topsoil stockpiles that will be stored for more than three months. The stockpile must be kept suitably moist to maintain the vitality of the vegetation. The vegetation must not include weed species and must comprise of grass or groundcovers. The vegetation cover protects the stockpile from erosion and desiccation. Long term storage of soils may result in the loss of vital organisms within the soil, thus reducing the productivity of the soil and consequently reducing re-vegetation or landscaping success.
- The topsoil stockpiles that will be stored for less than three months must be covered with a material that is durable yet permeable to protect the topsoil from wind, rain and erosion. The stockpile must be kept moderately moist to maintain the vitality of the soil.

Permanent hard surfaces

Permanent hard surfaces are defined as:

- Any permanent structure (e.g. building or car park); and
- Any impervious or semi-impervious surfaces (e.g. paved or unpaved car parks).

Where there is insufficient topsoil to spread a 200mm layer at project completion, at least 75% of the volume of pre-development productive topsoil occurring within the impacted area must remain on site.

The correct implementation of the topsoil management plan will demonstrate that the integrity of the site's topsoil was not compromised during construction works.

BACKGROUND

Topsoil is a valuable and diminishing natural resource in South Africa and globally. The most meaningful indicator for the health of the land, and the long-term wealth of a nation, is whether soil is being formed or lost. If soil is being lost, so too is the economic and ecological foundation on which production and conservation are based (Jones 2002).

Conservation is necessary because soil formation is a slow process. One centimeter of soil takes between 100 and 400 years to develop (Kassam *et al*; 1992).

REFERENCES & FURTHER INFORMATION

Water Related Best Management Practices in the Landscape *Watershed Science Institute United States Department of Agriculture and Mississippi State University 1999, <http://abe.msstate.edu/csd/NRCS-BMPs/contents.html>.*

Refer also to the Management Category Man-7 'Waste Management'.

ECO-1 Topsoil

POINTS
AVAILABLE**1**

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Miscellaneous topsoil

Technical Clarification Number: ECO1-T-OB1-0106

Guidance: 2010-10-13

Topsoil contained within non-permanent landscape, such as potted plants, planter boxes, or other non-insitu landscape features, which can be removed or relocated, is not considered part of the 'site' and is therefore not within the scope of the Eco-1 Topsoil credit. All other topsoil, including that contained in permanent or insitu landscape features, must be included in calculations demonstrating compliance with the credit criteria.

Technical Clarification: Contaminated soil

Technical Clarification Number: ECO1-T-OB1-0010

Guidance: 2009-02-06

Pre-existing contaminated topsoil is excluded from this credit and is dealt with in the following two ways.

1. For contamination of a portion of the existing topsoil, the contaminated soil is not included in the topsoil calculations.
2. For contamination of all existing topsoil, the credit is 'Not Applicable' and should be marked 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

If existing topsoil is contaminated during the construction process, the credit can not be earned and must be marked as zero points achieved.

Technical Clarification: Reused topsoil

Technical Clarification Number: ECO1-T-OB1-0002

Guidance: 2009-02-05

ECO-1 Topsoil

POINTS
AVAILABLE**1**

Topsoil that is reused on other building sites does not qualify for credit. The productivity and value of topsoil is linked to the site it is located on, and moving topsoil between building sites may compromise its ecological integrity. In order to achieve the credit, project teams must demonstrate that 75% of all protected topsoil remains productive and on site.

The following errata have been incorporated into the body of the credit:

ECO1-E-OB1-0544 (2012-08-22) : Green Star SA – Office v1 Technical Manual: Page 279

ECO1-E-OB1-0122 (2011-01-06): Green Star SA - Office v1 Technical Manual: Page 281

ECO-2 Reuse of Land

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise the reuse of land that has previously been developed and where the site is within an existing municipally approved urban edge.

CREDIT CRITERIA

Two points are available as follows:

One point is awarded:

- If the project is a refurbishment or a building extension;
OR
- If at the time of the site purchase, the existing developing footprint (previously developed land) represents no less than 75% of the site area.

An additional point is awarded if the site is located within a municipally approved urban edge.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• Short report	• Short report

Short report from the project architect describing:

- The built area on the site at the time of purchase, and providing calculations (with justification of all inputs used) of the proportion of the built area on the site; and
- A locality plan that demonstrates that the location and extent of the site falls within the municipal approved urban edge.

ADDITIONAL GUIDANCE

For a new building, the documentation current at the time of site purchase must clearly demonstrate that at least 75% of the site area was previously developed land. Furthermore the second point will not be awarded if the documentation current at the time of site purchase indicates that the site was outside of the approved urban edge.

ECO-2 Reuse of Land

POINTS
AVAILABLE**2**

Previously developed land

Previously developed land is land that is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure.

'Curtilage' is defined as the enclosed area immediately surrounding a building including yards and paved surfaces (e.g. hardscape and landscaped areas)

Approved urban edge

An approved urban edge is defined as (DEADP, 2005):

A defined line drawn around an urban area as a growth boundary, i.e. the outer limit of urban areas. The urban edge marks the transition between rural and urban land use, i.e. generally between urban areas where full municipal services are provided to land uses other than agriculture and the rural, predominantly agricultural, conservation and nature areas. Urban edges are intended to include an adequate supply of land that can be efficiently provided with urban services (roads, sewers, water, storm water systems and streetlights) to accommodate the expected growth of the urban area for a defined period. By providing land for urban uses within the urban edge (growth boundary), the rural area can be protected from urban sprawl. To find out more about these parameters within the provincial context, the relevant provincial and local government planning departments should be contacted.

To determine the alignment and status of an urban edge within a municipality, the project team should contact the planning department of the district or metropolitan municipality or alternatively the relevant provincial department with the planning mandate.

BACKGROUND

Redevelopment of previously built-upon or reclaimed sites will not only reduce the burden on previously undeveloped sites and greenfield space, but can also provide investment and regeneration in previously defunct industrial and landfill sites. This in turn can help create socially and environmentally sustainable communities. Development pressure and urban sprawl are key threats to sensitive and threatened ecosystems and natural resources identified by the South African State of the Environment Report. Reusing previously developed land is a significant method of reducing the need to clear undeveloped land for construction of new buildings, and building within the urban edge is vitally important in preventing urban sprawl and the associated impacts on the environment.

REFERENCES & FURTHER INFORMATION

DEADP (2005) *Provincial Urban Edge Guideline*. Western Cape Department of Environmental Affairs and Development Planning: Directorate Integrated Environmental Management.

State of the Environment Report, Department of Environmental Affairs and Tourism, The Republic of South Africa

<http://soer.deat.gov.za/themes.aspx?m=492&amid=3444>

ECO-2 Reuse of LandPOINTS
AVAILABLE**2****TECHNICAL CLARIFICATIONS AND ERRATUM**

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification: Previously developed land - exclusions

Technical Clarification Number: ECO2-T-OB1-0394

Guidance: 2012-01-23

The following are excluded from 'previously developed land' (i.e. cannot be claimed as previously developed):

- Land that has been developed for minerals extraction or waste disposal by landfill purposes where provision for restoration has been made through development control procedures;

AND

- Land that was previously developed but where the remains of the permanent structure or fixed surfaces have blended into the landscape in the process of time (to the extent that it can reasonably be considered as part of the natural surroundings).

The following errata have been incorporated into the body of the credit:

ECO2-E-OB1-0392 (2012-01-23) : Green Star SA - Office v1 Technical Manual: Page 283

ECO2-E-OB1-0393 (2012-01-23) : Green Star SA - Office v1 Technical Manual: Page 284

ECO2-E-OB1-0123 (2011-01-06) : Green Star SA - Office v1 Technical Manual: Page 283

ECO-3 Reclaimed Contaminated LandPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise developments that reclaim contaminated land that otherwise would not have been developed.

CREDIT CRITERIA

Two points are awarded where:

- The site was contaminated at the time of purchase;
- AND
- The developer has undertaken full remedial steps to decontaminate the site prior to construction.

This credit is 'Not Applicable' for projects that are refurbishments or building extensions, and is excluded from the Points Available, used to calculate the Land Use & Ecology Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• Short report Where the credit is claimed as 'Not Applicable': • No evidence is required from projects that are refurbishments or building extensions.	• Short report Where the credit is claimed as 'Not Applicable': • No evidence is required from projects that are refurbishments or building extensions

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Identifying the type and extent of contamination;
- Outlining all available decontamination options, and proposing the remediation strategy where required; and
- In order for encapsulation to be deemed appropriate for meeting the Credit Criteria, the report must clearly identify that no other remediation options exist for this project.

ECO-3 Reclaimed Contaminated LandPOINTS
AVAILABLE**2****ADDITIONAL GUIDANCE**

The submission must show that:

- The site was designated as significantly contaminated at the time of purchase, where 'significant contamination' is defined as any contamination (regardless of extent, concentration, toxicity or otherwise) requiring remediation as determined by the relevant national, provincial or local authorities;
- The site was correctly and appropriately decontaminated prior to the beginning of the construction phase of the project in accordance with the relevant National and Provincial legislation and standards, including but not limited to the National Environmental Management: Waste Management Bill (General Notice 1832 of 2007) and subsequent legislation that comes into effect with the enactment of this or similar bill; and
- As a result of decontamination, the site was certified as uncontaminated and satisfactory for use.

Encapsulation is only an acceptable form of remediation if there are technically no other remediation options.

To be deemed no longer contaminated, the site must meet the regulated levels deemed suitable by the relevant competent authority. The environmental auditor or waste management control officer who certifies that the site has been duly decontaminated must meet the requirements of standards set at National, Provincial and local level.

Contamination is defined in the *National Environmental Management: Waste Management Bill* as: the presence in or under any land, site, buildings or structures of a substance or micro organism above the concentration which is normally present in or under that land which substances directly or indirectly affect or may affect the quality of soil or the environment adversely. Existing building contamination is addressed in credit IEQ-11 while this credit ECO-3 deals with reclaimed contaminated land only.

It is noted that minor local contamination will occur on most previously used sites and such minor decontamination is not addressed by this credit. For the purpose of this credit, existing contamination should be 'significant'. This means that there should be substantial recommendations for containment and/or removal in the site contamination report.

Please note the contamination resulting from this development (e.g. with asbestos from demolition of the existing buildings) cannot contribute to this credit.

Remediation of the Environment means 'the clean-up or making safe of a site or water body that is contaminated by toxic substances, whether they are natural or man-made'.

Treatment as defined in the *National Environmental Management: Waste Management Bill* means any method, technique or process that is designed to change the physical, biological or chemical character or composition of a waste, or to remove, separate, concentrate or recover a hazardous or toxic component of a waste or to destroy or reduce the toxicity of the waste in order to minimise the impact of the waste on the environment.

ECO-3 Reclaimed Contaminated Land

POINTS
AVAILABLE**2**

BACKGROUND

Numerous sites throughout South Africa are affected by contamination, caused by petrochemical, manufacturing, military, urban, agricultural and mining activities. Many of these sites are suitable for development following the correct treatment and remediation measures. The development of contaminated sites not only brings back into use a redundant, formerly developed land but also makes safe land that would otherwise be considered unhealthy for human occupation and a danger to the local natural environment. The treatment and remediation of contaminated sites for reuse also limits the demand for undeveloped sites that may be of ecological importance.

REFERENCES & FURTHER INFORMATION

National Environmental Management: Waste Management Bill (General Notice 1832 of 2007)

Hazardous Substances Act 15 of 1973

SABS Codes of Practice 0228 & 0229

Asbestos Regulations 2001

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

The following errata have been incorporated into the body of the credit:

ECO3-E-OB1-0124 (2011-01-06): Green Star SA - Office v1 Technical Manual: Page 285

ECO3-E-OB1-0125 (2011-01-06) : Green Star SA - Office v1 Technical Manual: Page 285

ECO3-E-OB1-0126 (2011-01-06): Green Star SA - Office v1 Technical Manual: Page 286

ECO-4 Change in Ecological Value

POINTS
AVAILABLE**4**

AIM OF CREDIT

To encourage and recognise developments that maintain or enhance the ecological value of their sites.

CREDIT CRITERIA

Up to four points are awarded where:

- For greenfield sites, the site has no threatened or vulnerable species or sensitive ecological units and for reused sites (e.g. refurbishments), such species and ecological units are adequately protected if present; AND
- There is no net reduction of native vegetation; AND
- There is no change in sensitivity class through transformation of, or reduction in extent of, threatened vegetation types; AND
- The ecological value of the site is either not diminished, or is enhanced beyond its previously existing state.

The points are determined by the Green Star SA Change of Ecological Value Calculator.

DOCUMENTATION REQUIREMENTS

The inputs used for the Change of Ecological Value Calculator must be justified by supporting documentation and used consistently throughout the submission, wherever relevant.

The previously existing state is defined as the state at the time of site purchase.

To achieve more than one point in the Calculator, it is expected that the project team will need to substantially enhance the site's ecological value. It is also anticipated that in most cases, initiatives that enhance the site's ecological value will contribute towards other Green Star SA – Office credits.

The region where the project is to be located must be nominated in the documentation provided.

Where threatened species are present on the site of a refurbishment project, points can be achieved only if it is clearly demonstrated that those species are adequately demarcated and protected from disturbance and deterioration.

Where the project submission claims to create land types with ecological value of 25 or greater in accordance with Table Eco-4.1 in the Additional Guidance, e.g. a wetland, more than one point will only be awarded if it has been clearly demonstrated that the proposed ecosystems will function as intended by the design.

ECO-4 Change in Ecological ValuePOINTS
AVAILABLE**4**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
- Completed Change of Ecological Value Calculator - Short report - Landscaping schedule Where the project claims to create land types with ecological value of 25 or greater, the following is also required: - Evidence of ecosystem viability For reused sites where threatened or vulnerable species are present, the following is also required: - Endangered species protection plan - Confirmation from a suitably qualified registered ecologist	- Completed Change of Ecological Value Calculator - Short report - As built architectural site plan - Landscaping schedule Where the project claims to create land types with ecological value of 25 or greater, the following is also required: - Evidence of ecosystem viability For reused sites where threatened or vulnerable species are present, the following is also required: - Endangered species protection plan - Confirmation from a suitably qualified registered ecologist

Completed Change of Ecological Value Calculator, using inputs consistent with supporting documentation.

Short report by a suitably qualified registered ecologist nominating the bioregion and vegetation type of the site and describing land types, with corresponding areas, in the 'before' and 'after' condition of the site.

- Where the site is identified as a brownfield site by selecting the urban area 'vegetation type', justification must be provided;
- Where the site's bioregion and vegetation type is identified and the presence of threatened or vulnerable species on the site is either confirmed or refuted;
- Where the project claims to create land types with ecological value of 25 or greater, the report must identify the conditions and time period necessary for the these areas to assume and perform their ecological function;
- In complex and sensitive designs, instalment and maintenance plans will be required to be developed and implemented by the building management, e.g. as part of the Operations and Maintenance (O&M) Manual; and
- The short report may rely on additional evidence of ecosystem viability to demonstrate that the installed landscape will function as intended by the design.

As built architectural site plan of the design clearly identifying all land types present on the site in accordance with the Change of Ecological Value Calculator and indicating the area they occupy.

Landscaping schedule where planting and any requirements necessary to ensure that the landscaping functions as intended by the design are nominated.

Evidence of ecosystem viability including any evidence that may be necessary to demonstrate that the installed landscape will function as intended by the design.

ECO-4 Change in Ecological Value

POINTS
AVAILABLE

4

Endangered species protection plan for protecting the existing threatened or vulnerable species and that:

- Identifies the threatened or vulnerable species present on the site;
- Identifies the conditions necessary for the thriving of these species; and
- Outlines the plan for protecting these species.

