TECHNICAL MANUAL GREEN STAR SA

MULTI UNIT RESIDENTIAL v1

Multi Unit Residential Design / As Built v1

GREEN BUILDING COUNCIL SA

greenstar
Multi Unit Residential v1
★★★★★★
GREEN BUILDING COUNCIL
OF SOUTH AFRICA

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Table of Contents

INTRODUCTION ..... **V**
Authorisation & Disclaimer v
Acknowledgements vii
Green Star SA Credits xi
Green Star SA – Multi Unit Residential v1 Rating Tool xv
Green Star SA Certification xvii
Green Star SA Updates & Feedback xxv
Glossary xxvii
Technical Manual & Submission Guidance xlvii
Credit Summary Table liii
MANAGEMENT **1**
INDOOR ENVIRONMENTAL QUALITY **45**
ENERGY **111**
TRANSPORT **161**
WATER **187**
MATERIALS **217**
LAND USE AND ECOLOGY **269**
EMISSIONS **319**
INNOVATION **359**
APPENDIX A - WEIGHTINGS **373**

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Authorisation & 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 Working Groups, Advisory Groups and Committees.

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Acknowledgements

GREEN STAR SA – MULTI UNIT RESIDENTIAL V1

The Green Star SA – Multi Unit Residential v1 rating tool provides for both Green Star SA – Multi Unit Residential Design and Green Star SA – Multi Unit Residential As Built ratings, through separate documentation paths. The tool has been adapted from the Australian Green Star – Multi Unit Residential v1 tool and the South African Green Star SA – Office v1 and Retail v1 tools, under license from the Green Building Council of Australia and the Green Building Council of South Africa. 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 parties who have worked on and supported the development of the Green Star SA – Multi Unit Residential v1 rating tool.

SPONSORSHIP

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SUPPORT

The Green Building Council of South Africa acknowledges the Green Building Council of Australia in providing their Green Star intellectual property.

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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 fitout) and for different building classes (office, retail, healthcare, education, residential, industrial, public buildings etc.).

Green Star SA has built on existing systems and tools in overseas markets, most notably the Green Star system developed by the Green Building Council of Australia (GBCA), by adapting and establishing individual environmental measurement criteria relevant to the South African marketplace and environmental context.

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

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

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Green Star SA Credits

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

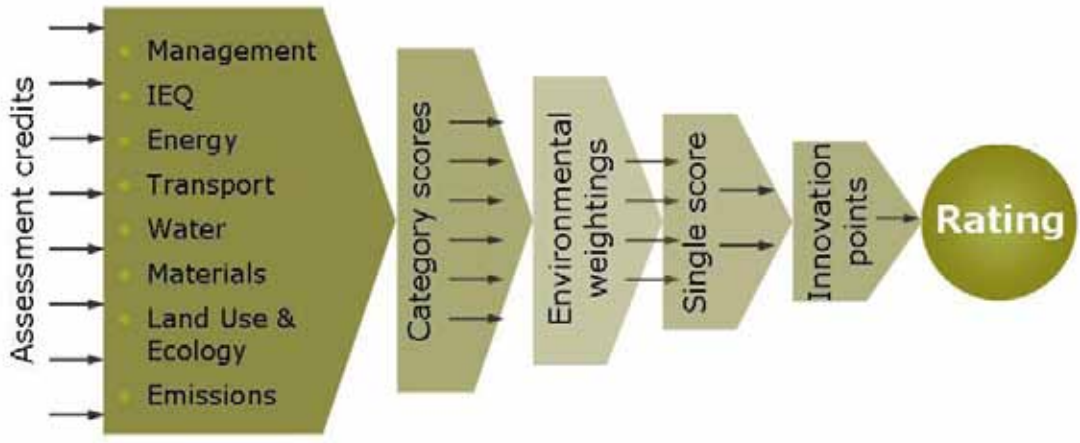

***Figure 1**: Structure of the Green Star SA rating system*

Green Star SA 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.

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Green Star SA Credits

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 opinion. The 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.

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.

Category Score

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

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

For example, if 10 Energy points are achieved out of a total available of 32 then the Category Score is 31.3%.

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:

Weighted Category Score = Category Score (%) x Weighting Factor (%) x 100.

Using the example provided in the Category Score section above, the Weighted Category Score for Energy, with a weighting factor of 28%, is 0.313 x 0.28 x 100 = 8.75.

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, making the maximum attainable score in Green Star SA 105.

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

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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.

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 – Multi Unit Residential , 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.

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Green Star SA – Multi Unit Residential v1 Rating Tool

Green Star SA – Multi Unit Residential validates the environmental initiatives of the design phase of new multi unit residential construction or base building refurbishment; or construction and procurement phase of a multi unit residential development.

Green Star SA – Multi Unit Residential v1 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 improve awareness and encourage more efficient operational use);
- 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 multi unit residential development or base building refurbishment. The same Green Star SA - Multi Unit Residential tool is used for both Design and As Built certifications, but different documentation is required from the project team. The Green Star SA – Multi Unit Residential 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. The Green Star SA – Multi Unit Residential As Built certification assess 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 Green Star SA – Multi Unit Residential Design and Green Star SA – Multi Unit Residential As Built is that the documentation required to verify environmental initiatives varies depending on whether the project is at the design phase or has been constructed.

It is important to note that the Green Star SA – Multi Unit Residential Technical Manual addresses both the Green Star SA – Multi Unit Residential Design and Green Star SA – Multi Unit Residential As Built certification in one Technical Manual.

ASSESSMENT CREDITS

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

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

- Aim of Credit;
- Credit Criteria;
- Documentation Requirements;
- Additional Guidance;

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- Background; and
- References.

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 cannot be addressed and are not applicable to the project.

For example, dwellings may be predominantly of masonry construction with no significant steel content. In this case, it would be impossible to demonstrate that steel used had any recycled content. In this instance, points awarded for recycled steel content would be 'not applicable' to the project and would not contribute to the overall project weighted score.

CONDITIONAL REQUIREMENTS

Green Star SA – Multi Unit Residential v1 has two criteria that must be achieved (known as 'Conditional Requirements') in order to obtain a Green Star SA – Multi Unit Residential v1 certified rating. The Conditional Requirements fall within the Energy and Land Use & 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 – Multi Unit Residential v1 to benchmark the operational performance of buildings and, as a result, the tool provides comparable benchmarked outcomes rather than estimates of actual performance.

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Green Star SA Certification

A development cannot publicly claim a Green Star SA rating unless the GBCSA has certified the rating. The GBCSA will commission two 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 – Multi Unit Residential v1 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 six provisions of the Green Star SA Eligibility Criteria detailed below.

1. Spatial Differentiation
2. Space Use
3. Conditional Requirements
4. Timing of Certification
5. Minimum Dwellings, Common Property and Governance Schemes
6. Development Delivery

CONFIRMING ELIGIBILITY

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

Whenever unsure, Project Teams can request an eligibility confirmation from the GBCSA by forwarding a brief description of the project to 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.

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ELIGIBILITY CRITERION 1: SPATIAL DIFFERENTIATION

To be eligible for a Green Star SA Multi Unit Residential rating, the development must be clearly distinct. A Green Star SA rating must provide a meaningful result, and send a clear message to the marketplace, about a distinct project. Only distinct projects are eligible for assessment; project components are not eligible.

Shared building services (such as electrical, 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. For further information, refer to the 'Guidelines for Interdependent Projects' in the 'Technical Manual & Submission Guidance' of the Technical Manual.

The following describes projects that meet this Eligibility Criterion:

- Functionally autonomous buildings that are:
  - Freestanding; or
  - On top of public infrastructure (e.g. transport hubs); or
  - Connected to other buildings for secondary access only; or
  - Laterally adjacent to other functionally autonomous buildings; or
  - Buildings that are being extended.
- Building extensions (see 'Options for Building Extensions' below).
- Multiple building developments (See 'Options for Multiple-Building Developments' over page).

Options for Building Extensions:

There are two options available for an assessment of a building extension:

1. The building extension and the initial building are rated as one building; OR
2. The building extension is rated separately.

Where the building extension is rated separately, the Green Star SA rating will only relate to and can only be marketed for the extension, as will be made evident in the registered name of the project, and will not extend to the remainder of the building or any part thereof.

The primary building does not need to have, or qualify for, a Green Star SA certified rating in order for the extension to be eligible.

A project can qualify for assessment as a building extension if it meets all of the following criteria:

- The extension has full functional independence from the initial building;
- The extension has a distinct address or name (e.g. 'West Wing');
- The initial building's main function is not to service the extension;
- If the project scope includes work to the initial building, it only includes refurbishment or modification to the initial building's spaces/structures that support the extension. If

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the modifications affect primary spaces/structures in the initial building, the entire development will be deemed one building;

- There is a clearly defined 'Project site' used consistently throughout the submission:

  i. for a vertical extension, the 'site' will be defined as the area occupied by the extension's footprint only; or
  ii. for a lateral extension, the 'site' will be defined as the area occupied by the extension's footprint plus adjacent area extending to the boundary of the site of the initial building;

- All services and incoming mains supplies are separated or sub-metered (or the entire system(s) must comply with the applicable Credit Criteria); and

- Either of the following attributes applies to the extension:

  i. It has a different street address from the initial building; OR
  ii. It accounts for at least 20% of the total GFA.

Options for Multiple-Building Developments:

It is recognised that developments are commonly split over several buildings. Such developments have the following options for Green Star SA assessments:

1. Single building certification, where selected buildings, which satisfy the minimum number of dwellings requirement, individually undergo assessment and receive individual ratings; OR
2. Single certification for multiple buildings, where all the buildings are certified at the same time and awarded one rating.

A multiple-building development can be eligible for a single rating if it meets all the following criteria:

- It is under one ownership OR under single property management and control;
- It is recognised by a distinct name;
- It represents one project scope (even if buildings within that scope are completed at different times); and
- All buildings on the site are included in the project submission.

For the purposes of Green Star SA – Multi Unit Residential certification, ‘the project’ may consist of the entire development or part thereof as outlined below:

- Where the development consists of multiple, visually distinct residential buildings which are not detached single dwelling units or semi-detached double dwelling units (duplexes), and each building contains a minimum of 3 dwelling units each, INDIVIDUAL, a

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COMBINATION OF or ALL buildings can be registered as “the project” for assessment under Green Star SA - Multi Unit Residential v1;

OR

- Where the development contains a minimum of 3 dwelling units in total and consists of multiple visually distinct residential buildings where each building is either a detached single dwelling unit or semi-detached double dwelling unit (duplex), ALL buildings must be registered as “the project” for assessment under Green Star SA - Multi Unit Residential v1;

  OR

- Where the development is mixed use, the residential component of the development can be registered as “the project” provided the residential component is visually distinct (i.e. a separate building or wing) from all other space types; single buildings consisting of less than 80% residential GFA (as defined in the glossary) cannot be registered as “the project”.

ELIGIBILITY CRITERION 2: SPACE USE

To be eligible for a Green Star SA Multi Unit Residential rating the development must include a minimum of 80% of GFA (measured to exclude internal car parks) comprised of residential usage (SABS 0400 occupancy class ‘H3 domestic residence’). This includes new developments; major refurbishments of existing multi unit residential developments; and conversions to multi unit residential use.

The following types of multi unit residential developments are within the scope of the Green Star SA – Multi Unit Residential v1 tool;

- Apartment buildings;
- Blocks of flats;
- Townhouses;
- Detached or semi-detached single access housing developments consisting of three or more dwellings (e.g. gated communities, retirement villages etc.);
- Self-catering student accommodation; and,
- Multi-family dwellings (i.e. communal living), which would include communal kitchen/living/ablution facilities to a maximum of 9 bedrooms per kitchen facility.

Development types currently excluded from the scope of the Green Star SA Multi Unit Residential rating tool include: freehold single detached or semi-detached dwelling units with no common property or governance schemes; hotels; motels; nursing homes; and fully catered boarding houses/dormitories.

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 ecological value). Regardless of how many other credits the development claims, it will not be eligible for a Green Star SA rating unless all of the Conditional Requirements are met.

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Green Star SA Certification

There are two Conditional Requirements in Green Star SA – Multi Unit Residential v1:

- Ene-0 Conditional Requirement (refer to the Energy Category for further details);
- AND
- Eco-0 Conditional Requirement (refer to the Land Use & Ecology Category for further details).

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 must be achieved 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.

ELIGIBILITY CRITERION 5: MINIMUM DWELLINGS, COMMON PROPERTY AND GOVERNANCE SCHEMES

To be eligible for a Green Star SA Multi Unit Residential certified rating, the development must include the following:

- Three or more dwelling units, either attached, semi-detached or detached;
- Common property, shared services and infrastructure among dwellings; and
- When completed, a governance scheme as per 'Sectional Title', 'Home Owners or Property Owners Association', 'Share Block' or 'Fractional Ownership' (and the applicable Acts), or an equivalent 'Management Entity'.

Projects which consist of one or two dwelling units, either attached, semi-detached or detached, or those which do not have common property or governance schemes cannot register for assessment under Green Star SA - Multi Unit Residential.

ELIGIBILITY CRITERION 6: DEVELOPMENT DELIVERY

The Green Star SA - Multi Unit Residential rating tool can only be used for developments where design AND construction of all dwellings lies under complete control of a single developer or owner.

The Green Star SA - Multi Unit Residential rating tool cannot be used to rate the environmental attributes of 'design manuals' for multi unit residential estates where individual owners engage separate design teams.

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Green Star SA Certification

CERTIFICATION PROCESS

Up to date information on the Green Star SA certification process is outlined in detail on the GBCSA website (www.gbcsa.org.za). Templates, forms and checklists are available on this website to guide projects through the process.

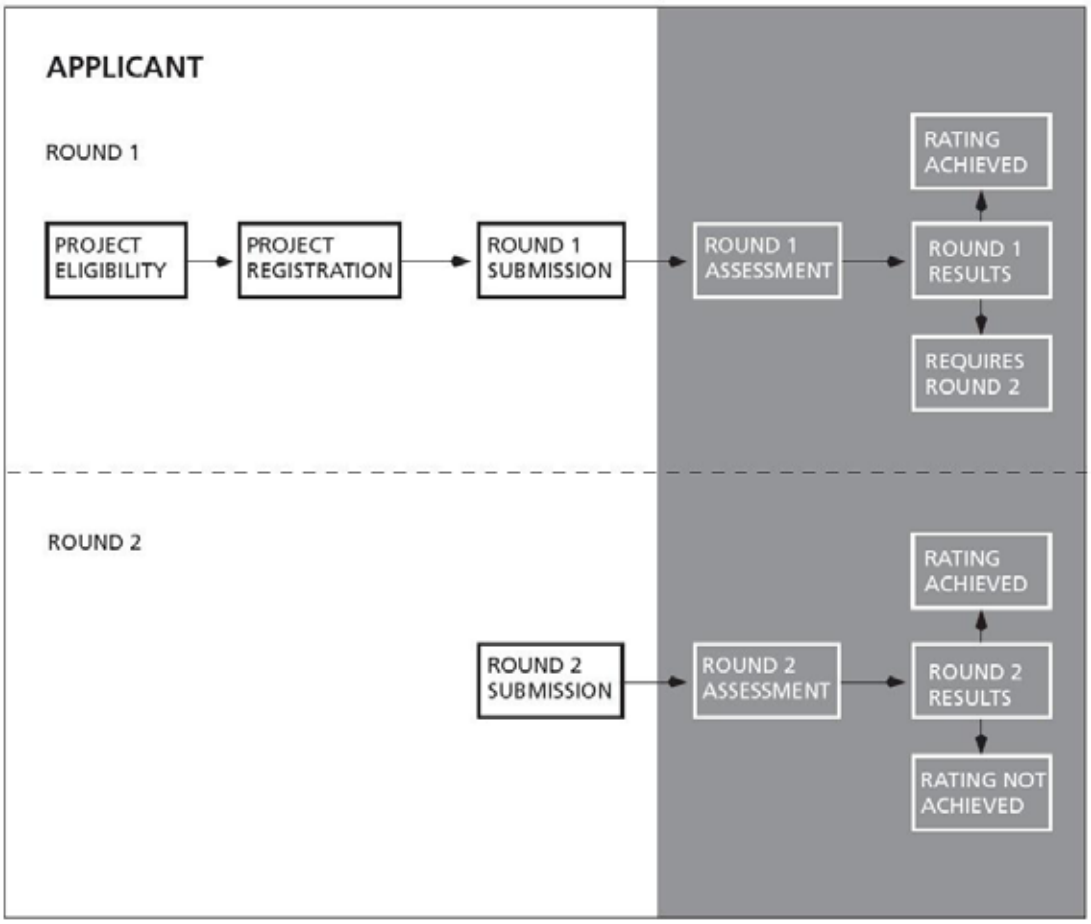

Figure 2: *Overview of certification process (adapted from GBCA).*

Registration

Registering a project with the GBCSA declares the intent to pursue certification under a specific rating tool and is the first step in the certification process. Registration establishes a connection with the GBCSA and gives the project access to essential information and assistance with the submission process. Projects should register as soon as possible during the project, though there is no deadline during the design or construction process. Registration takes place through a form in the Green Star SA certification section of the GBCSA website (www.gbcsa.org.za).

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Green Star SA Certification

Part one of the Certification Fee (50%) must be paid to the GBCSA upon registration of a project, and an executed Certification Agreement (sent to the project owner upon registration) must be received by the GBCSA to finalise a project's registration. Details of the Certification Fees can be found on the GBCSA website. Part two of the certification fee – the other 50% - is due when the project submits for Round 1 certification.

Please note that registering a project simply declares the intent to pursue certification and should not be confused with actual project certification which is awarded by the GBCSA once a project has demonstrated its achievement of a certain rating level.

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 documentation 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 – Multi Unit Residential v1 Technical Manual as there are only two rounds of Assessment.

Assessors will not award the point(s) unless it is demonstrated that all the requirements have been met exactly as detailed in the Technical Manual. See the GBCS website for the most up to date templates and submissions forms.

Round 1 Submission

From the date of receipt of the Round 1 submission at the GBCSA offices, the GBCSA provide the Round 1 assessment results in 7 weeks.

Part two of the Certification Fee (50%) must be paid to the GBCSA on or before the Round 1 submission date, and projects must also provide the completed Round 1 pre-submission checklist found on the GBCSA website when they submit.

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

The GBCSA will conduct a pre-assessment submission quality review of a project submission prior to the commissioning of a review by the Assessors. A project may be required to resubmit the submission prior to Round 1 assessment if the submission quality review suggests that the quality of the submission would result in an erroneous or extended assessment. There is no fee associated with the pre-assessment completed by the GBCSA.

Round 1 Assessment

The Assessment Panel, containing two third-party Assessors, 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.

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Green Star SA Certification

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.

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

Projects must also provide the completed Round 2 pre-submission checklist found on the GBCSA website when they submit.

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.

Certified Rating not Awarded

If a desired Certified Rating is not achieved, the project may be eligible to Appeal select credits for a fee to re-asses. Please contact the GBCSA for further details.

Technical Clarifications and Credit Interpretation Requests

The Green Star SA Technical Clarifications (TC) and Credit Interpretation Request (CIR) rulings provide an essential source of information to all projects undertaking Green Star SA assessment. They are available on the GBCSA website (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 Credit Criteria/Additional Guidance of the relevant Technical Manual.

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Green Star SA Updates & Feedback

Updating the Green Star SA – Multi Unit Residential rating tool

Green Star SA – Multi Unit Residential v1 was developed on the basis of information available at the time of its development. Some issues have not been addressed in Green Star SA – Multi Unit Residential v1 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; and
- Lack of standards of measurement in South Africa and availability of suppliers' data (e.g. material toxicity).

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

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

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

Feedback on Green Star SA – Multi Unit Residential v1

The GBCSA encourages feedback on all Green Star SA rating tools, including Green Star SA – Multi Unit Residential v1.

Feedback is to be sent to greenstarsa@gbcsa.org.za for consideration by the GBCSA.

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Glossary

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

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

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

Admittance
A measure of how easy it is for heat to be absorbed/emitted by a construction: the rate of heat flow between the internal surface of a construction and the environmental temperature in the space, for each degree of deviation of the space temperature about its mean value (W/m^2K).

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.*

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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.

Breeze Path
A continuous path which connects ventilation openings across a space, and shows how air can flow through the space.

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.

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

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

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

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

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Glossary

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 fossil 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 advancement of an installation from the state of static completion to full working order to the specified requirements. It includes the setting to work of an installation, the regulation of the system and the fine tuning of the system.

Common Living Area
Deemed to include formal or informal lounges, TV/multimedia rooms and dining areas.

Common Property
Typically common property can be defined as any structure or building service that lies outside of the privately owned dwellings, which is managed by the Management Entity. The Common Property is owned by each individual owner within the Management Entity, in undivided shares and is controlled by the Management Entity.

Common Property Services
Services for which the operation and maintenance are the responsibility of the Management Entity and include, but are not limited to, centralised HVAC systems, common property lighting and control systems, centralise water harvesting and reuse systems (i.e. rain, grey or black water), onsite energy generation systems (renewable or otherwise), centralised hot water systems, building management systems (or equivalent), car park ventilation systems, lifts etc.

Compulsory Initiative
A compulsory design initiative which must be included within a development to satisfy a Conditional Requirement of the Green Star SA Multi Unit v1 Residential rating tool.

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

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.

Contract Value
The Rand value that will be required to complete the works for the entire project, including site works (landscaping, external paving, etc). The contract value must include contractor fee, contingencies and any other items included as part of the contract amount, but exclude demolition works, consultants fees, design fees, project management fees, VAT, works outside the site area, and buildings or areas within the site that are not being assessed for purposes of Green Star SA. In the Green Star SA Multi Unit Residential v1 tool the contract value excludes occupant allowances, even if these form part of the contract value.

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

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

Conventional Delivery
Finishes and services are applied to common areas. Tenancies are delivered with ceilings, floor coverings and lighting systems (no paint). Ducts from air supply and return risers, electrical and hydraulic services are installed above the ceiling from the riser throughout the tenancy areas.

Common Area
See 'List of Areas', 'Technical Manual & Submission Guidance' Section

CPRT
See Current Public Transport Record

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

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

Credit Interpretation Request
Credit Interpretation Requests are submitted prior to assessment by a project that clearly meets the Aim of Credit but does not adhere to the stated Credit Criteria of the relevant

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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.

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

Current Public Transport Record
A survey of public transport undertaken regularly by Local and District Municipalities as mandated by National Government.

Curtilage
The ground adjacent to a dwelling and appertaining to it, as a yard, garden, or court.

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
See Department of Environmental Affairs and Tourism (South Africa).

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 recycling and minimises the amount of waste landfilled.*

Deemed Occupancy
The number of occupants deemed to reside in a dwelling / development, based on the type and size of residential unit(s). Refer to the introduction, credit criteria and modelling protocol guides for the definition of deemed occupancy.

Deemed to Satisfy
Prescriptive provisions which satisfy performance requirements, or stated level of performance.

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

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

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

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

Design Team
The professionals normally engaged in the design and contract administration of a building project. These typically include architects, engineers (e.g. structural, civil, mechanical, electrical, hydraulics, fire etc.), project manager, cost consultant and building surveyor plus

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other specialists including green building consultant, landscape architect, acoustics consultant, façade engineer, lighting consultant, etc.

Development Footprint
The extent of all disturbance to the site, including hardscape footprint (building footprint, parking areas, roads and all paved or sealed surfaces), construction related disturbances and softscape footprint (landscaping and water detention & treatment areas) excluding areas of natural or rehabilitated vegetation.

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
See Department of Health (South Africa).

DOT
See Department of Transport (South Africa).

DTS
See Deemed to Satisfy.

DWA
See Department of Water Affairs (South Africa).

Dwelling
For the purposes of Green Star SA, a self-contained residential unit provided with adequate sanitary and cooking facilities, having a class of occupancy or building as 'H3 Domestic Residence' as per SABS 0400-1990.

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

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.*

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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 Agency – See http://www.epa.gov.

EMP
Environmental Management Plan.

EMS
Environmental Management System.

Environmental Tobacco Smoke
Also known as second-hand 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

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

Extension
A wing or structure added to an existing building.

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

Forestry Stewardship Council
See http://www.fsc.org.

FFL
Finished Floor Level.

Free Area
The geometric open area of a ventilation opening.

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

FSC
See Forest Stewardship Council.

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

GBCSA
See Green Building Council of South Africa.

GFA
See 'List of Areas', 'Technical Manual & Submission Guidance' Section.

Gross Floor Area
See GFA.

GHG
See Greenhouse Gas.

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

Greenbelt Zones
Zones or areas in or around a city where the removal of native vegetation is prohibited and/or parks and other open, undeveloped, and vegetated space is protected.*

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

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

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

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 Gas
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.*

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

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

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

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.*

Habitable Area / Habitable Space / Habitable Room
See 'List of Areas', 'Technical Manual & Submission Guidance' Section.

Hardscape
Pavers, sidewalks, raised planters, retaining walls, site furnishings and other non-living design elements used to enhance landscaped areas.

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
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.*

HDPE
See High Density Poly Ethylene.

High Density Poly Ethylene
A type of plastic that can be used to make pipes and other plastic products as an alternative to PVC.

HVAC
See Heating, Ventilation and Air Conditioning.

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

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

IEQ
See Indoor Environment Quality.

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
Covers issues such as indoor air quality, thermal comfort, illumination, daylight, views, acoustics and occupant control of building systems.

Integrated Fitout
A fitout 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.

Interdependent Projects
Projects that share services and amenities.

IPCC
See Intergovernmental Panel on Climate Change.

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

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

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Leadership in Energy and Environmental Design
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.

LEED
See Leadership in Energy and Environmental Design.

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

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

Light Pollution
Waste light from buildings that is directed upward to the sky or is directed away from the site.

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

Management Entity
A management structure that is responsible for management of the multi unit residential development after completion. This may include a Body Corporate, Home Owners or Property Owners Association or other management bodies.

Material Cost
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, VAT or any other amounts.

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

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

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 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.

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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.

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

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 (borehole 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.

Occupant Users' Guide
A simple and easy to use non-technical guide for the dwelling occupant, that, through practical recommendations, encourages the use of the green building features of the design.

Occupancy
See Deemed Occupancy.

ODP
See Ozone Depleting Potential.

OECD
See Organisation for Economic Co-operation and Development

OHS
Occupational Health and Safety.

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

Organisation for Economic Co-operation and Development
See www.oecd.org.

Ozone (O_3)
A naturally occurring, highly reactive, irritating trace gas comprising of tri-atomic oxygen formed by recombination of oxygen in the presence of ultraviolet radiation.*

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

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

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

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

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

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

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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.

PMV
See Predicted Mean Vote.

PPD
See Predicted Percent Dissatisfied.

Poly Vinyl Chloride
A form of plastic that is used typically in buildings for electrical tubing, electrical insulation around wires and piping for plumbing installations. It is also sometimes used in carpets and other building materials.

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.

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

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 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).

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

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

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

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

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

Project Value
See 'Contract Value'.

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

PVC
See Poly Vinyl Chloride.

RBZ
See Riparian Buffer Zone.

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).

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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.*

Redevelopment
The restoration and improvement of an existing structure or property.

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
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.

Relevant Project Team Member
A member of the Project Team; no specific profession or skills are required for the purpose of 'Documentation Requirements'.

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).*

Rentable Area
See 'List of Areas', 'Technical Manual & Submission Guidance' Section.

RH
See Relative Humidity.

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

Rules
The rules implemented for the control, management and administration of the common property within a multi unit residential development.

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.

Shared Dwelling
A self-contained residential unit with up to 9 bedrooms, some or all of which are designed to be rented or owned individually. The unit must contain bathroom(s), kitchen(s) and living/dining area(s).

Shared Services
See Common Property Services.

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

Site
See Project Site.

Solar Reflectance Index
A value that incorporates both solar reflectance and emittance in a single value to represent a material's temperature in the sun. SRI quantifies how hot a surface would get relative to standard black and standard white surfaces. It is calculated using equations based on previously measured values of solar reflectance and emittance as laid out in the American Society for Testing and Materials Standard E 1980. It is expressed as a fraction (0.0 to 1.0) or percentage (0% to 100%).

South African Bureau of Standards
See http://www.sabs.co.za

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

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South African Institute of Architects
See http://www.saia.org.za

South African Property Owners Association
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).*

SRI
See Solar Reflectance Index

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

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

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

TFG
See Tenancy Fitout Guide.

TRY
See Test Reference Year.

TWG
See Technical Working Group.

Technical Working Group
An advisory panel convened by the GBCSA and designated as the 'Technical Working Group'.

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

Test Reference Year
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.

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Thermal Envelope
For the purposes of Green Star SA, the parts of a dwelling's fabric that separate a conditioned space or habitable room from the exterior of the dwelling or a non-conditioned space (e.g. garage, store room, plant room, machine room or the like).

Thermostatic Control
A device which measures the room temperature and automatically switches the heating/cooling system on and off according to the set point temperature which can be adjusted by the occupant(s).

Timeclock Control
A device which allows the occupant(s) to set times at which a specific system (e.g. geyser or HVAC system) is switched on and off. Both one day (24 hour) and 7 day timeclock controls are available, the latter allowing different settings to be used at weekends.

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

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

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

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

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
See Visual Light Transmittance.

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

VOC
See Volatile Organic Compounds.

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

Waste Management Plan
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.

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Glossary

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 work setting for each two chairs provided.

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

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

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Technical Manual & Submission Guidance

A GUIDE TO THE STRUCTURE OF GREEN STAR SA CREDITS

Aim of Credit

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

Credit Criteria

Explains clearly how the Aim of Credit section is to be met. Where the Aim of Credit is the guiding principle, Credit Criteria outlines measures that must be undertaken within a project to achieve it. It is important to read this section carefully as every project must meet the criteria outlined in this section for the credit to be awarded. 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 Assessors.

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

Each credit has a submission checklist that lists the documentation requirements for the assessment of a 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. 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. All information in Additional Guidance is mandatory. The Assessors reserve the right to determine whether or not the project needs to meet the requirements of this section.

Background

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

References & Further Information

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

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LIST OF AREAS

Gross Floor Area (GFA)
The total floor area of all parts of a building that are permanently covered and can be protected from the elements but excluding car parking areas, measured at each covered floor level over the external walls to the external finished surface. For the purposes of the Green Star SA submission, Gross Floor Area must be calculated as the building Construction Area, less the area of car parking, as per Section 4.2.1 of the SAPOA publication '*Method for Measuring Floor Areas in Buildings*[1]'. Gross floor area should be defined and used consistently throughout the Green Star SA submission.

Rentable Area (RA)
Rentable Area must be calculated as per Section 4.2.2 of the SAPOA publication '*Method for Measuring Floor Areas in Buildings*'. The rentable area should exclude 'supplementary areas' which are deemed those areas attached to or exclusively servicing the main dwelling such as patio (open or closed), parking garage and storage areas and staff quarters. Rentable area should be defined and used consistently throughout the Green Star SA submission.

Habitable Area (HA)
An area, space or room used for normal domestic activities and;

- Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room and sun room; but
- Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes-drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.

Habitable area must be measured within the finished surfaces of bounding walls. Habitable area should be calculated for all dwelling types and used consistently throughout the Green Star SA submission.

Floor Area (FA)
Either habitable or non-habitable area measured within the finished surfaces of bounding walls (generic).

Common Area (CA)
Deemed non-dwelling areas for the use of more than one dwelling. Includes, but is not limited to; internal corridors and passages, internal lobbies, internal stairwells (fire escape or otherwise), internal spaces used for communal activities (e.g. meeting room, gyms, libraries, theatre rooms, media rooms etc.), caretaker/management or other similar spaces. The measurement of individual dwellings shall exclude common areas. Common area should be calculated for the development and used consistently throughout the Green Star SA submission.

[1] *Method for Measuring Floor Areas in Buildings, South African Property Owners Association (SAPOA), 2005.*

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Technical Manual & Submission Guidance

DWELLING TYPES

To simplify Green Star SA – Multi Unit Residential v1 submissions, if the development includes a number of dwellings which are identical or almost identical, these dwellings can be considered as of the same 'dwelling type'. The submission is therefore completed for each dwelling type. Data is only entered into the 'Building Input' page and Ene-1 Energy, Wat-1 Water and Ene-7 Hot Water calculators for each dwelling type.

To be considered a 'dwelling type', all applicable dwellings must comply with the following:

- Layout - similar floor plans and ceiling heights. It is acceptable for dwellings that are mirror images of each other to be considered as the same dwelling type provided the glazing complies with the requirement below;
- Rentable Area – Within ± 10%;
- Fabric – Identical construction for walls, ceiling, floors etc.;
- Orientation – Main orientation within ± 25° of each other;
- Glazing/windows – Total glazed area within ± 5% for each façade;
- Exposure – External walls/ceiling/floor should be the same (i.e. a ground floor flat cannot be considered the same type as a first floor flat);
- Overshadowing – Similar shading conditions;
- Building Services – Identical heating and cooling systems;
- Amenity fittings – Identical water efficiency performance of taps, bath size, showers, toilets etc.

Within the 'General' section of a Green Star SA – Multi Unit Residential v1 submission, all dwelling types, and justification of, must be demonstrated. Project Teams' must ensure that all dwelling types identified fully comply with the above requirements.

DWELLING OCCUPANCY

Each dwelling type must be assigned as either 'Private' or 'Shared' as follows:

- Private Dwelling – A self-contained residential unit designed to accommodate a single household;
- Shared Dwelling – A self-contained residential unit with up to 9 bedrooms, some or all of which are designed to be rented or owned individually by related or non-related people. The unit must contain bathroom(s), kitchen(s) and living/dining area(s).

The primary difference in the Green Star SA - Multi Unit Residential v1 tool is the deemed occupancy assigned to the two types. In the case of a private dwelling, occupancy of 2 people in the master bedroom plus 1 person per additional bedroom is assumed. In the case of a shared dwelling, a higher occupancy of 2 people per bedroom is assumed.

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A 'shared dwelling' effectively acts as a flat or dwelling of up to nine bedrooms. Hence any references within the Green Star SA – Multi Unit Residential v1 Technical Manual to a 'dwelling' or 'dwelling type' include such communal living units.

For example, a new twenty room commune is proposed and wishes to seek a Green Star SA certified rating. The proposal is a four level building with each level containing a kitchen, a living area and ablution facilities, to serve the five rooms on the level. For the purpose of Green Star SA – Multi Unit Residential, the commune can be considered as a building with 4 self-contained 'shared dwellings', each with five bedrooms. All Credit Criteria are applicable on a per dwelling basis, not per 'room'.

GUIDELINES FOR INTERDEPENDENT PROJECTS

If well-designed and operated, shared services and amenities can result in outcomes which are superior to individual solutions. The following guidelines apply to any shared services and amenities which are shared by buildings not included in the project submission:

Energy generation, refrigeration and water treatment services

- Both shared and off-site services can contribute to a project's Green Star SA rating; however, in all cases a Credit Interpretation Request (CIR) must be submitted to initiate a GBCSA ruling on the manner in which the Certified Assessors are to evaluate compliance.

- The GBCSA strongly supports the use of shared/ centralised energy or treatment facilities (sometimes beyond the site boundary of the development being assessed). Energy, Water and Emissions credits can be achieved with a shared infrastructure as long as the use of such facilities by the development seeking Green Star SA certification is not subject to operational uncertainty.

- For shared mechanical plants, projects must justify how the plant is apportioned; energy modelling is then conducted for the building as if it were served by a dedicated plant.

- For grey and blackwater treatment facilities, which are shared with other developments that are not included in the submission, projects must justify how the treatment plant is apportioned.

As Green Star SA rating tools assess the inherent attributes of buildings, external amenities can only be rewarded if they are provided for the life of the development to the same degree of service and certainty as internal facilities. As a result, the following applies to amenities that are located on separate premises:

- The scope of assessment is not extended beyond the assessed development, 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 will be assessed against the Credit Criteria of the credit towards which they contribute;

- The assessed development and the amenities must be under the same ownership and cannot change ownership separately (i.e. they are on the same title or equivalent);

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- The assessed development and the amenities must be 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 amenities must be completed by the date of practical completion of the assessed development; and
- The amenities must fully meet the Credit Criteria and be documented in strict accordance with the Technical Manual.

Should any of the above conditions not be met, the external amenities cannot contribute to the development's Green Star SA rating unless a Credit Interpretation Request (CIR) is submitted to the GBCSA and granted to acknowledge alternative yet equivalent compliance.

SUBMISSION GENERAL SECTION

In addition to the documentation which must be submitted as per the 'Documentation Requirements' stipulated for each credit, the project' Green Star SA submissions (both Round 1 and Round 2) must contain a 'General Section' containing the following information:

Project overview document which provides a brief summary and description of the project. This need not be detailed, however should contain enough information to allow the Assessors to become familiar with the project prior to the assessment (a project brief would suffice).

Project program document clearly demonstrating the key dates of 'Schematic Design', Design Development', 'Contract Documentation', Tender, Construction Commencement and Practical Completion.

Architectural drawings clearly issued 'For Tender', 'For Construction' or 'As Built' (as appropriate), including the following;

- Plan drawings of all levels, marked-up to show the rentable area of each dwelling;
- Elevation drawings of all facades;
- Section drawings (where applicable)

Building services drawings clearly issued 'For Tender', 'For Construction' or 'As Built' (as appropriate), including the following;

- Mechanical services drawings;
- Electrical services drawings; and,
- Wet services drawings.

Where a building service is included on the architectural drawings (above) it is not necessary to re-submit.

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Site documentation comprising of either**;**

- A site plan identifying the existing building(s) or structure(s) (if present), the extent of both the development footprint and the boundary of the project site (for the purposes of the Green Star SA submission) and the erf size, all (in m^2);

  OR

- An aerial photograph generated at, or prior to, site purchase, identifying the existing building(s) or structure(s) (if present), the extent of both the development footprint and boundary of the project site (for the purposes of the Green Star SA submission) and the erf size, (in m^2).

Area schedule identifying the development area parameters, including the site area, development footprint area, landscape area, building footprint area, Gross Floor Area (GFA), Rentable Area (RA) and Common Area. This information must correlate with that entered into the 'Building Input' page of the Green Star SA – Multi Unit Residential v1 rating tool spreadsheet.

Dwelling schedule for all dwellings in the development, clearly identifying the dwelling types as entered into the 'Building Input' page of the Green Star SA – Multi Unit Residential v1 rating tool spreadsheet. For each dwelling, the schedule must list the rentable area, fabric construction, main orientation, glazing area ratio for each façade, building services (heating & cooling) and amenity fitting details. It must be evident from the dwelling schedule that the number of 'dwelling types' defined are justified and accurate.

Rating tool spreadsheet in the form of the spreadsheet file, with all credits and calculators completed (as applicable).

GBCSA correspondence between the GBCSA and the Project Team pertaining to general queries, Technical Clarifications (TCs) or Credit Interpretation Requests (CIRs).

Statement of confirmation from the Green Star SA Accredited Professional, in the form of signed correspondence confirming that all information contained within the submission is a true and accurate representation of the project and that the submission has been compiled in accordance with the Green Star SA Submission Guidelines.

Project Teams must ensure that all documentation above is included in the 'General' section of the submission. Submissions lacking this information will not pass the pre-assessment submission quality review and will be returned to the Project Team.

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Credit Summary Table

CATEGORY	TITLE	CREDIT NO.	POINTS AVAILABLE
Management			
	Green Star SA Accredited Professional	Man - 1	2
	Commissioning	Man - 2	2
	Occupant Users' Guide	Man - 5	1
	Environmental Management	Man - 6	2
	Waste Management	Man - 7	3
	Airtightness Testing	Man - 8	1
	Common Property Rules	Man - 12	2
		TOTAL	**13**
Indoor Environment Quality			
	Ventilation	IEQ - 1	3
	Daylight	IEQ - 4	3
	Thermal Comfort	IEQ - 9	3
	Hazardous Materials	IEQ - 11	1
	Internal Noise Levels	IEQ - 12	2
	Volatile Organic Compounds	IEQ - 13	4
	Formaldehyde Minimisation	IEQ - 14	1
	Private Outdoor Space	IEQ - 19	1
	Universal Access	IEQ - 22	1
		TOTAL	**19**
Energy			
	Conditional Requirement	Ene - 0	0
	Greenhouse Gas Emissions – Heating & Cooling	Ene - 1	10
	Energy Sub-Metering	Ene - 2	3
	Lighting Energy Use	Ene - 3	3
	Maximum Electrical Demand Production	Ene - 5	2
	Hot Water Energy Use	Ene - 7	5
	Common Property Energy Use	Ene - 8	3
	Low Emission Energy Generation	Ene - 9	4
	Energy Efficient Appliances	Ene - 10	2
		TOTAL	**32**
Transport			
	Provision of Car Parking	Tra - 1	2
	Fuel-Efficient Transport	Tra - 2	2
	Cyclist Facilities	Tra - 3	2
	Commuting Mass Transport	Tra - 4	5
	Local Connectivity	Tra - 5	2
		TOTAL	**13**

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Credit Summary Table

Water			
	Occupant Amenity Water	Wat - 1	5
	Water Sub-Metering	Wat - 2	2
	Landscape Irrigation	Wat - 3	3
	Fire System Water Consumption	Wat - 5	1
	Potable Water Efficient Appliances	Wat - 7	2
	Swimming Pool / Spa Water Efficiency	Wat - 8	2
		TOTAL	**15**
Materials			
	Recycling Waste Storage	Mat - 1	2
	Building Reuse	Mat - 2	5
	Recycled Content & Re-used Materials	Mat - 3	3
	Concrete	Mat - 5	3
	Steel	Mat - 6	3
	Sustainable Timber	Mat - 8	2
	Dematerialisation	Mat - 10	2
	Local Sourcing	Mat - 11	2
	Efficient Dwelling Size	Mat - 12	1
	Masonry	Mat - 13	2
		TOTAL	**25**
Land Use & Ecology			
	Conditional Requirement	Eco - 0	0
	Topsoil	Eco - 1	1
	Reuse of Land	Eco - 2	2
	Reclaimed Contaminated Land	Eco - 3	2
	Change of Ecological Value	Eco - 4	4
	Urban Heat Island	Eco - 5	2
	Outdoor Communal Facilities	Eco - 6	2
	Urban Consolidation	Eco - 7	1
		TOTAL	**14**
Emissions			
	Refrigerant / Gaseous ODP	Emi - 1	1
	Refrigerant GWP	Emi - 2	2
	Insulant ODP	Emi - 4	1
	Watercourse Pollution	Emi - 5	4
	Discharge to Sewer	Emi - 6	5
	Light Pollution	Emi - 7	1
	Boiler and Generator Emissions	Emi - 9	1
		TOTAL	**15**
Innovation			
	Innovative Strategies & Technologies	Inn - 1	2
	Exceeding Green Star SA Benchmarks	Inn - 2	2
	Environmental Design Initiatives	Inn - 3	1
		TOTAL	**5**

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Management

The credits within the Management Category promote the adoption of environmental principles from project inception, design and construction phases, to commissioning, - 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 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 on-going information management, enable building users to contribute to the building's environmental performance.

Green Star SA rewards project teams for developing a comprehensive Occupants 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 and in developed countries it is often as much as 40%[2]. 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 design process.

[2] *Gauteng Provincial State of the Environment Report (SoER) June 2004, http://www.environment.gov.za/soer/reports/gauteng/MEC%20Report%20&%20Table%20of%20Contents.pdf*

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Man-1 Green Star SA Accredited Professional

POINTS 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 member of the design team is a Green Star SA Accredited Professional and has;
  - Been engaged by the Developer to provide green building advice from the schematic design phase through to construction completion;
    AND
  - Provided guidance to the project team regarding, or was responsible for, the Green Star SA documentation submission compilation.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Proof of accreditation 2. Statement of confirmation	1. Proof of accreditation 2. Statement of confirmation

Proof of accreditation must take the form of either:

- 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.

Statement of confirmation from the Developer in the form of signed correspondence, confirming the engagement/appointment of the Green Star SA Accredited Professional by;

- Detailing the date of engagement/appointment (i.e. dates from/to); and

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- Describing their scope of works and confirming that they have provided guidance to the project team regarding, or were responsible for, the Green Star SA submission compilation.

ADDITIONAL GUIDANCE

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

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

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.