Confirmation from a suitably qualified registered ecologist that the proposed plan for protecting the existing threatened or vulnerable species on the site is adequate.

ADDITIONAL GUIDANCE

Change of Ecological Value Calculator Guide

The Change of Ecological Value Calculator compares the relative ecological value of land at the time of site purchase and after development.

The following information is required to use the Calculator:

- Whether the site contains threatened or vulnerable species;
- The Bio-region in which the site is located;
- The Vegetation Type in which the site is located;
- The area of each different ecological land type on the site before development; and
- The area of each different ecological land type on the site after development.

How the Calculator works

The Change of Ecological Value Calculator is used to assess the different types of vegetative and non-vegetative cover on a proposed development site using the following:

- The different ecological land types have been assigned relative Ecological Weightings by qualified ecologists for comparative purposes only (refer to information following for further advice);
- The area of each land type is multiplied by the Ecological Weighting, for the site both before and after development, to give an Ecological Score for each;
- For existing natural indigenous land types, wetlands and waterways the Ecological Score is multiplied by a Bioregion Reservation Importance Factor;

ECO-4 Change in Ecological Value

POINTS
AVAILABLE

4

- Where the vegetation type is unknown ('Don't know' option selected), the opportunity to score credits is severely diminished;
- For certain existing natural land types, wetlands and waterways/riparian zone the Ecological Score after development is limited and cannot exceed the before development score (this is based on the understanding that truly natural systems cannot be created in the relatively short term of a design implementation and therefore the existing natural land types cannot increase in extent);
- For a brownfield site with the 'Brownfield Site' vegetation type selected, the Ecological Weighting Score of certain man-made vegetated land types are multiplied by 2 (resulting in the doubling of the score) while certain indigenous natural vegetation land types are multiplied by 0 (resulting in a zero score – refer to information following for further advice);
- A total Ecological Score for the site both before and after development is determined by then adding the Ecological Scores for each land type;
- A comparative Ecological Diversity Index for the site before and after development is calculated by dividing the Total Ecological Score by the site area;
- The Change in Ecological Value is calculated by subtracting the Ecological Diversity Index (before) from the Ecological Diversity Index (after); and
- Credits are then awarded based on the Change in Ecological Value achieved.

Except for the selection from the drop down lists and the data entered into the 'Before' and 'After' columns, the scores and final credits are calculated automatically. There are many National and Provincial threatened species and ecosystems. The presence or absence on site of either must be verified by a suitably qualified and registered ecologist.

Weightings for greenfield versus brownfield sites

The Change of Ecological Value Calculator is structured in a way so as to acknowledge the stark difference in baseline ecological value between an undeveloped greenfield site and a previously developed brownfield site.

On a greenfield site the ecological value is predominantly dictated by the climate, geology & soils and the living systems that inhabit it. Where the site is cultivated, the agricultural management practices will affect the ecological value. A greenfield site is located within a much larger regional area of vegetated land types.

The ecological value of a brownfield site is predominantly dictated by the extent of hard surface land types and disturbance through human activities on and surrounding the site. A brownfield site is located within an urban area with little to no ecological habitat.

Due to the much higher land cost in urban areas, the doubling of the weighting on brownfield sites for man-made vegetated land types encourages the project team to consider enhancing the ecological value of the site despite the limited area that can viably be allocated to vegetated or wetland land types.

Since the brownfield site is isolated by urban development from the regional natural and agricultural landscape, areas of regenerated indigenous habitats cannot be integrated with broader natural landscape and are unlikely to be self sustaining. They are therefore zero weighted.

Using the Change of Ecological Value Calculator

This involves four steps:

1. Determining if the site is a greenfield or brownfield site;
2. Where the site is a greenfield site, determining the bioregion and vegetation type in which the site occurs;
3. Determining whether rare, threatened or vulnerable flora or fauna occur on site ;
and

ECO-4 Change in Ecological Value

POINTS
AVAILABLE**4**

4. Entering the land type data to determine the Ecological Diversity Index of the site 'Before' and 'After' design.

How to select a brownfield site

A brownfield site is one that has been previously developed and typically occurs within a fully developed urban environment. It could include existing structures that may be derelict. It can include sites where previous structures have been demolished and where the site is in a neglected condition. It may or may not be contaminated. A brownfield site will be separated on all sides by fully developed sites, covered by buildings and paved surfaces, either immediately adjacent to it or on the opposite side of the street. The surrounding developed sites essentially isolate the site from the regional open space system or any large defined open space.

Where the site is determined to be a brownfield site then:

1. Using the Change of Ecological Value Calculator sheet answer the first question 'Does the site contain any rare, threatened or vulnerable flora or fauna that are **not** adequately protected?', answer 'Y' or 'N'.
2. If the answer is 'Y' no credits are awarded and no further input is required for the calculator.
3. If the answer is 'No' then select the 'Urban Area and Unallocated' option from the bioregion type.
4. The 'Brownfield Site' option must then be selected from the list of vegetation types.

On a brownfield site the ecological value of non natural land types are doubled while the indigenous natural land types have zero values. This increases the reward for enhancing the ecological value in urban areas where there was little to no ecological value to start with.

Determine the bioregion and vegetation types

To acknowledge that biodiversity importance varies across different regions of South Africa, a Bioregion Reservation Importance Factor has been included in the Change in Ecological Value Credit Calculator. Using a Bioregion Reservation Importance Factor results in an increased Ecological Score being given to the indigenous vegetation, wetlands and waterways in areas where the vegetation is less abundant and ecosystems are threatened.

The ecological weightings allocated to the calculator are based on the IUCN Red Data categories used to describe the conservation status of the vegetation types in *The vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford, (eds) 2006). These categories have been assigned a numerical rating between 0.25 and 2.

Where the vegetation type is unknown, the '<Don't know>' option can be selected; however the ecological weightings of this option are punitive.

In all scenarios other than the brownfield scenario, the site is considered to be a greenfield site and the ecological weightings of the land types are influenced by the ecosystem status/sensitivity of the vegetation type in which the site occurs.

The most recent atlas of vegetation types in South Africa documented in *Vegetation map of South Africa, Lesotho and Swaziland 1:1 000 000 scale sheet maps* is referred to in the calculator. The ecosystem status of each vegetation type is provided in the book supporting the vegetation maps. Four categories of ecosystem status are used:

- Critically Endangered (CE),
- Endangered (EN);
- Vulnerable (VU); and
- Least Threatened (LT).

ECO-4 Change in Ecological Value

POINTS
AVAILABLE**4**

Where:

Sensitivity Category	Importance Factor
CE	2
EN	1
VU	0.5
LT	0.25

Table Eco-4.1: Bioregion importance factors

To determine the relevant bioregion and vegetation type for the site the project team can either obtain a copy of the *Vegetation map of South Africa, Lesotho and Swaziland 1:1 000 000 scale sheet maps* or consult a suitably qualified registered ecologist. The vegetation maps are available for purchase from the SANBI bookshop in Pretoria and the Botanical Society bookshop at Kirstenbosch National Botanical Garden in Cape Town. Reference should be made to:

Mucina, L., Rutherford, M.C. & Powrie, L.W. (eds) 2005. **Vegetation map of South Africa, Lesotho and Swaziland**, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria.

Establish the presence of rare, threatened or vulnerable flora or fauna

The presence of rare, threatened or vulnerable flora or fauna on the site should be determined by a suitably qualified registered ecologist. If the answer is positive no points will be awarded. Select the 'Yes' option from the first drop down list adjacent to the question '*Does the site contain any protected, rare, threatened or vulnerable flora or fauna?*'. No further input is required in the calculator.

Where there is no protected, rare, threatened or vulnerable flora or fauna on site, continue to use the calculator to determine the change in the Ecological Diversity Index as discussed in the following text.

Land Type and Ecological Diversity Index

The instructions below will enable the project team to enter the 'Before' and 'After' land type data and complete the Change of Ecological Value Calculator. The Calculator determines the number of points achieved based on the following:

- The area (m²) entered into one or more of the land types in the 'Before' column;
- The area (m²) entered into one or more of the land types in the 'After' column based on the project design;
- The default ecological value of each land type;
- Whether the site is a brownfield or greenfield site; and
- The ecosystem status of the selected vegetation type.

The project team needs to define the land types and their extent for the entire area of the site before any construction or clearing activities take place and complete the 'Before' column of the calculator according to one or more of the land types in Table Eco 4.

The system of ecological weightings to fulfil this requirement was established in consultation with local ecologists to reflect South African conditions.

ECO-4 Change in Ecological Value

POINTS
AVAILABLE

4

Land Type	Ecological Value
Building	0
Impermeable/concreted Area	0
Bare Ground	1
Weed Infestations	5
Exotic Garden	5
Indigenous Garden	10
Indigenous Roof Garden	10
Exotic Grazing	5
Existing Natural Grazing*	25
Crop Farming	5
Existing Natural Waterway/Riparian Zone*	75
Existing Natural Wetland*	100
Rehabilitation/Creation of Wetland/Riparian	50
Exotic Plantation Forest	5
Indigenous Plantation Forest	20
Regenerated Indigenous Habitat(< 10 years old)*	50
Indigenous Habitat (> 10 years old)*	75
Indigenous Habitat (> 20 years old)*	100

Items with an asterisk * are affected by the ecosystem status weighting of the Vegetation type.

Table Eco-4.2: Relative ecological weightings for different land types

The Calculator automatically adjusts and in specific circumstances overrides the default ecological value of each land type for both the 'Before' and 'After' columns based on the selected option under the bioregion and vegetation type lists.

Only the soil surface of roof gardens contributes towards recognition in this credit (i.e. in vertical or roof gardens only the amount of soil/substrate in which the plants are rooted is recognised, not the total area covered by the plants). For example, a project with a building area of 10,000m² and a roof garden of 2,000m² (soil planted area) comprising indigenous garden would be entered into the Calculator as: building area of 8,000m²; and a indigenous roof garden area of 2,000m².

Vertical gardens are to be included as follows:

- Only outdoor vertical gardens can be included in this Calculator;
- Only the soil/substrate area of the vertical garden can count;
- The Ecological Land Type is determined by the associated vegetation; and
- The substrate area of the vertical garden can offset impervious horizontal areas at the ratio of 2-to-1 (e.g. two square meters of a vertical garden offsets one square meter of pavement). The area of pavement offset by the vertical garden must be added to either the Exotic or Indigenous Garden land type depending on the plant species used.

The table below provides the accepted description of each land type. It is acknowledged that in certain instances a design may include a land type that does not fit neatly into one of these descriptions. In these instances the project team needs to provide a motivation for using either one land type or dividing the area across two or more of the specified land types.

ECO-4 Change in Ecological ValuePOINTS
AVAILABLE**4**

LAND TYPE	DESCRIPTION
Building	All built structures with a roof or cover either fully or partially enclosed.
Impermeable/concreted Area	All horizontal surfaces in contact with the soil which are largely impervious to water infiltration either of natural or man-made materials.
Bare Ground	Soil that is not covered by either man-made or vegetative material.
Weed Infestations	Soil that is predominantly covered by plants considered to be weeds or invasive species.
Exotic Garden	Landscaped areas comprised predominantly of an equal mix in area of exotic plant species: trees, shrubs, ground covers, perennials, grasses; with few if any indigenous species.
Indigenous Garden	Landscape areas comprised of an equal mix in area of indigenous preferably locally occurring plant species: trees, shrubs, ground covers, perennials, grasses. Landscapes dominated by mowed lawn areas even if comprised of indigenous grass species would be considered to be Exotic Gardens.
Indigenous Roof Garden	As described in the Indigenous Garden but occurring in planters or soil substrate on the roof of the building.
Exotic Grazing	Land that has either specifically been cultivated or has been invaded by exotic grasses and is used for grazing of domesticated animals.
Existing Natural Grazing*	Land that has not been cultivated and where the vegetation is used for grazing of domesticated animals.
Crop Farming	Land that is being or has been cultivated in the last ten years.

ECO-4 Change in Ecological Value

POINTS
AVAILABLE **4**

Existing Natural Waterway/Riparian Zone*	Waterways that have naturally formed along the drainage line in a catchment area and are largely unmodified by man. This includes the vegetation associated with the waterway and that would be described as the riparian zone.
Existing Natural Wetland*	As defined under Eco – Conditional Requirement.
Rehabilitation/Creation of Wetland/Riparian	The rehabilitation of once natural wetlands that have been degraded through past human activities, the creation of new man-made wetlands or riparian zones that provide some or all of the ecological functions typically provided by a natural wetland.
Exotic Plantation Forest	Land planted with exotic trees for commercial use or other purpose whether actively managed or neglected.
Indigenous Plantation Forest	Land planted with indigenous trees for commercial use or other purpose. Where the project team wishes to enhance the ecological value of the site using an indigenous plantation forest this must include a management plan that address the sustainable harvesting of trees and prevents the degradation of the forest over time.
Regenerated Indigenous Habitat(< 10 years old)*	Land that has naturally or through a managed process been repopulated by the diversity of plant species that make up the habitat associated with the vegetation type of that area and which includes mature plant specimens.
Indigenous Habitat (> 10 years old)*	Land that has naturally or through a managed process been repopulated over a period of not less than ten years by the diversity of plant species that make up the habitat associated with the vegetation type of that area and includes mature plant species or communities ten years or more in age.
Indigenous Habitat (> 20 years old)*	Land that has naturally or through a managed process been repopulated over a period of not less than twenty years by the diversity of plant species that make up the habitat associated with the vegetation type of that area and includes mature plant species or communities twenty years or more in age.

Table Eco-4.3: Description of land types

The Calculator checks that the cumulative area in the two columns match. Where the cumulative areas do not match no points are awarded. The Ecological Diversity Index for both the 'Before' and 'After' states are determined by dividing the overall ecological score by the cumulative value of each state.

The change in ecological diversity index is calculated by subtracting the value of the 'Before' state from that of the 'After' state. The result is used to look up the number of points to award based on the degree of change in the ecological diversity index. Up to 4 points can be awarded with each additional point requiring a proportionally larger change in the ecological diversity index.

The calculations will be executed automatically once the areas of the appropriate land types have been entered in both the 'Before' and 'After' columns.

Points awarded for enhancing ecological value on site

The project team can increase the number of points awarded by substantially enhancing the ecological value of the site in the following ways:

- Most importantly do not reduce the area of existing indigenous vegetation and wetland areas;

ECO-4 Change in Ecological Value

POINTS
AVAILABLE

4

- Rehabilitate or create wetland or riparian areas;
- Set aside an area and provide management plans to regenerate indigenous habitat on site;
- On brownfield sites replace impermeable surfaces, bare ground and weed infested areas with either indigenous landscaping or indigenous plantation forests or add wetland area;
- Include a roof garden planted with indigenous vegetation; and
- Include a vertical garden, preferably using indigenous plant species.

Generally aim to increase the ratio of regenerated indigenous vegetation and wetland cover on site compared that of the building and paved footprint.

BACKGROUND

South Africa is one of the world's most biologically diverse countries, with a rich and spectacular array of terrestrial, aquatic, and marine ecosystems. It occupies only 2% of the world's land surface, yet contains a disproportionately large share of global biodiversity, being home to nearly 10% of the planet's plant species and 7% of the reptile, bird, and mammal species.

The species richness per taxonomic group of the biomes of South Africa are indicated in the charts on the following pages.

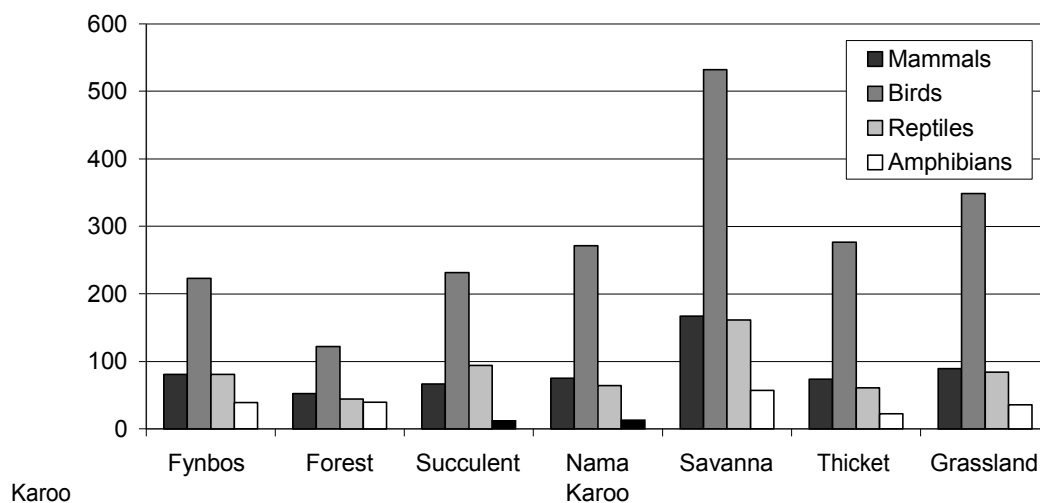


Figure Eco-4.1: Fauna species richness per taxonomic group of the biomes of South Africa

ECO-4 Change in Ecological Value

POINTS
AVAILABLE

4

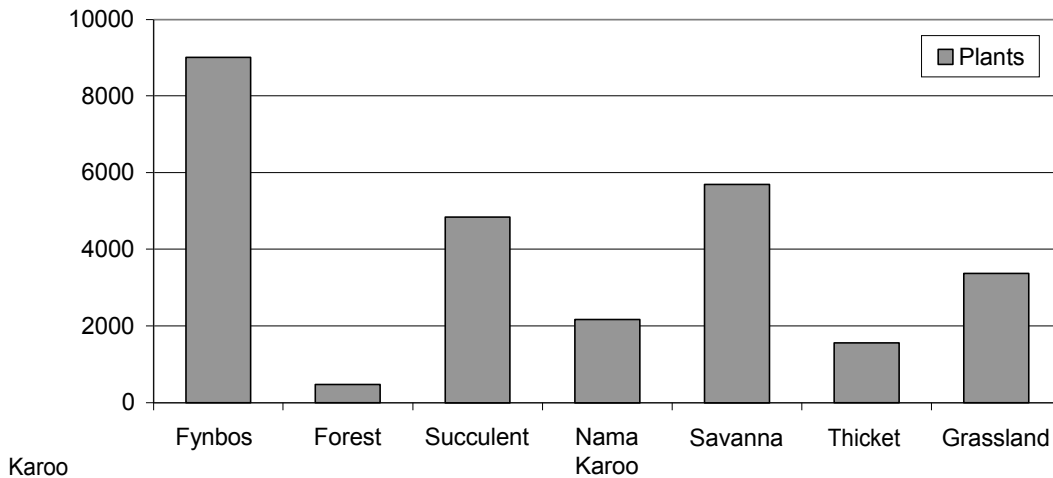


Figure Eco-4.2: Flora species richness per taxonomic group of the biomes of South Africa

Source: Endangered Wildlife Trust (2002). The Biodiversity of South Africa 2002: Indicators, Trends and Human Impacts. Struik, Cape Town. In Department of Environmental Affairs and Tourism (2005) (<http://soer.deat.gov.za/indicator.aspx?m=433>).

Changes to the landscape and indigenous habitat as a result of human activity and habitation have put many of these unique species at risk. Over the last 200 years many species of plants and animals have become extinct. The aim is to reward those sites that have a limited impact on the local ecology and/or enhance such sites through the re-introduction of indigenous species, thus helping to reduce the impact of building development on the local environment.

REFERENCES & FURTHER INFORMATION

Mucina, L. & Rutherford, M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. SANBI, Pretoria. 804 pages.

EA (2001), *Draft National Framework for Assessing Indigenous Vegetation Condition*, Environment South Africa.

Department of Environmental Affairs and Tourism (2005) *South African National State of the Environment Report*

<http://soer.deat.gov.za/frontpage.aspx?m=2>

ECO-4 Change in Ecological Value

POINTS
AVAILABLE**4**

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request: Brownfield definition - previously cleared or tilled agricultural land

Credit Interpretation Request Number: ECO4-T-OB1-0211

Ruling: 2010-11-15

The Credit Interpretation Request (CIR) to permit the classification of previously cleared or previously tilled agricultural land as 'Brownfield' for the purpose of inclusion in the Change of Ecological Value Calculator, is denied. The definition of 'Brownfield' is internationally recognised and relates to specific characteristics, as detailed in the current definition in the Green Star SA Office v1 Technical Manual.

Technical Clarification: Internal landscape

Technical Clarification Number: ECO4-T-OB1-0104

Guidance: 2010-09-08

Landscape enclosed within the building such as enclosed atria gardens, vertical gardens or water features, are deemed not to serve the full ecological function as equivalent external landscape within the scope of this credit. This is due to the disconnection of enclosed landscapes to broader ecosystems external to the building, limiting the contribution to biodiversity. Such areas are to be excluded from calculations to demonstrate compliance with the Credit Criteria. Project teams that believe their designs maintain justifiable connectedness to external ecosystems may submit a project specific CIR.

Technical Clarification: Non-permanent landscape

Technical Clarification Number: ECO4-T-OB1-0101

Guidance: 2010-09-07

Non-permanent landscape, such as potted plants, planter boxes, or other non-insitu landscape features, which can be removed or relocated, are not considered part of the 'site' and are therefore not within the scope of the Eco-4 credit. The area of, and ecological contribution to, the site for such non-permanent landscape are to be excluded from calculations to demonstrate compliance with the Credit Criteria.

ECO-4 Change in Ecological Value

POINTS
AVAILABLE**4**

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Technical Clarification: Ground types

Technical Clarification Number: ECO4-T-OB1-0023

Guidance: 2009-02-06

Permeable pavers are classified as 'bare ground' for the purposes of this credit. Traditional water features with underlying impermeable brick or concrete structures are classified as 'impermeable/concrete area' for the purposes of this credit. Lawn areas are classified as 'bare ground' for the purposes of this credit.

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Ecology Calculator Example

CHANGE OF ECOLOGICAL VALUE CALCULATOR EXAMPLE

An existing building development is to be redeveloped. The existing site land uses, and associated areas, are as follows:

- Existing Building: 500m²
- Impermeable car park area: 250m²
- Concreted walkway: 50m²
- Bare ground: 500m²
- Weeds: 500m²
- Exotic Garden: 200m²
- Indigenous habitat which has not been disturbed for at least 10 years: 1,000m²

The site does not include any rare, threatened or vulnerable flora or fauna

After the redevelopment, the site will consist of:

- Proposed building: 1,500m² less area of green roof (500m²) = 1,000m²
- Indigenous roof garden: 500m²
- Created wetland area: 500m²
- Indigenous habitat is not disturbed and remains at 1,000m²

Ecology Calculator Example

The output from the Ecology Calculator is as follows:

In which bio-region is the site located?

Highveld Grassland

In which vegetation type is the site located?

Egoli Granite Grassland

Land Type	BEFORE Land Types Before Construction (m ²)	AFTER Land Types After Construction (m ²)
Building	500	1,000
Impermeable/concreted Area	300	
Bare Ground	500	
Weed Infestations	500	
Exotic Garden	200	
Indigenous Garden		
Indigenous Roof Garden		500
Exotic Grazing		
Existing Natural Grazing*		
Crop Farming		
Existing Natural Waterway/Riparian Zone*		
Existing Natural Wetland*		
Rehabilitation/Creation of Wetland/Riparian		500
Exotic Plantation Forest		
Indigenous Plantation Forest		
Regenerated Indigenous Habitat (< 10 years old)*		
Indigenous Habitat (> 10 years old)*		
Indigenous Habitat (> 20 years old)*	1,000	1,000
TOTAL	3,000	3,000
ECOLOGICAL DIVERSITY INDEX:	34.67	43.33
CHANGE IN ECOLOGICAL DIVERSITY INDEX	8.67	
Points Achieved	2	

* = affected by Bioregion Reservation Importance Factor

Table App-C.1: Example of results using Ecology Calculator

EMI-1 Refrigerant/ Gaseous ODP

POINTS
AVAILABLE**1**

AIM OF CREDIT

To encourage and recognise the selection of refrigerants and other gases that do not contribute to long-term damage to the Earth's stratospheric ozone layer.

CREDIT CRITERIA

One point is awarded where

- All HVAC refrigerants and gaseous fire suppression systems used have an Ozone Depletion Potential (ODP) of zero;
- OR
- No refrigerants or gaseous fire suppression systems are used.

DOCUMENTATION REQUIREMENTS

If a number of different systems are installed on a project, the documentation must account for and describe all systems within the project.

It must be clearly demonstrated that only zero-ODP refrigerants are utilised in all HVAC systems (including any heat pumps for domestic hot water production) and fire suppression systems throughout the project.

Refurbishment projects must demonstrate that the existing system(s) are converted to systems that utilize zero-ODP refrigerants viably and without loss of refrigerant to the atmosphere. Specifying that the original refrigerants be replaced with zero-ODP refrigerants will not suffice.

Where no refrigerants are used, the applicant must provide evidence demonstrating that the building is naturally ventilated or mechanically ventilated without refrigerant-based cooling.

EMI-1 Refrigerant/ Gaseous ODPPOINTS
AVAILABLE**1**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For buildings with refrigerants/gasses: • Short report • Tender stage mechanical schematic drawing(s) • Extract(s) from the specification(s)/schedule(s) For buildings with no refrigerants/gasses: • Signed letter from building owner OR Short report detailing non-refrigerant cooling systems	For buildings with refrigerants/gasses: • Short report • As built mechanical schematic drawing(s) • Confirmation from the supplier(s) For buildings with no refrigerants/gasses: • Signed letter from building owner OR Short report detailing non-refrigerant cooling systems • Extract(s) from commissioning records • Confirmation from Contractor (2)

Short report prepared by a suitably qualified person that describes how the Credit Criteria have been met by:

- Referencing specifications and tender drawings;
- Describing the HVAC system (including any heat pumps for domestic hot water production) and identifying all systems that contain refrigerant;
- Describing any gaseous fire suppression systems;
- Indicating all of the type and mass of refrigerant(s) used in the system(s); and
- Where the project is a refurbishment, describing how the existing system(s) are converted, confirming this can be performed and maintained viably and without any refrigerant loss to the atmosphere.

Tender stage mechanical schematic drawing(s) of the HVAC system(s) (including any heat pumps for domestic hot water production), indicating location and type of all components containing refrigerant.

Extract(s) from the specification(s), schedules or tender contract:

- Where the requirements for the HVAC system (including any heat pumps for domestic hot water production) are stipulated;
- Where it is stipulated that any refrigerant must have an ODP of zero;
- Where it is stipulated that any gaseous fire suppression system must have an ODP of zero; and
- Where the project is a refurbishment, stipulating the requirements for the conversion of the existing system.

EMI-1 Refrigerant/ Gaseous ODPPOINTS
AVAILABLE**1**

As built schematic mechanical drawing(s) of the HVAC system(s) (including any heat pumps for domestic hot water production), indicating location and type of all components containing refrigerant.

Confirmation from the supplier(s) detailing: The HVAC system (including any heat pumps for domestic hot water production) (and where applicable, the Fire Suppression system.) The equipment; the quantity of equipment supplied to the project; the type(s) of refrigerant/gasses used in the equipment; and the total volume of refrigerant/gasses within the equipment supplier(s) to declare the total gas installed as kg and m3.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems (including any heat pumps for domestic hot water production) have been commissioned and found to operate as intended by the design.

Signed letter from the building owner confirming that the base-building services do not include any artificial cooling or gaseous fire suppression systems.

Short report detailing non-refrigerant cooling systems to include all non-refrigerant cooling systems used to provide cooling to the building (such as absorption chillers, evaporative cooling etc).

Confirmation from Contractor (2) Certification confirming that no refrigerants or gaseous fire suppression systems are used.

ADDITIONAL GUIDANCE

The following table gives Ozone Depletion Potential for some commonly used gases. For other gases, manufacturer's data or other evidence must be submitted to verify the ODP. Greyed out cells mean that the gas does not comply with the Green Star SA requirements.

Refrigerant/Gas	Ozone Depletion Potential (ODP)
R11	1.0
R12	0.83
R22	0.05
R134a	0
R407c	0
R410a	0
R290 (propane)	0
R600 (butane)	0
R1270 (propene)	0
Ammonia	0
Halon 1211	3

EMI-1 Refrigerant/ Gaseous ODPPOINTS
AVAILABLE**1**

HFC227ea (FM200)	0
IG541	0
CO ₂	0
Air	0
Water	0

Table Emi-1.1: *Ozone Depletion Potential of some common gases*

Currently there are no Chlorofluorocarbon (CFC) and Hydrochlorofluorocarbon (HCFC) refrigerants available which meet the requirements of this credit. The credit can, however, be achieved through the use of Hydrofluorocarbons (HFCs) or hydrocarbon-based refrigerants.

BACKGROUND

Building services have an impact on the amount of damage done to the ozone layer from Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs). These substances are used as refrigerants and in some insulation materials. These substances have been known to cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. They also have significant global-warming potentials and contribute to global warming (refer to credit Emi-2 'Refrigerant GWP').

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. The ODP is defined as the total change in ozone, per unit mass, when the substance has reached a steady state in the atmosphere.

HCFCs are 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 plastic foam manufacture, and are scheduled to be completely phased out by 2030 according to the US Environmental Protection Agency and the Montreal Protocol.

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.

EMI-1 Refrigerant/ Gaseous ODPPOINTS
AVAILABLE**1**

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://www.defra.gov.uk/environment/climatechange/uk/fgas/pdf/fluorgasreg-guidance.pdf>

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH) (2003), *Refrigerant Selection Guide 2003*. Melbourne.
http://www.airah.org.au/downloads/airah_rsg2003.pdf

United Nations Environmental Program, Ozone Secretariat.
www.unep.org/ozone

US Environmental Protection Agency
<http://www.epa.gov/ozone/>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: EMI1-T-OB1-0712

Guidance: 2013-07-22

Refrigerant / Gaseous ODP and 'Shell & Core' spaces

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office Design v1 Technical Manual.

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to all HVAC systems and fire suppression systems provided for the base building.

Technical Clarification Number: EMI1-T-OB1-0399

Guidance: 2012-01-26

Scope of credit - clarification

EMI-1 Refrigerant/ Gaseous ODPPOINTS
AVAILABLE **1**

For the purposes of this credit, it must be demonstrated that all refrigerants are accounted for including refrigerants within HVAC systems (heating and cooling equipment) and heat-pump systems used for domestic hotwater generation.

The following errata have been incorporated:

EMI1-E-OB1-0235 (2011-02-08) Green Star SA - Office v1 Technical Manual: Page 304 & 305

EMI1-E-OB1-0234 (2011-02-08) Green Star SA - Office v1 Technical Manual: Page 304

EMI1-E-OB1-0348 (2012-01-23) Green Star SA - Office v1 Technical Manual: Page 306

EMI1-E-OB1-0399 (2012-01-26) Green Star SA - Office v1 Technical Manual: Page 303-305

EMI1-E-OB1-0626 (2013-04-25) Green Star SA - Office v1 Technical Manual: Page 304

EMI1-E-OB1-0745 (2013-10-15) Green Star SA - Office v1 Technical Manual: Page 305

EMI-2 Refrigerant GWP

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise the selection of refrigerants that reduce the potential for increased global warming from the emission of refrigerants to the atmosphere.