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

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Man-2 Commissioning

POINTS AVAILABLE 2

AIM OF CREDIT

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

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- For building services within dwellings;
  - Commissioning is contractually required to be performed for all building services provided within dwellings in accordance with system/equipment/appliance manufacturer's commissioning specifications or requirements;

  AND
- For common property services within the development (where applicable);
  - Comprehensive pre-commissioning, commissioning, and quality monitoring are contractually required to be performed for all common property services;

    AND
  - The works outlined above are done in exact accordance with CIBSE Commissioning Codes. Alternatively, ASHRAE Commissioning Guideline 1-1996 'The HVAC Commissioning Process' can be used for the mechanical services.

An additional point is awarded where:

- The point above is achieved;

  AND
- The Design Team and Contractor transfer 'Project Knowledge' to the development's Management Entity through the provision of the following:
  - A Maintenance Logbook, provided for each common property service, in accordance with the Additional Guidance;
  - Commissioning Certificates, provided for each dwelling, in accordance with the Additional Guidance;
  - As-built drawings (complete set);
  - An Operations and Maintenance (O&M) Manual for common property service(s); and,
  - Relevant manufacturer documentation (e.g. user or operation manuals, maintenance documents, etc.) for all building services provided within dwellings.

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Man-2 Commissioning

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Project program	1. Extract(s) from Commissioning Report(s) Where additional point claimed: 2. Commissioning Certificates 3. Extract(s) from Maintenance Logbook(s) 4. Statement of confirmation

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

- Each typical dwelling's building services that are to be commissioned, including a description of each services' intended function, operation and conditions and what commissioning strategy is to be implemented;
- The roles and responsibilities for the commissioning process for the dwellings, specifying the involved parties and the allocated time for the commissioning process;

Additionally where common property services exist:

- Each common property service that is to be pre-commissioned, commissioned and quality monitored, including a description of each services' intended function, operation and conditions;
- The roles and responsibilities for the commissioning process for the common property services, specifying the involved parties and the allocated time for the commissioning process.

Extract(s) from tender documentation clearly demonstrating the contractual requirement that:

- For building services within dwellings, commissioning is to be performed in exact accordance with system/equipment/appliance manufacturer's commissioning specifications or requirements;

Additionally where common property services exist:

- For each common property service that pre-commissioning, commissioning and quality monitoring are to be in exact accordance with CIBSE Commissioning Codes, or

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alternatively ASHRAE Guideline 1-1996 - The HVAC Commissioning Process for the mechanical services.

Additionally where additional point claimed:

- The Contractor's requirement to provide the Management Entity with the following 'Project Knowledge' documentation (where applicable) at development handover:
  - A 'Maintenance Logbook' for each common property service;
  - As-built drawings (complete set);
  - Operations and Maintenance (O&M) Manual for common property service(s);
  - Relevant manufacturer documentation (e.g. user or operation manuals, maintenance documents, etc.) for all services within dwellings; and,
  - Commissioning Certificates for each dwelling.

Project program demonstrating the inclusion of a commissioning period, showing key dates or milestones and allocated time.

Extract(s) from Commissioning Report(s) clearly demonstrating:

- That commissioning has been performed in accordance with system/equipment/appliance manufacturer's commissioning specifications or requirements for all services within dwellings;
- Commissioning dates, records of all commissioning testing undertaken, list any future testing, and a written list of outstanding commissioning issues (if applicable); and
- The outcomes and changes made to the dwelling services as a result of the commissioning process.

Additionally where common property services exist:

- That pre-commissioning, commissioning and quality monitoring were completed for all common property services in exact accordance with CIBSE Commissioning Codes, or alternatively ASHRAE Guideline 1-1996 - The HVAC Commissioning Process for the mechanical services;
- Commissioning dates, records of all functional/commissioning testing undertaken, list any future seasonal testing, and a written list of outstanding commissioning issues (if applicable); and
- The outcomes and changes made to the common property services as a result of the commissioning process, accounting for all of the recommendations.

Commissioning Certificates for all dwellings and in accordance with the Additional Guidance and signed on behalf of the Developer and Contractor.

Extract(s) from Maintenance Logbook(s) for each common property service, in compliance with the Additional Guidance, demonstrating;

- The basic details (e.g. capacity, location etc.) of the common property service necessary for identification by facility management or maintenance staff;

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- The particulars of the initial commissioning of the common property service, including (at a minimum) the date of commissioning, who was responsible for the commissioning (i.e. name and company), details of any corrective action taken where non-compliance identified; and,
- The recommended time period for regular inspection or recommissioning (where applicable) and a recommended date after initial commissioning for the next inspection.

Statement of confirmation from the Management Entity in the form of signed correspondence, listing all documents provided and confirming that the 'Project Knowledge', as per the Credit Criteria, was received.

ADDITIONAL GUIDANCE

Common property services and dwelling building services

Common property services are considered as those services for which the operation and maintenance are the responsibility of the Management Entity and include, but are not limited to, centralised HVAC systems, common property lighting and control systems, centralise water harvesting and reuse systems (i.e. rain, grey or black water), onsite energy generation systems (renewable or otherwise), centralised hot water systems, building management systems (or equivalent), car park ventilation systems, lifts etc.

The operation and maintenance of these systems is typically of little concern to the dwelling occupants and is therefore the responsibility of the Management Entity, which may in turn be outsourced to facility managers or maintenance contractors. On some multi unit residential developments, common property services may consist of a simple exterior lighting system only, requiring basic commissioning. However for some multi unit residential developments, common property services may include more complex building services and resemble those typical of commercial buildings, which will require more comprehensive commissioning.

The dwelling building services are considered those services within the dwellings for which the operation and maintenance of is typically the responsibility of the dwelling occupants (or owner). These include, but are not limited to, heating and cooling systems, lighting and control systems, home automation systems and wet services fittings & equipment. Although such systems are not usually technically complex, appropriate commissioning can identify problems and avoid unnecessary energy or water consumption throughout the dwelling's operation. The commissioning of these systems can be straightforward (e.g. check of all lighting switches, whether hot water is available, control and operation of air conditioning units etc.).

Demonstrating the application of the CIBSE Commissioning Codes

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

- Particular and definitive commissioning specifications from the design engineer of each service/discipline setting out clearly what is expected of the commissioning specialist

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(independent or otherwise). This should include commissioning tolerances on all commissioning parameters and a clear description of how it is intended that the system should operate and the design parameters. The design engineer should also produce 'cause and effect' sheets showing how the design is intended to operate. Also, commissioning specification details of safety controls and interlocks to protect the equipment and personnel during the commissioning process;

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

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

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

Commissioning Reports

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

Commissioning Certificates

The intent of the Commissioning Certificates within the 'Project Knowledge' to be transferred to the development's Management Entity is for the Developer and Contractor to clearly communicate to the dwelling occupants that all systems/equipment/appliances within their dwelling have been commissioned in accordance with the system/equipment/appliance manufacturer's commissioning requirements (where applicable). The certificates must also provide guidance to the occupant as to when next the systems/equipment/appliances should be inspected and recommissioned if necessary (or applicable). The purpose of the certificates is also to clearly communicate both warranty periods of systems/equipment/appliances (where provided) and the 'Defects and Liability Period' of the development.

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The GBCSA does not prescribe the specific format of the Commissioning Certificates, however they must provide, at a minimum, the following information:

- Each building service within the dwelling commissioned;
- The date of commissioning of the system/equipment/appliance and the result of the commissioning, detailing any corrective action take where non-compliance identified;
- The recommended time period for regular inspection or recommissioning (where applicable);
- The manufacturer's warranty period of each system/equipment/appliance commissioned (where no warranty is provided, this must be indicated); and,
- The 'Defects & Liability Period' of the development and the associated information pertaining to this period.

The Commissioning Certificates must be signed by both the Contractor and Developer as a commitment to the content of information contained within the certificate.

Maintenance Logbook

The intent of the 'Maintenance Logbook' for each common property service is to provide the development's Management Entity with a record of the commissioning of each common property service and to guide the future maintenance of these services. The GBCSA does not prescribe the specific format of the Maintenance Logbook, however they must provide, at a minimum, the following information:

- The basic details (e.g. capacity, location etc.) of the common property service necessary for identification by facility management or maintenance staff;
- The particulars of the initial commissioning of the common property service, including (at a minimum);
  - The date of commissioning;
  - Who was responsible for the commissioning (i.e. name and company); and,
  - Details of any corrective action taken where non-compliance identified.
- The recommended time period for regular inspection or recommissioning (where applicable) and a recommended date after initial commissioning.

The provision of the 'Maintenance Logbook' for each common property service is to facilitate on-going maintenance of these services by the Management Entity.

BACKGROUND

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

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Man-2 Commissioning

POINTS AVAILABLE 2

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

- The Management Entity 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.

Chartered Institution of Building Services Engineers (CIBSE) Commissioning Codes

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

Commissioning of buildings and building services is vitally important to the safe and energy efficient operation of buildings but it is not always carried out – or carried out systematically. The CIBSE Commissioning Codes set out clearly and systematically the steps required to commission building services in a proper and timely manner and will make a significant contribution to achieving properly commissioned buildings. This key step in the construction of a building enables the systems to operate as they were designed to do.

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

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

ASHRAE Guideline 1-1996 - The HVAC Commissioning Process

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

- Management Entity's assumptions and requirements;
- ‘Design Intent’, ‘Basis of Design’, and expected performance;

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- Verification and functional performance testing; and
- Operation and maintenance criteria.

This guideline specifically details the process for:

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

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

REFERENCES & FURTHER INFORMATION

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

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

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

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

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

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

Office of Energy Efficiency and Renewable Energy Federal Management Program
http://www.eere.energy.gov

Building Service Centre UK
http://www.communities.gov.uk

Chartered Institute of Building Service Engineers, TM31 Building Log Book Toolkit, 2006
http://www.cibse.org

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Man-5 Occupant Users' Guide

POINTS AVAILABLE 1

AIM OF CREDIT

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

CREDIT CRITERIA

One point is awarded where:

- A simple and easy-to-read 'Occupant Users' Guide', which includes information relevant for the occupants of the development, is created and made available to all dwelling owners and occupants;

  AND

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

Design Initiatives:

- Descriptions of the dwelling and common property design initiatives related to energy (and associated greenhouse gas emissions), water efficiency and waste;
- Descriptions of the Green Star SA initiatives which have been incorporated into the development for the purposes of achieving Certification;

Targets & Benchmarks:

- Outline the energy and water targets or benchmarks;
- Describe the automated metering strategy for the dwellings and common property (if applicable);
- Information on simple strategies for saving energy and water within dwellings;

Basic Functions:

- Details of the building services systems within the dwellings and their basic function/operation;
- Details of where necessary maintenance or trouble-shooting information can be found;

Transport Opportunities:

- Details on the 'green' transport facilities available including (where applicable), local public transport information, maps and timetable links, bike paths etc.;

Waste & Recycling:

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

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Appliances:

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

Preferred Materials:

- Descriptions of the materials or products which have been incorporated into the dwellings to improve indoor environment quality;
- Descriptions of the materials or products which have been incorporated into the development because of their improved sustainability (i.e. recycled content, FCS timber, etc.); and

Management Plans & Policies:

- Information on any management plan or policy adopted by the Management Entity, including a description of the plans and where they can be sourced.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Occupant Users' Guide	1. Occupant Users' Guide 2. Statement of confirmation

Occupants Users' Guide which includes all required information as outlined under the Credit Criteria.

Statement of confirmation from the Management Entity in the form of signed correspondence, confirming receipt of the final Occupant Users' Guide and that it has satisfied the Credit Criteria.

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Man-5 Occupant Users' Guide

POINTS AVAILABLE 1

ADDITIONAL GUIDANCE

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

The document should try to limit extensive sections of text and communicate through more visual means such as simplified diagrams, graphs, maps etc. If the Assessors deem the document to not be "user-friendly", points will not be awarded.

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

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

The provision of an Operation and Maintenance (O&M) manual does not meet the Occupant Users' Guide requirement. The O&M manual typically only provides the detailed specialist information required by the Management Entity and maintenance staff and contractors, not information intended for occupants.

BACKGROUND

This credit targets the development's occupants. Although there are many ways in which a multi unit residential development can be designed and constructed in a sustainable manner, the sustainability focus can be lost once the dwellings have been occupied. Unless it is operated efficiently, a highly sustainable building can still perform poorly. In handing over a development, the design team places trust in the occupants to utilise the building according to its design. Occupants can only do this if they are aware of all aspects of the development's design. Such awareness is generated through the Occupant Users' Guide.

The Occupant Users' Guide is expected to provide details on the everyday operation of the dwellings and common areas and the systems occupants encounter, making it easy for all occupants to understand. The aim of the credit is to ensure that the development's design initiatives are used efficiently as possible and not hindered by a lack of knowledge by the occupants.

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Man-5 Occupant Users' Guide

POINTS AVAILABLE 1

REFERENCES & FURTHER INFORMATION

Sydney Harbour Foreshore Authority, Green Building User Guide: Enabling a Sustainable Future, 2008
http://www.shfa.nsw.gov.au

Smart Living Handbook – City of Cape Town
http://www.capetown.gov.za/en/EnvironmentalResourceManagement/Pages/SmartLivingHandbook.aspx

Your Home Technical Manual, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.yourhome.gov.au/

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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 as follows:

One point is awarded where:

- The Contractor implements a comprehensive, project-specific Environmental Management Plan (EMP) throughout the construction phase of the project (i.e. from construction commencement to practical completion);

  AND

- The EMP is in strict accordance with the Provincial Government of the Western Cape Environmental Management Plan Guidelines (2005) as evidence by correlation with Table Man-6.1 of the Additional Guidance;

  AND

- The Contractor and Sub-Contractors achieve compliance with the EMP.

One point is awarded where:

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

  AND

- All Sub-Contractors relevant to the project and engaged by the Contractor, adhere to all applicable ISO14001 requirements.

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Man-6 Environmental Management

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report Additionally where first point claimed and contract not awarded: 2. Extract(s) from tender documentation Additionally where first point claimed and contract awarded: 3. Environmental Management Plan Additionally where second point claimed and contract not awarded: 4. Extract(s) from tender documentation Additionally where second point claimed and contract awarded: 5. ISO14001 certificate 6. Statement of confirmation	Where first point claimed: 1. EMP compliance report 2. Environmental Management Plan Additionally where second point claimed: 3. ISO14001 certificate 4. Statement of confirmation

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

- Confirming if the principle building contract has been awarded or not, and where awarded, the name of the Contractor.

Additionally where first point claimed and contract awarded:

- Clearly correlating the provisions of the Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005) with the provisions of the project-specific EMP in accordance with Table Man-6.1; and,
- Describing the requirements, roles and responsibilities of the compliance auditing process during EMP implementation;

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

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- Is in strict accordance with the requirements of the Provincial Government of the Western Cape Environmental Management Plan Guidelines (2005);
- Clearly demonstrates the requirement that Contractor and Sub-Contractors must adhere to the exact provisions of the EMP.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

Where first point claimed:

- The Contractor is to implement and achieve compliance with a project specific EMP, developed for the project and in strict accordance with the requirements of the Provincial Government of the Western Cape Environmental Management Plan Guidelines (2005);

Additionally where second point claimed:

- The Contractor to have ISO14001 accreditation at commencement of construction and that the Contractor will maintain this certification throughout the full construction phase of the project; and
- That any Sub-Contractors relevant to the project and engaged by the Contractor are to adhere to all applicable ISO14001 requirements.

EMP Compliance Report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by;

- Confirming the dates of construction commencement and practical completion;
- Clearly correlating the provisions of the Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005) with the provisions of the project-specific EMP in accordance with Table Man-6.1;
- Describing the requirements, roles and responsibilities of the compliance auditing process that were undertaken during the construction phase of the project; and,
- Confirming that compliance with the project specific EMP was achieved by the Contractor and Sub-Contractors.

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

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

- The dates of construction commencement and practical completion; and
- That any Sub-Contractors relevant to the project will, or did, adhere to all applicable ISO14001 requirements.

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Man-6 Environmental Management

POINTS AVAILABLE 2

ADDITIONAL GUIDANCE

For the purposes of Green Star SA, the date of 'construction commencement' is deemed to be the date upon which the project site is handed over to the Contractor. The 'total construction phase' is deemed to extend from the date of receipt of the site by the Contractor from the developer, to the date of practical completion when the site is handed back to the developer from the Contractor.

The EMP must be implemented from the date of construction commencement and cannot be awarded where construction has commenced without a project-specific EMP, irrespective of how soon after construction commencement the EMP is implemented. Where this cannot be reliably confirmed, the point will not be awarded.

Any demolition activity undertaken on the project site under the same ownership must be included within the scope of the project specific Environmental Management Plan. Where this was not achieved, compliance with credit cannot be achieved and points will not be awarded.

Environmental Management Plan (EMP)

The project specific EMP must clearly demonstrate compliance.

The EMP must be fully comprehensive and project-specific. The GBCSA expects that where an EMP has been correctly implemented, internal audit documentation is generated for on-going compliance during construction.

The EMP need not be produced by the contractor, so 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.

Compliance with the Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005) is to be demonstrated by completion of the checklist as provided in Table Man-6.1 (over page).

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Man-6 Environmental Management

POINTS AVAILABLE 2

	EMP Element	Location
1	**EAP (Environmental Assessment Practitioner)** Provides information to the credibility and expertise of the EAP to prepare an EMP.	
1.1	*Details of the EAP*	
	Have details of the EAP been provided?	
1.2	*EAP Registration*	
	Is the EAP registered with the Environmental Assessment Practitioners Association of South Africa (EAPSA)?	
2	**Background** Provides an overview of the project which provides a foundation for understanding the project	
2.1	*Introduction*	
	Are details of the proponent responsible for the EMP provided?	
	Has the purpose of the EMP been stated? (e.g. EMP developed as part of an EIA process but also seeks to fulfil the requirements of the GBCSA accreditation process)	
2.2	*Project Description*	
	Has a brief description of the project been provided?	
	Is a brief description of the affected environment (biophysical, social and economic) provided? (Reference to EIA reports may be made if relevant)	
	Are potential areas of sensitivity onsite or adjacent to the site (including wetlands, rivers etc.) identified?	
	Is a map of the site included?	
2.3	*EMP Context*	
	Have the boundaries of the EMP been described (i.e. timeline and phases of the project to which applies i.e. planning and design, pre-construction and construction, operations etc.)?	
2.4	*EMP Objectives*	
	Have EMP objectives been clearly stated (i.e. to achieve GBCSA credit, ensure environmental performance and reduce environmental risk etc.)?	
2.5	*Environmental Policy*	
	Have the proponent's environmental management policies and commitments that apply to the EMP been described?	
3	**Environmental Management** Provides the context for the environmental commitments (legislated and or company commitments.)	
3.1	*Environmental Management Structure and Responsibility*	
	Has an organisational structure including the description of roles and responsibilities been specified for implementing the EMP?	

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Man-6 Environmental Management

POINTS AVAILABLE 2

	EMP Element	Location
3.2	*Approval and Licensing Requirements*	
	Does the EMP identify the project's regulatory framework including a list of licenses, approvals or permits required to be obtained under the legislation? (copies of these must be included as an Appendix)	
3.3	*Reporting*	
	Does the EMP describe a system of reporting which includes; a description of a typical report; document control procedures, system for documenting environmental training, and frequency of report?	
3.4	*Environmental Training*	
	Does the EMP specify the program for employees to undergo environmental awareness training as well as training with regards to their responsibilities under the EMP?	
3.5	*Emergency Contacts and Response*	
	Does the EMP nominate a contact person including 24 hour details for emergencies, who has the authority to stop or direct works?	
	Does the EMP include procedures for emergency response?	
4	**Implementation** This section provides the bulk of the document and aside from section 4.4 can be quite easily tabulated for ease of representation and site guidance.	
4.1	*Risk Assessment*	
	Is a list of activities to be carried out (this must include activities undertaken onsite by subcontractors or suppliers) included?	
	Does the EMP identify the actual and potential impacts associated with each activity?	
	Does the EMP categorise the risk in terms of significance?	
4.2	*Environmental Management Activities and Control*	
	Does the EMP specify all the environmental management activities, mitigation and control measures that will be used to prevent or minimise the environmental impacts?	
	Does the EMP assign responsibility for control measures to specific personnel and provide timeframes for their implementation?	
4.4	*Environmental Schedules*	
	Does the EMP provide schedules, registers, forms etc. which will be used as for the day-to-day environmental management of the site. These will include but not be limited to: Site inspection checklist, Environmental incident register, Environmental training register, Complaints report, Non-compliance and corrective action report etc.?	
4.5	*Contractor responsibilities*	
	Have the EMP requirements been formally transferred (e.g. included in tender documents) to the contractor and sub-contractors?	

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	EMP Element	Location
5	**Monitoring and Review** Provides a methodology for a system of ensuring that the EMP is being implemented as intended, as well as remains relevant to site activities.	
5.1	*Environmental Auditing*	
	Does the EMP describe the programme and procedure for periodic auditing, covering both internal and external auditing?	
5.2	*Corrective Action*	
	Does the EMP define procedures for non-compliance and corrective actions as well as stipulate a responsible individual for investigating and non-compliance, taking action and completing corrective and preventative action?	
5.3	*EMP Review*	
	Does the EMP describe the responsible individual and frequency of EMP review?	
	Does the EMP plan for informing site/project team of changes?	

Table Man-6.1: *EMP compliance checklist*

Environmental Management Systems (EMS) Certification

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

ISO14001 Alternatives

For smaller organisations (fewer than 30 staff) simpler tools other than ISO14001 are acceptable where the results are externally available to customers and the public and internally to staff and other building occupants. An external auditor's report confirming evidence of effective use of 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 on-going. 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.

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Man-6 Environmental Management

POINTS AVAILABLE 2

BACKGROUND

Construction and demolition are responsible for significant environmental 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;
- Reduced waste generation and disposal costs; and
- Utilisation of recoverable resources.

REFERENCES & FURTHER INFORMATION

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

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

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

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

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.

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Man-6 Environmental Management

POINTS AVAILABLE 2

Guidelines for Environmental Management Plans (2005), Department of Environmental Affairs and Development Planning, Provincial Government of the Western Cape
http://www.westerncape.gov.za/eng/pubs/guides/g

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

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Man-7 Waste Management

POINTS AVAILABLE 3

AIM OF CREDIT

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

CREDIT CRITERIA

Up to three points are awarded where:

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

  AND

- The Contractor retains waste records and issues quarterly reports to the Developer;

  AND

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

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Extract(s) from tender documentation	1. Short report 2. Waste Management Plan 3. Quarterly waste reports

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the Contractor to;

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- Develop a Waste Management Plan prior to the start of construction or demolition works, and implement it throughout the construction phase of the project (i.e. from construction commencement to practical completion);
- Issue the Developer with quarterly waste reports identifying the total waste generated (in mass) and the percentage diverted from disposal;
- Recycle the stated percentage (by mass) of construction and demolition waste.

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

- Providing a tabulated summary of all categories of waste with their corresponding total quantities (in mass) as identified in the quarterly waste reports; and,
- Demonstrating that the diversion from disposal percentage was achieved for the project.

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

Quarterly waste reports issued to the Developer showing the categories of waste, their corresponding quantities (in mass) for the period, the percentage diverted from disposal and how that diverted is reused/recycled.

ADDITIONAL GUIDANCE

It must be clearly demonstrated that the quarterly waste reports accounts for all of the demolition and construction waste and that the stipulated proportion of waste has been reused or recycled.

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), and the site has remained under the same ownership, the demolition waste generated throughout the scope of the whole demolition contract must be included in calculations demonstrating compliance with the Credit Criteria

Waste management plan

The Waste Management Plan must detail, as a minimum, the following;

- How all generated waste was monitored;
- Which type of waste streams were collected for recycling or reuse; and
- The roles and responsibilities of those involved in the waste management process

Conversion of volume to mass

If waste is measured by volume rather than mass, the data must be converted to mass using the densities provided in Table Man-7.1.

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Solid Waste Type	Density (kg/m³)
Cardboard	60
Gypsum Wallboard	300
Rubble	830
Steel	600
Wood	180
Mixed waste	210

Table Man-7.1: *Densities to be assumed for various solid waste types*

For any materials which are not listed in Table Man-7.1, Project Teams may propose their own densities along with accompanying calculations and justifications by Credit Interpretation Request (CIR). Project teams must demonstrate within the CIR how the density was arrived at and how calculations were done. The densities of some materials can vary widely depending on their composition and manufacture (e.g. concrete could include asphalt, gravel or many other materials). The CIR must also demonstrate that calculations have taken into account the difference between the density of the material in transport/crushed form, rather than in solid form/in situ.

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

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 as an average.

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

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

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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 and/or clean fill used as road-base/foundations or for land reclamation;
- 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.

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 a plan for 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.

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REFERENCES & FURTHER INFORMATION

Department of Environmental Affairs and Tourism (2006) South Africa Environmental Outlook, A report on the state of the environment 2006
http://soer.deat.gov.za/frontpage.aspx?m=2

Provincial State of the Environment Reports
http://soer.deat.gov.za/docport.aspx?m=97&d=5

Onsite Minimising Construction Waste, Maximising Competitiveness
http://onsite.rmit.edu.au

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

CSIR (2011). 'Municipal waste management - good practices', Edition 1., CSIR, Pretoria.
http://www.csir.co.za/enews/2011_jun/02.html

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Man-8 Airtightness Testing

POINTS AVAILABLE 1

AIM OF CREDIT

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

CREDIT CRITERIA

One point is awarded where:

- Airtightness testing is carried out on a minimum of 5% of the total number of dwellings (or 1 dwelling, whichever is greater) in accordance with CIBSE TM23:2000 *Testing buildings for air leakage*;

  AND

- For each dwelling tested, a leakage rate of not more than 15 m3/hr/m² is achieved at a relative pressure of 50 Pa;

  AND

- The testing process allows for remedial sealing measures and re-testing if required, with remedial sealing measures taken in the sample dwelling(s) replicated through all other dwellings.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Extract(s) from tender documentation 2. Project program	1. Airtightness test report

Extract(s) from tender documentation clearly demonstrating the contractual requirement for;

- Airtightness testing to be carried out in accordance with CIBSE TM23:2000 on completion of the dwellings;
- Where non-compliance identified, remedial sealing measures and retesting to achieve the maximum air leakage rates; and,

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- Remedial sealing measures to be replicated throughout all other dwellings.

Project program demonstrating the inclusion and time allocated for the airtightness testing.

Airtightness test report prepared by the sub-contractor responsible for the airtightness testing, demonstrating how the Credit Criteria has been met by;

- Describing the application of the test methodology to the dwellings;
- Providing a tabulated summary of the dwellings tested, the initial airflow rates achieved, the test relative pressures, envelope areas used, and the final air leakage rates; and,
- The remedial sealing measures undertaken in all dwellings (where applicable).

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*.

The building airtightness 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.

The benchmark threshold of $15m^3/hr/m^2$ is an air leakage rate per unit of envelope area. Please refer to the BSRIA Airtightness publication for further details on the calculation of this area.

Alternatively, the method described in ASTM-E779 "Standard Test Method for Determining Air Leakage Rate by Fan Pressurization" can be used to determine the leakage rate in m^3/hr at a pressure of 50Pa. To demonstrate compliance with the Credit Criteria, this air leakage rate can then be divided this by the surface area of the building external envelope (including the ground floor) in m^2 as explained in CIBSE TM23.

BACKGROUND

This credit addresses the airtightness of dwellings only. Common areas, irrespective of being serviced by HVAC systems or not, are not within the scope of this Credit Criteria and do not need to be tested.

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Man-8 Airtightness Testing

POINTS AVAILABLE 1

Infiltration is uncontrolled air leakage through cracks and gaps in the dwelling fabric. It is affected strongly by design decisions and construction quality. Pressure and temperature differences between the inside and the outside of the dwelling 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 general. 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 airtight 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 *Air tightness 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 or individual dwellings. 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 or dwelling air leakage test is the most effective way of determining the building or dwelling airtightness.

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

BSRIA Airtightness, 'Airtightness Testing for New Dwellings; The essential guide to Part L1 of the 2006 Building Regulations'.

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Man-12 Common Property Rules

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise Developers who embed legal and contractual environmental management initiatives within the formal management structures of the development

CREDIT CRITERIA

Two points are awarded where:

Within the Rules of the development the Management Entity commits to:

- Undertake regularly scheduled inspection and maintenance of all common property services such that;
  - Inspection and maintenance services commence 12 months after practical completion of the development and continue once every 2 years thereafter;

    AND
  - After each inspection & maintenance event, an 'Inspection & Maintenance Report' (in accordance with the Additional Guidance) is provided to all dwelling owners and occupants;

  AND
- The provision of an 'Environmental Performance Report' (in accordance with the Additional Guidance) to all dwelling owners and occupants every 6 months (i.e. bi-annually).

  AND
- The implementation of the following operational management plan and policy (in accordance with the Additional Guidance);
  - A 'Waste and Recycling Management Plan';

    AND
  - A 'Retrofit and Maintenance Policy'.

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Man-12 Common Property Rules

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Extract(s) from Rules 2. Environmental Performance Reporting strategy 3. Waste Management Plan 4. Retrofit & Maintenance Policy	1. Extract(s) from Rules 2. Environmental Performance Reporting strategy 3. Waste Management Plan 4. Retrofit & Maintenance Policy
Additionally for Body Corporate or Home Owners Association: 5. Statement of confirmation	Additionally for Body Corporate of Home Owners Association: 5. Statement of confirmation

Extract(s) from Rules clearly demonstrating the legal requirement of the Management Entity to undertake, provide and/or implement:

- Scheduled inspection and maintenance of all common property services commencing 12 months after practical completion and then once every 2 years thereafter;
- An 'Inspection & Maintenance Report' after each maintenance event;
- An 'Environmental Performance Report' to all the dwelling owners and occupants with reference to the documented strategy every 6 months (i.e. biannually).
- The 'Waste and Recycling Management Plan' with reference to the documented plan; and
- The 'Retrofit and Maintenance Policy' with reference to the documented policy.

Environmental Performance Reporting strategy prepared by a relevant project team member which clearly;

- Outlines the strategy which is to be used to collect and process energy and water data by the Management Entity in the preparation of the quarterly performance reports (including conversion factors where applicable);
- References 'automated metering strategies' developed for Ene-2 Energy Sub-Metering or Wat-2 Water Sub-Metering (where applicable); and
- Includes a sample template of the 'Environmental Performance Report' which can be used by the Management Entity.

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Waste Management Plan clearly demonstrating the inclusion of the necessary requirements as defined under 'Additional Guidance'.

Retrofit & Maintenance Policy clearly demonstrating the inclusion of the necessary requirements as defined under 'Additional Guidance'.

Statement of confirmation from Conveyancer or Municipality clearly demonstrating that the Rules for the development have been legally incorporated into the formal management structure of the development, and in the form of:

- A signed letter from the Conveyancer stating that the Rules have been submitted and accepted (Sectional Title);

  OR

- A copy of the Conveyancer's Certificate for the development (Sectional Title);

  OR

- A copy of the Constitution which has been stamped and signed by a representative of the appropriate department of the relevant Municipality (Home Owners Association).

ADDITIONAL GUIDANCE

For the purposes of this credit, the term "Management Entity" refers to a Body Corporate, Home Owners Association, or other formal management body for a multi unit residential development. The term "Rules" refers to the rules implemented for the control, management and administration of the common property only. For a Sectional Title Scheme, this refers to the 'Management Rules' as it is not the intention of this credit to influence the 'Conduct Rules' (where applicable).

It must be clearly evident from the documentation that the Rules have been legally incorporated into the formal management structure of the development. Where this cannot be determined from the Conveyancer or Municipality confirmation, the points will not be awarded.

Environmental Performance Report

The intent of the Environmental Performance Report is to communicate to the development occupants on a regular basis the performance of the common property with regards to energy and water consumption. This creates a culture of disclosure and permits occupants to raise concerns or motivate for improvements, to the Management Entity.

The GBCSA does not prescribe the specific format of the Environmental Performance Report, however it must provide, at a minimum, the following information:

- The period for which the environmental performance report is for (i.e. dates from/to);
- The total energy consumption (electricity and gas, where applicable) and the resulting greenhouse gas emissions, and water consumption (potable and non-potable, where applicable) of the common property services, for both;

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  - The current period (e.g. 1st Jan 2011 – 30th June 2011);
    AND
  - The equivalent period 12 months prior (e.g. 1st Jan 2010 – 30th June 2010);
- The greenhouse gas emission coefficient used to convert energy (i.e. kWh or MJ) to greenhouse gas emissions (i.e. kgCO_2 equivalent);
- The cost (in Rands) of energy and water for the common property services for the period; and,
- Itemise the service included within the scope of the Environmental Performance Report (e.g. common property lighting, car park ventilation system, lifts etc.).

The Environmental performance reporting strategy must provide sufficient guidance to the Management Entity to enable the Environmental Performance Report to be compiled by someone without technical knowledge. It must, at a minimum, describe;

- How the sub-metering data is accessed for the common property metering system. (Where an 'Automated metering strategy' has been prepared for Ene-2 and/or Wat-2, this should form the basis of this document);
- The purpose of the greenhouse gas emission coefficients used to convert energy (i.e. kWh or MJ) data to greenhouse gas emissions (i.e. kgCO_2 equivalent), and where these coefficients can be found for future reference.
- How the Environmental Performance Report is to be distributed to owners and occupants and the frequency of distribution;
- Who is responsible for the collation and preparation of the report, and where or how the Environmental Performance Reports are to be stored.

The sample template of the Environmental Performance Report may consist of a basic spreadsheet file to which sub-metering data is loaded and the report generated automatically. For the purposes of the Documentation Requirements, the sample template would just need to be a print off of the spreadsheet.

How the Environmental Performance Report is circulated to owners and occupants is at the discretion of the Management Entity. This may include hardcopy drops to individual dwellings, posting on central notice boards in communal areas (e.g. entry foyers, mailbox areas etc.), or electronic issue by email.

Waste Management Plan

The Waste Management Plan for the development must establish and delegate responsibility for the tasks involved in on-going waste management, including, at a minimum;

- Moving bins to and from the storage point to the collection point (if required) on collection day;
- Washing bins and maintaining storage areas;
- Arranging for the prompt removal of dumped rubbish;
- Displaying and maintaining consistent signs on all bins and in all communal storage areas;
- Managing communal composting areas (if applicable);

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- Ensuring all residents are informed of the garbage, recycling, organics and bulky waste arrangements;
- The roles and responsibilities of the building manager/caretaker and/or gardener, where such staff are proposed for the development

The Waste Management Plan should also outline the collection frequency and waste streams to be collected where a service provider is to be engaged.

Retrofit & Maintenance Policy

The Retrofit & Maintenance Policy must outline the policies to be adopted by the Management Entity for where retrofit or maintenance work is commissioned for the common property. The intent of this policy is to ensure that the initiatives taken in the original design and construction of the development are carried through into the operation phase of the development where applicable. The Retrofit & Maintenance Policy can be provided by the Management Entity to Contractors to ensure in their commissioned scope of work they source and use compliant materials.

Where the development incorporates materials or products of preferred environmental performance, it would be required of the policy that these material or product requirements are met for any future retrofit or maintenance works.

Examples, regardless of a Design or As Built rating, include;

- Where compliance to the IEQ-13 Volatile Organic Compounds or IEQ-14 Formaldehyde Minimisation credit is achieved, the Retrofit & Maintenance Policy should reflect the requirement for future materials to meet the TVOC or formaldehyde requirements;
- Where compliance to the Ene-8 Common Property Energy Use credit is achieved, the Retrofit & Maintenance Policy should reflect the requirement for future lamps for common property lighting to be of a minimum luminous efficacy;
- Where compliance to the Mat-8 Sustainable Timber credit is achieved, the Retrofit & Maintenance Policy should reflect the requirement for future timber to be sustainably sourced or recycled/reused;

The Retrofit & Maintenance Policy must clearly outline the performance requirements for all such materials to provide Contractors with sufficient information to source compliant materials. It is not acceptable to simply refer to Green Star SA Technical Manuals; the applicable information or criteria must be explicitly provided in the policy document.

BACKGROUND

Multi unit residential developments create diverse communities, bringing together occupants from different cultures, income brackets, age groups, life perspectives and opinions. In many cases, the only common interest between occupants is ownership of a unit in the multi unit residential development. To ensure that multi unit residential developments function as intended, creating equitable and liveable communities, ‘management entities’ and ‘rules’ are required.

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Man-12 Common Property Rules

POINTS AVAILABLE 2

Depending on the type of multi unit residential development, the management entity may be a Body Corporate (Sectional Title), Home Owners Association (HOA), or other formal management body (i.e. social housing operator). Each presents a different legal status and rules.

Within a Sectional Title Scheme, a Body Corporate is a statutory body comprising of all the owners of each unit, as required by the Sectional Titles Act (No. 95 of 1986). The Act, amongst other purposes, is "to provide for the division of buildings into sections and common property and for the acquisition of separate ownership in sections coupled with joint ownership in common property", and "the establishment of bodies corporate to control common property and for that purpose to apply rules" (Sectional Titles Act, 1986). The rules are in place to ensure that the sectional title scheme is properly run, for the control, management, administration, use and enjoyment of the sections and common property. Typically in a Sectional Title Scheme, the rules consist of 'Management Rules' which govern the Body Corporate, and 'Conduct Rules' which govern the behaviour of occupants. The Body Corporate comes into being as soon as the Developer of a multi unit residential sectional title scheme transfers a unit (i.e. dwelling) to a new owner.

Home Owners Associations (HOA), unlike Sectional Title Schemes, operate in many cases on conventional ownership of a dwelling. HOA are not governed by the Sectional Titles Act, nor is there a national statute which requires their formation or operation. In such developments, each owner obtains the registered title to a freehold property as described on a general plan of the development. Unlike conventional property acquisition, within a HOA development, each owner of a dwelling becomes a member of the HOA, which is the registered owner of the development's infrastructure. The function and operation of the HOA is governed by the Constitution, which includes "rules" pertaining to operational management issues.

Although both Sectional Title Schemes and Home Owners Associations are popular in South Africa for developments targeted at middle and high income earners, other schemes exist for developments addressing low income housing. Large multi unit social housing communities are often developed by Section 21 non-profit organisations on behalf of Provincial or National Government (or international donor organisations), governed by the Social Housing Act (No 16 of 2008). In this scenario, Provincial or National Government retains ownership of the development, with dwellings leased to low income households, in particular formerly disadvantaged members of the community. However, the on-going management and operation of the development is the responsibility of Section 21 non-profit organisation, which acts as the management body and implements rules.

The formal legal structures and rules of a Body Corporate (Sectional Title), Home Owners Association (HOA), or other formal management body described above offer an excellent opportunity to influence how a development is managed in terms of its on-going environmental performance and how this performance is communicated to occupants.

The Man-12 Common Property Rules credit intends to insure that the 'Management Entity' of the development conducts regular maintenance and inspection for common property services, ensuring efficient operation, and that the performance of common property services (e.g. energy or water consumption) is clearly communicated to the development occupants on a regular basis. This creates a culture of disclosure and permits occupants to raise concerns or motivate for improvements, to the Management Entity.

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Man-12 Common Property Rules

POINTS AVAILABLE 2

It is also the intention to ensure that the Management Entity implements plans and policies to maintain the environmental performance of the development. This includes where retrofit or maintenance work is commissioned for the common property, it is done in accordance with the original principles applied in the design and construction of the development (e.g. low VOC paints are used, sustainable timber is procured, formaldehyde containing engineered wood products are avoided etc.), and that a waste management plan is implemented to optimise the use of the waste management infrastructure.

REFERENCES & FURTHER INFORMATION

City of Cape Town (2005) Smart Living Handbook, Cape Town, South Africa.
http://www.capetown.gov.za/en/EnvironmentalResourceManagement/Pages/SmartLivingHandbook.aspx

City of Sydney (2005) Policy for Waste Minimisation in New Developments, City of Sydney, Sydney

Department of Environmental Affairs and Tourism (2006) South Africa Environmental Outlook, A report on the state of the environment
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Sectional Titles Act (No. 95 of 1986), Government of the Republic of South Africa
http://csg.dla.gov.za/act95_86.htm

Social Housing Act (No. 16 of 2008), Government of the Republic of South Africa
http://www.info.gov.za/view/DownloadFileAction?id=91903

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Indoor Environment 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 heating and cooling systems, lighting, indoor air pollutants and some building attributes contribute to a healthier indoor environment quality.

Comfort factors addressed within this category are thermal comfort and noise levels. Health issues such as minimisation of indoor volatile organic compounds, asbestos and formaldehyde emissions as well as ventilation.

Acknowledging a broad range of issues which impact indoor environment quality, the Green Star SA Multi Unit Residential rating tool also addresses issues such as private outdoor space and universal access.

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 avoiding the installation of heating and/or cooling systems, but this would potentially be at the expense of the occupant comfort and wellbeing. The IEQ category in the Green Star SA tool encourages healthy and good indoor environmental quality. 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.

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

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IEQ-1 Ventilation

POINTS AVAILABLE 3

AIM OF CREDIT

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

CREDIT CRITERIA

Up to 3 points are awarded independently as follows:

One point is awarded where:

- All dwellings are naturally ventilated in accordance with SANS 10400-O;

  AND

- For a minimum 70% of dwellings, effective natural ventilation is achieved via 'cross-ventilated design' in accordance with the Additional Guidance.

One point is awarded where:

- All dwellings are naturally ventilated in accordance with SANS 10400-O;

  AND

- For all dwellings, each habitable room with a floor area greater than 4m² is provided with manually controllable background ventilation openings (i.e. trickle ventilators) of sufficient 'Equivalent Area', in accordance with the Additional Guidance.

One point is awarded where:

- All dwellings are naturally ventilated in accordance with SANS 10400-O;

  AND

- For each dwelling, any two (2) of the qualifying ventilation initiatives described below are implemented.

Qualifying ventilation initiatives are:

Kitchen extract

For all dwellings, each kitchen is provided with a dedicated extract system in accordance with the Additional Guidance.

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Bathroom ventilation

All rooms within which there exist shower(s) and/or bath(s) are provided with a dedicated mechanical extract system;

Carbon monoxide (CO) monitoring

For each habitable room that contains applicable combustion devices, or the provision is made for future installation of combustion devices, a CO monitor is provided in accordance with the Additional Guidance.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report; 2. Tender drawing(s) 3. Extract(s) from tender documentation	1. Short report 2. As Built drawing(s) Additionally where second or third point claimed; 3. Extract(s) from Commissioning Report(s) 4. Manufacturer product datasheet(s)

Short report prepared by a suitably qualified professional demonstrating how the Credit Criteria have been met by:

- Providing a tabulated summary of all dwelling types confirming that the requirements of SANS 10400-O are met and indicating the ventilation initiatives claimed for each; and

Additionally where first point claimed;

- Clearly demonstrating through plan and section drawing extracts for each dwelling type, the compliant cross-ventilation breeze path(s) claimed, the length of breeze path(s) and the free area of each inlet, outlet and doors or opening (where applicable);

Additionally where second point claimed:

- Providing a tabulated summary for each dwelling type, listing each habitable area, the number and type of background ventilation openings and their equivalent area, demonstrating compliance with the Credit Criteria.

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Additionally where third point claimed;

- Providing a tabulated summary for each dwelling type of the habitable rooms provided with carbon monoxide (CO) monitors (where applicable); AND/OR
- Providing a tabulated summary for each dwelling type of the kitchen(s) and/or rooms with shower(s) and/or bath(s) provided with dedicated extract systems in compliance with SANS 10400-O.

Tender / As Built drawing(s) for each dwelling type, including;

Where first point claimed;

- Window schedule clearly marked-up to identify all ventilation openings and each free area as claimed in the short report;

Where second point claimed;

- Plan drawings marked-up to clearly show the location and equivalent area of each background ventilation opening(s).

Where third point claimed;

- Plan drawings marked-up to clearly show the provision of dedicated extract systems; and/or,
- Plan drawings marked-up to clearly show the location of all CO monitors.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for;

Where first point claimed;

- Security screen door(s) and door catches (only where doors that provide access from a public or communal space into the dwelling are claimed);

Where second point claimed;

- The provisions of manually controllable background ventilation openings in the locations as indicated on the tender drawings, each of sufficient equivalent area in accordance with the Additional Guidance.

Where third point claimed;

- The provision for applicable dedicated extract system(s) in accordance with SANS 10400-O and manual local user control, as referenced in the short report; AND/OR
- The provision of sufficient minimum distance between exhaust point(s) and natural ventilation opening(s) (where applicable); AND/OR
- The provision of CO monitors which provide an audible alarm to all applicable habitable rooms as referenced in the drawings (where applicable);

Extract(s) from Commissioning Report(s) demonstrating that the manually controllable background ventilation openings and/or dedicated extract systems have been commissioned and operate as intended by the design.

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Manufacturer product datasheet(s) for each dedicated extract system (unitary systems only), carbon monoxide (CO) monitor and/or background ventilation product, demonstrating compliance with the Credit Criteria.

ADDITIONAL GUIDANCE

Given the prevalence of natural ventilation (as defined in SANS10400-O) for dwellings in South Africa, the Credit Criteria is specifically developed for this context. However, where dwelling(s) are mechanically ventilated such that the minimum quantity of fresh air (as required by SANS10400-O) is supplied by a dedicated mechanical supply system (i.e. ducted supply via a fan into the dwelling) the GBCSA requests a Technical Clarification to be submitted. Please note that the provision of mechanical extract systems to miscellaneous areas (i.e. toilets and bathrooms) does not constitute a mechanically ventilated dwelling.

Cross-ventilation design

For the purpose of this credit, Effective Natural Ventilation is achieved when the following breeze path and cross ventilation criteria are met:

1. At least one continuous, cross ventilation breeze path which passes through the common living areas (e.g. formal/informal lounges, TV/multimedia rooms, dining areas etc.) is provided for each dwelling (multiple paths are acceptable as the intention is to have effective cross-flow ventilation, not a single path); AND
2. Each breeze path is in accordance with one of the permitted configurations shown in Figure IEQ-1.1; AND
3. The total length of all breeze paths is less than 15 metres, measured between ventilation openings and including deviations around internal obstructions and any changes in height (measure between centre line of ventilation openings); AND
4. Ventilation openings have a free area of at least $1m^2$ and are located on an external wall or roof; AND
5. Ventilation openings are located either in opposite or adjacent walls, or a combination of wall and roof or ceiling openings. If on adjacent walls, they must be separated by a distance of at least 3 metres, measured from the closest point of each opening; AND
6. There is not more than ONE (1) doorway or opening with a free area smaller than $2m^2$ between ventilation openings (i.e. inlet and outlet).

Doors that provide access from a public or communal space into the dwelling cannot be used to comply with the cross ventilation criteria unless they are fitted with a security screen door that maintains security to the dwelling while the door to the public or communal area is open, and door catches.

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IEQ-1 Ventilation

POINTS AVAILABLE 3

Single sided natural ventilation, irrespective of the locations of inlets and outlets, does not meet the intent of this credit. This credit promotes the design of dwellings with dual aspect ventilation openings.

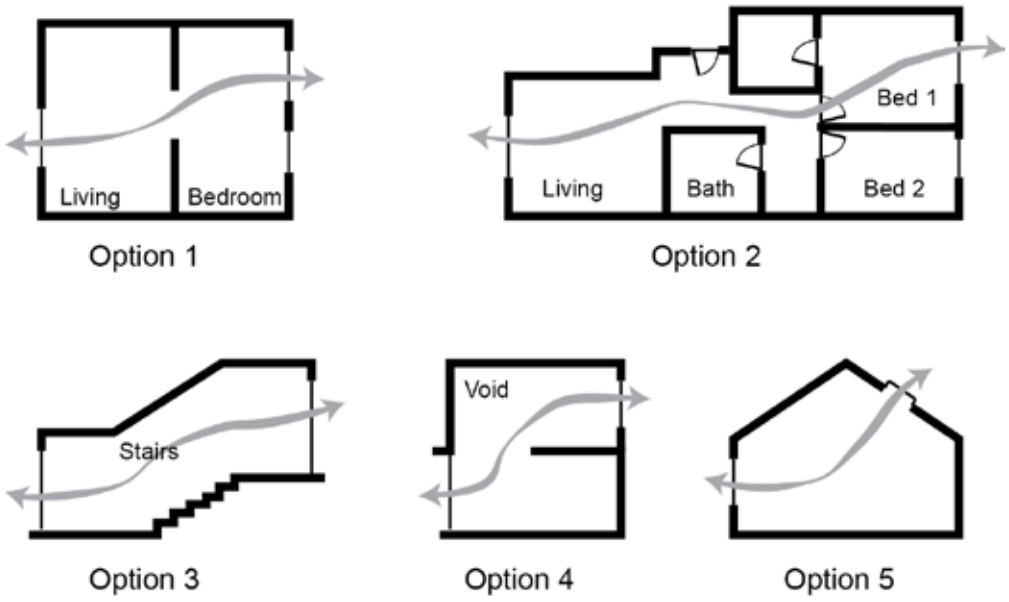

Figure IEQ-1.1: *Diagrams illustrating acceptable breeze paths for effective natural ventilation.*

The 'free area' of each ventilation opening claimed must be clearly marled-up on the documentation submitted. Where 'Option 3' or 'Option 4' is claimed, breeze paths must be demonstrated in both plan and section in the extracts of drawings in the short report. Where 'Option 3' is claimed and the breeze path direction is opposite to the direction of the stairs, it must be evident that the breeze path claimed is justified (i.e. stairs have an open side or open risers). Where stairs have closed sides, the measurement of the breeze path must extend to the base of the stair, prior to passing up/down the stairs.

'Free area' is defined as the geometric open area of a ventilation opening. With respect to windows this does not, by default, represent the face area of the window or glazing panel(s). In order to determine the geometric open area, the following geometric restriction to the free area must be factored into the calculation for each opening:

- Basic geometric open area measured from internal faces/edges of window frame;
- Pivoting nature of window (top hung, bottom hung, side swing);
- Nature of window opening restrictors; and
- Depth of external window sill.

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Background ventilation – trickle ventilators

The trickle ventilator(s) provided to each habitable room of floor area greater than 4m² is such that;

- The cumulative equivalent area of background ventilation openings in a dwelling is greater than 8,000mm²; AND
- The equivalent area of the background ventilation opening in each room is at least 4,000mm²; AND
- The background ventilation openings are positioned above windows or doors at a minimum height of 1.75m from finished floor level; AND
- The background ventilation openings are provided with a manually controlled mechanism for regulating and terminating supply air rates as desired by occupants.

The 'equivalent area' (also referred to as 'effective aerodynamic area') must be used as the measure of air flow performance of a background ventilator and therefore to demonstrate the design provision in accordance with the Credit Criteria.

The equivalent area is defined as the area of a sharp edged circular orifice which would pass the same air flow rate and at the same applied pressure difference as the background ventilator considered. The more contorted the air flow passages in a ventilator, the higher pressure required to transfer a particular air flow rate through the device. As such, two different ventilators with the same free area will not necessarily have the same air flow under the same pressure difference between inlet and outlet faces. The equivalent area metric considers device aerodynamics for various pressure differences and is therefore a more accurate approach.

Equivalent area must be determined and obtained from product manufacturers under test conditions. The European Standard, BS EN 13141-1:2004 (Clause 4) outlines a method for manufacturers to determine the equivalent area of background ventilation openings. For the purposes of this credit it is required that equivalent area is specified in terms of mm^2 at a 1Pa pressure difference.

Unlike equivalent area, 'free area' is simply a measure of the physical size of an aperture and therefore may not accurately reflect the air flow performance which the ventilator will achieve.

Kitchen extract and bathroom ventilation

Mechanical extract ventilation systems provided to kitchens and bathrooms must be compliant with the following requirements:

- Extract ventilation rates are in accordance with SANS 10400-O; AND
- Local, manual user control is provided for on/off switching; AND
- Filtration provisions (grease; where provided) and ductwork design (where provided) are in accordance with SANS 10400-O; AND
- For centralised exhaust systems serving two or more units; a sufficient minimum distance is achieved between the external exhaust discharge point and natural ventilation openings or fresh air intake points, as per Table IEQ-1.2;

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Recirculating type cooker hoods where air is filtered but not extracted from the dwelling do not satisfy the requirements for this point.

The Credit Criteria can be satisfied via a combination of local extract fans connecting to a dedicated centralised exhaust riser (separately for kitchen and separately for bathroom) each with centralised extract fan providing final discharge to outside. In such scenarios, the central exhaust riser(s) must be shown to be used exclusively for the applicable service (i.e. for kitchen or bathroom exhaust), and not combined.

For kitchen exhaust, each kitchen must also be shown to contain a dedicated and separate extract fan and ducting that connects directly to the central riser. To minimise the risk of cooking smells causing a nuisance to occupants and neighbours, the kitchen exhaust discharge must be separated in accordance with requirements defined in Table IEQ-1.2.

Kitchen Exhaust Discharge Rate [l/s]	Separation distance (ventilation opening/fresh air intake) [m]
<100	>1m
<400	>2m
<600	>3m
<800	>4m
<1000	>5m
>1000	>6m

Table IEQ-1.2: *Minimum separation between kitchen exhaust points and fresh air intakes (Source: Australian Standard, AS 1668.2-2002).*

Carbon monoxide (CO) monitoring

Carbon monoxide (CO) monitors must provide an audible alarm when permitted CO levels are exceeded. Such monitors are usually similar in appearance to smoke alarms. Installation is simple since they are usually battery powered, with battery lifetimes of typically up to seven years. A regular warning signal is emitted as the battery approaches its end of life. On detection of high CO levels the units alert occupants with a loud audible alarm.

For the purposes of Green Star SA, an applicable combustion device is any appliance, fixed or portable, which combusts a fuel (e.g. gas, paraffin, oil, wood etc.) irrespective of being a cooking appliance or not, including ornamental fires.

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The “provision” for the installation of a combustion device includes, but is not limited to, the installation of pipework from the fuel storage location to the kitchen or habitable space(s) of the dwelling(s).

BACKGROUND

Appropriate ventilation is an important aspect of multi unit residential dwelling design and although primarily influencing indoor air quality, ventilation also influences other issues such as energy consumption, thermal comfort of occupants and, for kitchen/bathroom ventilation, the longevity of surface finishes and materials.

The IEQ-1 Ventilation credit point allocation has been structured to allow project teams to address ventilation issues as deemed important for their particular design, with options from a range of ‘qualifying ventilation initiatives’.

Cross-ventilation design

Widely used across cultures and throughout history, dual aspect design is an effective passive design strategy for achieving cross-ventilation and natural cooling within a dwelling. The strategy utilises openings on two external walls in a dwelling unit to provide prevailing air currents a path through which to travel, pulling cool fresh air in and forcing warm stale air out. Because dual aspect design does not rely on fans but simply on opposite or adjacent-facing windows and breezes, the cooling and ventilation provided is free of energy consumption (therefore greenhouse gas emissions) and financial costs associated with mechanical ventilation.

Wind pressure is harnessed to improve ventilation through a dwelling. Studying wind patterns for a site location will dictate where windows should be placed on windward and leeward sides to take advantage of air pressure for cross-ventilation. Larger differences in window opening areas between the windward and leeward sides of a dwelling will increase airflow rates when wind is travelling in the prevailing direction.

Background ventilation – trickle ventilation

There are two requirements for effective ventilation of dwellings:

1) Background ventilation (sometimes called ‘trickle ventilation’): This is a relatively low level of ventilation which operates 24 hours a day and is needed to prevent the build-up of odours, to reduce the risk of humidity and damp problems, and to provide adequate fresh air to occupants.

2) Rapid ventilation (sometimes called ‘purge ventilation’): This is much higher rates of ventilation usually achieved by opening windows, which is needed to reduce overheating or to deal with particular air quality problems such as burnt food, etc.

The SANS 10400-O criteria for classification of a space as naturally ventilated of 5% openable windows is based on providing adequate rapid ventilation. However, it is not usually energy efficient to open windows during very cold or very hot weather, since excessive amounts of fresh air are allowed to enter the space.

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IEQ-1 Ventilation

POINTS AVAILABLE 3

Historically, buildings in South Africa have been leaky which means that significant amounts of fresh air enter through cracks and gaps in the construction. However, as construction methods improve and buildings become more airtight, it is important to provide dedicated controllable openings for background ventilation.

The Green Star SA Multi Unit Residential v1 rating tool therefore rewards the provision of vents which are specifically intended to provide a low level rate of background ventilation. These can be incorporated in window frames, or else take the form of air bricks with controllable grilles.

Kitchen extract and bathroom ventilation

Cooking, bathing and showering release moisture (and for kitchens, grease) into the surrounding air as a result of the combustion and cooking processes, and the evaporation of hot water. The most common effect of high humidity levels in a residential environment is the increased growth in dust mites and fungi, which are allergens and can lead to asthma and other respiratory problems (Baughman 1996).

Mould is a type of fungus. There are numerous naturally occurring fungi 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 dwelling. 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.

The release of quantities of moisture and grease into poorly ventilated dwellings over an extended period of time may also lead to the discolouration and degradation of interior surface finishes. This results in reduced serviceable lives of finishes and increases the frequency of maintenance and retrofits.

The air quality problems posed by cooking, showers and baths as noted above are easily mitigated by extracting the moisture and grease laden air from the kitchen and bathroom areas and discharging it outside.

Carbon monoxide (CO) monitoring

Carbon monoxide (CO) is a colourless, odourless, tasteless toxic gas produced by incomplete combustion in fuel-burning combustion devices. The Journal of the American Medical Association lists carbon monoxide as the leading cause of accidental poisoning deaths in America. Persons with CO poisoning often overlook the symptoms (e.g. headache, nausea, dizziness, or confusion) and undetected exposure can be fatal. Unintentional CO exposure accounts for an estimated 15,000 emergency department visits and 500 unintentional deaths in the United States each year.

While gas heating is less prevalent in South Africa than in colder climates, combustion devices may be used for the purpose of space heating, domestic water heating or cooking and will typically utilise solid fuel (e.g. open fires), Liquid Petroleum Gas (LPG) or Compressed Natural Gas (CNG). Such devices present a potentially high risk of producing carbon monoxide.

Sufficient fresh air (i.e. oxygen) for complete combustion, effective combustion gas extraction and regular maintenance will assist to reduce this risk. With increasing air-tightness of

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dwellings, there is a reducing amount of incidental infiltration air leaking into and out of buildings to ensure carbon monoxide levels are not dangerous if present.

Provision of carbon monoxide sensors in rooms containing combustion devices provides an affordable and effective early warning against unforeseen carbon monoxide build-up.

REFERENCES & FURTHER INFORMATION

BASIX definition of Cross ventilation
http://www.basix.nsw.gov.au/help/BASIX_Help.htm

NSW Department of Planning NSW SEPP No. 65 -Residential Flat Design Code Part 3 Building Design, Building Amenity, Natural Ventilation
http://www.planning.nsw.gov.au

Reardon, C. (2008), 4.6 Passive Cooling, Your Home Technical Manual,
http://www.yourhome. gov.au/technical/fs46.html

Rofail, T. (2006), Natural Ventilation in Buildings, NEERG Seminar Presentation, 16 August,
http://www.windtech.com.au/pages/newsletters/files/Natural%20Ventilation%20in%20Buildings.pdf

Walker, A. (2008), Natural Ventilation, Whole Building Design Guide,
http://www.wbdg.org/resources/naturalventilation.php

Australian Standard, AS 1668.2-2002, The Use of Ventilation and Air-conditioning in buildings, Part 2: Ventilation Design for Indoor Air Contaminant Control.
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http://www.sabs.co.za

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S.) (2007), ASHRAE Standard 62-2007 Ventilation for Acceptable Air Quality.
http://www.ashrae.org

Baughman, A.V and Arens, E.A. (1996), 'Indoor Humidity and Human Health – Part I: Literature Review of Health Effects of Humidity-Influenced Indoor Pollutants, ASHRAE Transactions 1996, Vol 102, Part I.
http://www.cbe.berkeley.edu/research/pdf_files/ArensBaughman1996_Pt2.pdf

United States Environmental Protection Agency (US EPA) (1994), Indoor Air Pollution: an Introduction for health professionals,
www.epa.gov/iaq/pubs/hpguide.html#Int

European Standard, BS EN 13141-1:2004, Ventilation for buildings. Performance testing of components /products for residential ventilation of Background Ventilator openings
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www.cibse.org

American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S (ASHRAE) ASHRAE Fundamentals Handbook 1997.
http://www.ashrae.org

ASHRAE – Minimizing Indoor Mould 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

Carbon Monoxide Poisoning Advice
http://www.carbonmonoxidekills.com

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IEQ-4 Daylight

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise designs that provide good levels of daylight within dwellings.

CREDIT CRITERIA

Up to three points are awarded:

One point is awarded where for a minimum 90% of dwellings:

- 60% of the habitable area [excluding kitchens] of each dwelling meets the minimum daylight criteria detailed below.

OR

Two points are awarded where for a minimum 90% of dwellings;

- 90% of the habitable area [excluding kitchens] of each dwelling meets the minimum daylight criteria detailed below.

The minimum daylight criterion for Credit Criteria compliance is;

- A Daylight Factor (DF) of no less than 1.5% (measured at FFL);

  OR
- A Daylight Illuminance (DI) of no less than 150 lux (measure at FFL).

An additional point is awarded where:

- At least one point is achieved above:

  AND
- A Daylight Factor (DF) of no less than 2% or a Daylight Illuminance (DI) of no less than 200 lux is achieved for 90% of the nominated area of the kitchen (measured at 900mm above FFL) for all dwellings where the criteria above is achieved.

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IEQ-4 Daylight

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Daylight report 2. Tender drawing(s) 3. Extract(s) from tender documentation	1. Daylight report 2. As Built drawing(s) 3. Manufacturer product datasheet(s)

Daylight report prepared by a suitably qualified 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 dwelling/building model(s) including values of reflectance and transmittance used for each relevant material/glazing;
- Describing how the impacts of window frames and reveals have been considered in the simulation;
- Describing the height(s) above finished floor level used for the calculation plane(s);
- For each dwelling types, showing outputs from the daylight modelling;
- Providing a summary table that identifies all spaces within each dwelling types' habitable area, areas compliant, identifies the DF or DI values within those areas, and provides calculations to confirm that compliant areas jointly contribute to the claimed percentage of the habitable area for the dwelling type;
- Describing the design sky used for the daylight model; and,
- Justifying the inclusion or exclusion of surrounding buildings, with reference to supporting evidence (e.g. aerial image or site plan) and detailing the average reflectance used for surrounding buildings (where applicable).
- Where compliance is on the basis of DI, confirming the calculation method is as described in the Additional Guidance section.

Tender / As Built drawings marked-up to identify;

- The relevant glazing elements within the façade(s) and relevant roof lights within the roof (where applicable);
- The habitable areas modelled.

Extract(s) from tender documentation where all glazing specifications (i.e. visual light transmittance factors) are nominated.

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Manufacturer product datasheet(s) from the glazing manufacturer for each glass type used within the development and indicating the visual light transmittance of each.

ADDITIONAL GUIDANCE

Analysis grid

All software calculates Daylight Factor or Daylight Illuminance 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.

Modelling to calculate the Daylight Factor or Daylight Illuminance must consider the total floor area and be calculated at finished floor level (FFL) for at least 1 analysis point for each $1m^2$ 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, each 1m² must begin at the façade. Results are then calculated in the centre point for each square in the grid.

Reflectance values

The following reference reflectance values are to be used whenever actual reflectance values are not known. If the actual values substantially differ from these reference values, 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 and dwelling design.

Overshadowing

Overshadowing must be taken into account in the modelling. A nearby building or structure 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 nominal reflectance of 0.5 must be used for surrounding buildings.

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IEQ-4 Daylight

POINTS AVAILABLE 2

Projects may choose to model and submit a report for typical floors or dwellings of their project, rather than for a number of identical floors or dwellings. Projects that choose to do so must justify that the selected floor plates or dwellings represent the 'worst case' scenario amongst the floors or dwellings they represent (incl. overshadowing by adjacent buildings). The Certified Assessor(s) reserve the right to request further clarification or justification to ensure that the project meets the Aim of the Credit.

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.

In this case, values must be derived from a statistical analysis of outdoor illuminance levels for the particular project location, representing a horizontal illuminance level that is exceeded 85% of the time between the hours of 8am and 6pm throughout the working year. Thus they also represent a worst-case scenario that a building can be designed to and ensure it will meet the desired light levels at least 85% of the time.

With a Uniform Sky, no matter where in the sky you look, the sky has the same illuminance value. The shading effect of the immediate surrounding building and any obstructions still have to be taken into account.

Daylight Illuminance method

The Daylight Illuminance levels within the dwellings must be simulated at 12 noon on the equinox (21st March/September) using a Clear Sky. Light levels above 150lux or 200lux (as required by the Credit Criteria) can count towards the credit.

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CIE Design Sky

Figure IEQ-4.1 illustrates the various CIE design skies which 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.

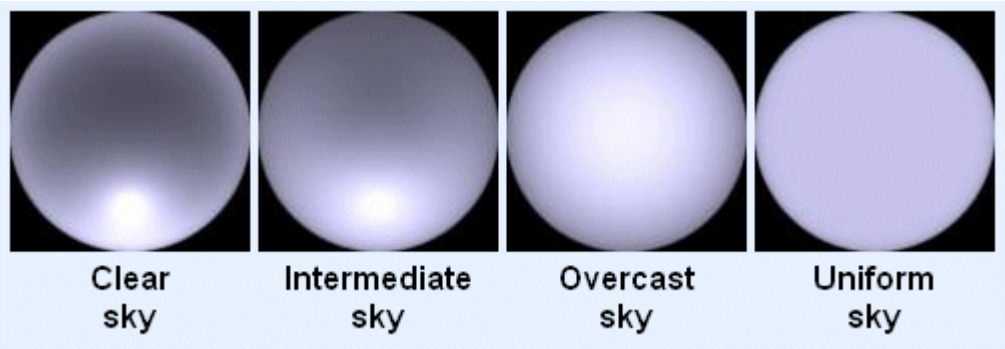

Figure IEQ-4.1: *Illustration of the different CIE design skies.*

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

BACKGROUND

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. 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 a case study 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 overall 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.

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IEQ-4 Daylight

POINTS AVAILABLE 2

Whilst most of the current research has been developed for school environments, the general improvements observed are considered relevant to improving the occupant health and wellbeing of residential occupants.

Natural lighting is not without its issues. These include glare, overheating, variability and privacy issues. Effective natural daylighting can be achieved through the strategic placement of skylights and windows and use of intelligent artificial lighting controls which monitor and respond to available daylight levels to maximise natural lighting without compromising day-to-day comfort.

REFERENCES & FURTHER INFORMATION

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http://www.cibse.org

International Energy Agency (2000), Daylighting in Buildings
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IEQ-9 Thermal Comfort

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise dwelling designs that achieve suitable levels of thermal comfort for occupants.

CREDIT CRITERIA

NOTE: *Project Teams must select Compliance Route 1 OR Compliance Route 2 in accordance with the compliance route selected for Ene-1 Greenhouse Gas Emissions – Heating & Cooling. Projects are NOT required to demonstrate compliance to both routes.*

Compliance Route 1 - Energy Modelling (up to 3 points)

Up to three points are awarded where:

- For all dwellings, the internal operative temperatures for both bedroom areas and remaining habitable areas are within the ASHRAE Standard 55-2004 80% *Acceptability Limits*, awarded as follows:
  - Two points for 85% of occupied hours as defined;
    OR
  - Three points for 95% of occupied hours as defined.

The modelling must be undertaken in accordance with the Green Star SA Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

Compliance Route 2 - Deemed-to-Satisfy (1 point)

One point (only) is awarded where the following criteria are achieved (as applicable):

- Where dwellings are provided with active heating system(s), for each dwelling they must:
  - Serve all habitable areas;
    AND
  - Include a minimum of one centrally located thermostat to control the heating system.

  AND
- Where dwellings are provided with active cooling system(s), for each dwelling they must:
  - Serve all habitable areas;
    AND
  - Include a minimum of one centrally located thermostat to control the cooling system.

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AND

- Where no active heating systems are provided within the development contract, all dwellings must demonstrate:
  - High performance specifications for wall, roof and window insulation, by achieving one point for Ene-1 Part A;
    AND
  - High performance specifications for window insulation, by achieving one point for Ene-1 Part D.

AND

- Where no active cooling systems are provided within the development contract, all dwellings must demonstrate all of the following:
  - Effective natural ventilation is achieved via 'cross-ventilated design', by achieving first point in IEQ-1;
    AND
  - Effective thermal mass, by achieving one point for Ene-1 Part B;
    AND
  - Effective control of solar heat gains, by achieving one point for Ene-1 Part D.

DOCUMENTATION REQUIREMENTS

Note: *Project Teams must select Compliance Route 1 OR Compliance Route 2 in accordance with the compliance route selected for Ene-1 Greenhouse Gas Emissions – Heating & Cooling. Projects are NOT required to demonstrate compliance to both routes.*

Compliance Route 1 – Energy Modelling

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Thermal comfort report	1. Thermal comfort report

Thermal comfort report prepared by a suitably qualified professional in accordance with the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide, demonstrating how the Credit Criteria have been met by:

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IEQ-9 Thermal Comfort

POINTS AVAILABLE 3

- Providing a description of the heating and/or cooling systems, or passive strategies (where applicable);
- Providing a tabulated summary of the bedroom and habitable areas addressed, demonstrating compliance with the Credit Criteria;
- Providing a summary of the thermal comfort conditions, aligning them with ASHRAE Standard 55-2004;
- Confirming that all modelling inputs are in exact accordance with the modelling presented in Ene-1 Greenhouse Gas Emissions – Heating & Cooling;
- Confirming that any active heating and/or cooling systems have been commissioned and operate as intended by the design as demonstrated in documentation presented in Ene-1 Greenhouse Gas Emissions – Heating & Cooling (As Built only)

Compliance Route 2 – Deemed to Satisfy

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report	1. Short report

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by;

- Describing how each deemed to satisfy requirement has been met for each dwelling type;
- Confirming that compliance with all deemed to satisfy requirements is demonstrated in documentation presented in Ene-1 Greenhouse Gas Emissions – Heating & Cooling.
- Confirming that any active heating and/or cooling systems have been commissioned and operate as intended by the design as demonstrated in documentation presented in Ene-1 Greenhouse Gas Emissions – Heating & Cooling (As Built only).

ADDITIONAL GUIDANCE

All inputs into the modelling or calculations (e.g. building form, materials, air conditioning system(s) etc.) must be referenced consistently throughout the rest of the submission (i.e. consistent in Ene-1 Greenhouse Gas Emissions – Heating & Cooling or IEQ-1 Ventilation).

While in the Green Star SA Office v1 and Green Star SA Retail Centre v1 rating tools, Predicted Mean Vote (PMV) is used to assess occupant thermal comfort, for the Green Star

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SA Multi Unit Residential v1 rating tool a less sophisticated measure of operative temperature and adaptive thermal comfort is used in order to simplify calculations.

ASHRAE 55-2004 Adaptive Comfort Temperatures

The ASHRAE 55-2004 guide defines a range of operative temperatures which are deemed comfortable for a naturally ventilated space, where occupants have control over openings.

Operative temperature can be assumed for the purpose of Green Star SA in the context of temperatures experienced in residential dwellings, as the average of the mean radiant and ambient air temperatures.

The mean radiant temperature is the mean of the temperatures of the exposed surfaces in the room. Rooms with limited glazing and heavyweight finishes will therefore tend to have more stable 'operative temperatures' than those with large windows and lightweight/insulating finishes.

As per ASHRAE 55-2004, the acceptable ranges of operative temperatures are governed by the mean monthly outside air temperature experienced at the project site. This is based on the concept that people living in warmer climates can tolerate higher internal temperatures than those living in colder climates. A summary of the ASHRAE 55-2004 acceptability limits for thermal comfort are contained in Table IEQ-9.1. Please refer to ASHRAE 55-2004 for full details.

Mean monthly outdoor temperature	Min internal temp (80% acceptability)	Min internal temp (90% acceptability)	Max internal temp (90% acceptability)	Max internal temp (80% acceptability)
°C	°C	°C	°C	°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*

Compliance to the 80% acceptability limits of ASHRAE 55-2004 should be determined using the following methodology:

a) Using hourly site data, determine the mean external temperature (24 hours per day) for each month of the year;

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b) Use the monthly mean temperatures as calculated in a) above to determine the operative temperatures corresponding to the upper and lower boundaries of the ASHRAE 55:2004 Acceptability Limits for each month;
c) Using dynamic thermal simulation/modelling software, determine the hourly operative temperature for each zone during the occupied hours of the day;
d) Compare the operative temperatures with the monthly limits to determine the number of hours that comply each month and calculate the percentage of hours during the year when the thermal comfort conditions are met;
e) If a dwelling has several bedrooms, the area weighted percentage of hours that meet the criteria should be determined based on the floor area of each bedroom (see example below). This process should be repeated separately for all other habitable spaces;
f) Determine the proportion of dwelling types where both the bedroom and other habitable areas comply.

To demonstrate compliance with the Credit Criteria, post-processing of results obtained from dynamic thermal simulation/modelling software will be required to be completed using commercially available spreadsheet programs.

For example, a dwelling has two large bedrooms with areas of $20m^2$ and $15m^2$. It has been calculated that the 80% Acceptability Limit has been met for 94% and 87% of the occupied bedroom hours respectively. The area weighted thermal comfort performance of the bedrooms is calculated as (94%×20 + 87%×15) / (20 + 15) = 91%.

The same dwelling has an open plan kitchen/lounge area of $30m^2$ and a study of $17m^2$ where the 80% Acceptability limits are met for 70% and 90% of the living areas occupied hours respectively The area weighted thermal comfort performance of the remaining habitable area is calculated as: (70%×30 + 90%×17) / (30 + 17) = 77%.

This has indicated that the dwelling does not comply with the Credit Criteria as, although the bedrooms meet the limits for over 85% of occupied hours, the remaining habitable areas (i.e. open plan kitchen/lounge and study) do not.

It must be demonstrated that the thermal comfort conditions are met based on the occupied hours in each zone as per the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

Bedroom zones are occupied for 12 hours per day, totalling to 4380 hours per year, and thus the bedrooms in a dwelling comply if the thermal comfort limits are exceeded (i.e. thermally uncomfortable) for up to 876 hours per year.

Other habitable areas are occupied for 15 hours per day, totalling to 5475 hours per year, and comply if the thermal comfort limits are exceeded (i.e. thermally uncomfortable) for up to 1095 hours per year. Studio apartments where the bedroom is within the same space as the living area are occupied for 24 hours per day, totalling 8760 hours per year.

It is not acceptable to complete a single area-weighting calculation for all zones within the development to demonstrate that the Credit Criteria are met. It must be completed on a dwelling type by dwelling type basis, clearly demonstrating which dwelling types comply and which dwelling types do not comply with the Credit Criteria;

All modelling completed to demonstrate compliance with the Credit Criteria must be in accordance with the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling

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Protocol Guide. Internal zones, zone distribution, weather data and standard variables for the model(s) are detailed within this Guide.

Where Project Teams wish to claim points in IEQ-9 Thermal Comfort using Compliance Route 2 however points are not being claimed in Ene-1 Greenhouse Gas Emissions – Heating & Cooling, the applicable 'Documentation Requirements' of Ene-1 must be satisfied to demonstrate compliance with IEQ-9.

BACKGROUND

Thermal comfort is an occupant's condition of mind which expresses satisfaction, or not, with their thermal environment. Thermal comfort is influenced by; air temperature, radiant temperature, humidity, movement of air, clothing and physiological characteristics (i.e. metabolic rate). Seldom do two occupants perceive the exact same level of thermal comfort satisfaction within the same space.

The theory of adaptive thermal comfort acknowledges that an occupants' perception of satisfaction with their thermal environment can vary depending on the climate they are accustom to; conditions of temperature, humidity and air speed within which comfort is perceived in one climate is not exactly the same as another. For example, an occupant from Upington and an occupant from St. Lucia may have different perceptions of air temperature and humidity which are thermally comfortable. Comfortable humidity levels in St. Lucia may not be deemed comfortable in Upington.

Occupants within residential dwellings have significantly greater ability to influence and control their thermal comfort compared to an occupant of an office building. Within residential dwellings clothing levels can be readily adapted, ventilation openings may be opened or closed and air conditioning or heating may be turned on or off. This is unlike an office environment where such variables are often not able to be changed (significantly) by occupants.

The thermal comfort levels which can be provided by a dwelling can influence both occupant wellbeing and the on-going energy consumption and greenhouse gas emissions of the dwelling. Poorly designed dwellings which do not maintain appropriate thermal comfort levels may exhibit over heating in summer, or be very cold in winter. Such dwellings can impact the wellbeing of occupants through sleep disruption, inducing lethargy or create conditions for susceptibility to illness. These issues are particularly relevant to the very young (i.e. babies or young children) or the elderly, whom may be limited in their ability to mitigate such uncomfortable conditions.

To maintain thermal comfort within poorly designed dwellings, active heating and or air conditioning systems are typically relied upon. However, where relied upon to provide thermal comfort for extended periods, a significant increase in energy consumption (and greenhouse gas emissions) and running costs may result compared to an equivalent dwelling which can maintain appropriate thermal comfort passively. By encouraging and recognising in Green Star SA, dwelling designs that achieve suitable levels of thermal comfort for occupants ensures that occupant wellbeing is improved, whilst also minimising the risk that active heating or air conditioning systems are retro-fitted to new dwellings in the future.

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IEQ-9 Thermal Comfort

POINTS AVAILABLE 3

REFERENCES & FURTHER INFORMATION

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) (2004), ASHRAE 55 – Thermal Environmental Conditions for Human Occupancy
http://www.ashrae.org

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), Fundamentals Handbook 2009
http://www.ashrae.org

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1992), Standard 55-1992 - Thermal environmental conditions
http://www.cibse.org

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IEQ-11 Hazardous Materials

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise actions taken to reduce health risks to dwelling occupants from the presence of hazardous materials.

CREDIT CRITERIA

One point is awarded where:

- A comprehensive hazardous material survey has been carried out on the project site, as defined by the South African Occupational Health and Safety (OH&S) Act;

  AND

- Wherever asbestos, lead or polychlorinated biphenyls (PCBs) were found, they have been removed in accordance with the standards listed under Table IEQ-11.1.

Where no buildings or structures existed at the time of site purchase, or for refurbishments or redevelopments where none of the above hazardous materials were found, 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 – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Hazardous materials survey report	1. Hazardous materials survey report
Additionally where applicable hazardous materials were found:	Additionally where applicable hazardous materials were found:
2. Hazardous materials survey report OR	2. Hazardous materials survey report OR
3. Extract(s) from contract	3. Disposal receipts
Where no existing buildings or structures were present:	Where no existing buildings or structures were present:
4. Short report	4. Short report

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IEQ-11 Hazardous Materials

POINTS AVAILABLE 1

Hazardous materials survey report prepared by a suitably qualified professional demonstrating how the Credit Criteria have been met by:

- Describing the hazardous material survey scope (i.e. what buildings or structures are included);

Where survey completed and hazardous materials identified:

- Detailing in a tabulated summary, all hazardous materials identified as present within all existing buildings and/or structures on the project site;

Where survey completed and no hazardous materials identified:

- Confirming that no asbestos, lead and/or PCBs were identified in any existing buildings and/or structures on the project site.

Additionally where post-decontamination hazardous material survey completed:

- Confirming there is no longer any asbestos, lead and/or polychlorinated biphenyls present within the project site; and
- Confirming that all hazardous materials identified in the initial 'Hazardous Material Survey Report' have been removed and disposed of in accordance with standards listed under Table IEQ-11.1.

Short report prepared by a relevant project team member describing how the credit is not applicable with reference to supporting evidence (e.g. aerial survey, site plan etc.).

Extract(s) from contract between the Developer and Contractor (or Sub-Contractor) clearly stipulating the removal of the hazardous materials identified in 'Hazardous Materials Survey Report'.

Disposal receipts from the recipient of the hazardous waste confirming the disposal of the identified hazardous materials.

ADDITIONAL GUIDANCE

This credit considers only those hazardous materials which may be present in existing buildings or structures within the project site. Hazardous materials or contaminants present in soil or sub-surface materials are considered in Eco-3 Reclaimed Contaminated Land within the Land Use & Ecology category.

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.

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IEQ-11 Hazardous Materials

POINTS AVAILABLE 1

The credit can only be deemed 'Not Applicable' whereby it is demonstrated via a hazardous materials survey that no asbestos, lead or PCBs are present in existing buildings or structures within the project site, or where no existing buildings or structures were present at the time of site purchase.

It must be clear from the submitted documentation that the hazardous materials within the scope of the credit will be or have been removed as per the relevant standards or legislation as detailed in Table IEQ-11.1.

Hazardous Materials	Relevant Standards or Legislation
Asbestos	South African National Occupational Health and Safety Act, 1993, National Environmental Management: Waste Act, 2008 and associated regulations.
Lead	South African National Occupational Health and Safety Act, 1993, National Environmental Management: Waste Act, 2008 and associated regulations.
PCBs	South African National Occupational Health and Safety Act, 1993, National Environmental Management: Waste Act, 2008 and associated regulations

Table IEQ-11.1: *List of relevant legislation and standards*

The disposal receipts must account for all hazardous materials in all locations as identified in 'Hazardous Materials Survey Report'. Where disposal receipts do not account for all hazardous materials in all locations identified, the credit will not be rewarded.

The contract must be counter-signed and demonstrate a contractual obligation by the Contractor or Sub-Contractor to remove the hazardous materials in accordance with the standards and legislation listed in Table IEQ-11.1.

The documentation requirement 'Hazardous materials survey report' may consist of two individual reports; an initial survey report and a post-decontamination report, with the latter referencing the former.

BACKGROUND

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

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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.

Asbestos is composed of many very small fibres. Because they are very fine, when they become airborne the fibres are easily inhaled or swallowed. When they are inhaled, the lung's defence cells try but cannot break down or destroy the fibres, which results in the asbestos fibres permanently remaining in the lungs causing scarring and inflammation for decades. This can further cause various lung-based diseases (mesothelioma, asbestosis, lung cancer) which can take up to 40 years to develop.

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 (POPs). 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. PCBs are most commonly found in the ballasts of fluorescent light fixtures.

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;
- 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 miscarriage 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.

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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.

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%. Thus the disturbance or removal of old paint can still create a health hazard to both humans and surrounding soil.

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.

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/

National Environmental Management: Waste Act, 2008.
http://www.info.gov.za/view/DownloadFileAction?id=97351

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

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IEQ-11 Hazardous Materials

POINTS AVAILABLE 1

ANZECC Guidelines Polychlorinated Biphenyls Management Plan
http://www.environment.gov.au/settlements/publications/chemicals/scheduled-waste/pubs/biphenyls.pdf

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IEQ-12 Internal Noise Levels

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise dwellings that are designed to maintain internal noise levels at an appropriate level.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

One point is awarded where:

- For all dwellings, the internal noise level (combined building services noise and external noise intrusion), does not exceed the following levels:
  - 35 dBLAeq (1 hour) in any bedroom during the night time period (10pm to 7am);
    AND
  - 40 dBLAeq (1 hour) in other habitable rooms [excluding kitchens & bathrooms] at any time during the day or night time period (24hrs).

One point is awarded where;

- For all dwellings the acoustic performance of:
  - All wall and floor constructions separating habitable areas of adjacent dwellings, achieves an airborne noise isolation standard of $R_w + C_{tr} \geq 55$;
    AND
  - Floor constructions between adjacent dwellings, achieve an impact isolation standard of $L_{n,w} - C_l \leq 55$.

Where less than 30% of the total number of dwellings share wall and/or floor/ceiling elements that separate habitable areas of adjacent dwellings, the second point is 'Not Applicable' and is excluded from the points available, used to calculate the Indoor Environment Quality category score.

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IEQ-12 Internal Noise Levels

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Acoustic report 2. Tender drawing(s) Where second point claimed 'Not Applicable': 3. Short report	1. Acoustic report Additionally where confirming noise levels by design implementation: 2. As Built drawing(s) Where second point claimed 'Not Applicable': 3. Short report

Acoustic report prepared by a qualified Acoustic Consultant that describes how Credit Criteria have been met by:

Where compliance demonstrated by design implementation (first point):

- Describing all relevant internal and external noise sources and quantified levels from building services, or lack thereof, and quantified levels from building services;
- Describing supporting external noise level measurements and measurement methodology, or justification why external noise level measurements were not required;
- Describing the noise control features required to achieve the Credit Criteria, with references to relevant supporting drawings;
- Providing a table of habitable areas for all dwelling types indicating where noise control features are included and compliance with the Credit Criteria is achieved;
- Providing comment on low frequency noise, confirming that this has been considered in the design of dwellings (if applicable); and,
- Providing a conclusion that supports compliance with the Credit Criteria.

Where compliance demonstrated by design implementation (second point):

- Providing a tabulated summary of all typical wall and floor constructions, the impact isolation and airborne noise isolation standard estimated for each; and,
- Confirming all wall and floor constructions achieve compliance with the Credit Criteria.

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IEQ-12 Internal Noise Levels

POINTS AVAILABLE 2

Where compliance demonstrated by noise level measurement and/or testing (As Built only; first point):

- Providing a summary table of the habitable spaces tested and confirming that this represents 10% of all habitable spaces in the development, the measured internal noise levels in each space;
- Confirming the test methodology used, the conditions under which the testing was done, including the time of testing and confirming that the spaces tested are representative and 'worst case';
- Proving architectural floor plans indicating the location of test points;
- Confirming that all plant and equipment was operating during the test (if applicable), and that the testing was conducted at a time appropriate to the external noise environment;
- Confirming that all dwellings are compliant with the Credit Criteria.

Where compliance demonstrated by noise level measurement and/or testing (As Built only; second point):

- Providing a tabulated summary of all typical wall and floor constructions tested, the impact isolation and airborne noise isolation standard achieved for each; and,
- Confirming compliance with the Credit Criteria.

Tender / As Built drawing(s) clearly marked-up to show, for all dwelling types, relevant wall and floor constructions and other relevant acoustic details, demonstrating that the noise control features have been incorporated as per the Acoustic report (where required).

Short report prepared by a relevant project team member, demonstrating through calculations, that the total number of dwellings that share wall and/or floors that separate habitable areas of adjacent dwellings is less than 30%.

ADDITIONAL GUIDANCE

The Credit Criteria applies to all dwellings irrespective of location. The Credit Criteria for the second point does not apply to internal walls or internal floors within the same dwelling.

Acoustic Reports

The GBCSA offers the following additional guidance for acoustic reports:

- The acoustic consultant must reach a conclusion that supports compliance with the Credit Criteria.
- The data provided in the report must clearly justify the conclusion and account for all constant noise sources (hydraulic and mechanical systems that are both internal and external to the space).
- In most cases, it is in the interest of the project to provide a tabulated summary listing the noise levels in all relevant spaces and comparing them to the values prescribed in the Credit Criteria.

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Low frequency 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.

Internal noise level measurements

Measurements must be carried out by a suitably qualified acoustic consultant to the applicable sections of SANS 10103:2004 'The measurement and rating of environmental noise with respect to land use, health, annoyance and speech communication'. These measurements must be taken when the dwelling is unoccupied, but with all the building services running as for normal operation of the building/dwelling.

Tests must be carried out in for at least 10% of rooms in the development and in accordance with the times stipulated in the credit criteria for bedrooms and other habitable rooms. The selected measurement locations must be demonstrated to be representative of all the spaces.

Considering the practical difficulties of achieving the internal noise criteria with all windows open, for the purpose of Green Star SA - Multi Unit Residential v1 tool, it is permitted for internal noise level criteria to be demonstrated with windows in the closed position. All background ventilation openings, however, must be open.

For the internal noise level measurements of an As Built submission, it is permissible to test a representative floor of a multi-story building with repetitive, identical floor plates and dwelling layouts, as long as the worst case of the repetitive floors is tested. The Project Team must clearly demonstrate and justify that the floor tested is "worst case". Any floor with a different floor plan and dwelling layout must be tested separately.

Occupants and equipment

Noise from occupants and non-base building services equipment such as washing machines and dishwashers must not be included in the analysis or measurements. However, noise from intermittent equipment such as emergency generators must be included in the analysis or measurements.

External noise level measurements

The GBCSA does not explicitly require that external noise level measurement surveys be conducted. It is at the discretion of the qualified Acoustic Consultant if external noise level measurement surveys are required to appropriately inform the acoustic design response. Where not deemed necessary, the qualified Acoustic Consultant must justify within the documentation as to why external noise level measurement surveys are not required.

Where deemed necessary and conducted, external noise levels must be measured on the actual project site and not on a neighbouring site, in order to accurately reflect true conditions. The period of measurement is also at the discretion of the qualified Acoustic Consultant, however must be selected such that all potential sources of noise (of concern) are measured.

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IEQ-12 Internal Noise Levels

POINTS AVAILABLE 2

BACKGROUND

Internal noise is a significant factor in terms of occupant satisfaction and wellbeing, 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.

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.