CREDIT CRITERIA

Up to two points are awarded as follows:

- One point where 50% of the fluorocarbon refrigerant charge has been replaced with refrigerant(s) that have a Global Warming Potential (GWP) of 10 or less;
- Two points where:
 - All refrigerants have a GWP of 10 or less;
 - OR
 - Where no refrigerants are used at all.

DOCUMENTATION REQUIREMENTS

If a number of different systems are installed on a project, the documentation must account for and describe all systems within the project.

The natural refrigerant must be used in an application that would normally involve a synthetic fluorocarbon refrigerant.

It must be clearly demonstrated that the GWP of all HVAC refrigerants is less than 10, and that the O&M manual specifies the future replacement of those refrigerants with similar refrigerants.

Refurbishment projects must demonstrate that the existing system(s) are converted to systems that utilize refrigerants with GWP of 10 or less viably and without loss of refrigerant to the atmosphere.

EMI-2 Refrigerant GWPPOINTS
AVAILABLE**2**

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For buildings with refrigerants/gasses: • Short report • Tender stage mechanical schematic drawing(s) • Extract(s) from the specification(s)/schedule(s) For buildings with no refrigerants/gasses: • Signed letter from building owner OR • Short report detailing non-refrigerant cooling systems	For buildings with refrigerants/gasses: • Short report • As built mechanical schematic drawing(s) • Extract(s) from O&M manuals • Confirmation from the Contractor/Supplier For buildings with no refrigerants/gasses: • Signed letter from building owner OR Short report detailing non-refrigerant cooling systems • Extract(s) from commissioning records • Confirmation from Contractor (2)

Short report prepared by a suitably qualified person that describes how the Credit Criteria have been met:

- Referencing specifications and tender drawings;
- Describing the HVAC system (including any heat pumps for domestic hot water production) and identifying all systems that contain refrigerant;
- Indicating all of the type and mass of refrigerant(s) used in the system(s); and
- Where the project is a refurbishment, describing how the existing system(s) are converted, confirming this can be performed and maintained viably and without any refrigerant loss to the atmosphere.

Tender stage mechanical schematic drawing(s) of the HVAC system(s) (including any heat pumps for domestic hot water production), indicating location and type of all elements containing refrigerant.

Extract(s) from the specification(s), schedule(s) or tender contract:

- Where the requirements for the HVAC system (including any heat pumps for domestic hot water production) are stipulated;
- Where it is stipulated that any refrigerant must have a GWP of less than 10; and
- Where the project is a refurbishment, stipulating the requirements for the conversion of the existing system.

As built mechanical schematic drawing(s) of the HVAC system(s) (including any heat pumps for domestic hot water production), indicating location and type of all elements containing refrigerant.

EMI-2 Refrigerant GWP

POINTS
AVAILABLE

2

Extract(s) from the O&M manuals that stipulate that only refrigerants with GWP of 10 or less can be used for any replacements of the relevant system(s).

Confirmation(s) from the contractor/supplier(s) of the type and quantity of all the refrigerants supplied to the project, to include evidence that the refrigerants have a GWP of 10 or less.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems (including any heat pumps for domestic hot water production) have been commissioned and found to operate as intended by the design.

Signed letter from the building owner confirming that the base-building services do not include any artificial cooling.

Short report detailing non-refrigerant cooling systems to include all non-refrigerant cooling systems used to provide cooling to the building (such as absorption chillers, evaporative cooling etc).

Confirmation from Contractor (2) Certification confirming that no refrigerants are used.

ADDITIONAL GUIDANCE

The following table gives Global Warming Potential for some commonly used gases. For other gases, manufacturer's data or other evidence must be submitted to verify the GWP. Greyed out cells mean that the gas does not comply with the Green Star SA requirements.

Global Warming Potential (GWP)

100 year time horizon

R11	4000
R12	8500
R22	1700
R134a	1300
R407c	1600
R410a	1900
R290 (propane)	3
R600 (butane)	3
R1270 (propene)	3
Ammonia	<1
Halon 1211	1300
HFC227ea (FM200)	2900

EMI-2 Refrigerant GWPPOINTS
AVAILABLE**2**

IG541	0
CO ₂	1
Air	0
Water	<1

Table Emi-2.1: Global Warming Potential of some common gases

The 100-year Global Warming Potential is considered for the purpose of the Green Star SA - Office 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), for further details see reference section below.

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.

Small packaged systems containing refrigerant can be exempted from these requirements if

- (a) credit Emi-1 has been awarded (i.e. the refrigerants have an ODP of zero) and
 - (b) the total refrigerant on the project from all such systems combined is less than 2.5kg.
- Manufacturers datasheets for the equipment indicating total refrigerant charge must be submitted to allow exemption.

BACKGROUND

The use of Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (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. However, the replacements currently favoured by the industry are Hydrofluorocarbons (HFCs) which have a high 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 should be carried

EMI-2 Refrigerant GWP

POINTS
AVAILABLE**2**

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.

REFERENCES & FURTHER INFORMATION

Refer to Emi-1.

Ammonia as a Refrigerant Position Document ASHRAE 2002 ASHRAE Standard 15, *Safety Standard for Refrigeration Systems*

Department of Trade and Industry (U.K.), Refrigeration and Air Conditioning CFC and HCFC Phase-Out: Advice on Alternatives and Guidelines for Users. <http://www.berr.gov.uk/files/file29101.pdf>

Intergovernmental Panel on Climate Change, Climate Change 2001, Working Group 1: *The Scientific basis Chapter 6 Radiative forcing of Climate Change*
http://www.grida.no/climate/ipcc_tar/wg1/247.htm

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: EMI2-T-OB1-0712

Guidance: 2013-07-22

Refrigerant GWP and 'Shell & Core' spaces

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to all refrigerants/gasses used in the systems provided for the base building.

.....

Technical Clarification Number: EMI2-T-OB1-0399

Guidance: 2012-01-26

Scope of credit - clarification

EMI-2 Refrigerant GWP

POINTS
AVAILABLE**2**

For the purposes of this credit, it must be demonstrated that all refrigerants are accounted for including refrigerants within HVAC systems (heating and cooling equipment) and heat-pump systems used for domestic hot water generation.

The following erratum have been incorporated:

EMI1-E-OB1-0349 (312 2012-01-23) Green Star SA - Office v1 Technical Manual: Page 312

EMI2-E-OB1-0399 (2012-01-26) Green Star SA - Office v1 Technical Manual: 309-311

EMI2-E-OB1-0626 (2013-04-25) Green Star SA - Office v1 Technical Manual: Page 310

EMI-3 Refrigerant Leaks

POINTS
AVAILABLE

2

AIM OF CREDIT

To encourage and recognise building systems design that minimises environmental damage from refrigerant leaks.

CREDIT CRITERIA

Up to two points are awarded as follows: One point is awarded where:

- HVAC Systems containing refrigerants are contained in a moderately air tight enclosure and a refrigerant leak detection system is installed 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 point is awarded where:

- The point above is achieved; AND
- The project has installed a refrigerant recovery system 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 points in Emi-1 'Refrigerant ODP' and Emi-2 'Refrigerant GWP' are achieved, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Emissions Category Score.

DOCUMENTATION REQUIREMENTS

If a number of different systems are installed on a project, the documentation must account for and describe all systems within the project. However the Credit Criteria does not need to be met for those systems that comply with both Emi-1 'Refrigerant ODP' and Emi-2 'Refrigerant GWP' (documented in accordance with the Technical Manual). Please refer to Emi-1 and Emi- 2 for Compliance Requirements relevant for those refrigerants.

The refrigerant leak detection and recovery systems must be viable, i.e. designed or commissioned to operate properly to meet the Aim of Credit.

EMI-3 Refrigerant Leaks

POINTS
AVAILABLE

2

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
To claim one or two points: • Short report • Extract(s) from the specification(s) • Tender schematic mechanical drawing(s) To claim credit as 'not applicable', for projects where refrigerants comply with Emi-1 & 2: • Emi-1 and 2 must have been awarded To claim credit as 'not applicable', for projects with no refrigerants: • Signed letter from building owner OR Short report detailing non-refrigerant cooling systems	To claim one or two points: • Short report • Extract(s) from O&M manual • As built mechanical drawing(s) • Extract(s) from the Commissioning Records To claim credit as 'not applicable', for projects where refrigerants comply with Emi-1 & 2: • Emi-1 and 2 must have been awarded To claim credit as 'not applicable', for projects with no refrigerants: • Signed letter from building owner OR Short report detailing non-refrigerant cooling systems • Confirmation from Contractor

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Referencing specifications and tender drawing(s);
- Describing the HVAC system and identifying all systems that contain refrigerant;
- Indicating all of the type and mass of refrigerant(s) used in the system(s);
- Outlining the design and intended operation of the refrigerant leak detection system(s) and if the additional point is claimed, of the refrigerant recovery system(s);
- Where the additional point is claimed, including full details of the refrigerant recovery system.

Extract(s) from the specification(s) demonstrating the refrigerant leak detection system(s) are detailed as per Credit Criteria;

Where the additional point is claimed, demonstrating the chiller and refrigerant recovery characteristics are as mentioned in the Credit Criteria.

Tender schematic mechanical drawing(s) of the HVAC system(s), indicating location and type of all elements containing refrigerant and if applicable showing the enclosure around each of the HVAC systems containing refrigerants, with the location, size and intended operation of the sensors and openings identified.

Extract(s) from the O&M Manual explaining the correct operation of the refrigerant leak detection and recovery system if the additional point is claimed.

EMI-3 Refrigerant Leaks

POINTS
AVAILABLE

2

As built mechanical drawing(s) of the HVAC system(s), indicating location and type of all elements containing refrigerants and if applicable showing the enclosure around each of the HVAC systems containing refrigerants, with the location, size and intended operation of the sensors and openings identified.

Extract(s) from the O&M Manual explaining the correct operation of the leak detection and recovery system.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems have been commissioned and found to operate as intended by the design.

Signed letter from the building owner confirming that the base-building services do not include any artificial cooling systems.

Short report detailing non-refrigerant cooling systems to include all non-refrigerant cooling systems used to provide cooling to the building (such as absorption chillers, evaporative cooling etc).

Confirmation from Contractor Certification confirming that no refrigerant systems are used.

ADDITIONAL GUIDANCE

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.

The Credit Criteria for refrigerant leak detection is applicable to negative-pressure refrigerants, as the Aim of the 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 should be approved by the compressor manufacturer.

EMI-3 Refrigerant Leaks

POINTS
AVAILABLE

2

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.

BACKGROUND

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

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S.), ASHRAE Fundamentals Handbook 1997.

ASHRAE Standard 15, Safety Standard for Refrigeration Systems.

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH) (2003), Refrigerant Selection Guide 2003, Melbourne.

<http://www.airah.org.au>

Automated Buildings Journal, Far-reaching International Standards and Regulations Requiring Refrigerant Leak Detection Still Not Generally Known.

<http://www.automatedbuildings.com/news/jun02/art/murco/mrc.htm>

Department of Trade and Industry (U.K.), Refrigeration and Air Conditioning CFC and HCFC Phase-Out: Advice on Alternatives and Guidelines for Users. <http://www.berr.gov.uk/files/file29101.pdf>

Journal of Non Destructive Testing (2003), A New Type of Refrigerant Leak Detector for Leak Tests in the Refrigerating and Air Conditioning Industry. Volume 8.

Naval Facilities Engineering Service Centre – Environmental Services (U.S.), Leak Detection and Prevention Guidelines for HVAC&R Systems

https://portal.navfac.navy.mil/portal/page?_pageid=181,1&_dad=portal&_schema=PORTAL

United Nations Environmental Program, Ozone Secretariat.

<http://www.unep.org/ozone/treaties.shtml>

EMI-3 Refrigerant Leaks

POINTS
AVAILABLE**2**

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: EMI3-T-OB1-0712**Guidance:**2013-07-22**Refrigerant Leak Detection and 'Shell & Core' spaces**

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star SA Office v1 Technical Manual.

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to all HVAC systems containing refrigerants provided for the base building.

Technical Clarification Number: EMI3-T-OB1-0414**Guidance:** 2012-02-10**Small packaged DX units**

Small packaged DX 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 Credit Criteria for Emi-1 and Emi-2.

The following erratum have been incorporated:**EMI3-E-OB1-0427** (2012-03-14) Green Star SA - Office v1 Technical Manual: Page 316**EMI3-E-OB1-0626** (2013-04-25) Green Star SA - Office v1 Technical Manual: Page 316

EMI-4 Insulant ODPPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise the selection of insulants that do not contribute to long-term damage to the Earth's stratospheric ozone layer.

CREDIT CRITERIA

One point is awarded where no ozone-depleting substances are associated with either the manufacture or the composition of all thermal insulants in the project.

DOCUMENTATION REQUIREMENTS

The specification must clearly stipulate all thermal insulation to be free of ozone-depleting substances in both manufacture and composition.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Extract(s) from the specification(s)	• Summary Sheet • Manufacturer's Data Sheets • Confirmation from the Contractor

Extract(s) from the specification(s) where the requirements for thermal insulants are stipulated clearly demonstrating compliance with the credit criteria.

Summary Sheet listing all thermal insulation products used on the project and their application

Manufacturer's Data Sheets for each product listed on the summary sheet. The MDS must clearly confirm that the insulants are free of ozone-depleting substances in both manufacture and composition.

Confirmation from the contractor that all materials installed were as per the summary sheet.

EMI-4 Insulant ODP

POINTS
AVAILABLE**1**

ADDITIONAL GUIDANCE

Substances that have an Ozone Depleting Potential (ODP) greater than zero are to be avoided in the manufacture or composition of all thermal insulants whilst satisfying all other criteria for their purpose. Alternatives to insulation manufactured and blown with ozone-depleting substances are available for almost all insulation applications.

The manufacturing process of thermal insulants changes regularly; manufacturer data will need to be consulted by design and specification team in order to achieve compliance.

Thermal insulants are likely to be used in the following application (the list is not exhaustive):

- Building services insulation; such as:
 - Chilled water pipework;
 - Refrigerant pipework;
 - Ductwork;
 - Hot & cold water pipes; and
 - Water tanks and water cylinders.
- Building fabric insulation in walls, roof, floor, window frames, doors, cavity closures, and lintels.

BACKGROUND

Some thermal insulants are manufactured with blowing agents that can cause long term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. 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.

Following the Montreal Protocol the production of CFCs are now banned. HCFCs are ozone-depleting but have a much lower ozone depletion potential than CFCs, and are considered a transitional chemical to aid the CFC phase out. CFCs are commonly used as refrigerants, solvents and blowing agents for plastic foam manufacture, and are scheduled to be phased out by 2020.

Hydrofluorocarbons (HFCs), are used as blowing agents 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.

REFERENCES & FURTHER INFORMATION

The Green Guide to Specification
<http://www.thegreenguide.org.uk>

United Nations Environmental Program, Ozone Secretariat.
www.unep.org/ozone/treaties.shtml

EMI-4 Insulant ODP

POINTS
AVAILABLE**1**

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: EMI4-T-OB1-0794

Guidance: 2014-05-26

Non-site applied insulation. This TC replaces TC EMI4-T-OB1-0458 issued on 25-02-2013

The credit aims to encourage and recognise the selection of insulants that do not contribute to long term damage to the Earth's stratospheric ozone layer. The credit looks therefore at the insulation of building services and building fabric and thus includes all applicable services such as mechanical, electrical, fire and hydraulics.