- 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).
- $L_{n,w}$ +C_l – This is used to describe impact sound performance of floors $L_{n,w}$= *Weighted Normalised Impact Sound Pressure Level* and C_l = *Spectrum Adaptation Term*. The lower the $L_{n,w}$ +C_l the better the performance of the floor.
- R_w + C_{tr} is used to describe the sound insulation performance R_w= the *Weighted Sound Reduction Index* and C_{tr} = A correction factor (and is a negative number). Therefore, if a building element has R_w of 60 and a C_{tr} of –10, its R_w+ C_{tr} will equal 50. The addition of C_{tr} and R_w helps to account for lower frequency sounds, such as those created by modern home theatre systems and music equipment. The higher the R_w +C_{tr} number, the better the performance of the system.

Ambient noise level is a measure of 'background sound' that tends to be of low intensity and is present for most of the time. In a building, it can be defined as the noise level in a space caused by a composite of sounds from HVAC, equipment, lighting systems, computers, activity noises and the like, but excluding specific sources of interest, such as a person talking in an adjacent space. Excessive amounts of ambient sound can cause stress, which can impede an individual's ability to work well or to be comfortable.

"Noise can interfere with sleep, rest and conversation, and cause fatigue, irritability, headaches and stress" (Milne, n.d.). Thoughtful design can minimise negative impacts of noise for residents. Design options include acoustic insulation, locating windows or quiet rooms away from noise sources and avoiding locating noise generators (laundries, bathrooms, living rooms) adjacent to bedrooms without adequate insulation, among others.

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REFERENCES & FURTHER INFORMATION

SANS 10103:2004 - The measurement and rating of environmental noise with respect to land use, health, annoyance and speech communication.
www.sabs.co.za

SANS 10218-1:2004, Acoustical properties of buildings – Part 1: Grading Criteria for the airborne sound insulation properties of buildings
www.sabs.co.za

SANS 10218-2:2004, Acoustical properties of buildings – Part 2: The Assessment of building plans with respect to their acoustical properties
www.sabs.co.za

SANS 11690-2:1996 – Acoustics – Recommended practice for the design of low noise workplaces containing machinery
www.sabs.co.za

ASHRAE HVAC Applications Volume (2003) – Chapter 47: Sound and Vibration Control

CIBSE Guide A – Environmental Design (2006) – 1.9 Acoustic Environment
CIBSE Guide B (2002) – B5 Noise and Vibration Control for HVAC

Milne, G. (undated), '2.7 Noise Control', Technical Manual: Design for Lifestyle and the Future, Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia, Canberra.
http://www.yourhome.gov.au/technical/fs27.html

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 ISO140-4 (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

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IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 4

AIM OF CREDIT

To encourage and recognise designs that incorporate interior finishes that minimise the contribution to levels of Volatile Organic Compounds within dwellings and common areas.

CREDIT CRITERIA

Up to four points are awarded independently as follows:

Paints

One point is awarded where:

- At least 95% of all painted surfaces within rentable area and applicable common area meet the TVOC Content Limits outlined in Table IEQ-13.1 and must not contain any added lead in the form of driers or pigments;

  OR

- Where no paint is used within rentable area or applicable common area.

Adhesives and Sealants

One point is awarded where:

- At least 95% of all adhesives and sealants applied within rentable area and applicable common area meet the TVOC Content Limits outlined in Table IEQ-13.2

  OR

- Where no adhesives or sealants are used within rentable area or applicable common area.

Wall and Ceiling Coverings

One point is awarded where:

- At least 95% of all wall and ceiling coverings within rentable area and applicable common area meet the TVOC Content Limits outlined in IEQ-13.4

  OR

- No wall and ceiling covering is installed within rentable area or applicable common area.

Carpets and Floor Coverings

One point is awarded where:

- At least 95% of all carpets and floor coverings within rentable area and applicable common area meet the TVOC emissions limits outlined in Table IEQ-13.3

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IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 4

Where no carpet or floor covering is installed in rentable area or applicable common area, the carpets and floor covering point is 'Not Applicable' and is excluded from the points available, used to calculate the Indoor Environment Quality category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation Additionally where proprietary products specified: 3. Manufacturer product datasheet(s)	1. Contractor compliance report 2. Manufacturer product datasheet(s) 3. Statement(s) of confirmation

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

- Listing all the products proposed within the project that are in the scope of the selected Credit Criteria (i.e. product categories);
- Listing all proprietary products specified in the extract(s) from tender documentation and indicating their compliance with the Credit Criteria, with reference to supporting documentation (where applicable);
- Where the extract(s) from tender documentation demonstrates a requirement of less than 100% compliance (e.g. all paints must comply), demonstration via calculation (of areas) that the 95% threshold of each applicable product category is met;

Where fourth point claimed 'Not Applicable':

- Confirming that rentable area or applicable common area does not incorporate any carpets or floor coverings.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- The products to meet the stipulated TVOC limits (by explicit mention) and lead content limits (where applicable) for each applicable product within rentable area and applicable common area;
- The Contractor/Sub-Contractor to obtain approval of the design team or client before substituting the applicable products and requiring that at the end of construction works, the

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contractor undertakes a final audit to ensure that the correct products have been used; and

- That where the project includes no finishes from a particular product category, it is clearly stated that no finishes are to be used for the particular application in the project.

Manufacturer product datasheet(s) must be official manufacturer product datasheets, be provided for each compliant product, and:

- Clearly indicates the compliant TVOC level as referenced in the short report;
- States the calculation method used to determine the TVOC level; and
- For paint finishes only; states that the paint product does not contain added lead.

Statement(s) of confirmation from supplier(s) in the form of signed correspondence stating the quantity of applicable product(s) supplied to the Contractor/Sub-Contractor for the project, and that the product(s) are compliant with the Credit Criteria (for each applicable product).

Contractor compliance report prepared by the Contractor that describes how Credit Criteria have been met by:

- Listing all the products used within the project, their application, their suppliers and inclusion or exclusion in the scope of the Credit Criteria;
- The actual TVOC limits of each product with reference to the appropriate manufacturer product datasheet(s) and nominating compliance with the Credit Criteria;
- Demonstrating that all applicable products within the scope of the Credit Criteria are compliant;

Where fourth point claimed 'Not Applicable':

- Confirming that no carpet or flooring was installed in the rentable area and applicable common area;

ADDITIONAL GUIDANCE

The scope of the Credit Criteria is inclusive of interior finishes within dwellings and finishes within applicable common areas, irrespective of exposed or concealed applications.

Applicable common areas include, but are not limited to, internal corridors and passages, internal lobbies, internal stairwells (fire escape or otherwise), internal spaces used for communal activities (e.g. meeting room, gyms, libraries, theatre rooms, media rooms etc.), caretaker/management or other similar spaces. Corridors or passages which are covered, but largely open to outside through the use of permanent openings, balustrades or fixed louvers, are considered as 'external' and excluded from the scope of the Credit Criteria. Common areas excluded from the scope of the Credit Criteria include, but are not limited to, car parking areas, storage areas, plant and equipment areas, lift shafts, garbage or recycling waste storage areas, communal bicycle storage areas etc. Finishes applied to all external spaces or surfaces are excluded from the scope of the Credit Criteria.

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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 within the documentation.

The specifications given to contractors must explicitly list all the appropriate low-VOC content or emissions (depending on the product category) next to each product used. A general clause that stipulates that compliance is required with Green Star SA – Multi Unit Residential Technical Manual, is not acceptable for the documentation requirements.

Manufacturer product datasheets

For the purposes of the IEQ-13 Volatile Organic Compounds credits, a 'Manufacturer product datasheet' is defined as:

- Laboratory test reports or test certificates – Product TVOC test reports / certificates must be issued by an ISO/IEC 17025 certified testing laboratory and must state the product name, TVOC result and the testing method used;

  OR

- Material Safety Data Sheets (MSDS) – Where a product MSDS includes TVOC information, it must include the numerical result expressed in g/litre of product and the test method used to obtain the results;

  OR

- Manufacturer prepared VOC data sheets – Product VOC data sheets that have been prepared by the manufacturer to demonstrate TVOC must be based on theoretical calculations of the subtotal of the known VOC values of the product's raw material components. The manufacturer prepared VOC data sheets must contain the following:
  - Numerical TVOC results expressed in g/litre of product (the total VOC content, not the itemized calculation. In other words, just the sum);
  - 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.

Screen captures of website information is not an acceptable form of documentation to demonstrate a product's compliance with the Credit Criteria.

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. Paints used in exterior applications do not require documentation and are excluded from this credit. All internal applications must meet the Credit Criteria, whether they are exposed or concealed, and whether the paint applied internally is classified for internal or external applications.

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 must reflect the final product as mixed and ready to use, inclusive of tints and irrespective of the number of coatings.

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IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 4

VOCs are to comply 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 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 Council of 21 April 2004.

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.

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).

Paints, varnishes, and protective coatings must comply with the TVOC limits as outlined in Table IEQ-13.1.

Product Type/Sub Category	Max TVOC content (g/L of ready-to-use product)
Ceilings - interior flat	14
Walls and ceilings – int. flat washable, low sheen, semi-gloss	16
Walls and ceilings – interior gloss	75
Trim - gloss, semi-gloss, satin, varnishes and wood stains	75
Timber and binding primers	30
Latex primer for galvanized iron and zincalume	60
Interior latex undercoat	65
Interior sealer + general wall & ceiling primer	65
One and two pack performance coatings for floors	140
Any solvent-based coatings whose purpose is not covered in table	200

** EU Directive 2004/42/CE, Annex II, Table A*

Table IEQ-13.1: *Maximum TVOC Content Limits for Paints, Varnishes and Protective Coatings*

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IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 4

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. Adhesives and sealants used in internal car parks or exterior applications do not require documentation and are excluded from this credit. All internal applications must meet the Credit Criteria, whether they are exposed or concealed. This includes exterior-grade and solvent-based sealants and adhesives, should they be employed in internal applications.

Acoustic Sealants must be categorised under the Product Type 'Architectural Sealants' (with a Max VOC Content limit of 250 g/Litre). 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 indoor spaces, and as such, the impact on the indoor environment quality of the completed project is negligible. Waterproofing membranes are included in the 'Architectural Sealant' category of table IEQ-13.2.

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 must 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).

Adhesives and sealants must comply with the maximum TVOC limits as outlined in Table IEQ-13.2 (over page).

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IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 4

Product Type	Max TVOC content* (g/litre of product)
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Resilient flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry Wall and 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 and Sealants*

Multipurpose construction adhesives includes, but not limited to, mastics, glues, epoxies, neoprene-based, acrylic, vinyl-emulsions, vinyl acetate, and any solvent-based adhesives. Architectural sealants includes, but not limited to, caulks and gap fillers, silicone, acrylic, polyurethane, latex, hybrids and any solvent-based sealants.

Floor Coverings

In addition to broadloom carpet, examples of floor coverings include, but not limited to, vinyl sheet, vinyl composite tiles (VCT), rubber, linoleum, cork, carpet tiles.

Compliance Testing Carpets: - Refer to Carpet and Rug Institute Green Label (USA), OR American Society for Testing and Materials (ASTM) D5116 Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products (24 hour test).

Compliance Testing Flooring (other than carpet): - Refer to the American Society for Testing and Materials (ASTM) D5116 Guide for Small Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products (24 hour test), OR the ISO 16000 – part 9, 10 and 11 test protocol, also known as the EN 13419 test protocol.

Timber flooring and hard surfaces (e.g. exposed concrete floor, stone, ceramic and concrete tile, etc.) are excluded from this aspect of the credit however the sealers or protective coatings applied to such products must comply with the criteria for ‘Interior sealer’ in Table IEQ-13.1.

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If carpet has an underlay or carpet pad, the underlay or pad must also 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.

Flooring product(s) must comply with TVOC emissions limits as outlined in Table IEQ-13.3 (below). Please note two different test protocols are acceptable.

ASTM D5116 *(Carpets and other flooring products):*	
Total VOC limit	0.5 mg/m2 per hour
4-PC (4-Phenylcyclohexene) limit	0.05mg/m2 per hour
ISO 16000 *(Flooring products other than carpet):*	
TVOC at 3 days	5mg/m²/h
TVOC at 28 days	0.5mg/m²/h

Table IEQ-13.3: *Maximum TVOC limits for Flooring*

Wall and Ceiling Coverings

Wall and ceiling coverings used in an internal application, and applied on-site (e.g. wall paper, vinyl, rubber and other resilient coverings, etc.) must meet the TVOC Content Limits outlined in Table IEQ-13.4 using the ISO 16000 - Part 9, 10 and 11 test protocol, also known as the EN 13419 test protocol.

Paints and protective coatings as per table IEQ-13.1 are excluded from this aspect of the credit. Timber and hard surface wall and ceiling coverings are also excluded from this aspect of the credit (e.g. wood/composite wood paneling, stone, ceramic and concrete tile, etc.) however the adhesives, sealers, paints, varnishes or protective coatings applied to such products must be documented in accordance with the criteria for Adhesives and Sealants, and/or Paints.

Wall and ceiling finishes must comply with the maximum TVOC limits as outlined in Table IEQ-13.4.

TVOC at 3 days	5.0mg/m²/h
TVOC at 28 days	0.5mg/m²/h

Table IEQ-13.4: *Maximum TVOC limits for Wall and Ceiling Coverings*

General

Reused items/products are not addressed by this credit and do not need to demonstrate compliance with the Credit Criteria.

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IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 4

For the purposes of Green Star SA, calculations for TVOC must include the exempt compounds (based on ASTM D3960 as well as SCAQMD Rule 1168), in the 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.

Adhesive tapes are excluded from the Credit Criteria for all applications.

BACKGROUND

'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 0.01kPa at 293.15 degrees Kelvin (20^{o}C).

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).

Volatile Organic Compound (VOC) is the term used to describe the several hundred organic chemicals which become a gas and thus airborne at room temperature, contributing to indoor air quality. Many of these consist primarily of petrochemical solvent-type compounds which are detrimental to human health and should be avoided.

The health implications of exposure to VOCs are consistent with 'sick building syndrome' effects including eye, nose and skin irritation, headache and lethargy.

Measurement standards

For Green Star SA purposes, the two primary and internationally-accepted ways to measure the impacts of TVOCs on indoor environment quality include:

- Measurement by 'rate' of emission – typically reported in g or mg/m²/hr; and

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- Measurement by content – reported by 'concentration' in grams of VOC per litre of product.

Lead in paint

Lead is added to paint mainly as a pigment ($PbCrO_4$ 'Chrome yellow' or $PbCO_3$ 'white lead') or to increase drying speed. Lead is known to increase paint durability and resist moisture. However lead is highly toxic and leads to nervous system damage especially in young children. It was believed that lead was primarily absorbed by children from chewing on painted surfaces, but the predominant exposure comes from ingestion of lead dust resulting from deteriorating lead paint or from renovation activities.

In 1921 the International Labor Organisation introduced the 'Convention Concerning the Use of White Lead in Painting' restricting the use of white lead in paints, which was however not ratified by all countries. Added lead in paint has been outlawed in the UK ('UK Lead Paint Regulation' in 1927 which was superseded by the 'Control of Lead at Work Regulation' in 1998), European Union (Marketing and Use Directive 76/769/EEC (1988)), Australia and the USA.

The Paint industry in South Africa subscribed to a voluntary agreement prohibiting the use of lead in paint. Nonetheless the practice of using lead in pigments and as driers still persists.

There is no current legal requirement for paint manufacturers to declare lead content in paint. The declaration required by the GBCSA that no lead has been added to the paint is deliberately more stringent than the proposed South African legislation which limits lead to a maximum of 600ppm.

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.
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http://carpet-rug.com

Ecospecifier, Products and Materials database search for low VOC paints, carpets and adhesives.
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http://www.svanen.nu/en

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http://www.aqmd.gov/rules/rulesreg.html

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http://europa.eu/legislation_summaries/environment/air_pollution/l28029b_en.htm

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http://www.geca.org.au

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US Environmental Protection Agency (US EPA) (no date), An Introduction to Indoor Air Quality: Organic Gases (VOCs).
http://www.epa.gov/iaq/voc.html

Aerias Air Quality Sciences IAQ Research Center (no date), VOCs: A major contributor to indoor pollution.
http://www.aerias.org/DesktopModules/ArticleDetail.aspx?articleId=131

Brown S.K. (1999), 'Occurrence of volatile organic compounds in indoor air', in T. Salthammer (ed.), Organic Indoor Air Pollutants, Wiley – VCH, Weinheim, pp.171–184.

Brown, S.K. (2003), 'Volatile organic pollutants in new and established buildings in Melbourne, Australia', Indoor Air, Vol.12, Iss.1, pp.55 63.

Carpet Institute of Australia, Australian Carpet Classification Scheme (ACCS) – Environmental Classification Scheme (ECS).
http://www.carpetinstitute.com.au/environment/index.htm

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IEQ-14 Formaldehyde Minimisation

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise the specification of products with low formaldehyde emission levels within rentable area and applicable common area.

CREDIT CRITERIA

One point is awarded where:

- All composite wood products used within rentable area and applicable common area, either:
  - Comply with the formaldehyde emission limits in Table IEQ-14.1;
    OR
  - Contain zero formaldehyde.

Where no composite wood products are used within rentable area or applicable common area, 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 – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation Additionally where specific proprietary products are specified: 3. Manufacturer product datasheet(s)	1. Contractor compliance report 2. Manufacturer product datasheet(s) 3. Statement(s) of confirmation Where credit is claimed as 'Not Applicable': 4. Contractor compliance report

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

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- Listing all the applications of composite wood products proposed within the project (that are in the scope of the Credit Criteria);
- Demonstrating that the Credit Criteria requirement for all (i.e. 100%) composite wood products (within the scope of the Credit Criteria) to be compliant is met for the project, with reference to supporting documentation; and,

Where credit claimed 'Not applicable':

- Confirmation that no composite wood products are to be used in the project, with reference to supporting documentation.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for**:**

- The applicable products within the design to meet the formaldehyde standards (explicitly stipulated);
- The Contractor/Sub-Contractor to obtain approval of the design team or client before substituting the applicable products and requiring that at the end of construction works, the contractor undertakes a final audit to ensure that the correct (i.e. compliant) products have been used;

Where credit claimed 'Not Applicable':

- An explicit statement confirming that no composite wood products (excepting excluded applications) are to be used in the project.

Manufacturer product datasheet(s) must be official manufacturer product datasheets, be provided for every compliant product and clearly indicate:

- The compliant formaldehyde emission level of the product as referenced in the short report; and,
- The test method to which the stated emission limit(s) and/or emission rate(s) have been determined.

Contractor compliance report prepared by the Contractor that describes how Credit Criteria have been met by:

- Listing all the composite wood products used within the project, their application, their suppliers and inclusion or exclusion in the scope of the Credit Criteria;
- The actual formaldehyde emission limits of each product with reference to the appropriate manufacturer product datasheet(s) and nominating compliance with the Credit Criteria;
- Demonstrating that all composite wood products within the scope of the Credit Criteria are compliant;

Where credit claimed 'Not Applicable':

- Confirming that no composite wood products have been used in the project (except for applications excluded from the Credit Criteria);

Statement(s) of confirmation from supplier(s) in the form of signed correspondence stating the quantity of applicable product(s) supplied to the Contractor/Sub-Contractor for the project, and that the product(s) are compliant with the Credit Criteria (for each applicable product).

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IEQ-14 Formaldehyde Minimisation

POINTS AVAILABLE 1

ADDITIONAL GUIDANCE

The scope of the Credit Criteria is inclusive of composite wood product applications within dwellings and within applicable common areas, irrespective of exposed or concealed applications.

Applicable common areas include, but are not limited to, internal corridors and passages, internal lobbies, internal stairwells (fire escape or otherwise), internal spaces used for communal activities (e.g. meeting room, gyms, libraries, theatre rooms, media rooms etc.), caretaker/management or other similar spaces. Corridors or passages which are covered, but largely open to outside through the use of permanent openings, balustrades or fixed louvers, are considered as 'external' and excluded from the scope of the Credit Criteria. Common areas excluded from the scope of the Credit Criteria include, but are not limited to, car parking areas, storage areas, plant and equipment areas, lift shafts, garbage or recycling waste storage areas, communal bicycle storage areas etc.

Composite wood products include, but are not limited to, particleboard, plywood, timber veneer, medium density fibreboard (MDF), laminated veneer lumber (LVL), glulam timber, high-pressure laminates, compact laminates, laminate flooring and decorative overlaid wood panels. The GBCSA also considers products made from other natural products such as wheat or rice straw fibres as composite wood products and are included in the scope of the Credit Criteria.

It must be clearly demonstrated that all composite wood products (including both 'raw' unfinished and finished products) used in the project (except excluded applications) have low formaldehyde emissions or contain no formaldehyde.

For a Design rating, the applicable formaldehyde limits must be explicitly contained within the tender documentation. A general clause that stipulates that compliance is required with Green Star SA – Multi Unit Residential Technical Manual, is not acceptable for the documentation requirements.

The following applications of composite wood products are excluded from this credit:

- Any composite wood products used in exterior applications;
- Formwork;
- Reused composite wood products; and,
- Timber (i.e. non-composite products).

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IEQ-14 Formaldehyde Minimisation

POINTS AVAILABLE 1

Emission requirements

The emission levels must be established by a NATA or ISO/IEC17025 registered laboratory as per the testing methodologies provided in Table IEQ-14.1.

Test Protocol	Emission limit/ Unit of measurements
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤ 1.0 mg/L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1.0 mg/L
AS/NZS 4357.4 – Laminated Veneer Lumber (LVL)	≤ 1.0 mg/L
Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL	≤ 1.0 mg/L
JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	≤ 1.0 mg/L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	≤ 1.0 mg/L
JIS A1901 (not applicable to Plywood)	≤ 1.0 mg/L
ASTM D5116	≤ 0.1 (+/- 0.0005) mg/m²hr*
ISO 16000 part 9, 10 and 11 (also known as EN 13419)	≤ 0.1 (+/- 0.0005) mg/m²hr (at 3 days)
ASTM D6007	≤ 0.1 (+/- 0.0005) mg/m²hr (at 3 days)
ASTM E1333	≤ 0.12mg/m³**
EN 717-1 (also known as DIN EN 717-1)	≤ 0.12 mg/m³***
EN 717-2 (also known as DIN EN 717-2)	≤ 0.12mg/m³

* mg/m^2hr may also be represented as $mg/m^2/hr$

** The test report must confirm that the conditions of Table 1 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.

*** The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.

Note, test methods and limits applicable to glulam timber, HPL and compact laminates are JIS A 1901, ASTM D5116 and ISO16000 part 9, 10 and 11. EN717-1 and EN717-2 are also applicable to glulam timber.

Table IEQ-14.1: *Formaldehyde emission limit values for different testing methods*

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IEQ-14 Formaldehyde Minimisation

POINTS AVAILABLE 1

BACKGROUND

Formaldehyde is a widely used industrial chemical (generally as a solution in water) and is a gas at room temperature, thus also a harmful VOC. 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 on-going debate within the industry regarding the approach of testing for formaldehyde emissions in products, with the principal approaches being either 'Industrial Production Testing' or 'Performance Testing'. The distinction between these two approaches is based on how formaldehyde emissions are considered in green building situations and addresses two key issues; the indoor environmental quality 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 indoor environmental quality 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. It is typically reported by $mg/m^2/h$.

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, 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 v1.0. 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

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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.

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

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.(2008)
http://www.healthybuilding.net

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IEQ-19 Private Outdoor Space

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise dwelling designs which improve the health and wellbeing of the occupants by providing private outdoor space.

CREDIT CRITERIA

One point is awarded where:

- For a minimum 90% of dwellings, a private outdoor space is provided which meet the following requirements:
  - The space is accessible for private use by the dwelling occupant(s) only; AND
  - The space is directly adjacent to, and accessible from, the associated dwelling; AND
  - The size provided per dwelling is at least 1m² per occupant OR at least 6m^2 (whichever is greater).

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Tender drawing(s)	1. Short report 2. As Built drawing(s)

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

- Providing a list of all typical dwellings and the area of private outdoor space provided;
- Confirming that each space is directly adjacent to or accessible from the dwelling served; and,
- Demonstrating that 90% dwellings are provided with compliant outdoor spaces.

Tender / As Built drawing(s) marked-up to clearly show the size and location of each private outdoor space.

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IEQ-19 Private Outdoor Space

POINTS AVAILABLE 1

ADDITIONAL GUIDANCE

The outdoor space for each of the compliant dwelling units must be for the sole use of the occupant(s) of that specific dwelling unit. It is not acceptable that multiple smaller areas contribute to achieving the minimum area to meet the Credit Criteria.

Private outdoor spaces include, but are not limited to, balconies, courtyards, private gardens etc. Where provided for ground floor dwellings, it must be clearly demonstrated how the space is private.

For shared occupancy scenarios, it is acceptable that one private area be provided which meets the area requirement for number of occupants within all 'bedrooms' served within each 'dwelling'.

BACKGROUND

Research suggests a disconnection between humans and nature may lead to physical and psychological health problems in humans (Heerwagen, 2008). Outdoor seating in visually appealing landscapes can provide residents with relaxation and psychological restoration, a private enclosure or screening can provide residents with visual privacy as needed, and green plantings and outdoor views can provide residents with a connection to nature and natural processes (Heerwagen, 2008).

Bernardini & Irvine (2007) have researched the 'roles that private and public green space play for an urban resident's sense of belonging', and have found that gardens are 'integral to people's identity as they provide a place to express personal values'. Furthermore, 'easy access and having control over the space facilitated [a] unique relationship with the private garden'. The researchers acknowledge that private gardens are not a substitute for public parks, but private gardens and spaces are important parts of urban residents' identities. Residents with easy access to a private outdoor space thus have a place to connect with the natural environment and a place of respite.

REFERENCES & FURTHER INFORMATION

Bernardini, C. & Irvine, K.N. (2007), 'The Place of Private Gardens and Public Green Space in Sustainable Cities', Project Description, Institute of Energy and Sustainable Development, De Montfort University, Leicester, UK,
http://www.iesd.dmu.ac.uk/posters/phd_ppgpgssc_cbki.pdf

Heerwagen, J. (2008), 'Psychosocial Value of Space', Whole Building Design Guide,
www.wbdg.org/resources/psychspace_value.php

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IEQ-22 Universal Access

POINTS AVAILABLE 1

AIM OF CREDIT

To recognise design that provides universal access, to and within dwellings, to meet the changing needs of occupants.

CREDIT CRITERIA

One point is awarded where:

- All dwellings, including peripheral exterior access to, and common property areas are designed wholly in accordance with the requirements of *SANS 10400-S: Facilities for persons with disabilities*;

  AND

- For all dwellings, the design of at least one toilet facility on the entry level of the dwelling facilitates wheelchair user access in accordance with the requirements defined in Additional Guidance.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Tender drawing(s)	1. Short report 2. As Built drawing(s)

Short report prepared by a suitably qualified professional, demonstrating how the Credit Criteria have been met by:

- Describing the design's compliance with the requirements stipulated in SANS 10400-S for:
  - General (Section 4.1)
  - Signage (Section 4.2)
  - Parking (Section 4.3)
  - External and internal circulation (Section 4.4)
  - Floor or ground surfaces (Section 4.5)
  - Doorways and doors (Section 4.6)

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- Ramps (Section 4.7)
- Stairways (Section 4.8)
- Handrails (Section 4.9)
- Lifts (Section 4.10)
- Toilet facilities (Section 4.11)
- Finishes (Section 4.12)
- Reach Positions – Controls, switches and power points (Section 4.13)
- Warning signals (Section 4.14)
- Lighting (Section 4.15)

- Describing the design's compliance with the requirements stipulated in Additional Guidance for wheelchair access spatial provisions associated with WCs within dwellings; and,
- Confirming that the design is in compliance with the Credit Criteria.

Tender / As Built drawing(s) marked-up to clearly demonstrate;

- Compliance with the relevant design requirements of SANS 10400-S; and,
- Compliant spatial provisions for wheelchair WC access within dwellings (in accordance with requirements defined in Additional Guidance).

ADDITIONAL GUIDANCE

To minimise documentation, representative drawings are permitted to be submitted for areas of the building whereby the design comprises repetitive, identical areas.

Interpretation of SANS 10400-S

SANS 10400 Part S applicability clauses state that design for disability is applicable to all buildings, with the following exceptions:

a) "Any building of which the whole of the ground storey compromises one or more of occupancies classified in terms of the regulation A20 as B1 (High Risk Commercial Service), B2 (Moderate Risk Commercial Service), D4 (Plant Room), H4 (Dwelling House), J1 (High Risk Storage) or J2 (Moderate Risk Storage)."

b) Any building classified as H1 (Hotel) in terms of regulation A20 where such building has less than 25 bedrooms and it can be reasonably proven that it is not possible to included wheelchair access in certain aspects of the design; and

c) Any storey above ground floor level of a building classified as H3 (Domestic Residence) in terms of regulation A20 and not provided with a lift."

While South African Building Regulations currently do not require residential buildings to meet SANS10400-S, compliance is included in Green Star SA as it reflects best practice to enhance

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universal access to persons with varying abilities. For the purpose of the Green Star SA Multi Unit Residential v1 rating tool, the following SANS 10400 Part S applicability interpretations must be adhered to:

- If there is a lift in the building, the complete building must comply with SANS 10400-S.
- If there is no lift in the building, the ground floor, or the principal entrance storey where there are habitable rooms must comply with SANS 10400-S; and/or
- If the ground floor compromises a sole occupancy other than H3 (Domestic Residence) or combination of occupancy types including H3, the complete building must comply with SANS 10400-S.

SANS 10400-S should be read in conjunction with *SANS 10246-Accessibility of Buildings to disabled persons*.

Supplementary Disabled WC Spatial Requirements to SANS 10400-S

In addition to compliance with SANS 10400-S, 'IEQ-22 Universal Access' requires that at least one toilet facility on the entry level of all dwellings accessible by wheelchair, is spatially designed to facilitate wheelchair user access. All dwellings located on the ground floor and on storeys provided with lift access must be considered to be 'accessible by wheelchair'.

For the purpose of the Green Star SA Multi Unit Residential v1 rating tool in the absence of an equivalent SA best practice document, the UK Building Regulations Part M Section 10 is selected as the design reference for definition of wheelchair access spatial requirements. This supplementary requirement is included to address the issue that SANS 10400-S disabled WC criteria relates to the provision and design of communal disabled WC toilet facilities only.

Accordingly, at least one toilet facility on the entry level of all dwellings accessible by wheelchair must satisfy the following design requirements:

- No stair(s) should obstruct the pathway between the WC room and habitable rooms;
- The door to the WC compartment must open outwards. It is acceptable that the door to the bathroom open inwards provided sufficient turning area is provided, however the door to the actual WC compartment must open outwards (see Figure IEQ-22.1);
- The position of the door to the WC must provide clear wheel chair access;
- The width of the doorway must comply with the relevant minimum doorway clear opening widths defined in Table IEQ-22.2; The basin in the WC compartment must not impede the movement of the wheelchair within the WC compartment; and,
- The WC compartment must provide enough space for a wheelchair to access the WC in both frontal access and oblique access scenarios, as defined in Figure IEQ 22:2.

For the purpose of this credit, as suitably qualified person is defined as a qualified Architect or Accessibility/Disability Consultant.

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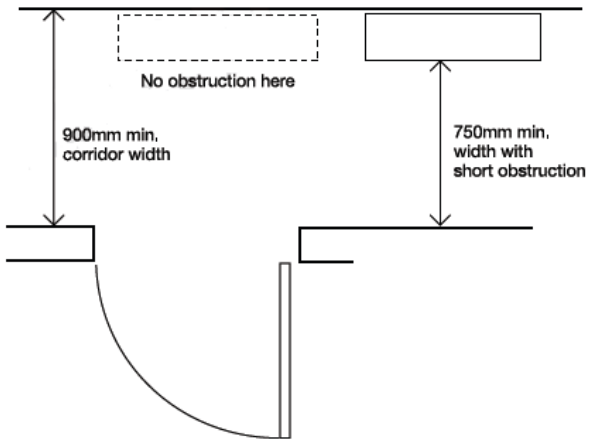

Figure IEQ-22.1: *Corridor/passage widths (adapted from UK National Building Regulations, Part M, 2004:72)*

Doorway clear opening width (mm)	Corridor/Passageway width (mm)
750 or wider	900 (when approach is head on)
750	1200 (when approach is not head on)
775	1050 (when approach is not head on)
800	900 (when approach is not head on)

Table IEQ-22.1: *Minimum doorway and passageway widths for wheelchair WC access*

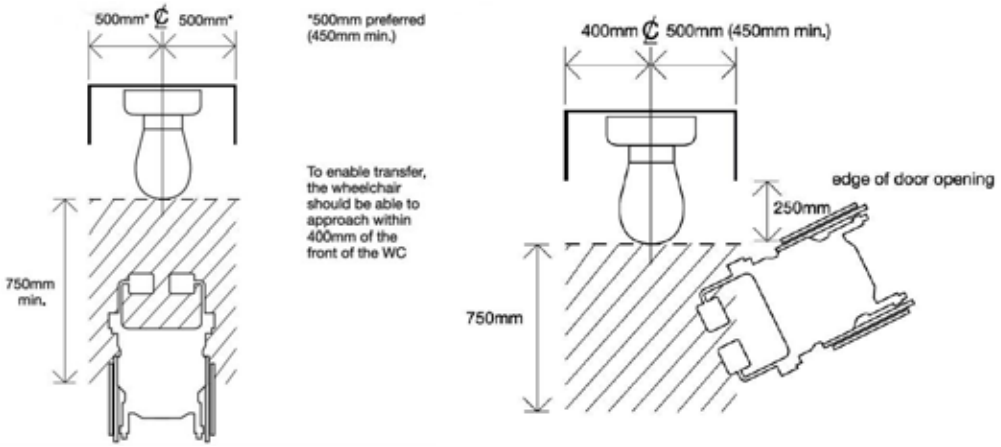

Figure IEQ-22.2: *Wheelchair spatial provision for frontal access to WC (left) and for oblique access to WC (right) (from UK National Building Regulations, Part M, 2004:72)*

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IEQ-22 Universal Access

POINTS AVAILABLE 1

BACKGROUND

Disabled persons, including the elderly, the young, those temporary disabled as a result of an injury or health issues, require equal access to and within the built environment as able bodied persons. Attention to design details that aid the removal of barriers for movement, vision and audio perception are considered a basic consideration for facilitating access to and within buildings for disabled persons.

Disabled persons are protected in South Africa by several laws, namely:

- The Constitution
- The Employment Equity Act
- The Occupational Health and Safety Act
- The promotion of Equality and Prevention of Unfair Discrimination Act

Section 28 of Promotion of Equality and Prevention of Unfair discrimination Act of 2000., 'Special measures to promote equality with regards to race, gender and disability' states that the state, any organisation and any person may not utilise any laws, codes of practise or actions that place a person in a disadvantaged position due to a disability.

From a legal perspective, buildings can therefore be interpreted as vehicles which facilitate discrimination if they do not accommodate access to, access within and facilities within living or working spaces for disabled persons. International precedent indicates that designing for universal access is an established and understood building practise. However, in South Africa, design for disabled persons and universal access is not as established as an industry practise. From an environmental perspective, the subsequent retrofitting of buildings for disabled persons will involve materials and energy consumption that could be avoided if considered in the original building design.

REFERENCES & FURTHER INFORMATION

SABS.2010. Draft SA Standard 10400**.** The Application of National Building Regulations. Part S: Facilities for persons with disabilities. 3rd Edition (Draft). SABS, South Africa.
South African Bureau of Standards

SABS. 1993. South African National Standard (SANS) 10246.Accessibility of Buildings to disabled persons. SABS, South Africa. Edition 1.
South African Bureau of Standards

Office of the Deputy Prime Minister. 2006. The Building Regulations 2010. Part M: Access to and use of buildings. 2004 Edition.
www.planningportal.gov.uk/buildingregulations/approveddocuments/partm/

US Department of Justice (1994), American Disability Act (ADA) Standards for Accessible Design, Appendix A, Excerpt from 28 CFR Part 36.

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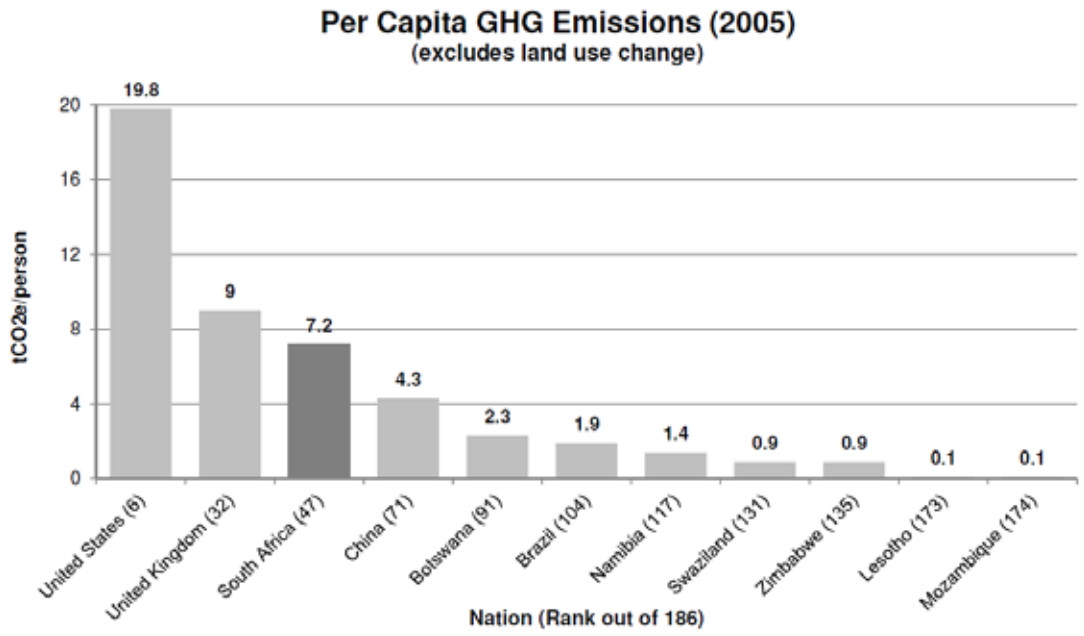
Energy

The credits within the Energy Category target an overall reduction in energy consumption and a reduction of greenhouse gas (GHG) emissions associated with energy generation from fossil fuels. Within multi unit residential developments, reductions in energy consumption can be achieved through increased energy efficiency of heating, cooling, lighting and hot water systems within dwellings, and common property services such as lighting and ventilation systems. The use of site energy resources through the installation of renewable energy systems can also reduce greenhouse gas emissions by reducing the demand for conventional energy sources.

Current research indicates that buildings consume 40% of the world's end-use energy, with nearly 60% of the world's electricity being consumed by residential and commercial buildings. This places buildings as one of the largest single contributors to global greenhouse gas emissions, currently accounting for one third of greenhouse gas emissions and projected to continue to account for this proportion in 2030[3].

In 2005, South Africa's national greenhouse gas emissions were 336.5 $MtCO_2e$ (million tonnes of carbon dioxide equivalent), which placed the nation 19th out of 186 nations in terms of annual greenhouse gas emissions. Although significantly smaller than the two largest emitters (United States 5,842 $MtCO_2e$ & China 5,590.9 $MtCO_2e$), South Africa's contribution is much greater than other African nations with large economies (Nigeria 98.5 $MtCO_2e$ - 39th, & Egypt 169.6 $MtCO_2e$ - 28th). The figure below displays the 2005 greenhouse gas emissions for several of South Africa's neighbouring nations, and several developed nations, on a per capita basis[4].



[3] *UNEP, 2011 'Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication', www.unep.org/greeneconomy*
[4] *Climate Analysis Indicators Tool (CAIT), World Resources Institute, http://cait.wri.org/*

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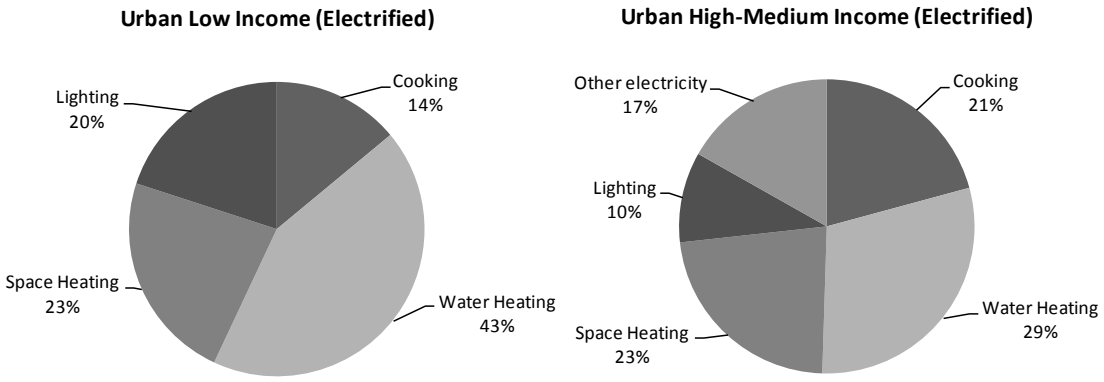
Energy

It is evident that the per capita greenhouse gas emissions of South Africa are much higher than its neighbours. This, however, is not simply due to South Africa's larger economy; the emissions in relation to GDP are also higher at 1.89 tCO_2e per US$1,000 GDP, compared to Botswana (0.51 tCO_2e), Namibia (0.50 tCO_2e), Swaziland (0.56 tCO_2e), and Mozambique (0.24 tCO_2e)[5].

Production of South Africa's electricity is predominantly from non-renewable fossil fuels and is the nation's greatest contributor of greenhouse gas emissions. 2006 data indicates that the residential sector in South Africa consumes 18% of national electricity output, which is greater than the electrical consumption of the nation's mining sector. Only 10% of energy consumed by the residential sector is renewable, with electricity comprising 69% of total energy consumed[6].

The figures below (adapted from UNEP, 2009) display the typical end-use energy breakdown for low income and high-medium income electrified urban dwellings in South Africa. For both scenarios, energy requirements for water heating, space heating and lighting represent the largest proportion of residential energy demands.



Energy demands for such services can be readily minimised through energy efficient systems and utilisation of renewable resources.

Concerns surrounding increasing national greenhouse gas emissions are exacerbated by the growing energy demands of an increasing South African population. To allow for this natural population increase, without causing a correlated increase in greenhouse gas emissions, it is critical to reduce residential energy demands, which is best achieved at the planning and design stages. With the current shortfall in electrical generation capacity in South Africa, reducing buildings' electrical energy demand has the added benefit of reducing strain on the generation and distribution infrastructure, minimising the future need for load shedding.

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[5] *Climate Analysis Indicators Tool (CAIT), World Resources Institute, http://cait.wri.org/*

[6] *UNEP, 2009 'Greenhouse Gas Emission and Baselines and Reduction Potentials from Buildings in South Africa', Sustainable Buildings & Climate Initiative, www.unep.org/sbci/pdfs/SBCI-SAreport.pdf*

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Ene-0 Conditional Requirement

AIM OF CREDIT

To encourage and recognise dwelling designs that minimise greenhouse gas emissions through increased passive thermal performance, increased lighting efficiency and increased hot water generation efficiency.

CONDITIONAL REQUIREMENT CRITERIA

To meet the Ene-0 Conditional Requirement, the project must satisfy all of the "Compulsory Initiatives" as defined in the applicable credits:

- Ene-1 Greenhouse Gas Emissions – Heating & Cooling;

Compliance Route 1

Compulsory Initiative - The project must demonstrate that the greenhouse gas emissions for the 'Actual Case' heating & cooling are less than or equal to the greenhouse gas emissions from the 'Notional Case' heating & cooling, when modelled in accordance with the Green Star SA Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

OR

Compliance Route 2

Compulsory Initiatives – All dwellings must achieve the Compulsory Initiative as outlined in Part A, Part C, Part D, Part E and Part F of Ene-1 Greenhouse Gas Emissions – Heating & Cooling:

Part A – Compulsory Initiative is achieved where the R-value of each wall element meets the minimum required as per Table 2.1.

Part C - Compulsory Initiative is achieved where the R-value of ceilings/roofs achieve the minimum required as outlined in Table 2.3.

Part D - Compulsory Initiative is achieved where the conductance (U-value) of the glazing per unit floor area (C_u) achieves the maximum requirement as outlined in Table 2.4.

Part E - Compulsory Initiative is achieved where brush, foam or similar seals are provided around external doors AND chimneys/flues are provided with either a non-return damper or flap that can be closed to seal the chimney/flue AND where all openable windows have a leakage ratio not more than 2.0 L/m^2/s at a pressure differential of 75 Pa when tested in accordance with SANS-613.