Project teams must thus demonstrate that the specification of thermal insulation in any of the above services avoids the use of ODP substances in both its manufacture and composition for both on-site and off-site applications.

Documentation requirements, As Built table, add bullet point "Statement of confirmation (2)"

Statement of confirmation (2) from supplier(s) confirming that all of the insulants used are free from ozone-depleting substances in both manufacture and composition. The supplier(s) must identify (with supporting evidence such as Manufacturer's Data sheet) the type and properties of the insulants used.

Note: These offsite applications include but are not limited to:

- Hot water cylinders
- Chillers

Technical Clarification Number: EMI4-T-OB1-0458

Guidance: 2013-02-25

Non-site applied insulation

The credit aims to encourage and recognise the selection of insulants that do not contribute to long term damage to the Earth's stratospheric ozone layer. The credit looks therefore at the insulation of building services and building fabric and thus includes all applicable services such as mechanical, electrical, fire and hydraulics.

EMI-4 Insulant ODP

POINTS
AVAILABLE**1**

Project teams must thus demonstrate that the specification of thermal insulation in any of the above services avoids the use of ODP substances in both its manufacture and composition for both on-site and off-site applications.

Documentation requirements, As Built table, add bullet point “Statement of confirmation”

Statement of confirmation from supplier(s) confirming that all of the insulants used are free from ozone-depleting substances in both manufacture and composition. The supplier(s) must identify (with supporting evidence such as Manufacturer’s Data sheet) the type and properties of the insulants used.

Note: These offsite applications include but are not limited to

- Hot water cylinders
- Chillers

Technical Clarification Number: EMI4-T-OB1-0328

Guidance: 2012-01-23

Fibre-based woven insulation products

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.

The following erratum has been incorporated:

EMI4-E-OB1-0127 (2011-01-0) Green Star SA - Office v1 Technical Manual: Page 321

EMI-5 WATERCOURSE POLLUTION

POINTS
AVAILABLE**3**

AIM OF CREDIT

To encourage and recognise developments that minimise stormwater run-off to, and the pollution of, natural watercourses and wetlands.

CREDIT CRITERIA

Up to three points are awarded independently as follows:

One point is awarded where:

- The development does not increase (pre-development) peak stormwater flows for rainfall events of up to a 1-in-2 year storm;

AND

- The Total Suspended Solids (TSS) are reduced by 80% for the runoff volume resulting from the 1-in-2 year storm;

AND

- Litter, oil and grease are trapped at source.

One point is awarded where:

- The development does not increase (pre-development) peak stormwater flows for rainfall events of up to a 1-in-20 year storm;

AND

- Litter, oil and grease are trapped at source.

One point is awarded where:

- The runoff volume resulting from the 1 day rainfall, that is equalled or exceeded on average 3 times per year, is either captured and re-used on-site or infiltrated within the site;

AND

- Litter, oil and grease are trapped at source.

EMI-5 WATERCOURSE POLLUTIONPOINTS
AVAILABLE**3****DOCUMENTATION REQUIREMENTS**

Green Star SA – Design	Green Star SA – As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Short report	Short report
Tender drawing(s)	As built drawing(s)
Extract(s) from tender documentation	Maintenance Plan(s)
Maintenance Plan(s)	Extract(s) from Management Rules

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

Where the first point is claimed:

- Providing calculations of original peak stormwater flow based on pre-development site conditions;
- Providing calculations of projected peak stormwater flow based on proposed site conditions;
- Confirming that the development does not increase the peak stormwater flow for up to a 1- in-2 year storm;
- Clearly nominating the design guidelines/manuals used for the treatment system design and justification for applicability to the site, and describing the treatment system(s) for TSS reduction;
- Providing calculations of the runoff volume;
- Confirming the TSS reduction as required can be achieved and that the system is capable of achieving the treatment reduction for the runoff volume;
- Describing the system's features to trap litter, oil and grease at source; and,
- Describing the on-going maintenance for the attenuation and treatment facilities, with reference to the 'Maintenance Plan'.

Where the second point is claimed:

- Providing calculations of original peak stormwater flow based on pre-development site conditions;
- Providing calculations of projected peak stormwater flow based on proposed site conditions;
- Confirming that the development does not increase the peak stormwater flow for up to a 1- in-20 year storm;
- Describing the system's features to trap litter, oil and grease at source; and,
- Describing the on-going maintenance for the attenuation facility, with reference to the 'Maintenance Plan'.

Where the third point is claimed:

- Providing calculations demonstrating the design rainfall used;
- Providing calculations of the sizing of any stormwater storage systems (where applicable);
- Describing the infiltration areas and justification for any infiltration assumptions such as rates, slope and area over which infiltration occurs (where applicable);
- Describing the system's features to trap litter, oil and grease at source; and,
- Describing the on-going maintenance for the infiltration facility, with reference to the 'Maintenance Plan'.

Tender / As Built drawing(s) clearly demonstrating the stormwater systems included in the project

EMI-5 WATERCOURSE POLLUTIONPOINTS
AVAILABLE**3**

design, including all landscaping stormwater mitigation initiatives.

Extract(s) from tender documentation where requirements for control and treatment of stormwater are stipulated.

Maintenance Plan(s) clearly describing the on-going maintenance requirements of the applicable infiltration, attenuation and/or treatment systems.

Extract(s) of Management Rules clearly demonstrating the commitment of the Management Entity to implement the maintenance plans for the infiltration, attenuation and/or treatment systems into the future.

ADDITIONAL GUIDANCE

Although the three credit points available in this credit can be targeted independently, achieving the Credit Criteria of one point may assist in achieving the Credit Criteria for the remaining credit points.

It must be evident that the Management Entity is committed to the maintenance of the infiltration, attenuation and/or treatment systems into the future. The Management Rules must clearly demonstrate the requirement for maintenance in accordance with the 'Maintenance Plan' for the infiltration, attenuation and/or treatment systems.

Pre-development site condition

For the purposes of peak stormwater flow calculation in Green Star SA, the 'pre-development' site condition is considered as the condition of the site in its natural state prior to any development on the site. For refurbishments or brownfield developments, the pre-development site condition is not the condition of the existing landscape and hardscape, but of the site prior to any development (i.e. greenfield condition).

Peak Flow Control

Where a system is designed to control the flows from the site for events up to both the 1-in-2 year and the 1-in-20 year storms, two or more outflow controls are likely to be required.

Consideration should also be made of what will happen when the design storm is exceeded (e.g. overland escape routes).

TSS reduction

For the purposes of Green Star SA, a stormwater management system that is designed, constructed and maintained to specific guidelines as deemed appropriate by the design team will be accepted to reduce TSS as outlined in those guidelines, based on existing field data. Guidelines should be selected to ensure relevance to the site's physical characteristics (e.g. climate, soil, vegetation, slope etc.).

EMI-5 WATERCOURSE POLLUTION

POINTS
AVAILABLE

3

Recommended stormwater design guidelines/manuals include, but are not limited to:

- Georgia Stormwater Management Manual (2001);
- Municipal Stormwater Management 2nd Ed. (2003);
- Virginia Stormwater Management Handbook (Vol. 1 & 2) 1st Ed. (1999); and,
- Melbourne Water WSUD Engineering Procedures: Stormwater (2005).

Please see References & Further Information for full details.

Shared stormwater services

If an attenuation/retention pond or other strategy is shared between sites or projects it must be demonstrated how this provides sufficient attenuation/treatment and achieves the applicable credit criteria for the Green Star SA project and all other sites/projects linked to the same pond (i.e. the applicable Credit Criteria must be met for all sites served by the shared/district system). It is not required that Project Teams submit Credit Interpretation Requests (CIR) for this scenario.

Watercourses and wetlands - definitions

The following definitions of watercourses and wetlands from the National Water Act, 1998 (Act No. 36 of 1998) (NWA) are adopted by the GBCSA with regards to the Green Star SA rating tools:

Watercourses: The NWA includes wetlands and rivers into the definition of the term watercourse as follows:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and,
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.

A reference to a watercourse includes, where relevant, its bed and banks.

Wetlands: Defined as “land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

Design Rainfall Depth

Daily rainfall data for locations across South Africa may be obtained from the South African Weather Service, where a site-specific record does not exist. A minimum of three complete years' data should be used, and ideally five years or more. The correct design rainfall depth should be calculated in accordance with the guidance provided below:

1) Obtain rainfall data

Daily rainfall data specific to the site (with justifications) should be sourced for a minimum of 3 complete years, however if longer records are obtainable, they should be used. For example, daily rainfall data obtained from 1st January 1999 to 31st December 2003 represents five (5) full years of data (i.e. $N = 5$).

2) Determine Relevant Daily Rank

The relevant daily rank can be determined by multiplying the number of years of data (i.e. N) by the desired annual frequency that the 1 day rainfall is equalled or exceeded per year. For the purposes of Green Star SA and this credit, this frequency is 3. Hence; *Relevant Daily Rank* = $3 \times N$ (e.g. $3 \times 5 = 15$)

3) Rank data

Using a data processing software package such as Microsoft Excel, the daily rainfall data obtained in Step 1 must be ranked based on daily rainfall from highest (i.e. heaviest rain event) to lowest (i.e. least intense rain event, or no rain) including the days where no rain was recorded. For this example, this is simulated overleaf:

Original Data			Ranked Data	
Date	Rainfall (mm)	Rank	Date	Rainfall (mm)
01/01/1999	0	1	23/01/2003	205.5
02/01/1999	4	2	07/01/2003	198

EMI-5 WATERCOURSE POLLUTIONPOINTS
AVAILABLE**3**

03/01/1999	0	3	08/02/2000	102.9
04/01/1999	3.9	4	12/01/2000	80.1
05/01/1999	0	5	09/02/2000	75.5
06/01/1999	0	6	12/09/2001	73.1
07/01/1999	28.5	7	07/02/2000	52
08/01/1999	0	8	01/02/1999	50.6
09/01/1999	0	9	25/10/2001	46.2
10/01/1999	0	10	21/10/1999	40
11/01/1999	14.6	11	02/03/2000	36
12/01/1999	0	12	10/02/2000	35.6
13/01/1999	0	13	01/03/2000	34.2
14/01/1999	0	14	18/09/2000	32.1
15/01/1999	0	15	16/11/2001	31.8
16/01/1999	0	16	24/01/2002	31
17/01/1999	0	17	18/03/2003	30.9
...	...	...	...	...
...	...	...	...	...
26/12/2003	14	1821	23/12/2003	0
27/12/2003	0	1822	27/12/2003	0
28/12/2003	0	1823	28/12/2003	0
29/12/2003	0	1824	29/12/2003	0
30/12/2003	0	1825	30/12/2003	0
31/12/2003	0	1826	31/12/2003	0

4) Determine design rainfall depth

To determine the design rainfall depth to use in calculations to demonstrate compliance with the Credit Criteria, simply take the relevant daily rank (determined in Step 2) and count backwards from highest intensity rain event as ranked in the data set (i.e. the 15th ranked rain event). On the basis on the worked example, the rainfall depth to use is therefore **31.8mm**.

BACKGROUND

Stormwater in South Africa has traditionally been channelled away from sites as rapidly as possible to the nearest watercourse, wetland or coastline without much consideration for quality. The necessity to deal with both the quantity and quality of runoff is now recognised through the encouragement of groundwater recharge through infiltration, and for storage and reuse of runoff.

Stormwater quantity

From an ecosystem perspective it is the high frequency of smaller floods that cause the most cumulative damage. In its natural state, a landscape will absorb the rainfall from normal rainfall and minor storm events. The high surface area of the leaves of trees, shrubs and grasses holds a large percentage of a light rain shower before the rainfall even reaches the soil. Often this moisture on the leaves will evaporate before the next shower.

During heavier or longer rainfall events once the leave's surfaces are saturated, the rainwater begins to soak into the soil. The amount of rainfall that will soak into the soil depends on how deep it is and its structure (clay to sandy). The water in the soil will be drawn up and lost through evaporation and evapotranspiration. The remaining water will continue to percolate downwards to recharge the water table or deeper still to recharge aquifers. The ground water, once it reaches an impermeable layer, will move laterally to re-emerge as a seep either on the hillside or adjacent to the water course where it slowly and continuously discharges into the watercourse. The vegetation along the watercourses which protects the soil against erosion has adapted to these conditions.

Only after a number of showers in close succession or a period of extended rainfall will the soil reach saturation point and excess rainfall move across the surface as runoff. The surface runoff is constantly dispersed and the energy dissipated by the vegetation cover until it reaches the watercourse or wetland. Damage to vegetation on the slopes and along the water course is usually limited and can recover between excessive storm events. In natural conditions it is normally only the infrequent large flood events that cause extensive damage to vegetation and soil. The vegetation recovers in the years between these events.

In developed areas the scenario changes. Rainfall is collected on impervious surfaces, roofs, roads and parking areas and immediately concentrated into stormwater pipes or surface channels. There is no vegetation to absorb the light showers, the surface is impermeable and there is no infiltration into the soil. Runoff is channeled to the nearest watercourse in a concentrated stream of high energy water.

EMI-5 WATERCOURSE POLLUTION

POINTS
AVAILABLE

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This means that every rainfall event results in a flood which results in damage to vegetation along the watercourse and soil erosion. Since every rainfall event results in a damaging flood within the watercourse there is no time for vegetation to recover and it is systematically removed and the exposed soil eroded. This damage is evident for some distance below the storm water discharge point until the vegetation along the watercourse eventually dissipates the energy.

The result of frequent minor and major floods along the watercourse is excessive ongoing scouring of the base of the watercourse to form erosion gullies and deeply incised watercourses. The water table either side of the watercourse drops to the lower level of the watercourse and deprives the riparian vegetation along the banks of the necessary water which is then replaced by terrestrial vegetation. The deeper cross section of the channels with no vegetation to dissipate the energy of the storm water means that storm water is further accelerated and does more damage further downstream.

Stormwater quality

The contaminants in stormwater can be grouped according to their water quality impacts:

- **Oils, grease and surfactants:** Rubber from tyres and oil and grease washed from road surfaces, domestic and industrial sites, plus surfactants from detergents used for washing vehicles, materials or surfaces are common sources of toxic pollutants in stormwater.
- **Litter:** This includes organic waste matter, paper, cigarette buds, plastics, glass, metal and other packaging materials from paved areas in urban catchments.
- **Total Suspended solids:** Suspended solids have two main constituents: organic, primarily from sewage, and inorganic, primarily from surface runoff. Turbidity from suspended solids reduces light penetration in water, affecting the growth of aquatic plants. When silts and clays settle, they may smother bottom dwelling organisms and disrupt their habitats. Since metals, phosphorus and various organics are adsorbed and transported with these particles, sediment deposits may lead to a slow release of toxins and nutrients in the waterway.
- **Nutrients:** Potential sources of nutrients are:
 - Sewage overflows;
 - Industrial discharges;
 - Animal wastes;
 - Fertilisers;
 - Domestic detergents; and
 - Septic tank seepage.