Part F - Compulsory Initiative is achieved where the fans, heating and cooling systems are in accordance with the minimum requirements of the deemed-to-satisfy clauses of Section 4.6 'Mechanical Ventilation and Air Conditioning' in SANS-204:2011.

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Ene-0 Conditional Requirement

- Ene-3 Lighting Energy Use;

> ***Compulsory Initiative*** - Is achieved where for each dwelling the interior lighting power density does not exceed 4.0W/m^2 (inclusive of parasitic losses).

- Ene-7 Hot Water Energy Use;

> ***Compulsory Initiative*** - Is achieved it is demonstrated that all geysers and hot water storage vessels are insulated in accordance with SANS-204:2011.

DOCUMENTATION REQUIREMENTS

Documentation is not required to be submitted for this Conditional Requirement. It must be clear from the documentation submitted for Ene-1 Greenhouse Gas Emissions – Heating & Cooling, Ene-3 Lighting Energy Use and Ene-7 Hot Water Energy Use, that all Compulsory Initiatives have been achieved.

ADDITIONAL GUIDANCE

This Conditional Requirement must be met in addition to the other Conditional Requirement's within the rating tool for the Project to be eligible for a Green Star SA Multi Unit Residential v1 certification. For further details, please refer to the Green Star SA Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

BACKGROUND

Please refer to Refer to Ene-1 Greenhouse Gas Emissions – Heating & Cooling, Ene-3 Lighting Energy Use and Ene-7 Hot Water Energy Use for further background information.

REFERENCES & FURTHER INFORMATION

Please refer to Refer to Ene-1 Greenhouse Gas Emissions – Heating & Cooling, Ene-3 Lighting Energy Use and Ene-7 Hot Water Energy Use for references and further information.

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Ene-1 GHG Emissions – Heating & Cooling

POINTS AVAILABLE **10**

AIM OF CREDIT

To encourage and recognise dwelling designs and building fabric that minimise greenhouse gas emissions associated with operational heating & cooling energy consumption.

CREDIT CRITERIA

Up to 10 points are awarded where it is demonstrated that the dwellings' predicted greenhouse gas emissions have been reduced.

NOTE: *Projects are required to select Compliance Route 1 OR Compliance Route 2. Projects are NOT required to demonstrate compliance to both routes*:

Compliance Route 1 - Energy Modelling (up to 10 points)

Compulsory Initiative - The project must demonstrate that the greenhouse gas emissions for the '*Actual Case*' heating & cooling are less than or equal to the greenhouse gas emissions from the 'Notional Case' heating & cooling, when modelled in accordance with the Green Star SA Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

The building(s) or dwelling(s) are to be modelled using the criteria in the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide. The predicted greenhouse gas emissions determined for the 'Actual Case' must be compared with those determined for the 'Notional Case' at the same site location. Whilst the 'Actual Case' represents the intended dwelling/building design, the 'Notional Case', however, is modelled based on fabric and heating & cooling performance characteristics as per the Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

Points are awarded on a linear scale with 0 points for equivalent emissions of the 'Actual Case' to the 'Notional Case' (i.e. meeting the Compulsory Initiative), and up to 10 points for a 75% reduction in greenhouse gas emissions. One point is awarded for every 7.5% saving below the 'Notional Case' greenhouse gas emissions benchmark.

The points are determined by the Green Star SA – Multi Unit Residential v1 Energy Calculator.

It is only acceptable to exclude heating and cooling systems from the 'Actual Case' for zones within a dwelling where the zone complies with IEQ-9 Thermal Comfort credit criteria for 1 point (i.e. the internal operative temperatures are within ASHRAE Standard 55-2004 80% acceptability limits for 85% of the occupied hours). Where a zone within a dwelling fails to

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achieve the thermal comfort criteria, heating and/or cooling must be included within the 'Actual Case' dwelling, as per the 'Notional Case' dwelling.

The basis for this approach is that with dwellings where suitable thermal comfort cannot be achieved passively, it is likely that that occupants' will need to retrofit cooling and/or heating systems in the future after occupation.

As it is impractical to retrofit building fabric for improved performance after initial construction, unless the passive performance of the dwelling can maintain suitable thermal comfort, the post-construction installation of services could lead to significant energy consumption, therefore must be accounted for.

Compliance Route 2 – Deemed-to-Satisfy (up to 6 points)

Compulsory Initiative – All dwellings must achieve the Compulsory Initiatives as outlined in Part A, Part C, Part D, Part E and Part F of Ene-1 Greenhouse Gas Emissions – Heating & Cooling.

Up to 6 points are awarded where for each dwelling the following are achieved:

Part A - Wall Thermal Resistance (1 point)

NOTE: Part A applies to all wall constructions which form part of a dwelling's *thermal envelope* only.

Compulsory Initiative A - Is achieved where the R-value of each wall meets the minimum required as per Table 2.1 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

One point is awarded where:

- The R-value of each wall achieves the minimum required as outlined in Table 2.1 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

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Part B - Thermal Mass (1 point)

NOTE: Part B applies to floor, ceiling and wall constructions in kitchens and common living areas only.

One point is awarded where:

- The admittance of floor, ceiling and wall constructions achieve the minimum required as outlined in Table 2.2 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

Part C - Roof Insulation (0 points – Compulsory Initiative only)

NOTE: Part C applies to all roof/ceiling constructions which form part of the dwelling's *thermal envelope* only.

Compulsory Initiative C - Is achieved where the R-value of ceilings/roofs achieve the minimum required as outlined in Table 2.3 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

Part D - Window Conductance and Solar Heat Gain (1 point)

NOTE: Part D applies to all glazing elements which form part of the dwelling's *thermal envelope* only. Roof lights and sky lights are not considered glazing elements for the purpose of Green Star SA.

Compulsory Initiative D - Is achieved where the conductance (U-value) of the glazing per unit floor area (C_u) achieves the maximum requirement as outlined in Table 2.4 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

One point is awarded where:

- The solar heat gain coefficient (SHGC) of the glazing per unit floor area (C_{SHGC}) does not exceed the maximum requirement as outlined in Table 2.4 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

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Ene-1 GHG Emissions – Heating & Cooling

POINTS AVAILABLE 10

Part E – Airtightness (0 points – Compulsory Initiative only)

NOTE: Part E applies to all external doors and openable windows which form part of the dwelling's *thermal envelope* only, and all chimneys/flues which serve habitable areas.

Compulsory Initiative E - Is achieved where brush, foam or similar seals are provided around external doors AND chimneys/flues are provided with either a non-return damper or flap that can be closed to seal the chimney/flue AND where all openable windows have a leakage ratio not more than 2.0 $L/m^2/s$ at a pressure differential of 75 Pa when tested in accordance with SANS-613.

Please refer to the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide for further details.

Part F – Heating and Cooling Systems (3 points)

NOTE: Part F applies to all active heating and cooling systems serving all dwellings (either individually or centralised) and are installed within the scope of the main development contract.

Compulsory Initiative F - Is achieved where the fans, heating and cooling systems are in accordance with the minimum requirements of the deemed-to-satisfy clauses of Section 4.6 'Mechanical Ventilation and Air Conditioning' in SANS-204:2011.

Up to three points are awarded where:

- No heating and/or cooling system(s) are provided on condition of satisfactory thermal comfort, in accordance with Table 2.5 and Table 2.6 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide;

  OR

- Energy efficient heating and cooling systems are provided with minimum performance requirements as outlined in Table 2.5 and Table 2.6 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide;

  OR

- Greenhouse gas efficient heating and cooling systems are provided with minimum primary fuel emission intensity requirements as outlined in Table 2.5 and Table 2.6 of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

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Ene-1 GHG Emissions – Heating & Cooling

POINTS AVAILABLE 10

DOCUMENTATION REQUIREMENTS

Note: *Project Teams must select Compliance Route 1 OR Compliance Route 2. Projects Teams are NOT required to demonstrate compliance to both routes.*

Compliance Route 1 – Energy Modelling

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Energy modelling report 2. Calculator extract	1. Energy modelling report 2. Calculator extract 3. Extract(s) from the Commissioning Report(s)

Energy modelling report prepared by a suitably qualified professional in accordance with the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide, describing how the Credit Criteria are met by:

- Describing the software package used, confirming it is in accordance with the requirements of the Green Star SA - Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide;
- Describing the weather data used and how it is applicable to the project site;
- Providing a general description of the servicing strategy (where applicable);
- Providing a tabulated summary of the dwelling types modelled, demonstrating compliance with the Credit Criteria for the development;
- Providing a tabulated summary for each dwelling type, the zones modelled and the inclusion of active heating/cooling systems in each zone (or not). Where not included, confirming that the zone achieve the required thermal comfort performance requirement as per IEQ-9 Thermal Comfort;
- Clearly identifying all occupant and other loads as per the Green Star SA Multi Unit Residential v1- DTS & Energy Modelling Protocol Guide;
- Clearly identifying all of the design-driven inputs (where assumptions are used, they must be justified);
- Extracts of applicable documentation (as appendices) justifying the design-driven inputs (e.g. specifications, drawings, manufacturer product datasheets etc.);
- Providing marked-up drawings identifying the zones used for energy modelling;

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- Confirming that the energy modelling report has been compiled in accordance with Appendix D of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide.

Calculator extract from the Green Star SA Multi Unit Residential v1 Energy Calculator that demonstrates what energy values have been entered for the 'Actual Case' and 'Notional Case' and the calculator's output result.

Extract(s) from Commissioning Report(s) demonstrating that any active heating and/or cooling systems have been commissioned and operate as intended by the design.

Compliance Route 2 – Deemed-to-Satisfy (DTS)

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Tender drawing(s) 3. Extract(s) from tender documentation	1. Short report 2. As Built drawing(s) Additionally where active heating/cooling systems provided: 3. Extract(s) of Commissioning Report(s)

Short report prepared by a suitably qualified professional that demonstrates for each dwelling type, compliance of each of the Deemed to Satisfy (DTS) criteria by;

- Defining the applicable thermal envelope;
- Part A: Demonstrating through calculation and reference to performance data that all applicable wall constructions meet the Compulsory Initiative, and minimum R-value (where claimed);
- Part B: Demonstrating through calculation and reference to performance data that the applicable floor, ceiling and wall constructions achieve the required admittance (where claimed);
- Part C: Demonstrating through calculation and reference to performance data that all applicable roof/ceiling constructions meet the Compulsory Initiative;
- Part D: Demonstrating through calculations and reference to performance data that all applicable glazing elements meet the Compulsory Initiative, and maximum solar heat gain coefficient (where claimed);
- Part E: Demonstrating through reference to supporting documentation the Compulsory Initiative is met;

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- Part F: Demonstrating through reference to supporting documentation that the Compulsory Initiative is met and all active heating and/or cooling systems (or absence of) are in accordance with the Credit Criteria.
- Confirming that the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide has been used to guide the preparation of the short report.

Tender / As Built drawing(s) of each dwelling type, marked-up and including:

- Plan, elevation and roof drawings marked up to clearly identify the thermal envelope;
- Section drawings showing the construction of the thermal envelope, as referenced in the short report;

Additionally where active heating/cooling is provided;

- Drawings clearly identifying the mechanical services design/installation.

Extract(s) from tender documentation clearly identifying the specification of the thermal envelope construction (e.g. materials, insulation levels etc.) as referenced in the short report.

Extract(s) from Commissioning Report(s) demonstrating that any active heating and/or cooling systems have been commissioned and operate as intended by the design.

ADDITIONAL GUIDANCE

Please refer to the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide for further additional guidance.

BACKGROUND

The energy requirement for space heating within both low income and high-medium income urban dwellings within South Africa typically represents just over 20% of the total energy consumption of the dwelling. In South Africa, 58% of dwellings use grid electricity for space heating, with 18% using wood and 4% coal, indicating that there exists significant scope to reduce greenhouse gas emissions associated with space heating in the residential sector.

Although emissions reductions could be achieved through a transition to renewable fuel sources for space heating, improved passive performance of dwellings can assist in significantly reducing the overall demand for active space heating (or cooling), regardless of fuel source. A dwelling which has sufficient levels of insulation, appropriate glazing orientation, shading, and thermal performance, and is well sealed to control infiltration, can maintain suitable levels of thermal comfort for occupants without the need for active heating or cooling for extended periods of the year.

Poorly designed dwellings which do not maintain appropriate thermal comfort levels may exhibit over-heating in summer, or be very cold in winter. To maintain thermal comfort within

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poorly designed dwellings, active heating and or air conditioning systems are typically relied upon. However, where relied upon to provide thermal comfort for extended periods, a significant increase in energy consumption (and greenhouse gas emissions) and running costs may result compared to an equivalent dwelling which can maintain appropriate thermal comfort passively.

Achieving high performance passive design requires the analysis of the complex interactions of different aspects of the building fabric, including insulation levels, thermal mass, glazing and airtightness. To enable designers to analyse the inter-relation between these aspects, efficiently within the design process, dynamic thermal simulation modelling tools may be used. Such modelling tools can allow designers to experiment and achieve the best solution for their scenario. However, where such tools are not accessible, first principles can be used to guide designers to better passive outcomes. Climatically appropriate 'deemed-to-satisfy' approaches, based on first principles, are used as a tool to guide better passive outcomes. However deemed-to-satisfy approaches may be restrictive to the designer, nor optimise the passive performance of a dwelling.

By encouraging and recognising in Green Star SA, dwelling designs that achieve suitable passive performance ensures that the reliance on active heating or cooling systems is minimised, reducing energy consumption, costs and greenhouse gas emissions. Also, ensuring that passive performance is considered and assessed at the design stage minimises the risk that active heating or cooling systems are retro-fitted to new dwellings in the future.

REFERENCES & FURTHER INFORMATION

CIBSE TM33:2006 Tests for Software Accreditation and Verification
http://www.cibse.org

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

International Energy Conservation Code, 2006 edition
http://www.iccsafe.org

BS EN ISO 13786:2007. Thermal performance of building components - Dynamic thermal characteristics - Calculation methods.
http://www.iso.org

SANS 204:2011 Energy Efficiency in Buildings
https://www.sabs.co.za/index.php?page=home

Thermal calculator to calculate admittance and other properties
http://www.emeraldenergy.ie/downloads/HeatCapCalculator.htm

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UNEP, 2009 'Greenhouse Gas Emissions Baselines and Reduction Potentials from Buildings in South Africa – A Discussion Document', Sustainable Buildings & Climate Initiative, UN.
www.unep.org/sbci/pdfs/SBCI-SAreport.pdf

Department of Minerals & Energy (DME), Energy Efficiency Strategy of the Republic of South Africa, 2005
http://www.energy.gov.za/files/esources/electricity/ee_strategy_05.pdf

Southern African Association for Energy Efficiency (SAEE)
http://www.saee.org.za

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

Carbon Dioxide Information Analysis Centre
http://cdiac.ornl.gov

Promoting Renewable Energy in Africa (PREA)
http://prea.ises.org

Sustainable Energy Society of Southern Africa
http://www.sessa.org.za

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Ene-2 Energy Sub-Metering

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise the installation of energy sub-metering to facilitate on-going management of energy consumption.

CREDIT CRITERIA

Up to three points are awarded as follows:

One point is awarded where:

For common property services;

- Sub-metering is provided for all substantive energy (electricity & gas) loads.

  AND

- Where present, sub-metering is provided for common property energy generation systems (renewable and non-renewable);

  AND

- An effective monitoring system is installed to monitor all sub-meters and an automated metering strategy is prepared.

Where no common property services are provided, or where loads are not deemed substantive, this credit is 'Not Applicable' and is excluded from the points available used to calculate the Energy Category score.

One point is awarded where:

For all dwellings, the following demands (where provided) are sub-metered:

- Electricity, gas and domestic hot water energy (see Additional Guidance);

  AND

- Sub-meters are located within or directly adjacent to dwellings such that occupants have easy access to read consumption data (*Note: this criterion is void where the additional point below is achieved*).

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Ene-2 Energy Sub-Metering

POINTS AVAILABLE 3

An additional point is awarded where:

- The second point above is achieved;

  AND

- Occupants are provided with a dedicated visual display and analysis system for the interrogation of the energy consumption data, as provided by their sub-metering system, which provides (at a minimum):
  - A visual display of the real time consumption/generation of all energy demands/sources sub-metered (numerically or graphically);
  - A function to analyse historical consumption data;
  - A simple benchmark comparison feature to compare current and historical consumption.

  AND

- The visual display and analysis system user interface is either;
  - Visual display infrastructure provided within each dwelling, installed in a easily accessible and visible location for use by the occupants;

    OR
  - An online external website or intranet accessible system with access permissible by personal computer, interactive multimedia or cell phone.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s) 4. Automated metering strategy	1. Short report 2. As Built drawing(s) 3. Automated metering strategy 4. Extract(s) from Commissioning Report(s) 5. Manufacturer product datasheet(s)

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Ene-2 Energy Sub-Metering

POINTS AVAILABLE 3

Short report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

Where first point claimed:

- Providing a summary table of all separately metered common property substantive energy and lighting/general power demands within the development, or justifying their exclusion through calculations;
- Describing the effective monitoring system;

Where first point claimed 'Not Applicable':

- Clearly demonstrating through calculations that none of the common property services are deemed substantive (as per the Additional Guidance), justifying the exclusion of the point.

Where second point claimed:

- Describing for each dwelling type, which energy demands are sub-metered and how dwelling occupants have access to their consumption data (if applicable);

Where third point claimed:

- Describing the visual display and analysis system, its functionality and confirming compliance with the Credit Criteria;

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

Where first point claimed:

- Energy sub-meters for all common property substantive energy and lighting/general power demands within the development as referenced in the short report;
- An effective monitoring system;

Where second point claimed:

- The sub-metering of applicable energy demands within dwellings in accordance with the Credit Criteria and that meters must be placed in accessible locations within or directly adjacent to dwellings;

Where third point claimed:

- The provision of a visual display and analysis system in accordance with the Credit Criteria.

Tender / As Built drawing(s) marked-up to clearly demonstrate the inclusion of all sub-meters and the loads of all substantive energy demands as referenced in the short report.

Extract(s) of Commissioning Report(s) demonstrating that the sub-meters, effective monitoring system and visual display and analysis systems (where applicable) have been installed and that all systems operate as intended by the design.

Manufacturer product datasheet(s) of the visual display and analysis system demonstrating the systems' functionality.

Automated metering strategy document in accordance with the Additional Guidance.

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Ene-2 Energy Sub-Metering

POINTS AVAILABLE 3

ADDITIONAL GUIDANCE

The documentation must account for all of the substantive electrical and gas demands in the development, and clearly identify the location, number and respective loads of all sub-meters.

Effective monitoring system

There must be an 'effective' system for collecting, recording and monitoring data from the common property sub-meters. In most cases, the requirement for an effective system will lead to the inclusion of automated monitoring systems. Manual monitoring of common property sub-meters is not acceptable to meet the Credit Criteria.

Substantive loads

Substantive loads are those where sub-metering is deemed sensible and beneficial for energy saving and monitoring by a suitable qualified professional. These are expected to include the following:

- Centralised hot water, heating, cooling or ventilation systems (electric and gas metering as appropriate);
- Car park lighting & ventilation (where estimated annual energy use is over 10,000 kWh);
- Common area lighting/general power (where estimated annual energy use is over 10,000 kWh);
- External lighting (where estimated annual energy use is over 10,000 kWh);
- Lifts (if collectively over 20 kVA)

The Project Team must justify the exclusion of any load based on the context of the development and calculation of the estimated annual energy consumption. The first point will only be considered not applicable where it is clearly evident that no common property services exist, or that the loads are not deemed substantive, demonstrated through calculation that the expected annual energy is below the applicable threshold.

Sub-metered energy - gas

Where gas is provided to dwellings via individual bottles, it is not necessary to provide sub-metering. Where bulk gas is provided to a development and reticulated to all dwellings, sub-metering would be required.

Sub-metered energy – hot water

As domestic hot water generation represents a significant energy demand in dwellings, sub-metering is required for the applicable energy source. For solar domestic hot water systems, sub-metering is required for the 'back-up' energy source only. Where a centralised domestic hot water system is provided, the consumption for each dwelling is required to be sub-metered. It is acceptable to achieve this by sub-metering the volume per dwelling to apportion consumption. In addition, sub-metering must be provided for the main energy source of the centralised system.

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Pre-paid meters

Pre-paid meters which are provided to dwellings satisfy the requirement for dwelling sub-metering provided occupants have easy access to reload and read consumption data within their dwelling or directly adjacent to their dwelling.

Visual display and analysis systems

The intent of the visual display and analysis system is to enable quick, simple and effective communication of a dwelling's energy consumption to the dwelling occupants. It must be clearly evident that the visual display and analysis system can communicate the real-time consumption/generation of all energy demands/sources sub-metered and that the system is equipped with functionality to permit occupants to review their historical consumption data and comparison with a benchmark.

The GBCSA has not prescribed the explicit functionality of such systems (i.e. comparison frequency, or extent of historical data available), as it is the opinion of the Project Team to select the most appropriate system for the context of the dwellings and occupants. Although a visual display system mounted in an accessible and visible location is preferred, the GBCSA acknowledge the increasing availability and role of mobile technology. As such, online external website or intranet accessible systems are acceptable provided that they meet the Credit Criteria.

Automated metering strategy

The automated metering strategy for common property sub-metering must describe;

- The frequency of meter readings, data collection and storage, and reporting method; and,
- How metering errors are to be identified and provide guidance on future calibration or verification requirements (where applicable).

This document must be based on what the actual methodology will be that the development will adopt for the common property sub-meters, hence must be developed in conjunction with the Management Entity.The strategy document need not be exhaustive and must be written in easy-to- read language for a non-technical reader.

District heating & cooling

Where dwelling(s) are provided with space heating and/or cooling from a district cooling or heating system, Project Teams are requested to submit a Credit Interpretation Request (CIR) outlining the proposed metering strategy.

BACKGROUND

Metering is an integral part of energy and resource conservation during a dwelling or development's operational life. Providing dwelling occupants with usage information can act as a meaningful deterrent to wasteful behaviour and also raise awareness of the benefits of reducing consumption of energy.

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Ene-2 Energy Sub-Metering

POINTS AVAILABLE 3

Energy sub-meters, measuring electrical and gas consumption, allow data from individual dwellings to be recorded and separately billed. Providing such information to occupants is a critical step in managing energy consumption as occupants are made aware of their own use and made accountable for the associated costs.

In buildings with central domestic hot water systems, unless the hot water is sub-metered there is little incentive for occupants to reduce their hot water consumption.

Intelligent meters (also referred to as 'Smart Meters') capture and transfer information to the occupant, and they can be a vital tool in reducing energy usage. By providing real-time data on energy use and cost, users can make more informed choices about their consumption and can better manage resources and reduce operating costs (Milne, 2008). According to Milne (2008), the UK Future Foundation found that 36% of individuals surveyed did not know how much energy they use, and 82% of respondents said displays of such information would encourage them to save energy.

Australia conducted a smart meter trial with time-based pricing and found that 83% of the 3000 customers were 'more aware of their electricity consumption' and 72% were 'actively making changes to their electricity usage' (Energy Australia, 2007). A study of smart-meter users in the Australian Capital Territory found a 5% reduction of electricity use and a 30% reduction in peak demand (Country Energy's 'Heat' study cited in Milne, 2008). A 2007 study conducted for Total Environment Centre shows that if all traditional meters were replaced with smart meters across Australia (and the meters inspired users to reduce energy consumption), the nation's total greenhouse gas emissions would be reduced by 1.4 to 3.5% (Crossley, 2007).

REFERENCES & FURTHER INFORMATION

International Performance Measurement & Verification Protocol
http://www.ipmvp.org

Crossley, D. (2007), Advanced metering for energy supply in Australia, Energy Futures Australia for total environment Centre
http://www.tec.org.au/index.php?option=com_content&t ask=view&id=599&Itemid=329,.

Department of Resources, Energy and Tourism, Demand Management and Smart Meters,
http://www.ret.gov.au

Energy Australia (2007), 1.5 million customers can plug into new electronic smart meters, news Release, 09 September,
http://www.energy.com.au

Milne, G. (2008), Smart metering, Your Development
http://yourdevelopment.org/factsheet/view/id/56

Porteous, J. (ed.) (2007), Smart approaches to electricity use, eCOS Magazine, Iss. 135, Feb Mar, pp.12 13
http://www.ecosmagazine.com/?paper=eC135p12

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Ene-3 Lighting Energy Use

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise dwelling designs that incorporate energy efficient artificial lighting to minimise lighting energy use.

CREDIT CRITERIA

The Credit Criteria is applicable private dwelling lighting only. Common property lighting is addressed in Ene-8 Common Property Energy Use.

Compulsory Initiative - Is achieved where for each dwelling the interior lighting power density does not exceed 4.0W/m^2 (inclusive of parasitic losses).

Up to three points are awarded as follows:

Interior dwelling lighting

Up to two points are awarded where for each dwelling type:

- A minimum of 75% (by quantity) of all interior luminaries satisfy a minimum lamp luminous efficacy, awarded as follows;
  - 45 lm/W for one point;
    OR
  - 70 lm/W for two points;

Exterior dwelling lighting

One point is awarded where:

- All exterior luminaries are provided with presence detection AND daylight control (individually or per circuit), AND each luminaire is less than 100W;

  OR
- All exterior luminaries are provided with daylight control (individually or per circuit) AND have a minimum lamp luminous efficacy of 45 lm/W;

  OR
- No exterior dwelling lighting is provided.

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Ene-3 Lighting Energy Use

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Tender drawing(s) 3. Extract(s) from tender documentation	1. Short report 2. As Built drawing(s) 3. Statement of confirmation

Short report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- For each dwelling type, providing a tabulated summary of all luminaries, with the electrical power for each, the total installed lighting load and the resultant lighting power density (maximum demand per unit area) for the dwelling;
- Confirming that all dwellings are compliant with the Compulsory Initiative.

Additionally for interior lighting:

- For each dwelling type, providing a tabulated summary of all interior luminaires used, their quantities, the luminous efficacy of each luminaire;
- Demonstrating the stated percentage of luminaires compliant with the Credit Criteria;

Additionally for exterior lighting:

- Providing a summary table that lists all exterior luminaries, the luminous efficacy of each luminaire and the control strategy of each circuit, demonstrating compliance with the Credit Criteria;

Tender / As Built drawing(s) clearly marked up to show the location and quantity of all applicable common property lighting.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- An interior lighting power density of not more than 4.0W/m2;
- The type of luminaires, lamp types and quantities as referenced in the short report.

Additionally for interior lighting:

- That the applicable stated percentage of luminaires must meet the applicable performance requirements;

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Ene-3 Lighting Energy Use

POINTS AVAILABLE 3

Additionally for exterior lighting:

- All applicable exterior dwelling lighting are to be compliant with the applicable lighting and control requirements as stipulated.

Statement of confirmation from the supplier(s) in the form of signed correspondence, confirming the type and quantity of luminaires supplied to the project.

ADDITIONAL GUIDANCE

The compulsory initiative of this credit recognises reasonable overall efficiency of the lighting system. To calculate the interior lighting power density, the electrical power for each luminaire installed within the dwelling should be summed, and divided by the total rentable floor area (RFA).

The first two points of the credit reward the efficiency of the internal lighting luminaires and lighting system, independent of the design lighting levels. The third point of the credit rewards efficient exterior lighting, either where efficient luminaires are used or else presence detection controls are provided.

The lighting power for a luminaire must include lamp power and ballast losses (where applicable) and any other parasitic losses (e.g. lighting control systems). Most manufacturers will be able to provide data for the performance of their products (including parasitic losses).

Lighting power density - example calculation

A dwelling with a rentable floor area of 103m2 contains the following internal luminaires and control system:

- 8 fittings 'Type A' – 11W with no losses; total power consumption = 11W each
- 2 fittings 'Type B' – 60W with no losses; total power consumption = 60W each
- 3 fittings 'Type C' – 56W with 13% loss; total power consumption = 64 W each
- Lighting control system with average parasitic power consumption = 5W

Total interior lighting load = (8x11) + (2x60) + (3x64) + 5 = 405 W

Total lighting power density = 405/103 = 3.93 W/m^2 < 4.0 W/m^2; therefore the dwelling satisfies the Compulsory Initiative.

BACKGROUND

Lighting energy use is a significant proportion of total energy use in residential buildings in South Africa, accounting for around 10% of the total energy demand of a high-middle income urban dwelling, and up to 20% of that of a low income urban dwelling.

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Ene-3 Lighting Energy Use

POINTS AVAILABLE 3

In developed nations such as the U.S., Australia and New Zealand, lighting energy use has increased significantly due to both increasing sizes of dwellings and the installation of more light fittings per dwelling.

However recent advancements in lighting technology provide the opportunity to significantly reduce lighting energy consumption, reducing both the cost to occupants of lighting their dwellings and reducing greenhouse gas emissions associated with lighting.

The efficiency of a lamp is referred to as 'luminous efficacy', which is a measure of how well a light source produces visible light and can be simply described as the ratio of the electrical energy input to the lamp and the visible light output.

Another important aspect of lighting and reducing lighting energy cost is the expected lifetime of the lamp. The expected lifetime of a lamp used within a dwelling can vary significantly and impact on the life cycle cost of the lighting design in a dwelling.

Table Ene-3.1 provides an overview of the luminous efficacy and typical lifetime of various lamps and lighting technologies.

Lamp	Typical Luminous Efficacy (lm/W)	Typical Lifetime (Hours)
Standard Incandescent (GLS)	10–17	750–2500
Tungsten Halogen (i.e.12V downlight)	12–22	2000–4000
Compact Fluorescent (CFL)	50–70	10,000
Linear Fluorescent	30–110	7000–24,000
Metal Halide	70–115	5000–20,000
High Pressure Sodium	50–140	16,000–24,000
Light Emitting Diode (LED) – Cool White	60–92	35,000–50,000
Light Emitting Diode (LED) – Warm White	27–54	35,000–50,000

Table Ene-3.1 *Typical luminous efficacy of lamp types (adapted from U.S. DoE Energy Savers)*

It can be seen from Table Ene-3.1 that there are lamp technologies which offer significant improvements in energy efficiency, coupled with much longer expected lifetimes.

Standard incandescent lamps have been the most commonly used type of lighting. The principle of this technology is that an electric element within the evacuated glass bulb is heated to white hot by passing an electrical current through it. This technology is, however, very inefficient with a significant proportion of the electrical energy input into the lamp converted

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into heat energy. Improvement in lighting technology now permits the replacement of a 60 Watt standard incandescent lamp by a 12 Watt CFL for the same light output.

Given the poor energy efficiency and short lifetime of standard incandescent lamps, many countries throughout the world have already, or are in the process of, phasing out this lighting technology through legislated minimum lamp energy efficiency requirements or minimum energy performance standards. Since November 2009 the Australian Government has placed a sales restriction on this type of lamp, targeting any light bulbs that have a luminous efficacy of less than 15 lm/W.

The phase out commenced by the Australian Government is expected to deliver considerable savings to the environment. On a national basis, avoiding the use of inefficient lamps is expected to save around 30 terawatt hours (TWh; 1 TWh = 1,000,000,000 kWh) of electricity and 28 million tonnes of greenhouse gas emissions between 2008 and 2020. This is equivalent to decommissioning a small coal-fired power station or taking more than 500,000 cars off the road.

In South Africa, as part of their on-going integrated demand management strategy, Eskom commenced a program in 2004 to exchange standard incandescent lamps with CFLs in selected areas. Since then, more than 40 million CFLs have been distributed and has saved in excess of 1 000 MW from the residential sector

Energy efficient lighting designs optimise the use of efficient lighting lamp and controls technology, natural daylight and basic good design principles. 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 dwelling occupants. For example, a lower level of illumination may be comfortable if the walls are well lit.

Lighting designers should take all these factors into account when generating the best design for the space, whilst minimising energy use for lighting.

REFERENCES & FURTHER INFORMATION

Energy Saver - Lighting, Department of Energy, Energy Efficiency & Renewable Energy (EERE). U.S. Government.
http://www.energysavers.gov/your_home/lighting_daylighting/index.cfm/mytopic=11985

Your Home Technical Manual – Lighting, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.yourhome.gov.au/technical/fs63.html

Lighting – Think Change, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.climatechange.gov.au/what-you-need-to-know/lighting

Eskom Integrated Demand Management Program
http://www.eskomidm.co.za/residential/residential-technologies/residential

Ene-3 Lighting Energy Use

POINTS AVAILABLE 3

SANS 10114-1:2005 Interior Lighting – Part1: Artificial Lighting of Interiors
https://www.sabs.co.za/index.php?page=home

SANS 204:2011 Energy Efficiency in Buildings
https://www.sabs.co.za/index.php?page=home

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Ene-5 Maximum Electrical Demand Reduction

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise dwelling designs which reduce the maximum demand on the electrical supply infrastructure.

CREDIT CRITERIA

Up to two points are awarded where:

- For each dwelling, a minimum number of qualifying maximum electrical demand reduction design initiatives are incorporated, awarded as follows;
  - Two design initiatives for one point;
    OR
  - Three design initiatives for two points.

Qualifying maximum electrical demand reduction design initiatives are:

Space heating

Where an active space heating system is installed, it utilises a non-electric primary energy source.

Domestic hot water

A hot water system with a non-electric primary energy source is installed.

Cooking appliances

All stoves/hobs and ovens installed are non-electric;

On-site energy generation

On-site energy generation is installed and can provide 200W per occupant at time of maximum electricity demand in the supply network.

Smart metering

'Smart Meters' linked to hot water geysers are installed to allow the utility to switch off geysers automatically at time of maximum electricity demand in the supply network.

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Ene-5 Maximum Electrical Demand Reduction

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Extract(s) from tender documentation	Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Extract(s) from the Commissioning Report(s)

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

- Describing which design initiatives have been included within each dwelling type;

Additionally where on-site generation claimed:

- Describing what on-site generation system is proposed, clearly indicating the capacity per occupant;
- Describing the availability of the on-site generation capacity at the time of peak demand and confirming that it can be guaranteed regardless of climatic conditions;

Extract(s) from tender documentation where the proposed design initiatives are described, clearly demonstrating a contractual requirement for inclusion by the Contractor.

Extract(s) from the Commissioning Report(s) demonstrating that the design initiatives have been commissioned and operate as intended by the design.

ADDITIONAL GUIDANCE

To qualify, solar hot water heaters must be provided with non-electric back-up or no back-up at all.

Cooking appliances include stove tops/hobs and ovens only. To qualify as a maximum electrical demand reduction initiative, both non-electric ovens and non-electric stoves/hobs must be provided.

Any on-site electrical energy generation systems must be capable of providing the stated power reliably and instantaneously, regardless of climatic conditions. Stand-by generators do not satisfy the on-site generation requirement unless they are designed and integrated into the development for the purpose of maximum electrical energy demand reduction and can be

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activated automatically. Renewable energy systems reliant on climatic conditions at the time (i.e. solar radiation or wind) cannot meet the credit criteria without energy storage systems.

For the purposes of this credit, the period of peak electrical demand is considered as the early evening in winter.

BACKGROUND

Electricity providers are obligated to have excess power generation and transmission capacity to handle peaks in the system. Within South African, electrical peak energy demand usually occurs in the early evening during cold weather (winter) due to a heavy reliance on electric space heating, electric water heating and electric cooking. This is unlike Australia, where the electrical peak energy demand usually occurs during the late afternoon during hot weather (summer) due to high air conditioning (cooling) loads.

The electrical generation capacity in South Africa has been unable to meet maximum demands at times, leading to regular load shedding and disruption. Reducing maximum loads will reduce the pressure on Eskom to provide short term solutions, such as the recommissioning of often older, 'dirtier' and greenhouse gas emission intensive generation infrastructure.

REFERENCES & FURTHER INFORMATION

ESKOM Annual Report 2010
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 Integrated Demand Management
http://www.eskomidm.co.za

CSIRO, Demand-Side Response and the Electricity Network
http://www.det.csiro.au/science/de_s/de_dsm.htm

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Ene-7 Hot Water Energy Use

POINTS AVAILABLE 5

AIM OF CREDIT

To encourage and recognise dwelling designs that reduce greenhouse gas emissions associated with domestic hot water production.

CREDIT CRITERIA

Compulsory Initiative - Is achieved where it is demonstrated that all geysers and hot water storage vessels are insulated in accordance with SANS-204:2011.

Up to five points are awarded where:

- The total greenhouse gas emissions associated with domestic hot water production within the development is reduced by a minimum percentage from a reference case, awarded as follows:
  - 15% for one point;
  - 30% for two points;
  - 45% for three points;
  - 60% for four points;
  - 75% for five points.

The percentage reduction and point awarded are calculated using the Green Star SA Multi Unit Residential v1 Hot Water Calculator.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Calculator extract	1. Short report 2. Calculator extract

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Ene-7 Hot Water Energy Use

POINTS AVAILABLE 5

3. Extract(s) from tender documentation 4. Tender drawing(s)	3. Extract(s) from Commissioning Report(s) 4. As Built drawing(s)

Short report prepared by a suitably qualified professional, demonstrating how the credit criteria have been achieved by:

- Identifying all inputs into the calculator and justifying them as appropriate (with reference to supporting documentation);
- Identifying any assumptions made and demonstrating that they are conservative;
- Confirming that all geysers and hot water storage vessels are insulated in accordance with SANS-204:2011.

Calculator extract from the Green Star SA Multi Unit Residential v1 Hot Water Calculator clearly showing what values have been entered and the output results.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- All geysers and hot water storage vessels in the development are insulated in accordance with SANS-204:2011; and
- The installation of the domestic hot water systems as referenced in the short report. All inputs to the Hot Water Calculator must be reflected in the tender documentation.

Tender / As Built drawing(s) demonstrating the inputs used in the Hot Water Calculator and referenced in the short report are reflected in the current design (where necessary).

Extract(s) from the Commissioning Report(s) demonstrating that:

- The hot water systems have been installed, commissioned and operate as intended by the design; and
- All geysers and hot water storage vessels are insulated in accordance with SANS-204:2011.

ADDITIONAL GUIDANCE

Please refer to the Green Star SA – Multi Unit Residential v1 Hot Water Calculator Guide for details on how to use the calculator. There are two ways in which to improve the score:

- Reduce hot water consumption, which is calculated from the water calculator. Low flow showers and taps will reduce hot water consumption and hence the amount of energy required to heat the water; or,
- Use more efficient systems or non-electric forms of primary energy to heat the hot water, such as heat pumps, solar energy or gas.

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Ene-7 Hot Water Energy Use

POINTS AVAILABLE 5

The calculator makes certain assumptions which cannot be adjusted as these are for the purposes of benchmarking.

The reference case is assumed compliant with the SANS10400-XA requirement, where 50% of the hot water demand is provided with a heat pump (with a seasonal COP of 3.0) and 50% is heated with an electric element. Points are then awarded based on the percentage improvement over the reference case.

BACKGROUND

Hot water energy use is a significant proportion of total energy use in residential buildings in South Africa, accounting for around 30% of the total energy demand of a high-middle income urban dwelling, and up to 43% of that of a low income urban dwelling.

These high demand figures are a combined result of the widespread use of inefficient hot water systems and poor water efficiency; water efficiency measures not only save water, but in addition save energy needed to heat water.

Traditionally in South Africa, like many countries around the world, domestic hot water heating has been achieved using direct electric resistance storage systems, with heating usually done at off-peak times. These hot water systems are now placing stress on the electrical distribution network as they contribute to network peak electrical demand (see Ene-5 Maximum Electrical Demand Reduction). Their reliance on coal-generated grid electricity as the primary fuel source alone places them as one of the largest single contributors of greenhouse gas emissions from residential dwellings.

However, there are now a range of alternative domestic hot water heating systems which can both reduce domestic water heating contribution to network peak electrical demand, reduce greenhouse gas emissions and reduce occupants' energy costs.

Such systems include;

- Solar hot water systems with electric or gas boost;
- Electric heat-pump systems; and
- Instantaneous gas hot water systems.

By using primary fuel sources which are renewable, or have lower greenhouse gas emission coefficients, and installing water efficient shower heads and taps, greenhouse gas emissions arising from domestic hot water heating can be significantly reduced without compromising the lifestyles of occupants. It is estimated that given South Africa's climate, the installation of a solar hot water system can reduce electricity consumption by 85% compared to that of a direct electric resistance hot water system, saving 4,500 kilograms of greenhouse gas emissions per year.

Although installing efficient domestic hot water systems using renewable or low emission primary energy sources, and installing efficient water fittings to reduce the demand for hot water, domestic hot water energy consumption can be reduced, there are other design

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initiatives which can be implemented for further savings. It is estimated that about 30 per cent of the energy used to heat water in a storage system is wasted due to heat loss from the storage tank and distribution pipework. To reduce these losses, hot water pipes should be kept as short as possible to minimise heat loss (and water loss), and wet areas (i.e. bathrooms, laundries and kitchens) should be positioned close together with the hot water system close to all points of hot water use.

Similar to other governments around the world, the Australian Government has commenced a phase-out of greenhouse gas intensive domestic hot water systems, which is estimated to reduce greenhouse gas emissions by about 78.7 million tonnes over the period from 2010 to 2030.

REFERENCES & FURTHER INFORMATION

Your Home Technical Manual – Hot Water Service, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.yourhome.gov.au/technical/fs65.html

Hot Water Systems – Think Change, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.climatechange.gov.au/en/what-you-need-to-know/appliances-and-equipment/hot-water-systems

Sustainable Energy Society Southern Africa (SESSA) – Solar Hot Water Heating
http://www.sessa.org.za/

Eskom Integrated Demand Management Program
http://www.eskomidm.co.za/residential/residential-technologies/residential

SAP - Standard Assessment Procedure for Energy Rating of Dwellings 2005 Edition, UK Government.
http://www.bre.co.uk/sap2005

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Ene-8 Common Property Energy Use

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise designs that reduce energy use associated with common property lifts, car park ventilation and lighting.

CREDIT CRITERIA

Up to three points are awarded independently as follows:

Lifts

One point is awarded where:

- Predicted lift energy consumption is reduced by 25% from a reference case;

  OR

- No lifts are provided in the development.

Where all buildings in the development are less than four storeys and no lifts are provided, this point is 'Not Applicable' and is excluded from the points available to calculate the Energy Category score.

Car park ventilation
One point is awarded where:

All car park areas (excluding visitor parking) within the development meet either, or a combination of, the following:

- Are provided with mechanical (supply and/or exhaust) ventilation system(s) and achieve a specific fan power of less than 0.5 W/l/s;

  OR

- Are provided with mechanical (supply and exhaust) ventilation system(s) controlled by Carbon Monoxide monitors only to operate at full capacity when required;

  OR

- Are naturally ventilated in accordance with SANS10400-Part O.

Where 90% or more dwellings are provided with private naturally ventilated garages, this point is 'Not Applicable' and is excluded from the points available to calculate the Energy Category score.

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Ene-8 Common Property Energy Use

POINTS AVAILABLE 3

Common property lighting

One point is awarded where:

- All exterior luminaries have;
  - Presence detection and daylight control (individually or per circuit), AND are less than 100W per luminaire;

    OR
  - Daylight control (individually or per circuit) AND have a minimum luminous efficacy of 45 lm/W;

  AND
- All interior luminaries within internal common property areas have time-clock or presence detection control (individually or per circuit), AND have a minimum luminous efficacy of 45 lm/W.

Where no common property lighting is provided, this this point is 'Not Applicable' and is excluded from the points available to calculate the Energy Category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s)	1. Short report 2. As Built drawing(s) 3. Extract(s) from Commissioning Report(s) 4. Manufacturer product datasheet(s)

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

Where lift point claimed:

- Providing calculations in accordance with Appendix E of the of the Green Star SA – Multi Unit Residential v1 DTS & Energy Modelling Protocol Guide, with references to supporting documentation;

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OR

- Where point is claimed as 'Not Applicable': Confirming that all building(s) are less than four storeys and that no lifts are provided.

Where car park ventilation point claimed:

- Providing details of all car parking area(s) and the ventilation strategy provided to each area;
- Where mechanically ventilated: Demonstrating through calculation, the specific fan power with reference to supporting documentation (where applicable);
- Where mechanically ventilated: Describing the function of the Carbon Monoxide control system (where applicable);
- Where naturally ventilated: Confirming that naturally ventilated car park areas are compliant with SANS10400-Part O (where applicable);

OR

- Where point claimed as 'Not Applicable': Confirming that 90% or more dwellings are provided with private parking garages.

Where common property lighting point claimed:

- Providing a summary table that lists all exterior common property luminaire types, the lamp power and luminous efficacy of each, and the control strategy of each area served, demonstrating compliance with the Credit Criteria (where applicable);
- Providing a summary table that lists all interior common property luminaire types, the luminous efficacy of each and the control strategy of each area served, demonstrating compliance with the Credit Criteria.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for;

Where lift point claimed:

- The installation of lift(s) which meet the performance specification as referenced in the short report lift energy calculation. All inputs must be evidenced in the tender documentation;

Where car park ventilation point claimed:

- The car park ventilation system(s) as referenced in the short report, clearly indicating the maximum specific fan power and inputs used in the short report calculations (where applicable);
- The car park ventilation system(s) as referenced in the short report, clearly demonstrating the performance specification of the Carbon Monoxide control system (where applicable).

Where common property lighting point claimed:

- All applicable common property lighting to be compliant with the applicable lighting and control requirements as stipulated. The requirements must be clearly stipulated in the tender documentation;
- The installation of the common property lighting system as referenced in the short report.

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Tender / As Built drawing(s) marked-up to clearly demonstrate:

Where lift point claimed:

- The location and number of lifts within the development.

Where car park ventilation point claimed:

- The car park ventilation system(s), clearly identifying the fans and ductwork of the system, and the location of Carbon Monoxide sensors (where applicable);

Where common property lighting point claimed:

- The common property lighting circuits and areas served, indicating the type of luminaires.

Manufacturer product datasheet(s) detailing the:

Where lift point claimed:

- The performance specifications of the installed lifts, confirming all relevant values used in the lift energy calculations in the short report;

Where car park ventilation point claimed:

- The performance specifications of the installed car park ventilation fans, reflecting the values use in the specific fan power calculations in the short report (where applicable).
- The performance specifications of the Carbon Monoxide control system (where applicable).

Where common property lighting claimed:

- The type, lamp power and luminous efficacy of all luminaires used.

Extract(s) from Commissioning Report(s) confirming that the lifts(s), car park ventilation system(s) and/or common property lighting systems have been installed, commissioned and operate as intended by the design.

ADDITIONAL GUIDANCE

Lifts

The lift energy usage is to be estimated using the method in Appendix D of the Green Star SA – Multi Unit Residential v1 Energy Modelling & DTS Guide. This allows for the effect of low standby power and regenerative braking to be rewarded as well as efficient motors.

Car park ventilation

The specific fan power (SFP) of a mechanical ventilation system is the sum of the design total circuit-watts, including all loses through switchgear and controls such as inverters, of all fans that supply air and exhaust it back outside of the car park (i.e. the sum of supply and extract fans), divided by the design ventilation rate through the car park. An example calculation is provided below.

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A car park ventilation system is designed such that it has two supply and two extract fans, with a total design flow of 2.6m³/s (2600l/s). The specified supply fans are nominated as 0.5 kW in operation (500W) while the extract fans are 0.4kW (400W). The specific fan power based on this design is then (2x500+2x400)/2600 = 0.69 W/l/s. Therefore this would not comply with the Credit Criteria.

This calculation can be completed for an as built system, however the flow rate used should be that determined from the commissioning, while the power can be either the actual measured power, or the name plate power of the fans.

Common property lighting

Areas where minimum lighting levels are required at all times for code compliance are exempt from the controls requirement, but must still meet the minimum luminous efficacy requirement.

BACKGROUND

Without design consideration, common property services can consume significant amounts of energy, representing a large proportion of a multi-unit residential development's total energy demand.

Poor selection of vertical transportation systems may result in large stand-by losses and reduced energy efficiency. The design of car park ventilation systems without time-clock control or other control strategies may resulting in car park ventilation systems operating for extended periods unnecessarily. Equally, the design of common property lighting systems, regardless of interior or external applications, without appropriate controls can lead to unnecessary energy wastage and greenhouse gas emissions.

Recent research into the common property energy consumption within multi unit residential buildings was completed in Sydney, Australia, in 2005. The research involved the audit of 41 multi unit residential buildings (a total of 3,670 dwellings) across a broad range of multi unit residential development types (high-rise, mid-rise, low-rise, townhouse and villa). All buildings were audited for energy consumption and peak demand characteristics. Although acknowledging a relatively small sample size, the researchers concluded that on both a per dwelling basis and per occupant basis, a reduction in greenhouse gas emissions was evident as multi unit residential buildings become free of common property services. On a per dwelling basis, the research indicated the following annual greenhouse gas emissions; High-rise (10.4 tCO_2e/yr), Mid-rise (7.3 tCO_2e/yr), Low-rise (6.5 tCO_2e/yr) and Townhouses & Villas (5.1 tCO_2e/yr).

This research indicates that common property services may have a significant impact on the overall energy efficiency and greenhouse gas emission performance of a multi unit residential development, unless appropriate design initiatives are implemented to optimise the efficiency of such services.

Recognising the challenges of common property energy consumption, in 2008 the City of Melbourne commissioned a pilot project aimed at researching how multi unit residential apartments can be made more sustainable. A key outcome of the pilot program was the

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implementation of energy efficiency upgrades to common property services of a large multi unit residential development (231 dwellings).

The initiatives implemented focused on the below ground car park lighting the common property lighting, both of which operated for 24hrs per day. Improvements to the car parking lighting produced energy savings of 42,224 kWh/year, with a payback period of less than two years. The introduction of more efficient lamps and manual control systems for certain areas of common property produced energy savings of 94,608 kWh/year, with a payback period of only 13.7 months.

The purpose of the Ene-8 Common Property Energy Use credit is to encourage and recognise initiatives such as these that optimise the efficiency of such services.

REFERENCES & FURTHER INFORMATION

Energy Australia – Multi Unit Residential Buildings Energy & Peak Demand Study, NSW Department of Infrastructure, Planning & Natural Resources.
https://www.basix.nsw.gov.au/information/common/pdf/alts_adds_req/energy_mu_study.pdf

Spring Street Towers – Case Study, Sustainable Living in the City, City of Melbourne
http://www.melbourne.vic.gov.au/Environment/WhatCanIDo/Pages/SustainableLivingintheCity.aspx

CIBSE Guide D "Transportation systems in buildings" 2005 Edition
http://www.cibse.org

Energy Saver - Lighting, Department of Energy, Energy Efficiency & Renewable Energy (EERE). U.S. Government.
http://www.energysavers.gov/your_home/lighting_daylighting/index.cfm/mytopic=11985

Your Home Technical Manual – Lighting, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.yourhome.gov.au/technical/fs63.html

Eskom Integrated Demand Management Program
http://www.eskomidm.co.za/residential/residential-technologies/residential

SANS 10114-1:2005 Interior Lighting – Part1: Artificial Lighting of Interiors
https://www.sabs.co.za/index.php?page=home

SANS 204:2011 Energy Efficiency in Buildings
https://www.sabs.co.za/index.php?page=home

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Ene-9 Low Emission Energy Generation

POINTS AVAILABLE 4

AIM OF CREDIT

To encourage and recognise designs that incorporate on-site energy generation systems utilising renewable or low emission energy sources.

CREDIT CRITERIA

Up to four points are awarded where:

- On-site energy generation system(s) are provided within the development;

  AND

- Generated low emission energy is distributed to all dwellings;

  AND

- Annual quantities of low emission energy are generated such that greenhouse gas emissions are reduced from that of a reference energy source, awarded as follows:
  - 6 $kgCO_2e/m^2$/year for one point;
  - 12 $kgCO_2e/m^2$/year for two points;
  - 18 $kgCO_2e/m^2$/year for three points;
  - 24 $kgCO_2e/m^2$/year for four points;

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s) 4. Manufacturer product datasheet(s)	1. Short report 2. Extract(s) from Commissioning Report(s) 3. As Built drawing(s) 4. Statement of confirmation

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Ene-9 Low Emission Energy Generation

POINTS AVAILABLE 4

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

- Detailing type and capacity of the energy generation system(s);
- Providing detailed calculations of the normalised emission reductions, in accordance with the Additional Guidance. This should reference supporting documentation and applicable calculation methodology or software programs;
- Providing a tabulated summary for all dwelling types, demonstrating that the applicable Credit Criteria is met.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the installation of the generation system(s) which meet the performance specification as referenced in the short report.

Manufacturer product datasheet(s) for each system, clearly demonstrating the applicable performance data or specifications of the energy generation system(s) as referenced in the short report.

Statement of confirmation from the supplier(s) or manufacturer(s) of the energy generation system(s) confirming the estimated annual energy generation of the system(s) as installed.

Tender / As Built drawing(s) marked up to show the integration of the energy generation system(s) into the development.

Extract(s) from Commissioning Report(s) clearly demonstrating the installation, commissioning and operation as intended by the design, of the energy generation system(s).

ADDITIONAL GUIDANCE

The Credit Criteria is normalised to dwelling rentable floor area (RFA), which must be used for the calculations to demonstrate compliance.

The reference energy source which may be assumed for all reference cases is mains electricity with a nominal greenhouse gas emissions coefficient of 1.2 $kgCO_2e/kWh$.

To demonstrate compliance with the Credit Criteria, the normalised emission reduction must be calculated using the following methodology:

Step 1: Determine 'Reference Emissions':

a) Calculate the predicted annual energy generated from the renewable or low emission generation system (in kWh);
b) Multiplying the figure in a) by the greenhouse gas emissions factor for the reference energy source (i.e. mains electricity; 1.2$kgCO_2/kWh$) to give the 'Reference Emissions';

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Ene-9 Low Emission Energy Generation

POINTS AVAILABLE 4

Step 2: Determine 'Estimate Emissions':

c) RENEWABLE SYSTEMS: Multiply the predicted annual energy generated from the renewable energy system, as calculated in a) above, by the applicable greenhouse gas emission coefficient in Table Ene-9.1 (below);
d) NON-RENEWABLE SYSTEMS: Multiply the input fuel quantity (in kWh) required to generate the predicted annual energy, as calculated in a) above, by the applicable greenhouse gas emission coefficient in Table Ene-9.1 (below);

Step 3: Determine normalised emissions reduction:

e) Subtract the 'Estimate Emissions' (calculated in Step 1) from the 'Reference Emissions' (calculated in Step 2) to calculate the net emissions reduction;
f) Divide the net emission reduction, as calculated in e) above, by the total rentable floor area (RFA) of the development. This will yield the normalized emissions reduction (i.e. $kgCO_2/m^2$/year) which must be used to demonstrate compliance with the Credit Criteria.

Type	Fuel Factor ($kgCO_2e/kWh$)
Mains electricity	1.2
On-site photovoltaics (PV)	0.0
On-site wind	0.0
On-site biogas	0.0
Liquefied Petroleum Gas (LPG)	0.227
Natural Gas	0.202
Off-site/distributed biogas	0.025
Town Gas (coal)	0.16
Coal	0.354
Diesel	0.267

Table Ene-9.1 *Fuel factors to be used when calculating greenhouse gas emissions ($kgCO_2$ equivalent)*

On-site PV and wind systems are deemed as those located on the project site and connected to the development's electrical distribution network or directly to dwellings. The purchase of renewable energy from sources beyond the project site must not be claimed.

On-site biogas systems are deemed those which use wastewater, putrescible domestic waste, and/or green waste generated by the development as a feedstock for bio-digester(s) located within the development. The purchase of biogas from sources beyond the project site must not be claimed.

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Ene-9 Low Emission Energy Generation

POINTS AVAILABLE 4

Calculations of the predicted annual energy generated from renewable or low emission generation system must be completed by a suitably qualified professional experienced in the specific generation system.

The predicted annual energy generated must be the energy available to the occupants after all (reasonable) losses are accounted for (where applicable). Annual energy yields stated without accounting for such losses are not acceptable.

Each dwelling must have access to the energy generated either by being provided with its own individual system, or be connected into the distribution network from a centralised energy system.

For renewable energy systems, estimates of energy generation must be derived from detailed calculations using site or project specific data, specific renewable energy modelling software or be provided from the system supplier with robust supporting evidence. Estimates for renewable energy generation based simply on equipment peak ratings and un-substantiated assumptions are not acceptable. The following comments are made on specific renewable energy systems:

- Photovoltaics (PV) – Estimates must be based on solar irradiation data for the specific site, and account for the module(s) orientation, tilt, efficiency and applicable performance coefficients (where applicable);
- Wind turbines – Estimates must be based on hourly wind data for the specific site (or an adjacent location within reason), corrected for height and gusts;
- Biogas – Estimates must include all assumptions about the biomass source material and quantity, the assumed occupancy, the expected generation rate (i.e. m^3/day) and the estimated percentage content of methane. A conversion factor of 36 MJ/m^3 (100% CH_4) must be used to convert from cubic meters of methane (100% CH_4) to energy.

For non-renewable energy systems such as cogeneration/trigeneration systems, the calculation of the input fuel must be based on the actual efficiency of the system, not an assumed figure. The efficiency must be clearly indicated in the manufacturer product datasheet(s). For the purposes of Green Star SA, it must be assumed that all input fuel is attributed to the output electrical energy of the system, not apportioned between electrical and thermal energy. The thermal energy output from a cogeneration/trigeneration is considered as a by-product of generating electrical energy, therefore an emissions coefficient of 0 $kgCO_2e$/kWh may be assumed (within Ene-1 Greenhouse Gas Emissions – Heating & Cooling).

Renewable or low emission energy used to generate hot water must not be claimed within this credit as this initiative is rewarded in Ene-7 Hot Water Energy Use. Similarly, renewable or low emission energy used to provide space heating must not be claimed within this credit as this initiative is rewarded in Ene-1 Greenhouse Gas Emissions – Heating & Cooling.

Given South Africa's warm climate, electric or gas pool heating is not considered standard practice, hence cannot be considered against reference emissions. On this basis renewable or low emission energy used for pool heating is excluded from the scope of this credit.

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Ene-9 Low Emission Energy Generation

POINTS AVAILABLE 4

BACKGROUND

The use of renewable and low emission energy generation has the potential to significantly lower a dwelling's greenhouse gas emissions, reduce energy costs and reliance on the national electricity distribution network. Renewable energy and low emission resources suitable for residential applications include solar PV, wind, biogas and cogeneration. Energy generated on-site using low or zero greenhouse gas emission sources reduces the demand for coal generated grid electricity.

Photovoltaic (PV) panels convert sunlight into direct current (DC) electricity. Through the use of an inverter, alternating current (AC) electricity can be produced for use in normal domestic appliances. These panels can either be mounted on a frame or integrated into the building fabric. South Africa has high levels of solar radiation, with average daily solar radiation of between 4.5 kWh and 6.5 kWh per square metre, making solar PV systems a viable alternative energy source. Solar PV systems which are 'grid tied' or 'grid connected' offer the optimum use of electricity generated; excess energy is fed back into the grid during peak periods of the day, with evening energy requirements met by the grid. Such a configuration avoids the requirement for energy storage systems on a local scale. There are, however, current challenges to this in South Africa.

South Africa has abundant wind resources. Currently, South Africa's potential commercial wind power capacity is estimated to be between 3 GW to 70 GW. Significant wind power potential exists along most coastal and escarpment areas with mean annual speeds above 6 meters per second. Domestic wind generators are usually used in standalone power systems and designed to charge a battery bank. Domestic sized wind generators range from 300 Watts to 5kW. Wind power systems may not be suitable for all sites given wind resources, turbulence from surrounding structures or vegetation, and noise.

Biogas is a low cost energy source from biomass waste resources such as animal manure, human waste, landscape waste and other organic matter. Biogas digesters consist of airtight tanks in which organic waste is decomposed by anaerobic bacteria. The result is a combination of methane (CH_4) and carbon dioxide (CO_2) gas with a composition of two-thirds and one-third of methane and carbon dioxide respectively, with small amounts of nitrogen, hydrogen, hydrogen sulphide and other impurities. The biogas can be connected to a household stove for cooking, heating or lighting purposes. Typically, one cubic meter of biogas will provide 1.5kWh energy output (or 2 hours of cooking time). Biogas can be used to displace the use of electricity for cooking purposes.

Cogeneration also known as Combined Heat and Power (CHP) is the simultaneous production of electricity and thermal energy from a single fuel source. Because cogeneration produces both electricity and heat, it can achieve energy end-use efficiency of up to 90%, which is much greater than the energy efficiency of using grid electricity. Thermal energy from cogeneration systems can be used for domestic hot water heating, space heating and even cooling through the use of absorption cooling. The fuel source for cogeneration is typically natural gas, however some systems in Europe now use biomass (i.e. waste wood pellets).

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Ene-9 Low Emission Energy Generation

POINTS AVAILABLE 4

REFERENCES & FURTHER INFORMATION

Europa - PV Potential Estimator (with solar data for Europe and Africa)
http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php

RETScreen Clean Energy Project Analysis Software, Natural Resources Canada
http://www.retscreen.net/ang/home.php

UNEP Energy Technology Fact Sheet - Cogeneration
http://www.unep.fr/energy/information/publications/factsheets/pdf/cogeneration.pdf

Your Home Technical Manual – Renewable Energy, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.yourhome.gov.au/technical/fs66.html

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Ene-10 Energy Efficient Appliances

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise initiatives which reduce energy consumption associated with major appliances.

CREDIT CRITERIA

Two points are awarded where for a minimum 90% of dwellings;

- A minimum of two applicable appliances are provided within the scope of the main contract;

  AND

- Each applicable appliance provided is certified with a minimum 'B' rating of the European "Energy Rating" labelling system.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Manufacturer product datasheet(s) OR Evidence of energy rating	1. Short report 2. Extract(s) from Commissioning Report(s) 3. Manufacturer product datasheet(s) OR Evidence of energy rating

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

- Providing a tabulated summary of all dwellings identifying (make, model and energy rating) the applicable appliances provided within the scope of the main contract;
- Confirming that a minimum 90% of dwellings are provided with applicable appliances and that the Credit Criteria is achieved.

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Ene-10 Energy Efficient Appliances

POINTS AVAILABLE 2

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the installation of appliances of the exact make, model, minimum energy rating and quantity as referenced in the short report.

Manufacturer product datasheet(s) for the applicable appliance claimed, clearly identifying the make, model and energy rating achieved under the applicable rating scheme.

Evidence of energy rating for the applicable appliance claimed, in the form of an energy rating certificate, with the make and model, and the applicable rating scheme identified.

Extract(s) from Commissioning Report(s) confirming the installation and functional operation of all applicable appliances claimed.

ADDITIONAL GUIDANCE

Applicable appliances include the following only;

- Refrigerators;
- Freezers;
- Dishwashers;
- Washing machines;
- Clothes driers;
- Stoves/hobs; and,
- Ovens.

To qualify for awarding of points, no less than two applicable appliances must be provided which are compliant with the Credit Criteria. Where more than two applicable appliances are provided, each applicable appliance must comply with the Credit Criteria.

Gas stoves/hobs can be considered as energy rated appliances which meet the credit criteria owing to the reduced greenhouse gas emission intensity of gas compared grid electricity generated from coal.

Stoves/hobs and ovens are considered separate appliances and as such, where combined ovens/stoves are provided (i.e. free standing units), both the stove/hob and oven may be treated separately.

Integrated refrigerators/freezers with one power connection must be considered as one appliance, irrespective of the number of compressors and refrigeration circuits. Where integrated refrigerator/freezer units have separate power connections for the refrigerator and freezer systems separately, these may be considered as two appliances.

Where communal or private clothes lines are installed, these may be considered as a clothes dryer(s) of the highest energy rating, provided the minimum total line length is not less than 6m per dwelling or 1m per occupant (whichever is greater). A communal clothes line must still

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meet the criteria in terms of length per occupant. Portable clothes lines or hoists are not acceptable for meeting the Credit Criteria. Clothes lines provided on dwelling balconies (i.e. retractable) are only acceptable if they are permanently fixed and clearly indicated within the documentation.

The explicit make and model of appliances claimed must be specified in the tender documentation to satisfy the GBCSA that those appliances have been appropriately priced for the development and are likely to be installed. Given the variance in cost between appliances and energy efficiency ratings, it is not acceptable for the purposes of Green Star SA to specify a minimum energy efficiency rating only.

BACKGROUND

Energy rating labels for domestic appliances allow the consumer to compare energy efficiency between different models, while also understanding the predicted total energy the appliance will likely consume over a year. Choosing energy efficient appliances is one way to both reduce greenhouse gas emissions associated with energy use, while also reducing operational costs for occupants.

Currently, South Africa does not have a legislated national appliance rating system, although many imported appliances have certified energy efficiency ratings to meet other international market requirements (i.e. Europe and Australia). A “South African National Appliances Energy Efficiency Action Plan” was released in draft form in September 2010 by the Department of Energy and Department of Trade and Industry. This includes plans to introduce ratings for washing machines, dishwashers, electric ovens, refrigerators and freezers, water heaters / geysers and air conditioners up to 5 kW. The intention is that the system will be based on the European energy efficiency labelling scheme (with some minor changes) and will require all products made in or imported into South Africa to be certified with an energy rating.

The European scheme ranks products on an efficiency scale of ‘A’ to ‘G’, with ‘A’ being the most efficient and ‘G’ being the least. In the United States, the ‘Energy Star’ program, developed by the U.S. EPA and U.S. Department of Energy, includes domestic appliances, and is successfully used to communicate appliance performance.

In the U.S, an energy rated refrigerator is 20% more efficient than an un-qualified model of the same size, and will consume less than half the energy of an equivalent manufactured before 1993. Modern refrigerators employ improved insulation, more efficient compressors, more precise temperature control and defrost systems. Refrigerators with freezer compartments on top use 10-25% less energy than those with bottom mounted or side mounted freezers.

Similarly, an energy rated clothes washer is 37% more efficient than an un-qualified model, and will consume 50% less water. A large Approximately 90% of the energy used by washing clothes often goes just to heat the water and therefore a lot of energy can be saved by using cold washes. Using a clothesline, retractable clothesline, or indoor drying rack will save energy and reduce fabric wear on your garments. Savings can be significant considering that an average family may do 400 loads of washing per year. Modern combined washer-dryers use advanced control features such as moisture sensing to minimise cycle times.

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Ene-10 Energy Efficient Appliances

POINTS AVAILABLE 2

REFERENCES & FURTHER INFORMATION

South African National Appliances Energy Efficiency Action Plan (Draft), Department of Energy and Department of Trade and Industry - September 2010

European 'EU Energy Label' Scheme
http://www.energy.eu/#energy-focus

U.S. EPA & U.S. DoE 'Energy Star' Scheme
http://www.energystar.gov/index.cfm?c=products.pr_find_es_products

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

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, 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[7]. This translates into more than 22% of carbon emissions for the province, which is a higher proportion than some other countries, such as Australia where the transport sector accounted for 13.5% of greenhouse gas emissions in 2004[8].

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[9]. Many commuters are in a position to make such a switch, particularly where development's design, facilities and location deliberately support alternative transport modes.

[7] *http://www.capegateway.gov.za/Text/2010/7/white_paper_-_sustainable_energy_western_cape.pdf*
[8] *http://www.environment.gov.au/soe/2006/publications/report/pubs/soe-2006-report.pdf*
[9] *www.environment.gov.za/HotIssues/2008/LTMS/A LTMS Scenarios for SA.pdf*

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Tra-1 Provision of Car Parking

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise developments that reduce the parking facilities provided for cars.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where the total number of car parking spaces is:

- At least 25% lower than the maximum local planning allowances applicable to the development;

  OR

- Not provided in excess of 1.25 car parking spaces per dwelling, where mandatory requirements do not exist at all, or are optional (i.e. recommended).

OR

Two points are awarded where the total number of car parking spaces is:

- At least 50% lower than the maximum local planning allowances applicable to the development;

  OR

- Not provided in excess of 0.7 car parking spaces per dwelling, where mandatory requirements do not exist at all, or are optional (i.e. recommended).

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Planning allowances extract(s) 3. Tender drawing(s)	1. Short report 2. Planning allowances extract(s) 3. As Built drawing(s)

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Tra-1 Provision of Car Parking

POINTS AVAILABLE 2

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

- 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, with reference to supporting documentation.

Planning allowances extract(s) from the local, provincial or national authority that clearly demonstrates the parking allowances for the project site and whether they are mandatory or otherwise.

Tender / As Built drawing(s) marked-up to show all car parking spaces in the development, including those within private garages.

ADDITIONAL GUIDANCE

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. This includes car parking requirements within the planning allowances or Development Approval requirements for the project. A number of South African municipalities do not have their own parking requirements, and defer to Department of Transport standards. Most that do have standards specify a minimum number of spaces.

The City of Cape Town in 2006 issued parking standards under the new Integrated Zoning Scheme that reduced the minimum parking ratios, but did not specify a maximum. The City of Johannesburg in 2007 prepared a set of parking maximums.

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.

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 South African State of the Environment Report 2006, vehicles contributed 21.3% to the total greenhouse gas emissions in the country. The majority of the transport emissions come from road transport, including cars, trucks and buses (DEAT, 2006).

Between 2000 and 2006 the number of vehicles has increased by 14%; furthermore vehicle emissions are predicted to increase by 27% and up by 44% by 2011 (base year 2002). The

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estimated car ownership rate for South Africa is about 129 vehicles per 1,000 people, which is marginally higher than the world average of 120 vehicles per 1,000 people (DEAT, 2006).

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 air pollutants.

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 & FURTHER INFORMATION

Department of Environmental Affairs and Tourism (2006) South Africa Environmental Outlook, A report on the state of the environment
http://soer.deat.gov.za/frontpage.aspx?m=2

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/department/statements/2005_2006/paes/part_c.aspx,

Nature Conservation Council, Smogbusters
http://www.nccnsw.org.au

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Tra-2 Fuel-Efficient Transport

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise developments that facilitate the use of more fuel efficient modes of transport.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

One point is awarded where:

- For every 20 car parking spaces provided for residents and visitors, a minimum of 1 parking space is provided for mopeds/scooters/motorbikes.

Where more than 90% of dwellings are provided with private garages, this point is 'Not Applicable' and is excluded from the points available used to calculate the Transport Category score.

One point is awarded where:

- A car-share program is provided within the development, such that;
  - Dedicated car parking space(s) are provided and clearly marked for car-share use; AND
  - A valid contractual agreement has been entered into by the Management Entity and a car-share service provider.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Tender drawing(s)	1. Short report 2. As Built drawing(s)

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Tra-2 Fuel-Efficient Transport

POINTS AVAILABLE 2

Additionally where credit claimed applicable: 3. Extract(s) from tender documentation Additionally where point for car-share claimed: 4. Extract(s) from contract	Additionally where credit claimed applicable: 3. Statement of confirmation Additionally where point for car sharing claimed: 4. Extract(s) from contract

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

Where first point claimed:

- Indicating the total number of car parking spaces provided within the development;
- The number of car parking spaces provided for mopeds, scooters and motorbikes, with calculations demonstrating compliance with the Credit Criteria; or
- Where point claimed 'Not Applicable': Confirming that 90% or more dwellings are provided with private garages, with reference to supporting documentation (where applicable).

Where second point claimed:

- Describing the car share program, including the number of vehicles provided, the service provider and the length of the agreement.

Tender / As Built drawing(s) clearly marked-up to indicate;

Where first point claimed:

- The total number and location of car parking spaces;
- The total number and location of scooter/moped/motorcycle parking spaces.

Where second point claimed:

- The total number and location of the car-share parking spaces.

Extract(s) from tender documentation demonstrating the contractual requirement for the dedicated use car parking to be clearly signed and marked with a separate colour to standard car parking spaces.

Extract(s) from contract signed by both the Management Entity and the service provider, clearly indicating;

- The number of car-share vehicles to be accommodated on the site; and,
- The time period that the agreement is valid for.

Statement of confirmation from the Contractor in the form of signed correspondence stating that all dedicated use car parking spaces are clearly signed and marked with a separate colour to standard car parking spaces.

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Tra-2 Fuel-Efficient Transport

POINTS AVAILABLE 2

ADDITIONAL GUIDANCE

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.

The concept of car sharing is that individuals can hire car(s) 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 daily basis.

This credit allows for the possibility that a Management Entity or an independent company may set up formal car-sharing arrangements for the use of occupants and potentially for other residents or workers in the vicinity of the development.

The number of parking spaces provided for the second point may be excluded for the purposes of the first point.

BACKGROUND

Over the last decade new private vehicle sales showed an average increase of 9.5% per annum up until 2008 worldwide (KPMG, 2008). During the same period petrol sales have increased by 14% and diesel sales by 50% (Mabusela & Mamakoko, 2006). While the 2001 South African Census shows that private vehicles account for 19% of all journeys taken, one can expect that this trend to increase, especially in the urban environment. In Johannesburg, for example, private car travel accounts for almost 50% of commuter trips with minibus travel being responsible for a further ~30% of trips (DEAT, 2006).

Increases in the extent of single occupancy vehicles, and increases in the number of cars per capita have been quoted in cities like Cape Town as proof of the growth in vehicle activity rates (City of Cape Town, 2003).

The greenhouse gas emissions from the typical petrol based passenger vehicle are approximately 60% greater than the emissions from a motorcycle. Choosing a two-wheeled vehicle can help to reduce air pollution, as well as minimise greenhouse gas emissions.

REFERENCES & FURTHER INFORMATION

DEAT (2003), 'Joint Implementation Strategy for the Control of Exhaust Emissions from Road-going Vehicles in the Republic of South Africa', Department of Environmental Affairs and Tourism & Department of Minerals and Energy, The Republic of South Africa.

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Moving South Africa: A Transport Strategy for 2020
http://www.transport.gov.za/projects/msa/msa.html

Department of Transport and Regional Services (DOTARS), Motor Vehicles and the Environment
http://www.dotars.gov.au/department/statements/2005_2006/paes/part_c.aspx

KPMG Global Automotive Executive Survey (2008) South Africa
http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Momentum/Documents/Momentum-AutoExec-2009.pdf

Mabusela X. & Mamakoko T. (2006), 'An overview of Joburg's vehicular emissions measurements and control methods', Department of Environmental Management, City of Johannesburg.
http://www.joburg-archive.co.za/2007/pdfs/air_quality/vehicle_emission_measurements2007.pdf

City of Cape Town (2003),'State of Environment Report'
http://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Pages/StateoftheEnvironmentReports%28Archive%29.aspx

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Tra-3 Cyclist Facilities

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise developments that facilitates the use of bicycles by occupants and visitors.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- A minimum of one bicycle storage space is provided for every two (2) bedrooms, where the storage space is within either;
  - An individual dedicated, enclosed bicycle locker or cage per dwelling;
    OR
  - A secure, communal bicycle storage room provided with storage racks.

  AND
- Safe and unimpeded cycling routes are provided within the development and to the adjacent street network;

An additional point is awarded where:

- The above point is achieved;

  AND
- A minimum of 0.25 secure visitor bicycle storage spaces are provided per dwelling.

Where more than 90% of dwellings are provided with private garages, the additional point is 'Not Applicable' and is excluded from the points available used to calculate the Transport Category score.

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Tra-3 Cyclist Facilities

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s)	1. Short report 2. As Built drawing(s) 3. Statement of confirmation

Short report prepared by a relevant team member that describes how the Credit Criteria have been met by:

- Demonstrating through calculations the number of bicycle storage spaces required for Credit Criteria compliance;
- Describing the location and provision of the bicycle storage spaces, and describing how the spaces are weather protected; and,
- Describing how the route between the bicycle storage space(s) and the adjacent street network is safe and unimpeded.

Where additional point claimed:

- Demonstrating through calculations the number of visitor bicycle storage spaces required;
- Describing how the spaces provided are secure, signposted in an accessible location near a major public entrance and provided with good natural surveillance;
- Describing how the route between the bicycle storage space(s) and the adjacent street network is safe and unimpeded.

Where additional point claimed 'Not Applicable':

- Confirming that 90% or more dwellings are provided with private garages.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for;

- The stipulated number of bicycle storage spaces required, as per the short report; and,
- Applicable signage as per the Additional Guidance.

Tender / As Built drawing(s) marked-up to clearly show;

- The number and location of all bicycle storage spaces; and,
- The safe and unimpeded bicycle route(s) between the storage spaces and the adjacent street network;

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Tra-3 Cyclist Facilities

POINTS AVAILABLE 2

Statement of confirmation from the Contractor in the form of signed correspondence, stating the number of bicycle storage spaces installed and the number of visitor bicycle storage spaces installed (where applicable).

ADDITIONAL GUIDANCE

For the purpose of the Transport credits, a major public entrance is defined as a public entrance to the development that is accessible from a main street or avenue, and not the entrance from a side street unless the side street entrance is the only public entrance to the development. Furthermore, the entrance to a multi-storey car park will also be considered to be a major public entrance if the visitors' cyclist facilities are clearly signposted at the entry to the car park and the designated parking is no more than one split level away (in either direction) from the entrance level.

In the case of bicycle storage (both occupant and visitor), railings, lamp posts or other non-purposeful bike parking facilities do not meet the intent of the credit.

Occupant bicycle parking

Secure bicycle storage for occupants must be in the form of either (or any combination of);

- A lockable storage space (i.e. locker or cage);
- A communal bicycle storage room with a lockable entrance; or,
- A private garage that is for the dedicated use of a single dwelling.

There must be adequate space to store the number of bicycles as required by the Credit Criteria. Storage racks to secure bicycles within individual lockers or storage cages provided per dwelling are not required. However storage racks must be provided within communal bicycle storage rooms, allowing bicycles to be secured as an additional security measure. Private car parking garages provided to each dwelling are deemed to be a "lockable storage space".

Visitor bicycle parking

Visitor bicycle racks must be located near a major public entrance in an accessible location that is clearly signposted, well lit and visible from the public entrance. Racks/rails must be designed to allow both a wheel and the frame to be locked securely to the structure. For visitor bicycle parking, convenience is the critical issue.

Safe and unimpeded routes

The requirement for safe and unimpeded cycling routes within the development and to the adjacent street network is intended to ensure that cyclists have access that is at least as convenient as vehicular access. This does not necessarily require a dedicated right-of-way or lane for cyclists, but it does require deliberate designing of the route (whether on-street or off-street) to ensure safe passage across the site, and through parking areas (if applicable). The term "unimpeded" implies that cyclists should not be obstructed by security booms, steps, gutters or the like, and should not need to portage bicycles to/from storage area(s).

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Tra-3 Cyclist Facilities

POINTS AVAILABLE 2

External cyclist amenities

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.

Opportunities to influence the development of off-site facilities are to be encouraged. For example, a multi unit residential development that has a strong body corporate provides an opportunity to coordinate cycling links. Even in the case of a high-rise block of flats in a Central Business District (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

Cycling 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 2.5 km.

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, Non-Motorised Transport (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 multi unit residential developments and other buildings, these initiatives should make it easier to cycle. Research in Australia and elsewhere has consistently found that people are more willing to cycle when the appropriate facilities are provided at the destination.

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Tra-3 Cyclist Facilities

POINTS AVAILABLE 2

REFERENCES & FURTHER INFORMATION

GAUTRANS Guidelines for the Provision of Pedestrian and Bicycle Facilities on Provincial Roads in Gauteng
http://www.up.ac.za/dspace/bitstream/2263/7115/1/Visser_Gautrans (2003).pdf

Provincial Government of the Western Cape, (2009), Department of Transport and Public Works, Non-motorised Transport in the Western Cape, Draft Strategy.
http://www.westerncape.gov.za/Text/2009/5/pgwc_nmt_report_english_march_09_upload_3.pdf

Infrastructure Policy, Planning and Design Digest
http://www.ibike.org/engineering/infrastructure.htm

Framework for non-motorised transport, January 2009
http://www.joburg-archive.co.za/2009/pdfs/transport/nmt_framework09.pdf

Australian Bicycle Council, 1999-2004 Australia Cycling: The National Strategy
http://www.austroads.com.au/abc/

City of Cape Town: NMT Policy and Strategy
http://www.cityenergy.org.za/transport/nmt

Bureau of Transport and Regional Economics (2002), Greenhouse Policy Options for Transport
http://www.btre.gov.au

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Tra-4 Commuting Mass Transport

POINTS AVAILABLE 5

AIM OF CREDIT

To encourage and recognise developments' that select a site near public transport and facilitate the use of mass transport.

CREDIT CRITERIA

Up to five points are awarded for the quality of mass transport options available to the occupants of the development, as follows:

Up to three points are awarded where:

The development site is assessed using the Green Star SA Commuting Mass Transport Calculator, with points being awarded based on the:

- Type of mass transport services available within 1,000m of the site;
- Number of routes served; and,
- Average interval between services during weekday peak commuter periods (AM and PM).

An additional point is awarded where:

- One point (minimum) is achieved using the Green Star SA Commuting Mass Transport Calculator;

  AND

- At least two services operate with minimum service frequency of one hour on weekdays between 06:00 to 23:00 (excluding peak commuter periods).

An additional point is awarded where:

- One point (minimum) is achieved using the Green Star SA Commuting Mass Transport Calculator;

  AND

- At least two services operate with minimum service frequency of one hour on Saturdays, Sundays and public holidays between 08:30 and 20:30.

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Tra-4 Commuting Mass Transport

POINTS AVAILABLE 5

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Calculator extract 3. Evidence of service frequency	1. Short report 2. Calculator extract 3. Evidence of service frequency

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

- Summarising the transport stops surrounding the site in compliance with the distance requirement;
- Showing the transport stop(s), appropriately labelled route(s) of service(s) and walking distances from the main entrance of the development to the transport stop(s) on an appropriately scaled map;
- Providing a tabulated summary of the service(s) and route(s) using each transport stop;
- Justifying all the inputs into the Mass Transport Calculator with reference to supporting documentation.

Calculator extract from the Green Star SA Multi Unit Residential v1 Mass Transport Calculator which clearly demonstrates all inputs and results outputs.

Evidence of service frequency for bus, minibus and/or trains in the form of any of the following:

- Extract(s) from timetable(s) for each route showing service frequency during peak periods. The timetable provided must not be more than one year old from the date of Green Star SA submission;
- Survey results of observed bus, minibus or train operations during peak commuter periods;
- Current Public Transport Record (CPTR) 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.

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Tra-4 Commuting Mass Transport

POINTS AVAILABLE 5

ADDITIONAL GUIDANCE

The number of points achieved is determined by using the Green Star SA Commuting Mass Transport Calculator in the Green Star SA Multi Unit Residential v1 rating tool spreadsheet.

The Green Star SA Commuting Mass Transport Calculator must be used in accordance with the Commuting Mass Transport Calculators Guide available from the GBCSA website (**http://www.gbcsa.org.za**).

BACKGROUND

When a development is poorly located in proximity to transport nodes (stops, stations and interchanges) and/or and the frequency of service is poor, then it is unlikely that residents will use mass transport to travel to work or complete other errands. Conversely, developments that are within close proximity of good transport nodes with frequent service can encourage residents 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. 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, which is 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 (DEAT, 2006).

Private transport trips are often undertaken over longer distances than public transport trips, with a corresponding increase in environmental impact. Nationwide in South Africa, 19% of the trips taken are by private vehicle transport (cars and motorcycles), while minibus taxis account for 11.5% of the trips. In urban areas these numbers are higher, for example in Johannesburg, private car travel accounts for almost 50% of commuter trips with minibus travel being responsible for a further 30% of trips (DEAT, 2006).

REFERENCES & FURTHER INFORMATION

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http://www.joburg.org.za/content/view/1226/78/1/4/

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Urban non-motorised transport (NMT) (2001) A critical look at the development of urban NMT policy and planning mechanism in South Africa from 1996 -2006
http://www.up.ac.za/dspace/bitstream/2263/5953/1/017.pdf

City Energy Support Unit: Sustainable Transport
http://www.cityenergy.org.za/transport

White Paper on National Transport Policy
http://www.info.gov.za/whitepapers/1996/transportpolicy.htm

The Sustainable Transport and Mobility Handbook
www.transportandmobility.co.za/

Urban Environmental Management: Sustainable Transportation
http://www.gdrc.org/uem/sustran/sustran.html

TDM Encyclopaedia; Transit Station Improvements
http://www.vtpi.org/tdm/tdm127.htm

StatsSA household survey
http://www.transport.gov.za/library/docs/stats/2001/statistics.html

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Tra-5 Local Connectivity

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise multi unit residential developments that are integrated with or built adjacent to amenities to encourage effective car-based trip reduction initiatives.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- At least three amenities listed below are, or are planned, within 1,000m unimpeded walking distance of the development site.

OR

Two points are awarded where:

- At least six amenities listed below are, or are planned, within 1,000m unimpeded walking distance of the development site.

Accepted amenities:

- Hardware store
- Public sports field
- Pharmacy
- Gym, pool or sports facility
- Library
- Bank or ATM
- School, University or Technikon
- Garden nursery
- Neighbourhood park, beach or nature reserve
- Post office
- Retail shop
- Supermarket or grocery store
- Registered childcare centre
- Officially designated 'Trading Area'
- Laundromat
- Convenience store
- Restaurant or food outlet
- Cinema or theatre
- Places of worship
- Community centre
- Hospital, clinic or healthcare centre
- Offices

It must be demonstrated that safe, well-lit, dedicated pedestrian footpaths or walkways are provided between the main entrance of the development and the amenities claimed. Where this cannot be demonstrated, an amenity cannot be claimed.

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Tra-5 Local Connectivity

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Evidence of amenity location Additionally where future amenities claimed: 3. Extract(s) of Site Development Plan 4. Statement of confirmation 5. Development program	1. Short report 2. Evidence of amenity location Additionally where future amenities claimed: 3. Extract(s) of Site Development Plan 4. Statement of confirmation 5. Development program

Short report prepared by a relevant project team member that describes how the Credit Criteria has been met by:

- Providing a suitably scaled surrounding area map, site plan or aerial image with the location of all amenities (existing and future, where applicable), and unimpeded walking routes indicated;
- Demonstrating that dedicated pedestrian footpaths or walkways are provided between the main entrance of the development and the amenities claimed;
- Demonstrating the provision of lighting for pedestrian footpaths or walkways claimed.

Additionally where existing amenities claimed:

- Providing a tabulated summary of all existing amenities claimed, their full addresses and the unimpeded walking route distance to each amenity, with reference to supporting documentation;

Additionally where future amenities claimed:

- Providing a tabulated summary of all future amenities claimed, their full address, the unimpeded walking route distance to each amenity and the expected practical completion date of each amenity, with reference to supporting documentation.

Evidence of amenity location in the form of any of the following:

- Extracts from 'White Pages', 'Yellow Pages', 'Google Maps' or equivalent;
- Business card, stationary or advertising material;
- In the case of buildings housing multiple amenities, either a letter from the building owner / manager confirming uses, or a survey of uses within the period 08:00 to 21:00 on a weekday and the period 08:00 and 13:00 on Saturday and Sunday;

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Tra-5 Local Connectivity

POINTS AVAILABLE 2

Extract(s) of Site Development Plan clearly identifying each amenity, or space type classification claimed.

Statement of confirmation in the form of signed correspondence from the Developer stating that the Site Development Plan (of stated revision and date) has been approved by the Relevant Planning Authority and that development rights have been obtained, supported by evidence of Site Development Plan approval.

Development program clearly indicating that the practical completion date of the amenities claimed is within 3 years of the practical completion of the residential dwellings (within the scope of the Green Star SA certification).

ADDITIONAL GUIDANCE

The general intent of this credit is to discourage short car trips made from home. Walking distance must be based on actual routes that allow for unimpeded pedestrian movement on paved surfaces removed from vehicular travel lanes. Distances “as the crow flies” are not acceptable as an indication of walking distances.

Communal indoor amenities (e.g. indoor pool or gym) provided within the development which are accessible to occupants only, may be claimed within the scope of the Credit Criteria as they reduce the need for car-based trips. However, outdoor communal facilities rewarded in Eco-6 Outdoor Communal Facilities are to be excluded and must not be used to demonstrate compliance with the Credit Criteria.

For the ‘Officially designated trading area’ amenity, the trading area must be such that no less than five traders are accommodated.

Unimpeded walking distance

The starting point for distance from the development must be either;

- The approximate geometric centre (at ground level) of the dwellings or buildings (where dwellings are within multiple building); or
- Where all dwellings are located within a single building, the main pedestrian entrance of the building.

Any amenities within the development itself may be included regardless of distance to the main entrance.

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).

It must be demonstrated that safe, well-lit, dedicated pedestrian footpaths or walkways are provided between the main entrance of the development and the amenities claimed. Where this cannot be demonstrated, an amenity cannot be claimed.