Excessive amounts of nutrients, such as nitrogen and phosphorous, can promote rapid growth of aquatic plants, including toxic and non-toxic algae. This excessive growth and oxygen depletion can cause fish and aquatic organisms to die.
- **Oxygen demanding materials:** Sources of oxygen-demanding materials are biodegradable organic debris, such as decomposing food and garden wastes, and the organic material contained in sewerage. Biological and chemical oxygen-depleting substances can cause water-borne diseases and present serious health risks.
- **Micro-organisms:** Bacteria and viruses found in soil and decaying vegetation, and faecal bacteria from sewer overflows, septic tank seepage and animal waste, are common contaminants in stormwater after heavy rain. Pathogens and micro-organisms, including bacteria, viruses and faecal coliforms, cause water-borne diseases. These can present serious health risks from cholera, typhoid, infectious hepatitis and a range of gastrointestinal diseases.
- **Toxic organics:** These include garden pesticides, industrial chemicals and landfill leachate. They may cause long-term ecological damage and threaten human health. Organochlorine pesticides, herbicides and insecticides can be accumulated in organisms and persist in the environment over long periods.
- **Toxic trace metals:** Industrial chemicals can enter stormwater from a number of sources including sewerage overflows, illegal dumping and accidental spillages. Dust from brake and clutch linings of motor vehicles coupled with waste from degrading roadways and water pipes can inject ammonia, hydrogen sulphide and heavy metals (mercury, cadmium, lead and zinc) into the stormwater system.

Effects of good stormwater design and treatment

EMI-5 WATERCOURSE POLLUTION

POINTS
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3

Recent research and demonstration projects in the USA have shown that stormwater can be exploited in a cost effective and environmentally sensitive manner for new urban developments. A well-designed stormwater system will control peak flows and reduce a variety of contaminants. Designs that reduce TSS typically provide additional water quality benefits, which are less easy to quantify.

In this context:

- Water reclamation can reduce potable water demand considerably;
- Properly managed stormwater flows can prevent the increase in flood risk and watercourse erosion typically caused by urbanisation and provide important flow return to streams, offsetting the environmental impact of upstream water supply diversions and reducing the need for costly in-ground stormwater infrastructure;
- The enhanced use of natural drainage corridors and depressions can provide open space, landscaped and recreational areas and conservation benefits increasing the amenity of new urban developments (multiple use corridors); and
- Treatment of stormwater closer to source minimises uncontrolled discharge of water containing high suspended solids, nutrients and organic material.

Control and treatment of stormwater and surface runoff from developments can be achieved through a variety of technologies and strategies, including for example:

- **Petrol, oil and sediment arresters** can have different design and operating dynamics, ranging from plate separators, to vortex, swirl and dynamic separators. Such separators are often sited in car parks and other points of high traffic density;
- **Sand filters, grassed swales and porous pavements**, can be effective treatment techniques, especially in car parks, commercial and industrial sites. Roof runoff, which is predominantly clean, can be directly infiltrated into the soil near a building by connecting the downpipe to a subsoil drain system with an overflow for large events, providing that there is a 'first flush' diverter or catchment system to filter out the initial flow of roof runoff;
- **Swales** are open, grass-lined channels that receive runoff from roads and other impervious surfaces. Small check dams can be added to slow velocities and increase pollutant removal, but a sequence of swale sections with proper growing medium and planting is necessary to properly filter and confine pollutants;
- **Permeable paving materials**, such as porous asphalt or porous concrete, are surfaces that mimic natural infiltration. Permeable surfaces can also be designed with a turf cell reinforcement structure or open-celled pavers, and concrete or plastic grids with voids that are filled with topsoil, growing medium or aggregate to ensure that vehicle or foot traffic can still use the area securely whilst surfaces remain permeable;
- **Constructed pollution control ponds**, or wet detention basins, are largely open water bodies of several metres depth; mosquitoes may become a problem if their prevention or deterrence is not factored into the design, and health and safety regulations must be observed for depths of water in publicly-accessible locations;
- **Constructed wetlands** resemble local natural wetlands and provide a balanced and productive ecosystem. When a constructed ecosystem is productive, it means that there is a significant biomass of plants and microscopic algae that take up nutrients, and provide habitat and food for animals. Note that birds are often attracted to constructed wetlands and can themselves increase the nutrient and pathogen levels in these systems. The problem can be limited by ensuring that roosting sites for large flocks (e.g. cormorants, ibis etc.) are not incorporated in the design.
- **Rainwater harvesting** for on-site uses will help to attenuate peak flows;
- **Roof gardens** can absorb significant amounts of rainfall, helping to attenuate peak flows. Super-imposed loads on the roof structure, plus retained rainwater, means that the roof needs to be designed to the extra loading;
- **Bio-Basins** are planted and shaded infiltration basins which trap polluted stormwater. The basin surface appears 'dry' as its surface is gravel and there are no ponds for mosquitoes to breed. The Bio-basin contains specialised wetland plants that act upon the water pollutants in much the same way they do in natural wetlands. Larger detained pollutant particles settle out to allow the natural bacteria processes to occur. Bio-Basins are easier to maintain and manage than constructed wetlands, but must be protected from fine sediment loads which could eventually clog the system;

EMI-5 WATERCOURSE POLLUTIONPOINTS
AVAILABLE**3**

- **Vegetated Filter Strips (VFS)** can also be used to help remove pollutants from stormwater; these are strips of grasses or plants placed across stormwater flow paths which filter stormwater runoff and minimise speed of stormwater discharge by encouraging a longer, more winding flow, especially where sheet flow rather than concentrated flow is intended; and,
- **Floating treatment systems** have rooted, emergent macrophytes growing on a floating artificial mat on the surface of the water. They are capable of surviving water depth fluctuations that typically occur in stormwater systems, without the risk of the plants becoming inundated or desiccated and stressed. The roots floating beneath the structure support a diverse microbial population which aid uptake of dissolved nutrients.

All of the above stormwater treatment technologies require careful and specific maintenance steps to be taken in order to ensure their on-going efficacy. Failure to undertake required maintenance will ultimately result in more costly repairs or even full replacement of the system.

Landscaping also plays an integral role in the design of most stormwater treatment systems, offering opportunities for their aesthetic incorporation in the surrounding area. The use of particular plants species is important since some species will be more effective in treating stormwater and better suited for surviving the ambient conditions. Co-ordination between stormwater engineers, landscapers and nurseries/growers is advised to ensure that the required plants are available for planting at the correct stage in the project.

REFERENCES & FURTHER INFORMATION

South African Weather Service
<http://www.weathersa.co.za/web/>

CSIRO Urban Stormwater: Best Practice Environmental Management Guidelines
<http://www.publish.csiro.au/nid/18/pid/2190.htm>

Georgia Stormwater Management Manual (2001)
<http://www.georgiastormwater.org>

Idaho Department of Environmental Quality (2005), Catalogue of Stormwater Best Management Practices for Idaho Cities and Counties
<http://www.deq.idaho.gov>

North Carolina Division of Water Quality (July 2007), Stormwater Best Management Practices Manual
<http://portal.ncdenr.org/web/wq>

SANS 1200:LE 1982 Stormwater Drainage – Standardized Specification for Civil Engineering Works
<http://www.sabs.co.za>

Department of Water and Environmental Affairs (Water Quality)
http://www.dwaf.gov.za/Dir_WQM/default.asp

National Environmental Management Act No. 107 OF 1998
<http://www.environment.gov.za/PolLeg/Legislation/NatEnvMgmtAct/NatEnvMgmtAct.htm>

CSIR (2000), Guidelines for Human Settlement Planning and Design, Chapter 6, Stormwater Management
http://www.csiro.co.za/Built_environment/RedBook/

Department of Environment and Water Resources (2002), Introduction to Urban Stormwater Management in Australia. Canberra.
<http://www.environment.gov.au/coasts/publications/stormwater/pubs/stormwater.pdf>

South African Water Research Commission
<http://www.wrc.org.za>

ANZECC (2002) Guidelines for Urban Stormwater Management:
dataserver.planning.sa.gov.au/publications/840p.pdf

EMI-5 WATERCOURSE POLLUTIONPOINTS
AVAILABLE**3**

CIRIA C697 (2007) The SUDS Manual.
<http://www.ciriabooks.com>

Debo, TN and Reese, A (2003), Municipal Stormwater Management. 2nd Edition, Lewis Publishers, CRC Press Company, Boca Raton, 2003.

US EPA (2007) Reducing Stormwater Costs through Low Impact Development
<http://www.epa.gov/owow/NPS/lid/costs07/>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: EMI5-T-OB1-0627

Guidance: 2013-03-14

The meaning of "Site-Specific Record"

The revised EMI-5 credit in the Green Star SA Office v1 Technical Manual under 'Additional Guidance', under 'Design Rainfall Depth' refers to a site-specific record.

The term 'site-specific record', follows the same guidance provided in the Green Star SA- Office v1 Energy Modelling Protocol Guide-Version 1.1, refers to the following:

- Weather data obtained from the South African Weather Service for a location within 50km of the building location; or
- In the absence of South African Weather Service Data, an actual year of recorded weather data from a location within 50km of the building location;
- In the absence of South African Weather Service Data or actual weather data within 50km, interpolated data based upon 3 points within 100km of the building location.

The base credit has been uploaded as per Erratum Number: EMI5-E-OB1-0520 (2012-11-19)
Green Star SA - Revised credit EMI-05 Water Pollution (Revised: 19 November 2012)

Please note that projects who registered prior to 19 November 2012 are eligible to use the previous EMI 5 credit, and should refer to the technical manual and TC's for guidance.

EMI-6 Discharge to SewerPOINTS
AVAILABLE**5****AIM OF CREDIT**

To encourage and recognise developments that minimise discharge to the municipal sewerage system.

CREDIT CRITERIA

Up to five points are available as follows:

Up to four points are awarded where the building outflows to the sewerage system due to building occupants' usage have been reduced against an average-practice benchmark as follows:

- One point for a 30% reduction;
- Two points for a 50% reduction;
- Three points for a 70% reduction; or
- Four points for a 90% reduction.

The points are determined by the Green Star SA Sewerage Calculator.

An additional point is awarded where:

- At least one point above is achieved; AND
- There is a Blackwater Treatment Maintenance Plan; AND
- There is a maintenance contract for a minimum of five year to ensure that the blackwater treatment system operates as intended by the design.

Where no blackwater treatment system is installed, the additional point is 'Not Applicable' and is excluded from the Points Available, used to calculate the Emissions Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

The number of points is determined using the Green Star SA Sewerage Calculator. Up to two points can be achieved for discharge reduction from fittings/fixtures alone; the other two points can only be obtained through grey and blackwater reuse systems.

All inputs into the Sewerage Calculator are referenced consistently throughout the rest of the submission (i.e. in related credits such as Wat-1 'Occupant Amenity Water') and are clearly justified by the documented design (for Green Star SA – Office Design v1 assessment) or by the as built evidence (for Green Star SA – Office As Built v1 assessment).

All water treatment systems are clearly incorporated into the design documentation.

EMI-6 Discharge to SewerPOINTS
AVAILABLE**5**

All guidance in the Potable Water & Sewerage Calculators Guide must be adhered to.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where no water reuse systems are installed: • Sewerage Calculator • Potable Water Calculator Where water reuse systems are installed the following is also required: • Short report • Extract(s) from the specification(s) • Tender hydraulic drawings Where the additional point is claimed the following is also required: • Blackwater treatment maintenance plan • Letter from Building Owner	Where no water reuse systems are installed: • Sewerage Calculator • Potable Water Calculator Where water reuse systems are installed the following is also required: • Short report • As built hydraulic drawings • Extract(s) from the commissioning records Where the additional point is claimed the following is also required: • Blackwater treatment maintenance plan • Copy of the maintenance contract

Sewerage Calculator, completed in accordance with the Potable Water & Sewerage Calculators Guide.

Potable Water Calculator, completed in accordance with the Potable Water & Sewerage Calculators Guide.

Short Report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Describing the system, how it works and its treatment capacity compared with typical demand annually; including how the annual percentage of water diverted from the sewer was calculated and calculations demonstrating capacity (under various rainfall conditions).

Extract(s) from the specification(s) where the system(s) are described. The specification is to detail the capacity of the system as described in the short report.

Tender hydraulic drawing(s) and As built hydraulic drawings showing the location and details of the treatment systems relative to the building including the location of water storage systems.

Extract from the Commissioning Records demonstrating that the water treatment systems have been commissioned and operate as intended by the design.

Blackwater Treatment Maintenance Plan including:

- A simplified diagram of the system(s);
- Description of its intended operation and its conditions;
- A list of the main components (including controls), and the value and conditions of their efficient

EMI-6 Discharge to Sewer

POINTS
AVAILABLE

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use;

- Details on maintenance, including recommended frequency; and
- A list of likely and tell-tale signs of system failure, system 'do's and don'ts', and notes on inefficient operation.

Copy of the maintenance contract for the blackwater treatment system, for a minimum of five years after commissioning and stipulating adherence to the Blackwater Treatment Maintenance Plan.

Letter from building owner confirming the commitment to appoint a contractor to operate and maintain the blackwater treatment system for a minimum of five years after commissioning and identifying a suitable contractor.

ADDITIONAL GUIDANCE

The Green Building Council of South Africa strongly encourages the reuse of water to protect the potable water resources in South Africa through grey-water and blackwater recycling.

Consent for blackwater treatment should however be sought from relevant authorities in line with SANS 10400 and the NEMA regulations.

Points can be achieved for this credit by minimising water use through efficient fittings, or through treatment and reuse of water.

The number of points achieved is determined by the Sewage Calculator from the information entered in the Potable Water Calculator. The Potable Water Calculator must be used in accordance with the Potable Water and Sewage Calculators Guide available from the GBCSA website (<http://www.gbcsa.org.za>). All teams claiming this credit are required to comply with the requirements outlined in this guide.

There are a number of water treatment and reuse technology options, most of which are generally divided into greywater treatment and blackwater treatment.

Greywater is water which would normally go to sewer from sources which are low risk relative to pathogens, chemicals and viruses - such as the water from showers and hand basins. This water may only require low level treatment before it can be reused for applications such as irrigation. Higher level treatment technologies can allow greywater to be reused for toilet flushing.

Blackwater is generally defined as water that has been mixed with faecal waste or water with a dangerous chemical content such as waste from cooling towers. Blackwater requires more intensive biological, chemical or physical treatment and disinfection before reuse.

Some applications where greywater and blackwater have recently been treated and reused in commercial building designs include:

- Irrigation;
- Toilet flushing;
- Cooling Towers; and
- Washdown.

Storage is important as it maximises the usefulness of greywater, although excessive periods of storage may lead to bacteria growth, smells etc. For these reasons greywater should be treated and disinfected before storage. Storage requirements will depend on:

- Climate (irrigation demands);
- Demand for reuse water;

EMI-6 Discharge to SewerPOINTS
AVAILABLE**5**

- Presence/size of disposal area; and
- Maximum daily greywater output.

In cases where the Potable Water & Sewerage Calculator does not adequately account for a specific situation, project teams may submit separate calculations demonstrating reductions in discharge to sewer.

BACKGROUND

Wastewater from buildings places a significant demand on public infrastructure and the local environment. Inadequately treated wastewater disposed to watercourses can be a significant source of pollution. As a result, wastewater represents a polluting emission from the developments and minimisation of this emission is encouraged through this credit with added benefit of reducing high demands on potable water sources.

REFERENCES & FURTHER INFORMATION**SANS: 10252-1: 2004**

Water Supply and Drainage for Building, Part 1 – Water Supply Installations for Buildings National Environmental Management Act No. 107 OF 1998

NEMA Regulations Government Notice R385 of 2006 Listing Notice 1 Government Notice R386 of 2006

Listing Notice 2 Government Notice R387 of 2006

(Department of Environment, Agriculture and Tourism (DEAT)

<http://www.deat.gov.za>

South Africa Department of Water Affairs & Forestry

<http://www.dwaf.gov.za>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: EMI6-T-OB1-0787

Guidance: 2014-05-13

EMI-6 Discharge to SewerPOINTS
AVAILABLE**5****Water calculator**

The GBCSA acknowledges the issue raised and approves the project teams approach. However, the GBCSA recommends that the attached calculator be used for the submission.