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Multiple amenities

Where there are two or more of one amenity, this will count as only two amenities. (For example, three restaurants will count as only two amenities.) Supermarkets, grocery stores and convenience stores count as the same type of amenity, so for example one supermarket and two convenience stores together count as only two amenities. Similarly, a standalone pharmacy and a pharmacy within a grocery or other store both contribute to the total pharmacies and cannot exceed two.

Where a building houses multiple amenities (e.g. a church which operates as a child care centre during the week), confirmation from the building owner/manager is required to confirm the multiple amenities or a survey of uses within the period 08:00 to 21:00 on a weekday and the period 08:00 and 13:00 on Saturday and Sunday.

Future amenities

For multi unit residential developments, local amenities are commonly developed by the developer to provide both residential and non-residential spaces types. However, the non-residential space types can either be developed at the same time as the residential dwellings (i.e. in parallel) or after the completion of the residential dwellings (i.e. sequential). In both scenarios, the amenities do not exist and are therefore considered as 'future' amenities. Such developments may be developed under separate development contracts and at different project phases, however will typically be incorporated in the 'Masterplan' or Site Development Plan. Such future amenities may only be claimed within the Tra-6 Trip Reduction – Mixed Use credit where;

- The amenities are clearly included within the scope of the Site Development Plan for the development;
- The Site Development Plan has been approved by the Relevant Planning Authority, rezoning has taken place and development rights obtained; and
- The practical completion date of the amenities is within 3 years of the practical completion date of the residential dwellings within the scope of the Green Star SA certification.

Future amenities which are not included within the Site Development Plan for the development cannot be claimed within the scope of this credit.

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, while the developer does not have direct control over amenities beyond the assessed property, the absence of certain facilities would hinder access to public amenities. It would therefore not be appropriate to award points for amenities if it were not possible to walk between the land uses (separated by physical barriers or highways without crossings).

It must be demonstrated that safe, well-lit, dedicated pedestrian footpaths or walkways are provided between the residential development and the adjacent street network. Where it cannot be demonstrated that lighting is provided to all footpaths or walkways claimed, points will not be awarded.

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Tra-5 Local Connectivity

POINTS AVAILABLE 2

BACKGROUND

Traditionally, land use planning for residential developments has put emphasis on private vehicles as the primary mode of access in the design, scale and layout of transport facilities. In most instances, these car-orientated developments actively inhibit pedestrians, cyclists and public transport users in their layout, design, scale and location. This credit aims to encourage developments that incorporate effective car-based trip reduction measures such as the provisions of quality pedestrian, cycling and public transport access. Mixed use development or residential centres within mixed use areas, and within walking distance, encourage shoppers living nearly, to make a modal switch from using cars to walking or cycling. Besides reducing congestion and pollution (bearing in mind that short car journeys generate more noxious emissions per kilometre), walking and cycling can also bring health benefits to the public and should be encouraged.

Some developments require the preparation of a Transportation Impact Study (TIS), and the amount of traffic generated by a proposed development is one of the most critical elements of a TIS. The Department of Transport published the second edition on South African Trip Generation Rates (1995). The document includes daily and peak hour trip generation rates for a wide variety of land uses, and implicitly assumes certain mode splits between public transport, private transport and non-motorised transport.

REFERENCES & FURTHER INFORMATION

City of Cape Town (2005), City of Cape Town NMT Strategy.
http://www.sustainable.org.za/transit/resource-library/non-motorised-transport/7.html

City of Johannesburg, (2007) City of Johannesburg Planning Framework for NMT in JHB.
http://www.joburg-archive.co.za/2009/pdfs/transport/nmt_framework09.pdf

Provincial Government of the Western Cape, (2009), Department of Transport and Public Works, Non-motorised Transport in the Western Cape, Draft Strategy.
http://www.westerncape.gov.za/Text/2009/5/pgwc_nmt_report_english_march_09_upload_3.pdf

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Water

Within the Water Category, credits address the reduction of potable water use through design of water efficient 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. Fresh water supplies are increasingly affected by a range of factors including catchment locations, contaminated sources drought and rising demand as Government embarks on projects to provide potable water to all communities. By 2006 the South African Government had provided safe drinking water to 16 million people since 1994[10].

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 the Directorate of Water Resource Planning on water availability per water management area clearly demonstrated 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[11]. 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.

In South Africa, water is consumed indirectly through the production of electricity. Currently, Eskom uses 1.35 litres of water and 1kg coal to generate 1 kWh of electricity[12]. Leakages contribute to declining water sources. A toilet leak and or a dripping tap can waste up to 30 litres of water an hour, which adds up to 10 000 litres a year. Water efficient basin taps left running for only 15 seconds, while brushing teeth can account for about 300 litres of water wasted per day if 200 individuals have the same habit. This shows that a dramatic change in the habits by occupants at a large scale can have a significant impact in reducing consumption of potable water. Leakage on building premises is not so much of a problem as improved pressure test standards during commissioning of water supply systems which can virtually eliminate water wastage through leakage. However, at municipality level the problem of water leaks is a major challenge.

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 harvesting rainwater, and recycling waste water. Currently, a very small proportion of buildings have water recycling systems.

Green Star SA encourages measures to reduce the potable water consumption in Multi Unit Residential developments. Such reductions will ease the pressure on South African water sources as well as contributing to more cost efficient operation and savings to residents.

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[10] *Department of Water Affairs &Forestry, http://www.dwaf.gov.za/Communications/PressReleases/2006/children16Nov06.pdf*

[11] *The Department of Water Affairs & Forestry: Directorate of Water Resources http://www.dwaf.gov.za/WAR/documents/WMAWaterAvailibility23Feb06.pdf*

[12] *The Environmental Handbook, www.trialogue.co.za*

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Wat-1 Occupant Amenity Water

POINTS AVAILABLE 5

AIM OF CREDIT

To encourage and recognise designs that reduce potable water consumption by dwelling occupants.

CREDIT CRITERIA

Up to five points are awarded for occupant amenity water efficiency, assessed using the Green Star SA – Multi Unit Residential v1 Potable Water Calculator (Part 1 & Part 2), as follows:

Up to two points are awarded where:

- The water efficiency performance of fixtures and fittings achieve a minimum percentage reduction in demand-side amenity water consumption from a reference case, awarded as follows;
  - 15% for one point;
    OR
  - 30% for two points.

Up to three points are awarded where:

- The use of water harvesting and recycling/reuse systems reduces the potable water demand for toilet flushing by a minimum percentage, awarded as follows;
  - 50% for one point;
    OR
  - 75% for two points;
    OR
  - 100% for three points.

Project Teams must ensure that any water harvesting or recycling system(s) installed in the development have been designed in strict compliance with all applicable National and Provincial Standards and Legislation pertaining to the use of recycled water.

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Wat-1 Occupant Amenity Water

POINTS AVAILABLE 5

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential v1 Design	Green Star SA – Multi Unit Residential v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Calculator extract 3. Extract(s) from tender documentation	1. Short report 2. Calculator extract 3. Manufacturer product datasheet(s)
Additionally where water harvesting and recycling/reuse system(s) installed: 4. Tender drawing(s)	Additionally where water harvesting and recycling system(s) installed: 4. As Built drawing(s) 5. Extract(s) from Commissioning Report(s)
Additionally where blackwater recycling system(s) installed: 5. Statement of confirmation	Additionally where blackwater recycling system(s) installed: 6. Statement of confirmation

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

- Providing a tabulated summary for each dwelling type, of fixtures and fittings included and nominating the water efficiency performance (i.e. L/min or L/flush) of each, with reference to supporting documentation;

Additionally where rain, grey or black water harvesting and recycling system(s) installed:

- Describing all water harvesting and recycling system(s), including a description of the functional operation of each;
- Indicating sources of harvested water (relevant to each system) and/or collection areas (with justification of run-off coefficient selected) nominated as inputs in the Potable Water Calculator, with reference to supporting documentation;
- Confirming any associated storage volumes nominated as inputs in the Potable Water Calculator, with reference to supporting documentation;
- Providing calculations undertaken for non-amenity uses or harvested sources (e.g. irrigation, washing machine, pool backwash etc.), nominated as inputs in the Potable Water Calculator, with reference to supporting documentation;
- Confirming that all water harvesting and recycling systems have been designed in accordance, and are compliant with, all relevant standards and legislation;

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Additionally where blackwater recycling system(s) installed:

- Confirming, with reference to supporting documentation, the stage of the necessary approval process.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- The installation of fixture and fittings which meet the minimum water efficiency performance requirements as referenced in the short report;
- The installation of all applicable water harvesting and recycling systems, with details of performance requirements and storage capacities as referenced in the short report.

Tender / As Built drawing(s) marked-up to clearly show the inclusion of all water harvesting and recycling systems with associated storage volumes as referenced in the short report.

Calculator extract from the Green Star SA Multi Unit Residential v1 Amenity Potable Water Calculator that clearly shows the values which have been entered and the output results.

Manufacturer product datasheet(s) for each applicable fixture and fitting, clearly indicating the water efficiency performance, correlating with that referenced in the short report.

Statement of confirmation from the Relevant Authority in the form of signed correspondence that confirms;

- For a Design rating: That the necessary approval process has commenced with the design "approved in principle" by the Relevant Authority;

  OR

- For an As Built rating: That the necessary approval process is complete and the applicable water treatment system(s) have been approved by the Relevant Authority.

Extract(s) from Commissioning Report(s) demonstrating that the relevant systems have been commissioned and operate as intended by the design. It must be clearly indicated that all the fixtures and fittings and all water reuse, collection and storage systems have been installed as referenced in the short report.

ADDITIONAL GUIDANCE

The number of points achieved is determined by using the Green Star SA Multi Unit Residential v1 Potable Water Calculator (Part 1 & Part 2).

The Potable Water Calculator must be used in accordance with the Potable Water and Sewage Calculator Guide available from the GBCSA website **(http://www.gbcsa.org.za).**

The Potable Water Calculator is a benchmarking tool only and must not be used to design harvesting and recycling systems. As such, it does not undertake detailed calculations of water storage efficiency and it is the responsibility of the design team to ensure appropriate storage capacities given dwelling and common property demands and available harvested sources.

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Wat-1 Occupant Amenity Water

POINTS AVAILABLE 5

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 impacts on the water table level, extracting ground water from any neighbouring fresh-water sources merely localises a problem what otherwise would take place on the municipal or provincial level.

Relevant authority approval

Project teams must ensure that any water harvesting or recycling system(s) installed in the development have been designed in strict compliance with all applicable National and Provincial standards and legislation pertaining to the use of recycled water. Where blackwater recycling systems are present, evidence of approval from the relevant authorities must be provided in accordance with the Documentation Requirements.

BACKGROUND

Collecting rainwater from roofs and other impervious surfaces can add to the amount of non-potable water available for use in buildings. Multi unit residential buildings with large roof areas are particularly well suited for rainwater collection due to non-potable water demand for toilet flushing and showering (assuming appropriate treatment).

Greywater can be harvested from sinks and showers, washing machines and other water sources that do not contain human wastes. Project teams must refer to local guidelines, however in many cases greywater can be used without treatment for sub-surface irrigation if used immediately, however for storage and use for other applications (e.g. toilet flushing), more involved treatment is required.

Blackwater is waste water contaminated with human urine and faecal wastes. The reuse of this water requires extensive treatment, however is a feasible and mature technology which can provide access to a water resource to supplement other demands.

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.

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Wat-1 Occupant Amenity Water

POINTS AVAILABLE 5

REFERENCES & FURTHER INFORMATION

South African Weather Service
http://www.weathersa.co.za

South Africa Rain Atlas
http://134.76.173.220/rainfall/index.html

South Africa Department of Water Affairs & 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

Your Home Technical Manual – Water Use, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.yourhome.gov.au/technical/fs71.html

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Wat-2 Water Sub-Metering

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise the installation of sub-metering to facilitate on-going management of water consumption.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- For common property services sub-metering is provided for:
  - All substantive water demands (see Additional Guidance); and,
  - Supply from onsite water harvesting and recycling/reuse system(s) (where installed);

  AND
- An effective monitoring system is installed to monitor the common property sub-meters and an automated metering strategy is prepared.

  AND
- For all dwellings, sub-metering is provided for;
  - Potable water (cold);
  - Non-potable water (where provided); and,
  - Domestic hot water (only where centralised service provided);

  AND
- Dwelling sub-meter(s) are located within or directly adjacent to dwellings such that occupants have easy access to read consumption data (*Note: this criterion is void where the additional point below is achieved*).

An additional point is awarded where:

- The point above is achieved;

  AND
- Occupants are provided with a dedicated visual display and analysis system for the interrogation of the water consumption data, as provided by their sub-metering system, which provides (at a minimum):
  - A function to analyse historical consumption data;
  - A simple benchmark comparison feature to compare current and historical consumption.

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AND

- The visual display and analysis system user interface is either;
  - Visual display infrastructure provided within each dwelling, installed in a easily accessible and visible location for use by the occupants;

    OR
  - An online external website or intranet accessible system with access permissible by personal computer, interactive multimedia or cell phone.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential v1 Design	**Green Star SA – Multi Unit Residential v1 As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s) 4. Automated metering strategy	1. Short report 2. As Built drawing(s) 3. Extract(s) from Commissioning Report(s) 4. Automated metering strategy 5. Manufacturer product datasheet(s)

Short report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Providing a summary table of all separately metered common property substantive water demands and recycled water sources (where applicable);
- Describing the effective monitoring system for the common property sub-meters;
- Describing for each dwelling type, the sub-metering provided and how dwelling occupants have access to their consumption data, demonstrating compliance with the Credit Criteria;

Where additional point claimed:

- Describing the functionality of the visual display and analysis system provided;

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- The installation of all sub-meters as referenced in the short report;
- The installation of the effective monitoring system for common property sub-meters, as referenced in the short report.

Wat-2 Water Sub-Metering

POINTS AVAILABLE 2

Where additional point claimed:

- The installation of visual display and analysis systems in accordance with Credit Criteria.

Tender / As Built drawing(s) marked-up to clearly demonstrate for each dwelling type, the location of all sub-meters, demonstrating that they are in an accessible location for occupants.

Extract(s) of Commissioning Report(s) demonstrating that the sub-meters, effective monitoring system and visual displays (where applicable) have been installed and that all systems operate as intended by the design.

Manufacturer product datasheet(s) for each sub-meter type provided and for the of the visual display system, clearly demonstrating the systems' functionality.

Automated metering strategy document in accordance with the Additional Guidance.

ADDITIONAL GUIDANCE

Substantive common property water demands are considered to include the following as a minimum (where applicable):

- Common laundry;
- Swimming pools and spas;
- Central hot water supply
- Irrigation systems and water features;
- Car & general wash-down facilities;

Pre-paid meters

Pre-paid meters which are provided to dwellings satisfy the requirement for dwelling sub-metering provided occupants have easy access to reload and read consumption data within their dwelling or directly adjacent to their dwelling.

Effective monitoring system

There must be an 'effective' system for collecting, recording and monitoring data from the common property sub-meters. In most cases, the requirement for an effective system will lead to the inclusion of automated monitoring systems. Manual monitoring of common property sub-meters is not acceptable to meet the Credit Criteria.

Visual display and analysis systems

The intent of the visual display and analysis system is to enable quick, simple and effective communication of a dwelling's water consumption to the dwelling occupants. It must be clearly evident that the visual display and analysis system can communicate the demands/sources sub-metered and that the system is equipped with functionality to permit occupants to review their historical consumption data and comparison with a benchmark.

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Wat-2 Water Sub-Metering

POINTS AVAILABLE 2

The GBCSA has not prescribed the explicit functionality of such systems (i.e. comparison frequency, or extent of historical data available), as it is the opinion of the Project Team to select the most appropriate system for the context of the dwellings and occupants. Although a visual display system mounted in an accessible and visible location is preferred, the GBCSA acknowledge the increasing availability and role of mobile technology. As such, online external website or intranet accessible systems are acceptable provided that they meet the Credit Criteria.

Automated metering strategy

The automated metering strategy for common property sub-metering must describe;

- The frequency of meter readings, data collection and storage, and reporting method; and,
- How metering errors are to be identified and provide guidance on future calibration or verification requirements (where applicable).

This document must be based on what the actual methodology will be that the development will adopt for the common property sub-meters, hence must be developed in conjunction with the Management Entity.The strategy document need not be exhaustive and must be written in easy-to- read language for a non-technical reader.

BACKGROUND

Water is an economic and natural resource which traditionally has not been extensively sub-metered in the built environment. In many cities throughout the world, water metering when installed, has been limited to a building scale only, with a single meter provided to a single building with multiple tenants. For multi unit residential buildings, it is common that the building owner is charged for the water consumption, with the consumption quantity derived from factors such as number of apartments, frontage and height of building. This water cost is then built into the rent or management fees of the building.

Sub-metering is now gaining popularity as an effective strategy for water resource management, as it permits the signalling of the marginal cost and increasing scarcity of water to consumers. These signals can assist in reducing per capita consumption within a distribution network. Building scale metering provided for multi unit residential buildings results in an information gap between consumption and cost, diffusing incentives for water efficiency initiatives by occupants.

Although having extensive building scale water metering, there is increasing pressure in the French capital, Paris, to transition to sub-metering. Three key reasons are driving this change. Firstly, building owners and management bodies see sub-metering as a strategy to reduce the operational costs of managing their properties and to also minimise liability for unpaid bills. Secondly, with increasing water tariffs within a privatised water supply sector, sub-metering is seen by occupants as a method of controlling costs through bills which reflect the actual quantity consumed. Thirdly, with concerns surrounding the environmental footprint of Paris, sub-metering is argued as a strategy to promote water efficiency.

Wat-2 Water Sub-Metering

POINTS AVAILABLE 2

Recent research by the UK NGO Waterwise into the feasibility of water sub-metering for the Greater London Area reviewed several international case studies pertaining to the potential of sub-metering to reduce demand. The case studies from Brazil and the United States all indicated demand reductions to varying extents, with the researchers noting that the effects on demand from sub-metering tend to be more pronounced than from building scale metering.

The UK Environment Agency notes that recent trials of sub-metering for residential dwellings have indicated savings of up to 17% have been achieved compared to dwellings without sub-metering. The report concluded, however, that consideration must be given to appropriate tariff structures to avoid cost increases for low-income, high-occupancy dwellings, where sub-metering is applied.

REFERENCES & FURTHER INFORMATION

Waterwise (2007),'International experiences of sub-metering: An analysis of four case cities to inform planning for domestic metering in the Greater London Area', Commissioned by the Greater London Authority, Waterwise.
http://legacy.london.gov.uk/mayor/environment/water/docs/international-experiences-sub-metering.pdf

Environment Agency (2011),'Position Statement: Household Water Metering', UK Environment Agency.
http://www.environment-agency.gov.uk/research/library/position/41229.aspx

City of Richmond (Canada) Water Meter Program
http://www.watermeter.ca/english/about.html

Water Efficiency South Africa
http://www.waterefficiencysa.co.za

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Wat-3 Landscape Irrigation

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise designs which reduce the consumption of potable water for landscape irrigation.

CREDIT CRITERIA

Up to three points are awarded as follows:

Up to two points are awarded where:

- The water efficiency of the landscaping design and/or irrigation system(s) achieve a minimum percentage reduction in irrigation potable water consumption against a reference case, awarded as follows;
  - 50% for one point;
    OR
  - 90% for two points

The Credit Criteria is applicable to both common property landscape and private dwelling landscape where the total area of either is greater than 1% of the total site area.

If there is no landscaping or the total landscaping represents less than 1% of the site area, these points are 'Not Applicable' and are excluded from the points available, used to calculate the Water Category score.

An additional point is awarded where:

- Two points are achieved above;
  AND
- A minimum 30% of the site area is landscaped;

If there is no landscaping, or the total landscaping (common and private) represents less than 30% of the site area, this point is 'Not Applicable' and is excluded from the points available, used to calculate the Water Category score.

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Wat-3 Landscape Irrigation

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential v1 Design	Green Star SA – Multi Unit Residential v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s) Where credit claimed 'Not Applicable': 4. Short report	1. Short report 2. Extract(s) from the Commissioning Report(s) 3. As Built drawing(s) Where credit claimed 'Not Applicable': 4. Short report

Short report prepared by a suitably qualified professional that demonstrates compliance with the Credit Criteria by:

- Describing the proposed landscape, any irrigation system(s) and water sources, with reference to supporting documentation;
- Providing calculations for the reference case with justification of values used from the LIASA Design Manual (see Additional Guidance), with comment on their application to this site given for vegetation and soil conditions etc.;
- Providing calculations demonstrating how the proposed system meets the Credit Criteria against the reference case;
- Where non-potable water sources used:
- Providing calculations demonstrating the non-potable water resources available, correlating with that entered in the Potable Water Calculator (where applicable);

Additionally where xeriscape is used:

- Justifying why the design can be classified as 'xeriscaping' with reference to supporting documentation; and,
- Confirming that once the establishment period of 12 months has expired, no further irrigation will be necessary.

Where the credit or third point claimed "Not Applicable":

- Providing calculations demonstrating the applicable landscaped area percentage as defined in the Credit Criteria, with reference to supporting documentation.

Extract(s) from tender documentation identifying the proposed landscape irrigation system, water sources and operation requirements.

Wat-3 Landscape Irrigation

POINTS AVAILABLE 3

Extract(s) from Commissioning Report(s) demonstrating that the system has been commissioned and operates as intended by the design.

Tender / As Built drawing(s) marked-up to clearly indicate the design, location and water supply of the irrigation system.

ADDITIONAL GUIDANCE

The Credit Criteria may be satisfied by either, or any combination of, the following strategies;

- Water efficient irrigation systems (e.g. drip irrigators, sub-soil irrigators etc.);
- Non-potable water sources (e.g. rain, storm, grey or black water treated to appropriate standards);
- Water efficient landscape species selection; or,
- Xeriscape (i.e. no irrigation required).

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').

Where a percentage reduction in irrigation potable water is claimed, the reduction must be demonstrated against a robust reference case, as prepared by the suitably qualified professional.

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.

If non-potable water resources are used for both irrigation and to meet amenity demands, the expected irrigation demand must be entered into the Potable Water Calculator in the Wat-1 Occupant Amenity Calculator.

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.

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 this credit.

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 can assume above-ground sprinkler

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systems for the reference scenario. However, should these become prohibited, it would not be acceptable to assume such a system for the reference case. For the reference case, the suitably qualified professional should consult the Landscape Irrigation Association of South Africa (LIASA) Irrigation Design Manual for reference irrigation rates. The use of figures and data from this manual must be justified by providing comment on their suitability to the project site given vegetation and soil conditions etc.

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. The suitably qualified professional must clearly justify on technical and ecological grounds as to why the landscape as proposed can be considered xeriscape.

Landscape for food production

Any area of landscape which is designated for the explicit use of onsite food production (e.g. the cultivation and harvest of commercially available fruit, vegetables, cereals, legumes, etc.) may be excluded from the Credit Criteria. Any applicable areas and their irrigation demands may be excluded from both the reference case and the actual case.

BACKGROUND

It is estimated in Australia that 60% of a dwelling's water consumption is for outdoor use, of which much is wasted. Strategies to improve the water efficiency of landscape include appropriate garden design, soil improvement, reduced lawn area, plant selection and mulching.

In South Africa the value of residential properties is strongly influenced by the landscape on the property. However, the quantity of water used for landscape irrigation in most instances accounts for a significant proportion of the total water consumed on the property.

REFERENCES & FURTHER INFORMATION

Landscape Irrigation Association of South Africa
http://www.liasa.co.za

Your Home Technical Manual – Outdoor Water Use, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.yourhome.gov.au/technical/fs76.html

Water Efficiency South Africa
http://www.waterefficiencysa.co.za

Wat-5 Fire System Water Consumption

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise designs that reduce consumption of potable water used for the development'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 and maintenance drain-downs water, for reuse on-site;

  AND

- Each floor fitted with a sprinkler system has isolation valves or shut-off points for floor-by-floor;

OR

- The fire protection system does not expel water for testing or maintenance.

If the building does not have a fire protection sprinkler system, this credit is 'Not Applicable' and is excluded from the points available used to calculate the Water Category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential v1 Design	**Green Star SA – Multi Unit Residential v1 As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s) Where credit claimed 'Not Applicable': 4. Short report	1. Short report 2. As Built drawing(s) 3. Extract(s) from Commissioning Report(s) Where credit claimed 'Not Applicable': 4. Short report

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Wat-5 Fire System Water Consumption

POINTS AVAILABLE 1

Short report prepared by a suitably qualified professional that describes how the Credit Criteria has been met by:

- Describing the proposed fire protection system;
- Providing a tabulated summary of all expected water expulsion events from each applicable system (frequency and quantity) and indicating which events are to be harvested for reuse;
- Demonstrating that a minimum of 80% of the test and maintenance drain-down water is harvested on an annual basis;
- Describing how the harvested water will be stored;

Where credit claimed 'Not Applicable':

- Confirming that the development does not incorporate fire protection sprinkler systems; and,
- Confirming that the development meets the required safety standards outlined in SANS10400:1990.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the provision of the fire protection service as referenced in the short report.

Tender / As Built drawing(s) showing the necessary details of the fire services and the additional design features to enable the harvesting of water and the storage and reuse system(s).

Extract(s) from Commissioning Report(s) demonstrating that the fire protection sprinkler system has been installed, commissioned and operates as intended by the design.

ADDITIONAL GUIDANCE

It must be clearly demonstrated that no less than 80% of the water from testing and maintenance drain-downs on an annual basis 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.

As sprinkler water may not be suitable for reuse, sprinkler pipe drain-down water can be excluded from this credit, where the credit applies to water for re-use.

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 municipal service(s).

Wat-5 Fire System Water Consumption

POINTS AVAILABLE 1

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 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 the sprinkler system on each floor with isolation valves or shut-off points ensures that the sprinkler system on any particular floor can be carried out independently of the sprinkler systems on other floors. However, all isolation valves fitted must be in accordance to the requirements of the fire fighting regulations.

REFERENCES & FURTHER INFORMATION

Automatic Sprinkler Inspection Bureau (Pty) Limited, Eleventh Edition Rules for Automatic Sprinkler Installations, 2009
http://www.asib.co.za

SANS 1475-2:2008, Fire Hose Reels, Hydrants and Booster Connections, Edition 4.
http://www.sabs.co.za

SANS 10287:2000, Code of Practice for Automatic Sprinkler Installation for Fire Fighting Purposes
http://www.sabs.co.za

SANS 10400:1990, Part T and W, Code of Practice for the Application of the National Building Regulations
http://www.sabs.co.za

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Wat-7 Potable Water Efficient Appliances

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise initiatives which reduce water consumption associated with major appliances.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

One point is awarded where:

- Clothes washers are provided for;
  - A minimum 90% of dwellings;
    OR
  - Communal laundry area(s);

  AND
- Either, or any combination, of the following are achieved for all clothes washers provided;
  - Clothes washers achieve a minimum water efficiency of 7.2 litres/kg;
    OR
  - Clothes washers are provided with non-potable water via a dedicated connection point.

One point is awarded where:

- Dishwashers are provided for a minimum 90% of dwellings;

  AND
- All dishwashers provided achieve a minimum water efficiency of 0.93 litres/placeset.

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Wat-7 Potable Water Efficient Appliances

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential v1 Design	Green Star SA – Multi Unit Residential v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Manufacturer product datasheet(s) Additionally where non-potable water connection provided: 4. Tender drawing(s)	1. Short report 2. Extract(s) from Commissioning Report(s) 3. Manufacturer product datasheet(s) Additionally where non-potable water connection provided: 4. As built drawing(s)

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

- Providing a summary table of all applicable appliances, the quantities included and the water efficiency performance of each appliance, with reference to supporting documentation;
- Confirming that all clothes washers have been provided with a non-potable water connection point, with reference to supporting documentation (where applicable).

Extract(s) from tender documentation demonstrating the contractual requirement for the provision of the clothes washer and/or dishwasher models, as referenced in the short report.

Manufacturer product datasheet(s) for each appliance claimed clearly indicating the applicable water consumption data.

Tender / As Built drawing(s) showing the non-potable water connection point provided for clothes washer(s).

Extract(s) from Commissioning Report(s) confirming;

- The installation and functional operation of all applicable appliances claimed;

  OR

- That the non-potable water connection points have been installed and the non-potable water source has been commissioned and operates as intended by the design.

Wat-7 Potable Water Efficient Appliances

POINTS AVAILABLE 2

ADDITIONAL GUIDANCE

In the absence of a water efficiency labelling scheme in South Africa, manufacturer's information on the water efficiency of appliances must be submitted in units consistent with those of the Credit Criteria.

As most manufacturers do not publish water consumption data for all washing cycles/programs available for a particular appliance, the water consumption for the "normal" (or most commonly used cycle) as provided in the manufacturer product literature must be used to demonstrate compliance with the Credit Criteria. However Project Teams must justify, with reference to the manufacturer product datasheet, that the water consumption is justified as the "normal" cycle/program.

Combined clothes washers and dryers (CWDs) that use water during their drying mode cannot be claimed to demonstrate compliance with the Credit Criteria. These machines use a vent-less condenser system in their drying mode which is water-cooled. Using cold water to condense the moisture evaporated from the clothes, this cooling water is pumped out of the machine and discharged to the sewage system.

To be awarded points for this credit for a Design certification, it must be evident within the tender documentation that specific appliances have been selected, specified and costed in the project. It is not acceptable to simply have performance requirements noted in the specification. As appliances are often selected at the design stage and used as marketing for the project, the GBCSA expects that this is demonstrated within the submission.

Where non-potable water is being provided to clothes washing machines, this consumption must be entered into the Potable Water Calculator in the Wat-1 Occupant Amenity Water credit. Project Teams must assume a full load usage of 4 times per month per occupant.

The water efficiency of clothes washers is based on the metric of litre/kg to account for the variation in clothes washer capacity.

The water efficiency of dishwashers is based on the metric of litres/placeset to account for the variation in dishwasher capacity. A 'placeset' is the dishwasher space that accommodates the plates and cutlery used by one person for a standard dinner meal. Dishes and utensils for a placeset are generally accepted as; a dinner plate, a salad plate, a dinner knife, a dinner fork, a soup spoon, a teaspoon, a desert plate and a single water tumbler.

BACKGROUND

Research conducted in Australia suggests that by 2021, water efficient products will help to reduce domestic water use by more than 100,000 ML each year, save approximately 800,000 ML and reduce total greenhouse gas output by 400,000 tonnes each year. Water efficient products include, low flow taps and showers, low volume flush toilets, reduced volume baths, low water use dishwashers and washing machines, rainwater harvesting and grey water recycling systems.

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Wat-7 Potable Water Efficient Appliances

POINTS AVAILABLE 2

Of the savings expected, improved water efficiency clothes washer could save about 25,600ML of water per year, which is enough to fill 12,500 Olympic swimming pools every 12 months. Similarly, improved efficiency dishwashers could save nearly 1,200 ML a year in national dishwasher water consumption-enough water to fill 600 Olympic swimming pools each year.

REFERENCES & FURTHER INFORMATION

Home Energy Magazine
www.homeenergy.org

South African National Standards
http://www.sabs.co.za

Your Home Technical Manual – Reducing Water Demand, Department of Climate Change and Energy Efficiency, Australian Government.
http://www.yourhome.gov.au/technical/fs72.html#wels

Water Efficiency Labelling and Standards (WELS) Scheme
http://www.waterrating.gov.au/products/index.html#clothes

Wat-8 Swimming Pool / Spa Water Efficiency

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise designs that reduce potable water consumption associated with swimming pools and spas.

CREDIT CRITERIA

Two points are awarded where:

- For any pool within the development;
  - A pool blanket is provided;
    AND
  - The pool filtration system avoids the requirement for backwashing (i.e. is not sorptive media or sand based filtration);

  AND
- For any spa within the development, a spa cover is provided.

OR

- No pool(s) and/or spa(s) are provided in the development.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential v1 Design	**Green Star SA – Multi Unit Residential v1 As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report Additionally where pool(s) and/or spa(s) are provided: 2. Tender drawing(s) 3. Extract(s) from tender documentation	1. Short report Additionally where pool(s) and/or spa(s) are provided: 2. As Built drawing(s) 3. Extract(s) from Commissioning Report(s)

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Wat-8 Swimming Pool / Spa Water Efficiency

POINTS AVAILABLE 2

Short report prepared by a suitably qualified professional describing how the credit has been met by:

Where pool(s) and/or spa(s) provided;

- Detailing all pool(s) and/or spa(s) provided;
- Confirming the provision of pool blanket(s) and/or spa cover(s), with reference to supporting documentation;
- Describing how the pool filtration system(s) meet the credit criteria, with reference to supporting documentation;

Where no pools or spas provided;

- Confirming that no pools or spas are provided;

Tender / As Built drawing(s) clearly showing the filtration system used to reduce potable water consumption and the collection and re-use system (where applicable).

Extract(s) from tender documentation demonstrating the contractual requirement for the provision of a pool blanket/cover for all pools and spas within the project, and the filtration system as referenced in the short report.

Extract(s) from Commissioning Report(s) confirming that the pool(s) and/or spa(s) have been installed, commissioned and operates as intended by the design.

ADDITIONAL GUIDANCE

Pool filtration systems which avoid the requirement for backwashing include, but are not limited to, cartridge filtration or natural filtration systems.

As the climatic conditions throughout South Africa are suitable for the installation of pools and spas, developments which do not install pools and spas are rewarded for this design decision which avoids the consumption of water for these amenity features.

Spa baths or tubs provided within bathrooms or ensuite are excluded from the Credit Criteria as they are addressed within the Wat-1 Occupant Amenity Water credit.

Where filtration systems that require backwash are installed, the GBCSA encourages the harvesting and recycling of backwash water for reuse on-site. This non-potable water resource may be claimed in Wat-1 Occupant Amenity Water to offset potable water demands (e.g. landscape irrigation or toilet flushing).

Wat-8 Swimming Pool / Spa Water Efficiency

POINTS AVAILABLE 2

BACKGROUND

Swimming pools and spa pools are significant consumers of water. In South Africa, approximately 32.5 billion litres of water is used to fill the estimated 650 000 swimming pools available.

Swimming pools lose water through evaporation and also through filter cleaning and backwashing. According to the Swimming Pool and Spa Association of Victoria (SPASA), a 50 000 litre pool in Sydney may need 20 000 – 30 000 litres top up annually. Evaporation is a major cause of water loss from swimming pools. The evaporation rate from an outdoor pool varies depending on the pool's temperature, air temperature and humidity, and the wind speed at the pool surface. The higher the pool temperature and wind speed and the lower the humidity, the greater the evaporation rate. In windy areas, you can add a windbreak—trees, shrubs, or a fence—to reduce evaporation. Indoor pools aren't subjected to the environment, but they still can lose a lot of energy from evaporation. They even require room ventilation to control indoor humidity caused by the large amount of evaporation.

However, SPASA states that swimming pools can be designed and or retrofitted to conserve water. This can be achieved through use of pool covers, temperature management, rainwater harvesting and efficient filtration systems.

Pool covers can be used to improve the swimming pool's heating and energy efficiency. Research shows that pool covers minimize evaporation from both outdoor and indoor pools and can lead to savings of 50%–70%.

REFERENCES & FURTHER INFORMATION

National Water Commission (2007), Introduction to Australian Water resources 2005, Commonwealth of Australia,
www.water.gov.au/IntroductiontoAWr2005/index.aspx?Menu=Level1_2

Swimming Pool and Spa Association of Victoria (SPASA) - Water Neutral Pool,
www.spasavic.com.au/WaterNeutralPool.html

Smart Living Handbook – City of Cape Town
http://www.capetown.gov.za/en/EnvironmentalResourceManagement/Pages/SmartLivingHandbook.aspx

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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 resources used in projects and choosing the least harmful when using virgin building materials. The Green Star SA rating tool rewards initiatives and strategies that do so.

Aspects of materials and resource use 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 approach to the use of materials, resources and building fabrics.

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Mat-1 Recycling Waste Storage

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise developments which include space that facilitates the recovery of resources used within developments to reduce waste going to disposal.

CREDIT CRITERIA

Two points are awarded where:

- The infrastructure for waste management within the development is in accordance with the NSW DECC '*Better Practice Guide for Waste Management in Multi-unit Dwellings*' as demonstrated by;
  - The estimation of waste generation rates and sizing of waste storage areas as per Appendix A;
    AND
  - The application of Section 2 as demonstrated through completion of checklist as per Appendix F;
    AND
  - Compliance with Section 3, 4, 5, 6, 7 OR 8 (as applicable for the development type);

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Compliance checklist 3. Tender drawing(s)	1. Short report 2. Compliance checklist 3. As Built drawing(s)

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

- Providing calculations demonstrating the estimated waste generation rates for the development and the infrastructure required;

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- Detailing the size of the waste storage area(s) and how this was determined using the above waste generation rates;
- Describing how the development complies with Section 3, 4, 5, 6, 7 or 8 (as applicable for the development type).

Compliance checklist from the Green Star SA Multi Unit Residential rating tool spreadsheet, completed to demonstrate the application of the better practice guideline.

Tender / As Built drawing(s) marked up to clearly demonstrate ALL infrastructure for waste management as referenced in the supporting documentation.

ADDITIONAL GUIDANCE

The New South Wales (NSW) Department of Climate Change (DECC) '*Better Practice Guide for Waste Management in Multi-Unit Dwellings*' is a free document which may be downloaded from the GBCSA website **(http://www.gbcsa.org.za)**.

The intent of the '*Better Practice Guide for Waste Management in Multi-Unit Dwellings*' is to highlight various essential aspects which must be carefully considered when designing waste management infrastructure for multi unit residential developments. The infrastructure provided should, where possible and appropriate, address;

- Garbage (residual domestic waste);
- Recycling (types generated in a typical household);
- Organics (garden and food organics); and,
- Bulky waste (furniture and white goods).

For information on how to use the guide, please refer to Page 10 of the '*Better Practice Guide for Waste Management in Multi-Unit Dwellings*'.

It must be demonstrated that the *'Better Practice Guide for Waste Management in Multi-unit Dwellings*' has been applied to inform the design of the waste infrastructure or points will not be awarded.

At a minimum where communal waste storage areas are provided, it would be expected that the application of the better practice guide would result in;

- The estimation of waste generation rates and appropriate sizing of waste storage areas to store garbage, recycling and bulky wastes;
- Waste collection points that are efficient, do not obstruct pedestrians or vehicles, are safe and allow for the easy transfer of bins to collection points;
- The avoidance of odours through ventilation and the prevention of vermin intrusion;
- The provision of hose and tap with correct drainage to sewer for bin and area wash-down purposes; and,

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- Appropriate signage for the location of waste storage and the correct use of waste management systems.

It must be evident in the tender or as built drawings that all waste management infrastructure referenced in the 'compliance checklist' is replicated. Where the 'compliance checklist' indicates that infrastructure has been provided, however is not replicated in the tender or as built documentation, no points will be awarded.

The intent of the 'Short report' is to demonstrate the derivation of the waste generation rates, storage requirements and storage area for garbage, recycling and bulky wastes. It is not necessary to replicate the information provided in the 'compliance checklist' within the 'short report'.

Project Teams must use the compliance checklist as provided in the Green Star SA Multi Unit Residential v1 rating tool spreadsheet. This version is based on that of Appendix F, however incorporates variations for the South African context. The 'compliance checklist' should be completed such that enough brief information is provided to describe the waste management system(s).

For mixed use developments where waste management infrastructure is shared, it is not necessary to submit a CIR to the GBCSA for approval of the shared service if compliance with the '*Better Practice Guide for Waste Management in Multi-Unit Dwellings*' can be demonstrated for the complete development.

For small developments where no communal waste storage areas are provided, many requirements of the compliance checklist will be 'not applicable'

The provision of composting or worm farm facilities is not a compulsory requirement for all developments, however the GBCSA strongly recommends that where suitable locations are available within the development and appropriate management structures exist (i.e. a building manager, caretaker or gardener), that these strategies are incorporated as better practice waste management.

Equally, the provision of a building manager, caretaker and/or gardener to complete waste management duties (e.g. transfer of bins to collection points, management of compost or worm farm facilities, bin washing etc.) is not a compulsory requirement for all developments, however the GBCSA strongly recommend this initiative. Where such management staff are not employed, it would be expected at the least that a waste management plan has been developed and circulated to residents and owners informing them of the waste infrastructure and processes.

BACKGROUND

The GBCSA acknowledges that different multi unit residential developments will require different approaches to the management of waste. The waste management infrastructure of an outer suburban detached housing development will be different to, yet no less important than, that of a high-rise inner city apartment building. As such, the Mat-1 Recyclable Waste Storage credit criteria has been developed to permit Project Teams flexibility to incorporate the best

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practice waste management infrastructure which best suits the development, considering for dwelling occupants, management structures, spatial constraints and the varying levels of municipal services.

The New South Wales (NSW) Department Environment and Climate Change (DECC) 'Better Practice Guide for Waste Management in Multi-Unit Dwellings' represents best practice for waste management in multi unit residential developments. "Better practice management systems are effective and safe: residents can use them with ease and collection crews can easily service them. The design, installation and on-going management of better practice systems encourage residents to use the services appropriately. This includes greater participation in the services provided, minimised waste generation, increased resource recovery and a reduction in contamination of recyclables and organics" (DECC, 2008).

Waste generation in the developed world grew by 20% between1980-2000 and is expected to increase by a further 30% by 2020. Most building types generate waste including paper and cardboard, glass bottles and jars, steel cans and aerosols, aluminium cans and packaging. plastic containers, garden and food organics, and furniture and white goods. These materials are commonly recycled, with many private companies and some local authorities providing collection. To make recycling schemes more economic, it is beneficial for waste to be collected quickly and efficiently.

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%.

An Australian study of Victorian household waste streams in 2002-03 found residents generated a total of 1.65 million tonnes of household waste (885kg per household), 28% of which was recyclable waste. Of all municipal waste, which includes household and public place waste, 47% was found to be food and organic waste, most of which could be composted or mulched (EcoRecycle Victoria, 2005). Recycling has become more and more commonplace over the last two decades; the amount of material recovered for recycling has tripled since 1993 in Victoria and 66% of households compost green waste (EcoRecycle Victoria, 2005).

Every tonne of paper recycled saves almost 13 trees. It also saves 380 gallons of oil and three cubic metres of landfill (LGSA, 2008). Producing paper from recovered fibres consumes 60% less energy and 55% less water than manufacturing paper from virgin pulp. Each steel or aluminium can, and each glass bottle, keeps valuable non-renewable resources such as bauxite, iron ore and sand in the ground. Every recycled item saves energy that would normally be used in mining, manufacturing and transporting.

Providing convenient and accessible recycling areas ensures residents will utilise the facilities and result in higher recycling rates (Hyder Consulting, 2006).

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REFERENCES & FURTHER INFORMATION

Department of Environment and Tourism
http://www.environment.gov.za/ProjProg/WasteMgmt/recycling/an-a.htm

National Waste Management Strategy Implementation Project, (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

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http://www.environment.nsw.gov.au/warr/BetterPracticeMUD.htm

SustainableChoice
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Institute of Waste Management of Southern Africa
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http://www.csir.co.za/enews/2011_jun/02.html

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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

Up to five points are awarded as follows:

Two points are awarded where:

- It is demonstrated that at least 50% (by area) of the total façade of the final building(s), comprises building façade reused from the existing building(s) and/or structure(s).

Up to three points are awarded where:

- The minimum proportion of the existing major structure, by gross building volume, is reused within the final building(s), awarded as follows:
  - 30% reuse for one point;
    OR
  - 60% reuse for two points;
    OR
  - 90% reuse for three points.

Where the site contained no building(s) or structure(s) at the time of purchase, or the total GFA of the existing building(s) or structure(s) is less than 20% of the final building GFA, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Materials Category score.

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Mat-2 Building Reuse

POINTS AVAILABLE 5

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report Additionally where façade or structure is being reused; 2. Tender drawing(s)	1. Short report Additionally where façade or structure is being reused: 2. As built drawing(s)

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

- Providing calculations that demonstrate that the GFA of the existing building(s) or structure(s) is greater than 20% of the final building(s) GFA, with reference to 'Site documentation' provided in the 'General' section of the submission;
- Describing what elements of the façade/structure are being retained from the existing building(s) or structure(s);
- Providing calculations demonstrating that the percentage total area (for façade calculations) or percentage volume (for structure calculations) reused from the existing building(s) or structure(s) meet the Credit Criteria, with reference to 'Site documentation' provided in the 'General' section of the submission;

Where credit claimed 'Not Applicable':

- Confirming that the site contained no building(s) or structure(s) at the time of purchase, with reference to 'Site documentation' provided in the 'General' section of the submission;

  OR

- Providing calculations that demonstrate that the GFA of the existing building(s) or structure(s) is less than 20% of the final building(s) GFA, with reference to 'Site documentation' provided in the 'General' section of the submission.