Supplementary Information

[Potable Water Calc Work - 09042014 of GSSA Office v1 20131125.xlsx](#)

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Technical Clarification Number: EMI6-T-OB1-0746

Guidance: 2014-01-01

Rainwater Harvesting System(s)

A Rainwater Harvesting System is not deemed a water reuse system. Water reuse systems are deemed to be systems that make use of water (greywater and/or blackwater) that has been previously used in the building and reuse it in various permitted applications such as landscape irrigation. As such, with specific reference to a Rainwater Harvesting System(s), no credit compliance documentation such as Tender Hydraulic drawings and specifications are required to prove credit compliance if such a system(s) is included in a project.

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Technical Clarification Number: EMI6-T-OB1-0395

Guidance: 2012-02-03

Septic tank and anaerobic digester treatment systems

The application of onsite blackwater treatment systems may contribute to reduced flow of sewage to the municipal sewage system, or may be a necessity where no municipal sewage system is provided.

For the purposes of Green Star SA in the scenario where no municipal sewage system is provided to the project site, septic tank systems or anaerobic digestion systems may only be considered as “blackwater treatment systems” where the effluent emanating from such systems undergoes appropriate treatment (in accordance with applicable Provincial or National requirements) such that it may be discharge into the environment without causing adverse environmental impacts. The direct discharge of effluent from septic tank systems or anaerobic digestion systems into French drains or soak-away fields is not considered best practice nor deemed appropriate treatment for the purposes of Green Star SA. Such treatment methods pose a contamination risk to groundwater and/or watercourses (see Emi-5 Watercourse Pollution).

Where septic tank or anaerobic digestion effluent undergoes appropriate treatment, the inflow to such systems may be entered as a blackwater ‘resource’ in the Wat-1 Potable Water Calculator, permitting projects to claim benefit in the Emi-6 Discharge to Sewer credit for both occupant amenity water efficiency initiatives and onsite blackwater treatment.

EMI-6 Discharge to SewerPOINTS
AVAILABLE**5**

Where septic tank or anaerobic digestion effluent does not undergo appropriate treatment, the inflow to such systems must not be entered as a blackwater 'resource' in the Wat-1 Potable Water Calculator. In this scenario, projects may only claim benefit in the Emi-6 Discharge to Sewer credit for occupant amenity water efficiency initiatives only, and not onsite blackwater treatment.

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Technical Clarification Number: EMI6-T-OB1-0279

Guidance: 2011-06-09

Evidence of approval from the relevant authority

Where rainwater collection or water reuse systems are installed, project teams are no longer required to provide 'evidence of approval from the relevant authority' within their documentation submitted for a Green Star SA Design / As Built rating.

Whilst this documentation is no longer required to be included within the submission for Green Star SA certification, the GBCSA would expect that project teams adhere to all relevant authority regulations and requirements (including approval of such systems where required).

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Credit Interpretation Request Number: EMI6-C-OB1-0046

Ruling: 2009-09-14

Approval of blackwater systems

The Credit Interpretation Request (CIR) seeking approval for exempting the project from approval from the relevant authority for a blackwater treatment system is granted for this specific project at this point in time. The project must demonstrate in the submission for certification that the project team has worked with the local authority to pursue approval of the system, has designed the system to all applicable SABS, SANS and DWAF standards, and must provide assurance that the system will be installed and used once authority approval is granted. Note that any future requests from other projects for exemption from approval from the relevant authority for a blackwater treatment system will be considered on their merits on a project-by-project basis.

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The following errata have been incorporated:

EMI6-E-OB1-0285 (2011-08-08) Green Star SA - Office v1 Technical Manual: Page 332

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EMI6-E-OB1-0286 (2011-08-08) Green Star SA - Office v1 Technical Manual: Page 333

EMI-7 Light Pollution

POINTS
AVAILABLE

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AIM OF CREDIT

To encourage and recognise developments that minimise light pollution into the night sky.

CREDIT CRITERIA

One point is awarded where:

- No light beam, generated from within the building or outside of the building boundary, is directed at any point in the sky hemisphere without falling directly onto a non-transparent surface; AND
- Facade lighting produces an average building Luminance of no more than 10 candelas/m²; AND
- 95% of outdoor spaces do not exceed the minimum requirements of CIBSE LG6 (Lighting Guide – the Outdoor Environment) for maintained illuminance levels; AND
- The lighting design complies with the additional guidance given in the Green Star SA - Office v1 Technical Manual.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Luminaire Schedule • Tender drawing(s)	• Short report • As built Luminaire Schedule • Manufacturer's Data Sheets • As built drawing(s)

Short report from the lighting engineer describing how the Credit criteria have been met by:

- Detailing the external and atrium lighting on the site, the areas illuminated, calculations and illumination diagrams (including horizontal and vertical light distribution) to demonstrate that no light spill is impacting the night sky.
- For any façade lighting, a calculating to show that the building Luminance meets the requirements above; and
- Confirming design and achieved light levels and that 95% of areas do not exceed the minimum requirements given in CIBSE LG6.

Extract(s) from the specification(s) where relevant lighting and its requirements is identified, e.g. atrium, internal perimeter areas and external lighting.

Luminaire schedule for all external lighting and relevant internal lighting (where a glazed atrium is

EMI-7 Light Pollution

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present), nominating the type, lighting distribution and quantity of each luminaire.

Tender drawing(s)

- Site plan indicating the location and type of all external luminaires and marked up with illuminance level(s) demonstrating that the minimum requirements of CIBSE LG6 are not exceeded; and
- Where a glazed atrium is present, atrium drawings indicating the location and type of internal luminaires.
- Where lighting is directed at a façade or structure, drawings with sections showing the set angle of the fitting(s) to ensure that light does not spill past the non-transparent surface of the facade or structure into the sky hemisphere.

As built drawing(s)

- Site plan indicating the location and type of all external luminaires and marked up with illuminance level(s) demonstrating that the minimum requirements of CIBSE LG6 are not exceeded; and
- Where a glazed atrium is present, atrium drawings indicating the location and type of internal luminaires.
- Where lighting is directed at a façade or structure, drawings with sections showing the set angle of the fitting(s) to ensure that light does not spill past the non-transparent surface of the facade or structure into the sky hemisphere.

As built luminaire schedule for all external lighting and relevant internal lighting (where a glazed atrium is present), nominating the type, lighting distribution and quantity of each luminary.

Manufacturer's Data Sheets for all relevant luminaires indicating light output levels and light distribution diagram.

ADDITIONAL GUIDANCE

Where the credit is achieved, there is to be no point in the sky hemisphere which looks directly at a light source.

Light reflected off external surfaces (which do not form part of the light fitting) is not considered as light spill for the purposes of the credit.

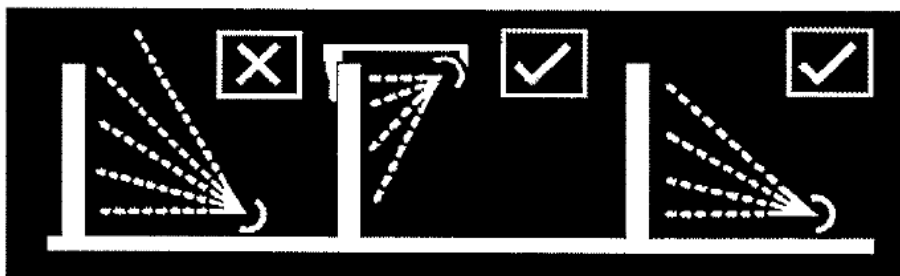


Figure Emi-7.1 Illustration of acceptable and unacceptable external lighting to achieve this credit (Institute of Lighting Engineers)

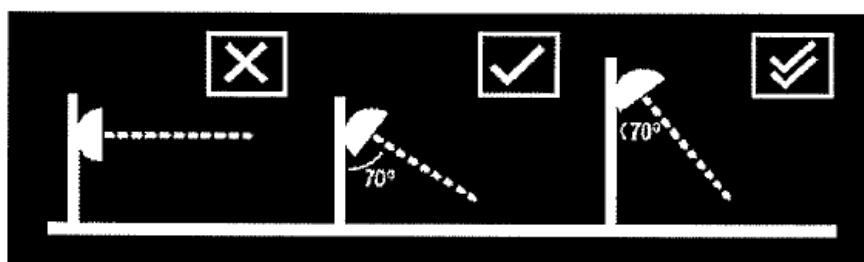
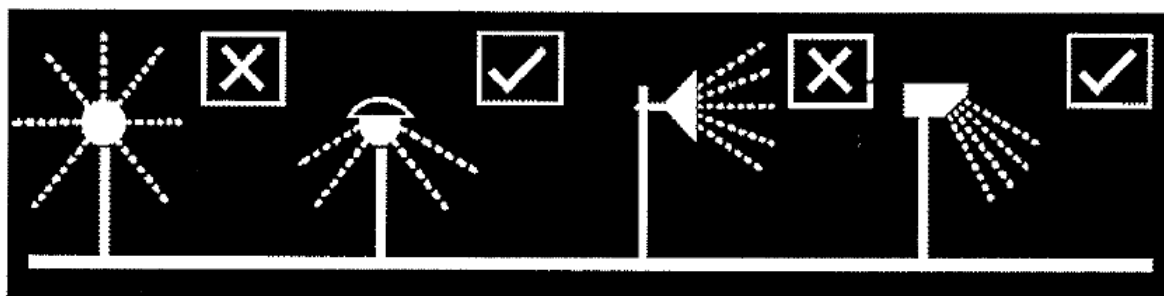
EMI-7 Light PollutionPOINTS
AVAILABLE**1**

Figure Emi-7.2 Illustrations of acceptable and unacceptable column lighting to achieve this credit (Institute of Lighting Engineers)

Light fittings that have an opaque canopy or polished asymmetrical reflectors will meet the requirements for the awarding of this credit.

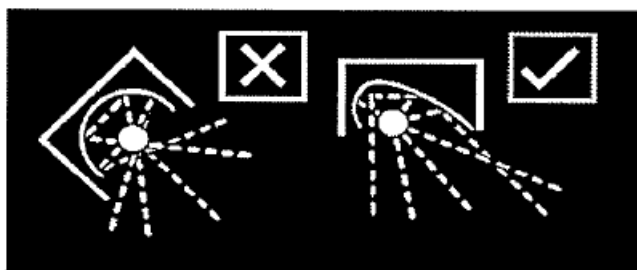


Figure Emi-7.3 Symmetrical and Asymmetrical reflectors (Institute of Lighting Engineers)

BACKGROUND

Light travelling up into the night sky (sky glow) or spilling on to neighbouring properties is a form of pollution. 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.

EMI-7 Light PollutionPOINTS
AVAILABLE**1****REFERENCES & FURTHER INFORMATION**

Institution of Lighting Engineers – GN01 (2005) *Guidance Notes For The Reduction Of Obtrusive Light*, available for free download at <http://www.ile.org.uk/index.php?page=technical>

CIBSE Lighting Guide 6: 1992, *The Outdoor Environment*

Fatal Light Awareness Program (US)

<http://www.flap.org>

Illuminating Engineering Society of North America, *IESNA Recommended Practice Manual: Lighting for Exterior Environments*.

<http://www.iesna.org>

International Dark-Sky Association.

<http://www.darksky.org>

International Electrotechnical Commission (IEC). IEC 60364-7-714 Ed. 1.0 b (1996): *Electrical installations of buildings - Part 7: Requirements for special installations or locations – Section 714: External lighting installations*.

<http://www.iec.ch/>

The Urban Wildlands Group (US).

<http://www.urbanwildlands.org>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Credit Interpretation Request Number:EMI7-T-OB1-0668

Ruling: 2013-04-22

Lack of photometric data for custom façade lighting

It is deemed acceptable for project teams to build a mock-up and measure the luminance (candelas/m²) of the custom façade lighting that doesn't contain photometric data.

If the luminance results comply with Green Star SA requirements and the project team pursues the credit point, these confirmed results need to be submitted as additional information towards the project submission in order to prove compliance with the 10 candelas/m² requirement.

The project team should note that all other credit requirements remain as per the technical manual, technical clarifications, credit interpretations requests and errata found on the GBCSA website.

EMI-7 Light Pollution

POINTS
AVAILABLE

1

The following errata have been incorporated:

EMI7-E-OB1-0304 (2011-08-08) Green Star SA - Office v1 Technical Manual: Page 337:

EMI7-E-OB1-0398 (2012-01-26) Green Star SA - Office v1 Technical Manual: Page 338

EMI7-E-OB1-0434 (2012-03-14) Green Star SA - Office v1 Technical Manual: Page 338

EMI-8 LegionellaPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise building systems design that eliminates the risk of Legionnaires' disease (Legionellosis).

CREDIT CRITERIA

One point is awarded where:

There are no evaporative cooling towers or other evaporative cooling systems serving the building.

DOCUMENTATION REQUIREMENTS

It must be demonstrated clearly and consistently throughout the submission that the building is fully naturally-ventilated or that the mechanical heat rejection systems in place do not rely on evaporative heat rejection and are viable (e.g. of sufficient capacity).

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Statement confirming no evaporative systems	Statement confirming no evaporative systems

Statement confirming no evaporative systems Prepared by a mechanical engineer confirming that there are no cooling towers (direct or indirect), evaporative cooling systems with circulating water, or any other evaporative systems which might pose a risk of legionella infection.

ADDITIONAL GUIDANCE

There are a number of alternatives to water-based heat rejection systems for buildings with heat rejection requirements. Alternatives which have already been applied on projects worldwide include:

- Natural ventilation;
- Mechanically assisted natural ventilation;
- Air-cooled heat rejection;
- Harbour heat rejection;

EMI-8 LegionellaPOINTS
AVAILABLE**1**

- River heat rejection; and
- Ground heat rejection.

BACKGROUND

Colonisation and growth of bacterium 'Legionella' (the causative agent for legionnaire's disease) can take place in any water-based system if the water is warm and supplied with nutrients. Such organisms can be transported outside the water-based heat rejection systems within drift aerosol. There is evidence that the inhalation of such drift containing Legionella is a means of infection.

In Philadelphia in 1976, the American Legion held a bi-centennial conference to celebrate 200 years since the signing of the declaration of independence from Britain. More than 180 delegates, all staying at the same hotel, developed an acute, severe illness and 29 died. The final toll was 34 deaths; some simply passers-by in the street.

Initially the cause of their illness was unknown, with food poisoning a major suspect. It is now known that what they had was 'Legionnaires' disease', a form of pneumonia, or infection of the lung.

The cause of Legionnaires' disease is a family of bacteria and as such, it is a micro-organism, not a virus. This distinction is important when it comes to treatment because few viral diseases respond to antibiotics, whereas most bacterial diseases do.

Legionella pneumophila is the name scientists gave to the bacterium but there are at least 50 other species, all closely related. The micro-organism is relatively hard to grow and detect in laboratory cultures, compared with other types of bacteria, but modern culture techniques have improved analysis. Growth on laboratory culture media is very slow, typically 7 days.

Incubation in the lung is similarly slow and may not be detected until a few days after infection. Growth in water-based heat rejection systems can also be relatively slow.

While the spread of Legionella can be prevented by the biocide effect of appropriate disinfectants in water-based heat rejection systems, this requires significant maintenance regimes including:

- Water quality and treatment frequency;
- Frequency and methods of cleaning of water-based heat rejection systems;
- Frequency of testing for total bacteria;
- Use of testing for Legionella;
- Follow-up actions required if detection of Legionella or high total bacterial counts;
- Disinfection of system during periods of disuse;
- Decontamination of water-based heat rejection systems in the event of outbreaks or notification of Legionnaires' disease;
- Maintenance and availability of records; and
- Auto-dosing and drift eliminators (subject to consultation with industry).

Legislation, guidelines and responsible authorities varies from state to state. However, while risks can be reduced by adequate maintenance they cannot be eliminated altogether and therefore this credit rewards buildings which do not contain any water-based heat rejection systems.

EMI-8 Legionella

POINTS
AVAILABLE**1**

REFERENCES & FURTHER INFORMATION

CIBSE TM13:2002 *Minimising the risk of Legionnaires Disease*

National Environmental Health Forum South Australia (1996), *Guidance for the control of Legionella*
<http://enhealth.nphg.gov.au/council/pubs/pdf/legionel.pdf>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: EMI8-T-OB1-0712

Guidance: 2013-07-22

Legionella and 'Shell & Core' spaces

The following guidance is provided for spaces delivered as 'Shell & Core', as defined in the Green Star Office v1 Technical Manual.

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to water-based heat rejection system(s) that have been provided serving the building's nominated area.

Credit Interpretation Request Number: EMI8-C-OB1-0258

Ruling: 2011-03-10

Alternative credit version

Projects registered for Green Star SA Office (Version 1) certification may elect to use the 'Aim of Credit', 'Credit Criteria', 'Documentation Requirements' and 'Additional Guidance' as outlined in the equivalent Emi-8 Legionella credit contained within the Green Star SA Retail Centre (Version 1) Technical Manual, to demonstrate compliance. Where the Green Star SA Retail Centre (Version 1) Emi-8 Legionella credit version is used, Project Teams must clearly indicate the use of this alternative credit version within the submission. For a copy of the Green Star SA Retail Centre (Version 1) Emi-8 Legionella credit, please contact the GBCSA.

EMI-8 Legionella

POINTS
AVAILABLE**1**

Technical Clarification Number: EMI8-T-OB1-0259

Guidance: 2011-03-10

Humidifiers

For the purpose of this credit, humidifiers within HVAC systems are not considered "evaporative cooling systems" or "water based heat rejection systems" and are excluded from the scope of the Credit Criteria.

The following errata have been incorporated:

EMI8-E-OB1-0240 (2011-02-08) Green Star SA - Office v1 Technical Manual: Page 343

EMI8-E-OB1-0239 (2011-02-08) Green Star SA - Office v1 Technical Manual: Page 343

EMI8-E-OB1-0238 (2011-02-08) Green Star SA - Office v1 Technical Manual: Page 343:

EMI-9 Boiler and Generator EmissionsPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise the use of boilers and generators that minimise harmful emissions.

CREDIT CRITERIA

One point is awarded where:

- All gas boilers have NO_x emissions of < 100 mg/kWh (at 0% excess O₂);

AND

- All generators comply with the Tier 3 emissions standards as defined by the United States Environmental Protection Agency (EPA) or the equivalent European Stage IIIA standard.

Where no boilers or generators are installed, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Emissions Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

If a number of different systems are installed on a project, the documentation must account for and describe all systems within the project.

It must be clearly demonstrated that all boilers and generators throughout the project comply with the requirements.

Refurbishment projects must demonstrate that the existing system(s) are compliant. Specifying the use of catalytic convertors alone will not suffice.

To claim the credit as 'Not Applicable', the project team must clearly document that the building is not served by any boilers or generators.

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirm compliance: • Short Report • Extract(s) from the specification(s)	Submit all the evidence and ensure it readily confirm compliance: • Short Report • Manufacturer Information
To claim credit as 'not applicable': • Signed letter from building owner	To claim credit as 'not applicable': • Signed letter from building owner

EMI-9 Boiler and Generator Emissions

POINTS
AVAILABLE

1

Short Report which describes how the Credit Criteria have been met by:

- Referencing each boiler and giving its capacity in kW and NOx emission rate in mg/kWh; and
- Referencing each generator and confirming that it meets the EPA Tier 3 or European Stage IIIA standard.

Extract(s) from the specification(s)

- Where the requirements for the boilers and generators are specified, clearly demonstrating compliance with the credit criteria.

Manufacturer Information for each boiler and generator clearly indicating compliance with the NOx emission rates of any boilers (in mg/kWh) or the EPA Tier 3 or European Stage IIIA standards for generators.

Signed letter from building owner confirming no boilers or generators present in the project.

ADDITIONAL GUIDANCE

The emissions should be estimated under normal operating conditions (not standby).

'Boilers' include all heat generating equipment excluding electrically heated equipment, combined heat and power (CHP) and cogeneration systems (which must however meet the generator requirements).

Where heat is provided by more than one system, an average NOx emission rate should be used, based on the ratio of power outputs from each source, i.e. multiply the emissions of each boiler by the percentage of heat demand it produces and total these values.

Any combined heat and power (CHP) or cogeneration systems must comply with the Tier 3 requirements to obtain the credit.

Boilers

NOx Conversion factors: Manufacturers should be asked to supply dry NOx emissions data in mg/kWh. Where this is not possible the applicant may use the following conversion factors to convert figures in ppm, mg/m³ or wet NOx. It should be noted that these conversion factors assume worst case efficiencies and are likely to give conservative answers. This could have the effect of lowering the number of credits achieved. See below for typical conversions;

- Figures in mg/m³ should be multiplied by 0.857 in order to gain emissions in mg/kWh. A conversion may also be necessary for data not calculated at 0% excess oxygen. (see below)
- Figures in parts per million (ppm) should be multiplied by 1.76 in order to obtain mg/kWh. A conversion may also be necessary for data not calculated at 0% excess oxygen. (see below)
- The Green Star SA criteria are based on dry NOx values – almost all manufacturers will quote emissions in dry NOx. However if wet NOx figures are supplied, these should be converted to dry NOx. This can be done by multiplying the wet NOx figure by 1.75.

Excess Oxygen Correction: If a NOx emission rate is quoted by the manufacturer in mg/m³ or ppm, then it should be established at what % excess oxygen this emission was made. The greater the amount of excess oxygen in the flue gases at the time of measurement, the more 'diluted' the NOx. It is therefore important to convert any emission rate back to 0% excess oxygen. For the purpose of Green Star SA, use the following conversion factors for the most frequently used rates supplied by manufacturers:

EMI-9 Boiler and Generator Emissions

POINTS
AVAILABLE**1**

% Excess O ₂	Conversion (c)
3 %	x 1.17
6%	x 1.40
15%	x 3.54

Table Emi-9,1: Conversion factors for Excess Oxygen

Conversion factor $c = 20.9 \div (20.9 - x)$

where x = % excess O₂ (NOT excess air) and 20.9 is the percentage of O₂ in the air.

Generators

United States EPA Tier 3 Non-Road Engine Emission Requirements

Engine size	Carbon Monoxide	Non methane hydrocarbons & oxides of nitrogen	Particulate matter
CO kW	NMHC+NO _x g/kWh	PM g/kWh	g/kWh
37 ≤ kW < 75	5.0	4.7	0.4 *
75 ≤ kW < 130	5.0	4.0	0.3 *
kW > 130	3.5	4.0	0.2 *

* based on Tier 2 standard (Tier 3 not ratified)

Table Emi-9,2: Tier 3 Generator compliance standards

Note that compliance with European Directive 2004/26/EC Stage IIIA is equivalent to compliance with the EPA Tier 3 standard.

BACKGROUND

Nitrogen Oxides (NO_x) emitted from the burning of fossil fuels contribute to the build up of local ozone levels and cause local pollution. They may also contribute to more wide scale pollution problems through deposition in the form of acid rain. The major contributors to local emissions come from transport, (covered elsewhere in Green Star SA); however boiler plant and generators in buildings do emit substantial levels of NO_x through normal operation, and these emissions can be reduced through careful specification of systems.

With an increasing reliance expected on locally generated electricity in South Africa in the short to mid term, it is important that electric generators are selected to minimize harmful emissions to the environment.

Use of mains electricity in buildings also leads to NO_x emissions at fossil-fuelled power stations, and due to the percentage of coal fired power stations, these are quite high in South Africa (averaged NO_x emissions 4300 mg/kWh from ESKOM annual report 2007).

EMI-9 Boiler and Generator Emissions

POINTS
AVAILABLE**1**

REFERENCES & FURTHER INFORMATION

British Standards EN 297:1994. A1:1995, A2:1996, A3:1996, A5:1998 and A6:2003 *Gasfired central heating boilers*, page 42, table 14, section 3.6.2

US Environmental Protection Agency
<http://www.epa.gov/nonroad-diesel/>

European Directive 2004/26/EC amending Directive 97/68/EC
<http://www.dieselnet.com/standards/us/nonroad.php>

TECHNICAL CLARIFICATIONS AND ERRATUM

The following TC/CIR's have been issued by the GBCSA in respect of this credit and will be incorporated into the credit over time. Please note that all TCIR's issued before the date of project registration are considered mandatory. Those issued subsequent to the registration of a project can be omitted or included at a projects discretion. Please ensure that you clearly note where such a TC/CIR is to be included.

Technical Clarification Number: EMI9-T-OB1-0082

Guidance: 2010-06-09

Generator additional guidance

Refer to the latest tables for emissions requirements from the United States EPA Tier 3 Non-Road Engine Emission Requirements on their website for Generators:

<http://www.epa.gov/OMS/standards/nonroad/nonroadci.htm>

In cases where Tier 3 is not yet ratified (and not shown in their tables) for a particular size generator, the generator must comply with the Tier 2 standards given in the EPA tables. As at December 2009, The European Stage IIIA standard is limited to generators below 560kW. Note that compliance with European Directive 2004/26/EC Stage IIIA is equivalent to compliance with the EPA Tier 3 standard.

Credit Interpretation Request Number: EMI9-C-OB1-0080

Ruling: 2010-06-09

Alternative emission standard

The Credit Interpretation Request (CIR) to deem the German 'TA Luft 2002' emission standard equivalent to the United States EPA Tier 3 emissions standard is granted conditionally on the project's ability to demonstrate the generator(s) compliance with all applicable pollutant (i.e. CO, PM and NOx) emission limits within the TA Luft 2002 emissions standard for the generator size, irrespective of

EMI-9 Boiler and Generator Emissions

POINTS
AVAILABLE**1**

whether the engine is to be used as an emergency/back-up unit or for the purposes of minimising peak electrical infrastructure load for less than 300 hours per year.

The following erratum has been incorporated:

EMI9-E-OB1-0128 (2011-01-06) Green Star SA - Office v1 Technical Manual: Page 347

INN-1 Innovative Strategies and TechnologiesPOINTS
AVAILABLE**10****AIM OF CREDIT**

This credit is 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 building 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 - Office projects applying that initiative will be permitted to be awarded innovation points. Where Design rated projects target the same innovation initiative in their As Built rating, this is considered 1 (one) project in the GBCSA's innovation register. 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 (www.gbcsa.org.za).

INN-1 Innovative Strategies and TechnologiesPOINTS
AVAILABLE**10****DOCUMENTATION REQUIREMENTS**

Green Star SA – Office
Submit all the evidence and ensure it readily confirms compliance.
1. Short report

Short report prepared by a suitably qualified individual 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 supports all claims.
- 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, letter from independent association/organisation 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 – Office 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.

INN-1 Innovative Strategies and TechnologiesPOINTS
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>

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/>

INN-2 Exceeding Green Star SA Benchmarks**POINTS
AVAILABLE****10****AIM OF CREDIT**

To encourage and recognise projects which 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 building assessment under Inn-1, Inn-2 and Inn-3 is ten (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Office
Submit all the evidence and ensure it readily confirms compliance.
1. Short report

Short report prepared by a suitably qualified individual 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 supports all claims.

INN-2 Exceeding Green Star SA Benchmarks**POINTS
AVAILABLE 10**

- 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, letter from independent association/organisation 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 – Office credits where relevant.

The metric used to demonstrate environmental benefit must be the same metric as the one used in the Green Star SA – Office credit that is being exceeded. For example if the building 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 – Office 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):

INN-2 Exceeding Green Star SA Benchmarks**POINTS
AVAILABLE****10**

Credit	Threshold required to eliminate environmental impact (one point)	Threshold required to have restorative environmental impact of at least 5% (two points)
Man-1 Accredited Professional	Full professional team are Accredited Professionals under the new buildings AP qualification.	Not available
Man-7 Waste Management	100% construction waste is diverted from landfill	Not available
IEQ-4 Daylight	Where 100% of the UA is completely daylight and there is no artificial lighting	Not available
IEQ-8 External Views	100% of the UA has external views.	Not available
IEQ-13 Volatile Organic Compounds	For all three categories of products under this credit all products used on the project have zero VOCs.	Not available
Ene-1	The building is a net zero energy building (energy neutral) - including tenant energy demands.	The building is a net positive energy building, and produces at least more than 5% of its energy demand that is used on a neighbouring project or fed into the supply grid.
Ene-3 Lighting Power Density	No artificial lighting is used in the usable area of the project.	Not available
Ene-5 Peak Energy Demand Reduction	The building has a completely flat daily load profile throughout the year.	The building consumes no energy from the grid throughout the year.
Tra-1 Provision of Car Parking	The building does not provide any parking for staff.	Not available
Tra-2 Fuel Efficient Transport	The building provides parking only to alternative	Not available

INN-2 Exceeding Green Star SA Benchmarks**POINTS
AVAILABLE****10**

	fuel vehicles and mopeds/motorbikes.	
Wat-1 Occupant Amenity Water	The building is a net zero water building (water neutral).	The building is a net positive water building, and produces at least more than 5% of its water demand that is used on a neighbouring project or fed into the water supply network.
Mat-2 Building Reuse	100% of the façade or structure is reused.	Not available
Mat-6 Steel	100% of structural steel and rebar is recycled	Not available
Mat-9 Design for Disassembly	100% of the structure is designed for disassembly	Not available
Mat-11 Local Sourcing	100% of the projects material and labour is sourced from within 400km radius of the site	Not available
Eco-1 Topsoil	Not available	Where the project after practical completion will create and provide top soil to neighbouring sites
Eco-4 Change of Ecological Value	Not available	Where the project significantly improves the ecological value of a neighbouring site as part of the project, that is at least 50% the size (in m ²) of the site on which the project is located.
Emi-5 Watercourse pollution	Where no storm water leaves the site boundary of the project.	Where the site acts as a storm water retention/detention facility for neighbouring site(s) that are at least a total of 50% the size (in m ²) of the site on which the project is located.

INN-2 Exceeding Green Star SA BenchmarksPOINTS
AVAILABLE**10**

Emi-6 Discharge to Sewer	Where no sewage water leaves the site.	Where the site acts as a sewage treatment facility for neighbouring site(s) that are at least a total of 50% the size (in m ²) of the site on which the project is located.

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>

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/>

INN-3 Environmental 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 implemented in the building 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 www.gbcsa.org.za

DOCUMENTATION REQUIREMENTS**Green Star SA – Office**

Submit all the evidence and ensure it readily confirms compliance.

1. Short report & any other relevant documentation requirements that form part of the credit-specific documentation requirements

Short report prepared by a suitably qualified individual 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 in this rating tool, and why relevant for this building type/project;
- Articulating the nature and quantifying the environmental benefit achieved by the initiative(s);

INN-3 Environmental Initiatives

POINTS
AVAILABLE **10**

- 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

INN-3 Environmental 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

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/>