Tender / As Built drawing(s) including the following:

- Elevation drawings of the existing building(s) or structure(s) marked-up to show the area of the reused façade or information for gross volume calculation (where applicable);
- Elevation drawings of the final building(s) marked-up to show the area of the total façade or information for gross volume calculation (where applicable);
- Plan drawings of the existing building(s) or structure(s) marked-up to show information for gross volume calculation (where applicable);

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- Plan drawings of the new building(s) marked-up to show information for gross volume calculation (where applicable).

ADDITIONAL GUIDANCE

The documentation must clearly demonstrate that the stipulated proportion of the façade/structure has been reused, regardless of how much additional material has been added. This credit addresses the reuse of existing materials, not the final design, therefore, it is irrelevant whether the reused elements are clad in, or otherwise refurbished with, additional material.

Existing buildings or structures which are constructed during earlier phase(s) of a multi-phase project, where the explicit intention of the earlier phase(s) is to service the latter phase(s), cannot be claimed as contributing to this credit. For example, it is not permissible to claim basement structures constructed during and earlier phase of a larger development as building reuse for later stages which are registered for Green Star SA certification.

This credit will only be deemed 'Not Applicable' if the calculations account for all of the building(s) and structure(s) that existed on the site at the time of site purchase.

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 as defined for the purposes of Green Star SA certification, the total GFA must be used in the calculations.

Externally affixed elements such as fixed shading devices are excluded from the calculation of façade area.

The final 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 'Tender/As built drawings' Documentation Requirement includes demolition documentation such as elevation and plan drawings.

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.

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Mat-2 Building Reuse

POINTS AVAILABLE 5

Repairing a structure saves natural resources, including raw materials, water and energy, and decreases the negative impact that are by-products of extraction, manufacturing and transportation of new materials. It also minimises the amount of demolition waste sent to 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

eThekwini Municipality website
http://www.durban.gov.za/durban/services/services/cleansing/recycling/construction

Sustainable Built Environment
http://www.sustainablebuiltenvironments.com

Smart Growth Online (U.S.), Green Building Case Studies
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National State of the Environment Report, South Africa
http://www.environment.gov.za/soer/index.html

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Mat-3 Recycled Content & Reused Materials

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise developments that prolong the useful life of existing products and materials and encourage uptake of products with recycled content.

CREDIT CRITERIA

Up to three points are awarded independently as follows:

One point is awarded where;

- At least 1% of the project's contract value is represented by re-used materials.

Up to two points are awarded where:

- A proportion of the project's contract value is represented as recycled content of materials, as follows;
  - 1% for one point;
    OR
  - 2% for two points;

This credit excludes steel, timber and concrete (i.e. aggregates and industrial waste product) and masonry units, which are addressed by other credits, and it does not address the reuse of façade or major structural elements of existing building(s) or structure(s) on the site.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation Additionally where reused materials claimed:	1. Short report 2. Statement of confirmation (2) Additionally where reused materials claimed:

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Mat-3 Recycled Content & Reused Materials

POINTS AVAILABLE 3

3. Statement of confirmation (1) Additionally where recycled content materials claimed: 4. Manufacturer product datasheet(s)	3. Statement of confirmation (1) Additionally where recycled content materials claimed: 4. Manufacturer product datasheet(s)

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

- Stating the contract value of the project;

Additionally where reused materials claimed:

- Providing a tabulated summary of all uses of reused materials in the project, including the manufacturer/source of the material;
- Indicating the 'fair market value' cost of each material as claimed, with reference to supporting documentation;
- Demonstrating the total cost of all reused material(s) claimed, represented as a percentage of the contract value, confirming compliance with the Credit Criteria;
- Confirming that for each reused material, if the material has been altered from its original form, and what alterations have been completed (where applicable).

Additionally where recycled content materials claimed:

- Providing a tabulated summary of all uses of recycled content materials in the project, including the manufacturer of the material and whether the material is post-consumer, post-agricultural or post-industrial, with reference to supporting documentation;
- Indicating the cost of the recycled material (only) for each material, with reference to supporting documentation;
- Demonstrating the total cost of all recycled content material(s) claimed represented as a percentage of the contract value, confirming compliance with the Credit Criteria.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for;

- The use of the specific material(s) with the nominated recycled content as referenced in the short report, clearly indicating the manufacturer(s) or source(s) (where applicable);
- The use of the reused material(s) as referenced in the short report, clearly indicating the manufacturer(s) or source(s) (where applicable).

Manufacturer product datasheet(s) for each material claimed with recycled content, clearly indicating the quantity or percentage of recycled content within the material.

Statement of confirmation (1) from the supplier of each reused product, in the form of signed correspondence clearly indicating the reused material and actual cost (where available).

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Mat-3 Recycled Content & Reused Materials

POINTS AVAILABLE 3

Statement of confirmation (2) from the Contractor, in the form of signed correspondence clearly listing all compliant materials and quantities by cost, and stating that the listed compliant materials have been installed within the project (this documentation must be provided for both recycled content and reused materials, as claimed).

ADDITIONAL GUIDANCE

Only materials or products permanently installed on the project site are eligible. Temporary materials used within the construction process, such as formwork, must not be claimed.

Reused material content

It must be demonstrated that the cost of reused materials is reasonably justified. The cost must be the 'fair market value' of a reused material. Estimate costs may be queried by the Assessors.

Examples of reused materials include, but are not limited to windows, cladding, pre-cast concrete panels (as their reuse is not rewarded in the 'Mat-5 Recycled Content of Concrete' credit), flooring, doors, sanitary and lighting fixtures/fittings.

Projects may claim materials which already exist on the site in the case of refurbishments or redevelopments, where materials are to be reused.

Recycled material content

Any recycled material that is derived from post-consumer, post-agricultural, and post-industrial process may be claimed for this credit. This excludes re-utilisation of materials such as rework, regrind, or scrap created in a process that is capable of being reclaimed within the same process that generated it.

This credit is calculated as the value of the product multiplied by the percentage recycled content contained therein, summed with other products containing recycled content.

Items with a high recycled content that may be considered for this credit include insulation, aluminium, glazing, gypsum, flooring, carpets, facades, and roofing materials.

Post-consumer material is defined as waste material generated by households, commercial, industrial, or institutional facilities as end-users of products which can no longer be used for its intended purpose.

Pre-consumer or post-industrial material is defined as material diverted from the waste stream during the manufacturing process, or waste incorporated into a product having been generated from a different manufacturing process. An example would be clothing fabric off-cuts incorporated into a cellulose-based insulation.

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Mat-3 Recycled Content & Reused Materials

POINTS AVAILABLE 3

To calculate the value of recycled content:

Material recycled content value = ***material cost*** X ***(% post-consumer recycled content*** + ***% post-industrial recycled content)***

Total value of recycled material content = sum of all materials' recycled content values

$$\textbf{Total recycled content percentage} = \frac{\textbf{Total value of recycled material content}}{\textbf{Contract value}}$$

Recycled content is defined in accordance with ISO14021 – Environmental Labels and Declarations – Self-Declared Environmental Claims (Type II Environmental Labelling).

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.

Incorporating recycled products into buildings helps reduce reliance on virgin materials, and creates a market for recycled materials. In addition, many products containing a recycled component, requires significantly less energy to manufacture, reducing the embodied energy of the product (Hammond & Jones, 2008).

REFERENCES & FURTHER INFORMATION

Kibert, C. J., Deconstruction as an Essential Component of Sustainable Construction, University of Florida, USA.
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http://www.durban.gov.za/durban/services/services/cleansing/recycling/construction

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Smart Growth Online (U.S.), Green Building Case Studies.
http://www.smartgrowth.org/engine/index.php/resources/case_studies

Department of Environment and Tourism, South African Government.
http://www.environment.gov.za

Hammond, G. & Jones, C. (2008), Inventory of Carbon & Energy (ICE) version 1.6a, Department of Mechanical Engineering, University of Bath.

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Mat-5 Concrete

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise the reduction of embodied energy and resource depletion occurring through use of concrete.

CREDIT CRITERIA

Up to three points are awarded:

Up to two points are awarded where:

- The project has reduced the absolute quantity of Portland cement by a minimum percentage, as an average across all concrete mixes, by substituting it with industrial waste product(s) or oversized aggregate, awarded as follows:
  - 30% reduction for one point;
    OR
  - 40% reduction for two points.

An additional point is awarded where:

- At least one point above is achieved;

  AND
- 10% of all aggregate used for structural purposes is either, or a combination of, the following;
  - Recycled aggregate (equivalent to Class 1 RCA as per Australian standard HB155-2002)
    OR
  - Slag aggregate;

  AND
- No virgin aggregates are used in non-structural concrete applications.

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.

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Mat-5 Concrete

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Concrete mix report(s) 3. Extract(s) from tender documentation 4. Extract(s) from Quantity Surveyor report Where credit claimed as 'Not Applicable': 5. Extract(s) from Quantity Surveyor report	Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Concrete mix report(s) 3. Statement of confirmation (1) 4. Statement of confirmation (2) Where credit claimed as 'Not Applicable': 5. Statement of confirmation (2)

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

- Providing a tabulated summary of all concrete uses in the project, with the application description, quantities, and proportions of all constituents clearly identified for each mix and application, with reference to supporting documentation;
- Providing a tabulated breakdown of the reference case mix for each application, clearly identifying the proportions of all constituents (i.e. kg/m^3);
- Confirming that the reference case(s) are valid for the same strength categories for the applicable applications, correlating with those mixes specified (Design) or used (As Built), and that the reference case(s) are representative of standard mixes (i.e. contain some % of supplementary cementitious materials);
- With reference to the proposed/actual case and reference case for each mix and application, clearly indicating the quantity of Portland cement replaced by the industrial waste product or oversize aggregate (where applicable);
- Clearly demonstrating the percentage reduction in Portland cement and compliance with the Credit Criteria.

Additionally where additional point claimed;

- Providing a tabulated summary of all aggregate uses in structural applications for the project, clearly describing where recycled, slag or virgin aggregate is used, and demonstrating through calculations that the Credit Criteria has been met;

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- Providing a tabulated breakdown of all aggregate uses in non-structural applications for the project, clearly describing where recycled or slag aggregate is used, and demonstrating that no virgin aggregate are used.

Concrete mix report(s) prepared by a Concrete Technologist, Structural Engineer or Civil Engineer for each applicable concrete mix specified (Design) or used (As Built) within the project that provides a tabulated description of the mix composition or proportions of components (i.e. kg/m^3).

Extract(s) from tender documentation clearly demonstrating a contractual requirement for;

- The minimum required percentage reduction of Portland cement;
- The proportion or mix constituent of industrial waste product to be used for each concrete application to reduce the total quantity of Portland cement for all applicable concrete mixes (where applicable);
- The source of industrial waste product(s) used in all applicable concrete mixes must not come from industrial facilities co-fired with hazardous waste (where applicable);
- The proportion or mix constituent of oversize aggregate to be used for each concrete application to reduce the total quantity of Portland cement for all applicable concrete mixes (where applicable);

Additionally where additional point claimed;

- The proportion or mix constituent of recycled or slag aggregate to be used for each mix application and stipulating that the recycled aggregate be equivalent to Class 1 RCA (in accordance with the Australian Standard HB 155-2002).

Extract(s) from Quantity Surveyor report confirming the quantity and total material value of the new concrete in the project as a percentage of the project's total contract value, demonstrating the applicability, or not, of the credit criteria.

Statement of confirmation (1) from concrete supplier(s) for each applicable concrete mix, in the form of signed correspondence confirming;

- The quantities of concrete supplied to the project;
- That no industrial waste product used as a supplementary cementitious material came from industrial facilities co-fired with hazardous waste;

Additionally where additional point claimed;

- That all recycled aggregates within the applicable mixes are equivalent to Class 1 RCA (in accordance with the Australian code HB 155-2002).

Statement of confirmation (2) from the Contractor, in the form of signed correspondence demonstrating, through calculations, the total quantity and material value of the actual new concrete used in the project as a percentage of the project's contract value, and the applicability, or not, of the credit criteria.

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Mat-5 Concrete

POINTS AVAILABLE 3

ADDITIONAL GUIDANCE

This credit addresses all concrete, including both structural and non-structural applications. Non-structural applications include, but are not limited to, 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.

As the use of supplementary cementitious materials to offset Portland cement is common within the construction industry, it is therefore unacceptable for the purposes of the reference case to assume a concrete mix without any supplementary cementitious material (i.e. maximum Portland cement content).

Slag is a by-product of the manufacture of steel. Ground Granulated Blast Furnace Slag (GGBFS) is slag ground to cement fitness and is a cementitious binder.

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.

Aggregates

It is a prerequisite to claim at least one point for cement replacement in order to claim the additional point for aggregate. For the purpose of this credit, recycled aggregate is defined follows:

- Aggregates derived from the processing of materials previously used in a product; and/or
- Aggregates from construction that would otherwise be put into landfill.

Common types are as follows:

- Recycled concrete aggregates
  - Aggregates produced by the reclamation, crushing and screening of demolition concrete waste; and
  - Slag aggregate which is an industrial waste product.
- Reclaimed aggregates
  - Aggregates produced from unused fresh concrete returned to its manufacturer in a state such that separation of the aggregates from the cement paste is still possible by washing and or screening; and
  - Aggregates produced from crushing selected surface rock from excavation works associated with building construction.

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Mat-5 Concrete

POINTS AVAILABLE 3

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 cement 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.

This credit deals with the percentage of post-consumer recycled content of the aggregate used in concrete for the project. It is acceptable to calculate the required 10% against the total volume of aggregates used across the project, in all concrete mixes. The recycled aggregate content can therefore be calculated across the entire concrete use in the project.

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 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.

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.

Concrete waste can be processed to produce road base/fill material, recycled concrete aggregate and recycled concrete fines. Extensive research has and is being undertaken to

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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 road base material, which reduces the need for natural fill. Further research and concrete mix design 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)
http://www.aggregain.org.uk

SANS 1491-1:2005 Portland cement extender Part 1: Ground granulated blast furnace slag.
http://www.sabs.co.za

SANS1491-2:2005 Portland cement extender Part 2: Flyash.
http://www.sabs.co.za

SANS1491-3:2006 Portland cement extender Part 3: Silica fume.
http://www.sabs.co.za

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Mat-6 Steel

POINTS 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 where:

- For a predominantly structural steel building:
  - The average post-consumer recycled content of the structural steel is at least 24% (by mass);

    OR
  - At least 60% (by mass) of the structural steel, is reused.

OR

- For a predominantly reinforced concrete or structural masonry building;
  - The average post-consumer recycled content of the steel reinforcing is at least 54% (by mass)

An additional two points are awarded where:

- The point above is achieved;

  AND
- The total of all applicable steel uses in the development (total of structural steel, steel reinforcing and applicable steel products) consists of;
  - At least 54% (by mass) post-consumer recycled content;

    OR
  - At least 90% (by mass) reused steel.

If the material cost of new steel 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.

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Mat-6 Steel

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Extract(s) of tender documentation 3. Statement of confirmation (1) 4. Extract(s) from Quantity Surveyor report Where credit claimed as 'Not Applicable': 5. Extract(s) from Quantity Surveyor report	Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Statement of confirmation (1) 3. Statement of confirmation (2) Where credit claimed as 'Not Applicable': 4. Statement of confirmation (2)

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

For a predominantly structural steel building where post-consumer recycled content claimed;

- Providing a tabulated summary of all structural applications and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all structural steel applications the post-consumer recycled content of the steel (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the steel with confirmed post-consumer recycled content jointly accounts for the stipulated proportion of structural steel in the project, in compliance with the Credit Criteria;

For a predominantly structural steel building where reused content claimed;

- Providing a tabulated summary of all structural applications and the total amount (by mass) of steel used for each application, and the supplier;
- Confirming for all structural steel applications the reused content (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the reused steel jointly accounts for the stipulated proportion of structural steel in the project, in compliance with the Credit Criteria;

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For a predominantly reinforced concrete or structural masonry building;

- Providing a tabulated summary of all steel reinforcing applications and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all steel reinforcing applications the post-consumer content of the reinforcing (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the steel reinforcing with confirmed post-consumer content jointly accounts for the stipulated proportion of steel reinforcing in the project, in compliance with the Credit Criteria;

Additionally where additional points claimed for a predominantly structural steel building where post-consumer recycled content claimed;

- Providing a tabulated summary of all steel applications beyond structural applications (as per the Additional Guidance) and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all non-structural steel applications the post-consumer content of the steel (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the steel with confirmed post-consumer content jointly accounts for the total stipulated proportion of steel in the project, in compliance with the Credit Criteria.

Additionally where additional points claimed for a predominantly structural steel building where reused content claimed;

- Providing a tabulated summary of all steel applications beyond structural applications (as per the Additional Guidance) and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all non-structural steel applications the reused content (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the reused steel jointly accounts for the total stipulated proportion of steel in the project, in compliance with the Credit Criteria.

Additionally where additional points claimed for a predominantly reinforced concrete or structural masonry building;

- Providing a tabulated summary of all steel applications beyond reinforcing applications (as per the Additional Guidance) and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all non-structural steel applications the post-consumer content of the steel (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the steel with confirmed post-consumer content jointly accounts for the total stipulated proportion of steel in the project, in compliance with the Credit Criteria.

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Extract(s) from tender documentation that clearly demonstrate the contractual requirement to use the specific material with the nominated content of post-consumer recycled material as referenced in the short report.

Statement of confirmation (1) from manufacturer(s) or supplier(s), in the form of signed correspondence confirming the post-consumer recycled content of each steel product claimed or that the steel is reused, as referenced in the short report.

Extract(s) from Quantity Survey report clearly demonstrating the total material value of the steel within the project and the cost as a percentage of the projects contract value, demonstrating the applicability, or not, of the credit criteria.

Statement of confirmation (2) from the Contractor in the form of signed correspondence, clearly demonstrating the total quantity and material value of the actual steel used in the project as a percentage of the project's contract value, and the applicability, or not, of the credit criteria.

ADDITIONAL GUIDANCE

The first point addresses 'structural steel' applications in predominantly steel-framed buildings and 'reinforcing steel' applications in buildings predominantly framed in concrete (insitu/precast/stressed) or masonry.

The steel applications that are applicable for each structure type include (but are not limited to);

- Predominantly structural steel building: 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);
- Predominantly reinforced concrete or structural masonry building: 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.

The two additional points address all 'major' steel applications in the building regardless of which framing system is more predominant. The 'major' steel applications in a building include;

- Structural steel applications (as above);

  AND

- Building envelope steel applications.

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Mat-6 Steel

POINTS AVAILABLE 3

The steel applications that are applicable for building envelope applications include;

- Wall cladding; and,
- Profiled roof decking

It is not the intent of the Credit Criteria to encompass minor miscellaneous steel applications such as door frames, balustrades, railings, fences, UFAD pedestals, or architectural features. Although noted as steel applications, these are excluded from the scope of the Mat-6 credit due to the general quantity of steel represented and the practicalities of quantification.

A predominantly structural steel framed building is defined where the structural steel framing component is greater than 50% (by cost), compared with the reinforced/ precast/ stressed concrete framing of the building.

A predominantly concrete building is defined where all concrete framing (reinforced/precast/ stressed) is greater than 50% (by cost), compared with the structural steel framing component of the building.

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.

$$\text{Average post-consumer recycled content} = \frac{\text{Total mass of post-consumer recycled content}}{\text{Total mass of steel (recycled + non-recycled)}}$$

For documenting recycled content of steel in an As Built submission, it is acceptable to provide evidence stating the overall, manufacturer-wide, average recycled content for the particular product or products, rather than the specific batch provided to the project.

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.

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.

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Mat-6 Steel

POINTS AVAILABLE 3

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 has decreased and 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 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

Steel Recycling Institute (US).
http://www.recycle-steel.org

UK Steel
http://www.uksteel.org.uk
http://www.uksteel.org.uk/fact5.htm

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Mat-8 Sustainable Timber

POINTS 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

Up to two points are awarded where:

- The project achieves a minimum percentage (by cost) of all timber and timber composite products used in the building and construction works compliant with the sourcing requirements, awarded as follows:
  - 50% (by cost) for one point;
    OR
  - 95% (by cost) for two points.

Compliant timber and timber composite products must be:

- Reused timber;
- Post-consumer recycled timber; or
- Forest Stewardship Council (FSC) certified timber.

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.

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Mat-8 Sustainable Timber

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Extract(s) from tender documentation 3. Extract(s) from Quantity Surveyor report Where credit claimed 'Not Applicable': 4. Extract(s) from Quantity Surveyor report	Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Statement of confirmation (1) 3. Chain of Custody Certificates 4. Statement of confirmation (2) Where credit claimed 'Not Applicable': 5. Statement of confirmation (2)

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

- Providing a tabulated summary of all timber uses in the project, indicating for each timber application the supplier/source and compliance, or otherwise, with the Credit Criteria;
- Identifying , with reference to supporting documentation, the cost of each timber use in the project;
- Demonstrating through calculations that reused, recycled and/or FSC certified timber jointly account for the minimum stipulated percentage cost as per the Credit Criteria.

Extract(s) from tender documentation clearly demonstrating a contractual requirement for:

- All applicable timber must be sourced from suppliers and sources compliant with the Credit Criteria for each timber application;
- Evidence confirming compliance with the Credit Criteria (e.g. FSC CoC certificates) and receipts must be kept and logged.

Extract(s) of Quantity Surveyor report clearly demonstrating:

- The total estimated material cost of all timber uses;
- For refurbishment projects only: the fair market value of timber material retained within the existing building which is reused; and,
- The total material cost of all timber within the project, as a percentage of the project's contract value, and the applicability, or not, of the credit criteria.

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Statement of confirmation (1) from each supplier of compliant timber product, in the form of signed correspondence, clearly confirming:

- The quantity, type, and cost of the timber supplied to the project;
- The source of the timber as related to the Credit Criteria (i.e. whether the timber is reused, recycled or FSC Certified);

Chain of Custody Certificates for all FSC Certified timber within the project, for the last company in the chain of custody of each product or material prior to it being procured for this project, as per the Additional Guidance.

Statement of confirmation (2) from Contractor signed and confirming;

- All timber uses within the project and the quantity and source of timber installed in the project; and,
- The material value of all timber as a percentage of the project's contract value, demonstrating the applicability, or not, of the credit criteria.

ADDITIONAL GUIDANCE

This credit addresses all timber within the project, including formwork, temporary works timber use and composite wood products. All fitout applications are included only for built-in items; loose furniture is not within the scope of the Credit.

No distinction is made between applications, temperate or tropical timbers, or between hardwoods and softwoods.

For each source that is claimed to satisfy the requirements of this credit, the supplier will be required to confirm the credentials of the timber against the Credit Criteria.

Note that any pre-existing timber that is retained in a refurbishment or redevelopment project can be included in the calculation of this credit, providing its quantification and estimate are well justified. The timber cost for such reused materials must be estimated by the Quantity Surveyor using fair market value for equivalent new material.

For a Design certification, it must be evident that nominated suppliers have been sourced for the timber applications. It is not acceptable that design teams specify the requirements without nominating a preferred supplier of compliant timber and composite timber products.

Expected timber uses within the scope of the Credit Criteria 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

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- Structural formwork.

Recycled timber

For the purpose of this credit, recycled timber must contain post-consumer recycled content; post-industrial content cannot contribute towards this credit.

For each recycled timber product, identify the percentage post-consumer recycled content by weight.

$$\text{Recycled content value (R)} = \text{\% post-consumer recycled content by weight} \times \text{material cost}$$

$$\text{Total percentage recycled content} = \frac{\text{total recycled content value (R)}}{\text{total timber cost}} \times 100$$

Chain of Custody (CoC) Certificates

Forestry Stewardship Council (FSC) Chain of Custody (CoC) Certificates must be presented for all FSC certified timber. As per the FSC, "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."

CoC Certificates must also be provided for the final party in custody of the material or product until it has been procured for the project, as per Table Mat-8.1.

Wood products identified as 'FSC Pure' and 'FSC Mixed Credit' must be valued at 100% of the product cost. Wood products identified as 'FSC Mixed [X]%' must be valued at the indicated percentage of their cost, e.g. a product identified as 'FSC Mixed 50%' must be valued at 50% of the cost.

$$\text{Certified wood material percentage} = \frac{\text{FSC–certified wood material value (R)}}{\text{Total new wood material value (R)}} \times 100$$

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.

For a timber or timber composite product to be awarded points within this credit for FSC certification, full chain of custody must exist. That is, all FSC certified wood materials used on the project must come from suppliers that have a valid FSC Chain of Custody certificate.

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For example, 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 sells the product to the workstation manufacturer who doesn't have FSC certification, who then sells it to the project, then chain of custody is lost.

Contractors and Sub-contractors are considered the end consumers and need not be chain of custody certified. A manufacturer that installs its own product (e.g. custom cabinetry) is not required to be chain of custody certified.

Industry Type required?	Process Stage	Chain-of-custody
Building & Construction	Sawmills, Lumberyards	YES
	Manufacturers of forest products	YES
	Timber broker	YES
	Building contractors/ sub-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*

Formwork

For compliance with the Credit Criteria, all formwork must be either, or any combination of, the following:

- New (i.e. first use) formwork with Forest Stewardship Council certification;

  OR

- Formwork that has been previously used in another project (i.e. re-used).

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Mat-8 Sustainable Timber

POINTS AVAILABLE 2

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/

Rainforest Alliance, Sustainable Forestry (SmartWood)
http://www.rainforest-alliance.org/
http://www.rainforest-alliance.org/forestry.cfm?id=certification

Australian Forestry Standard.
http://www.forestrystandard.org.au

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Mat-10 Dematerialisation

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise designs which produce a net reduction in the total amount of material used.

CREDIT CRITERIA

Up to two points are available where a substantial reduction in materials consumption occurs due to specific design initiatives:

- One point is awarded where any three of the dematerialisation initiatives below are achieved;

  OR

- Two points are awarded where any six of the dematerialisation initiatives below are achieved.

Finishes

All dwellings are designed to avoid the use of specific finishes as follows:

- 90% of all floors (excluding wet areas) within the dwelling are exposed structure with no covering (excluding sealants);

  OR

- 90% of all ceilings (excluding wet areas) within the dwelling are exposed structure with no lining;

  OR

- Where brick or block masonry walling is used, render and plaster are avoided (i.e. exposed finish),

Bathroom to bedroom ratio

- For 90% of all dwellings, the bathroom to bedroom ratio is such that;
  - No one-bedroom or studio dwellings have more than one bathroom and toilet;

    AND
  - No more than one bathroom and toilet is provided for every two bedrooms.

Bathroom efficiency

- For 90% of all dwellings, bathrooms are designed such that;

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– No bathroom contains both a bath and separate shower cubicle (unless it is the only bathroom in the unit);
  AND
– Each bathroom contains only one basin and tap set.

Shared structure

All dwellings are designed such that;

- 25% of the total perimeter walls of the units are shared;
  OR
- Greater than 50% of the total rentable floor area is shared.

Waterless toilets

- For 90% of dwellings, all toilets avoid the use of water (i.e. are composting);

Landscaping

- No irrigation system(s) are provided to either common property or private landscaping;

Lighting design

- For 90% of all dwellings, interior lighting is designed such that fittings are provided at a density of not less than 1 per 6m^2 of floor area served;

Layout design

- For 90% of all dwellings, the kitchen, lounge, dining and other habitable areas (excluding bedrooms and studies), are within one continuous space (i.e. open plan design);

Car parking

- All car parking provided below grade (i.e. basement car parking) is naturally ventilated as per SANS 10400-O.

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Mat-10 Dematerialisation

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Extract(s) from tender documentation	Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. As Built drawing(s) 3. Statement of confirmation

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

- Describing which dematerialisation initiatives are claimed;
- Providing calculations, summary tables, figures and drawing extracts wherever appropriate, to sufficiently demonstrate how the Credit Criteria have been achieved for each design initiative implemented;
- Referencing supporting documentation where necessary.

Extract(s) from tender documentation clearly indicating the contractual requirement for the inclusion of the design initiatives (where applicable).

Tender / As Built drawing(s) marked-up to clearly indicate the dematerialisation initiatives as referenced in the short report.

Statement of confirmation from the Contractor, in the form of signed correspondence confirming the dematerialisation initiatives included in the development, as referenced in the short report.

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.

Finishes

Compliance with this dematerialisation initiative to meet the credit criteria may include the application of;

- Concrete structure with polished concrete flooring and/or exposed ceilings;

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- Lightweight timber flooring with polished floor boards and/or exposed ceilings; or
- The exposed or painted masonry walling.

The flooring applied to wet areas (i.e. bathrooms and laundries) is excluded.

Bathroom to bedroom ratio

90% of all units can have only one bathroom and toilet for every two bedrooms. For one bedroom or studio units, only one bathroom and toilet is permitted. The toilet is permitted to be in a separate room or cubicle from the remainder of bathroom. For units with an odd number of bedrooms, the number of bathrooms and toilets can be rounded up. For example:

- 1 bed/studio and 2 bedroom units: 1 bathroom and toilet
- 3 and 4 bed units: 2 bathrooms and toilets
- 5 and 6 bedroom units: 3 bathrooms and toilets.

Cases where the toilet is separated from the remainder of the bathroom (e.g. in another room or cubicle), are permitted, and counted as 1 bathroom and toilet. If each bathroom includes a toilet, then an additional guest toilet would be considered an additional 'bathroom or toilet'.

Shared structure

25% of the total dwelling unit perimeter walls must be shared between units (e.g. back to back units, semi-detached units). Shared floor area is to be measured as a ratio of GFA to building footprint area, which must be greater than 2. This is calculated by dividing the building GFA by the building footprint:

$$\frac{\text{GFA (m}^2\text{)}}{\text{Building Footprint (m}^2\text{)}}$$

Waterless toilets

Waterless toilets rely on composting action and are becoming more popular for residential applications, including bush and eco-estates. Project Teams must ensure that proposed systems are in compliance with applicable National and Provincial regulations and legislations pertaining to sanitary systems.

Landscaping

Where irrigation systems are avoided, this reduces materials consumed for distribution (e.g. piping, sprinkler heads or drippers etc.), pumping, controls and, potentially, storage. Where the total landscaped area is less than 1% of the total site area, this initiative is ‘Not Applicable’.

Lighting design

This dematerialisation initiative rewards projects that have lighting systems which are not based on a large number of fittings (which may or may not require additional ballasts) and instead rely upon lighting designs that are more efficient in terms of the number of fittings required. These may include up-lighting or surface mounted ceiling lighting. Calculations must be based on the floor area of each room served by each lighting layout in each typical dwelling.

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Mat-10 Dematerialisation

POINTS AVAILABLE 2

Layout design

This initiative rewards designs where internal partition walls are avoided. Corridors are excluded and it is required that the kitchen, living, dinning, lounge and other habitable areas (with exception of bedrooms and studies) are provided in one open-plan area.

Car parking

The provision of mechanical ventilation systems for car parking areas requires materials with high embodied energy (e.g. sheet metal for ducting, fans etc.). Natural ventilation avoids this material requirement. To be awarded this initiative, it must be clearly demonstrated that all car parking provided is naturally ventilated in accordance with SANS10400-O. Where all car parking is provided at or above grade, this initiative is 'Not Applicable'.

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.

Although reuse and recycling of materials is encouraged and recognised by the GBCSA, but an overall reduction in materials used must be acknowledged and rewarded in order to reduce the overall amount of resources which are required for the construction of multi unit residential developments.

REFERENCES & FURTHER INFORMATION

Tonkinwise, C. (n.a.), 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

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Mat-11 Local Sourcing

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise the benefit of reduced transportation by using materials and products that are extracted, harvested, processed and/or manufactured within close proximity to the project site.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

One point is awarded where:

- 20% of the project's total contract value is represented by materials or products that have been sourced from within 400km of the site;

  AND

- Are fully compliant with the material and product requirements below.

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 50km of the site;

  AND

- Are fully compliant with the material and product requirements below.

Eligible materials and/or products must satisfy the following requirements:

- Are permanently installed on the project site;

  AND

- Be extracted, harvested, processed and manufactured within the applicable radii.

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Mat-11 Local Sourcing

POINTS AVAILABLE **2**

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Statement of confirmation (1) 3. Extract(s) from tender documentation 4. Extract(s) from Quantity Surveyor report	Submit all the evidence and ensure it readily confirms compliance. 1. Short report 2. Statement of confirmation (1) 3. 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 and/or 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;

Extract from Quantity Surveyor report clearly demonstrating the total contract value of the project and the estimated cost of all materials as claimed compliant with the Credit Criteria, as referenced in the short report.

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.

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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.

ADDITIONAL GUIDANCE

Mechanical, electrical, wet services equipment and specialty items (e.g. lifts, elevators etc.) must be excluded from the calculations of both local materials total and total contract value.

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.

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.

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.'

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.

BACKGROUND

It has been well established that in limiting the haulage of materials, and thereby reducing the transportation greenhouse gas emissions, one can achieve vast improvements 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.

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Mat-11 Local Sourcing

POINTS AVAILABLE 2

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 120,000 kilograms of CO_2 emissions. This is equivalent to the CO_2 burden of 10 people for a full year.

The choice to source materials and products locally does not in itself lead to any additional 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: Toolkit for Carbon Neutral Developments Part 1, Nicole Lazarus, Bioregional Development Group. **http://www.bioregional.com/news-views/publications/bedzed-toolkit-for-carbon-neutral-developments-part-1-construction-materials-report/**

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Mat-12 Efficient Dwelling Size

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise multi unit residential developments with efficiently sized dwelling units and reduced material consumption.

CREDIT CRITERIA

One point is awarded where:

- 50% of all dwellings have a Rentable Area of less than or equal to the following maximum criteria:
  - For studio apartments: ≤ 40m²
  - For one bedroom dwellings: ≤ 50m²
  - For two bedroom dwellings: ≤ 70m²
  - For three bedroom dwellings: ≤ 95m²
    AND
  - For each additional bedroom above 3, an additional 12m² is permitted.

AND

- A further 30% of all dwellings have a Rentable Area of less than or equal to the following maximum criteria:
  - For studio apartments: ≤ 60m²
  - For one bedroom dwellings: ≤ 75m²
  - For two bedroom dwellings: ≤ 105m²
  - For three bedroom dwellings: ≤ 143m²
    AND
  - For each additional bedroom above 3, an additional 18m² is permitted.

Compliance with the credit criteria is completed automatically by the 'Efficient Dwelling Size Calculator' within the rating tool spreadsheet.

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Mat-12 Efficient Dwelling Size

POINTS AVAILABLE 1

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Calculator extract	1. Calculator extract

Calculator extract from the Green Star SA Multi Unit Residential v1 Efficient Dwelling Size Calculator, clearly demonstrating compliance with the credit criteria.

ADDITIONAL GUIDANCE

Compliance with the Credit Criteria is calculated automatically by the 'Efficient Dwelling Size Calculator' using the input data entered on the 'Building Input' page of the rating tool spreadsheet. No further documentation is required.

BACKGROUND

This credit aims to encourage more efficient use of space in dwelling unit design, and to discourage the over-sizing of residential units. Through designing more efficient spaces, various benefits can be achieved. These include reduction in the use of materials and resources, densification, efficiencies of space use, and smarter design. All the benefits listed above are key in moving the residential market forward towards better design principles and more efficiently sized residential developments.

REFERENCES & FURTHER INFORMATION

Statistics South Africa (2010), P5041.3 - Selected building statistics of the private sector as reported by local government institutions, 2009
http://www.statssa.gov.za/publications/statsdownload.asp?PPN=P5041.3&SCH=4686

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Mat-13 Masonry

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise the reduction of embodied energy and resource depletion associated with a reduction of virgin material in masonry units.

CREDIT CRITERIA

Up to two points are awarded where:

- The minimum percentage (by area) of all applicable masonry units where any combination of the following strategies are used, is awarded as follows;
  - 50% (by area) for one point;
    OR
  - 80% (by area) for two points.

Clay bricks

- Perforated masonry units are used and the minimum percentage of perforations is 20%;
  OR
- Reused masonry units are used.

Concrete bricks

- Perforated masonry units are used and the minimum percentage of perforations is 20%;
  OR
- Concrete masonry bricks have the following recycled content requirement:
  - Minimum 30% recycled aggregate content;
    AND
  - Minimum 10% Portland cement replacement with industrial waste product.

Concrete blocks

- Concrete masonry blocks have the following recycled content requirement:
  - Minimum 30% recycled aggregate content;
    AND
  - Minimum 10% Portland cement replacement with industrial waste product.

If the material cost of applicable masonry units 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.

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Mat-13 Masonry

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Manufacturer product datasheet(s) 4. Extract(s) from Quantity Surveyor report Where credit claimed 'Not Applicable': 5. Extract(s) from Quantity Surveyor report	1. Short report 2. Statement(s) of confirmation (1) 3. Manufacturer product datasheet(s) 4. Statement of confirmation (2) Where credit claimed 'Not Applicable': 5. Statement of confirmation (2)

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

- Identifying all the applications of clay masonry units in the project, and the products for each application, with reference to supporting documentation;
- Demonstrating through calculations that the Credit Criteria has been met.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the application specific use of clay masonry units with a stipulated minimum perforation.

Statement(s) of confirmation (1) from supplier of each masonry product claimed, in the form of signed correspondence, confirming the product and quantities of clay masonry units supplied to the project.

Manufacturer product datasheet(s) of each clay masonry unit product supplied to the project, clearly stating the percentage perforation for that product.

Extract(s) from Quantity Surveyor report clearly demonstrating the total material value of the masonry units within the project and the cost as a percentage of the projects contract value, demonstrating the applicability, or not, of the credit criteria.

Statement of confirmation (2) from the Contractor in the form of signed correspondence, clearly demonstrating the total quantity and material value of the actual applicable masonry units used in the project as a percentage of the project's contract value, and the applicability, or not, of the credit criteria.

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Mat-13 Masonry

POINTS AVAILABLE 2

ADDITIONAL GUIDANCE

Applicable masonry units include those used for walling (structural and non-structural) only. Hardscape and miscellaneous landscape uses of masonry units are not included within the scope of this credit.

The demonstration of compliance for this credit is based on area. This are is considered the 'face' or 'elevation' area, irrespective of construction technique (e.g. single leaf, double brick cavity etc.). Where conversion from quantities to areas is required, the assumed number of masonry units per unit area must be clearly demonstrated and justified.

Perforations

The perforation of a clay masonry unit can be defined as the hollow section passing through the unit as a result of the extrusion process. The nominal diameter/size of the perforations must be used as provided by the manufacturer. The reduction in virgin material through perforations must be calculated against an equivalent solid unit with 0% perforations, of the same mix. The credit criteria can then be met by demonstrating the % perforations of the units specified for the project. The reduction of virgin material in the masonry units must be directly related to the % perforations.

BACKGROUND

Fired clay masonry units (i.e. bricks and pavers) are one of the most predominant building materials in South Africa, particularly for residential developments. The South African clay masonry manufacturing industry has an installed annual capacity, within normal working hours, of in excess of 5 billion brick equivalent units. Approximately 13 million tons of clay is extracted annually, processed and fired to supply clay masonry products for new and renovated buildings in South Africa.

South Africa has always had an abundance of brick making clays and good levels of sunshine, which has meant that clay brick manufacturing has traditionally often been manufactured by means of "field ovens" or "clamp kilns". Easy availability of thermal coal resulted in the use of this fuel source to vitrify the clay and form the finished products. Many different firing methods using thermal coal were developed and installed over time. Some of these methods remain common today, and are listed as critical activities in terms of the recently promulgated Air Quality Act and subject to stringent emissions controls.

With technological advancement in brick making, the availability of natural gas and the influence of European and American equipment suppliers in South Africa, many of the more advanced and larger manufacturers have moved to better technology and highly automated processes.

Approximately 70% of the brick equivalent units produced in SA are produced in "clamp kiln" facilities, which produce mainly stock bricks. Improvements to this type of facility are on the rise in the industry (for example, to more efficient vertical shaft systems). A quarter of

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production comes from the more advanced tunnel kiln operations, and 6% from Hoffman/Transverse Arch kilns.

Efficiencies vary drastically between the less-efficient facilities (higher than 8GJ / 1,000 bricks) and the more advanced facilities which align themselves with international best practice (under 4GJ / 1,000 bricks). Based on an internal study by one of the largest clay brick manufacturers in South Africa, approximately 150 MJ gas / 1,000 bricks can be saved, by taking out 100grams of clay per brick, depending on the efficiency of the facility.

There are numerous knock-on benefits of reducing the amount of virgin material in clay masonry units. Firstly, the reduction of virgin materials required reduces the strain on natural resources as well as the required extraction and transportation of these raw materials from the quarry to the brick manufacturing plant.

Through introducing higher levels of perforations into clay masonry units, the mass of the units is reduced which has a direct impact on the required drying and firing times, which are the most energy intensive processes in the manufacturing of clay masonry. Energy consumption during drying and firing is also affected by the mix recipe for the particular masonry product, for example the clay content, and the various types of clays and their water content.

Reducing the mass of a masonry unit impacts on haulage, with lighter loads and reduced transport related greenhouse gas emissions. It also leads to reduced loading on structures, which can lead to reductions in the size of structural members. Reduced mass of the units can also improve handling on site, reducing potential health and safety impacts. The addition of perforations into masonry units can also reduce the amount of mortar required, if laid correctly.

REFERENCES & FURTHER INFORMATION

Clay Brick Association
http://www.claybrick.org.za

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Land Use and Ecology

The credits allocated within the Land Use and Ecology Category of the Green Star SA rating tools 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[13].

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[14]. South Africa is one of 17 countries that have been termed as "mega diverse"; these 17 countries collectively house two thirds of the world's biodiversity[15].

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.

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.

The terms 'site' and 'project site' are used frequently in the credits within the Land Use and Ecology category as well as in credits within other categories. While a generic interpretation is often adequate for credits in other categories this is not the case in the Land Use and Ecology category as the spatial extent of the site serves as the basis for the calculation of credit thresholds and benchmarks.

[13] *http://www.botany.uwc.ac.za/envFacts/facts/biosa.htm*
[14] *http://www.botany.uwc.ac.za/envFacts/facts/biosa.htm*
[15] *http://www.biodiversitya-z.org/areas/26*

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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-0 Conditional Requirement is met where the project development footprint satisfies the following criterion:

1) Is not located on prime agricultural land;

   AND

2) Is not located on vegetation of high ecological value or within a 100 metre buffer of vegetation of high ecological value;

   AND

3) 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;

   AND

4) Is not located within the required buffer zones of watercourses as defined as:
   a. The project development footprint must not fall within the 100 year floodplain;

      OR

   b. Watercourses of 'high ecological value': A project's development footprint <u>can</u> be located on land within 100 metres of a watercourse of 'high ecological value' only if the project is a refurbishment/redevelopment that remains within the existing development footprint and the existing hardscape is not exceeded and the Watercourse Protection Measures are completed;

      OR

   c. Watercourses NOT of 'high ecological value': A project's development footprint <u>can</u> be located on land within 100 metres of a watercourse that is NOT of 'high ecological value' only if the Watercourse Protection Measures are completed.

Refurbishments, extensions or redevelopments that remain within the existing development footprint and the existing hardscape is not exceeded are exempt from criteria 1, 2, 3, 4a and 4c, however must ensure compliance with criterion 4b.

Watercourse Protection Measures

The Water Course Protection Measures required to be complied with for applicable developments are as follows:

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Eco-0 Conditional Requirement

- A site-specific Watercourse Management Plan is 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 Conditional Requirement requires that there is an official and appropriately dated report from a suitably qualified registered ecologist confirming that none of the above Conditional Requirement criteria applies, or applied at the time of purchase, to the site. In addition (where applicable), the project must abide by all measures in the Environmental Impact Assessment (EIA) for the project if one is required.

The GBCSA reserves the right to provide the final ruling on a project's compliance with this Conditional Requirement.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
1. Extract(s) from Ecologists report OR Extract(s) from Environmental Impact Assessment (EIA) report	1. Extract(s) from Ecologists report OR Extract(s) from Environmental Impact Assessment (EIA) report
Additionally where Watercourse Protection Measures required: 2. Watercourse Management Plan 3. Statement of confirmation	Additionally where Watercourse Protection Measures required: 2. Watercourse Management Plan 3. Statement of confirmation

Extract(s) from Ecologists report prepared by a suitably qualified registered ecologist, clearly confirming:

- The methodologies used to complete the assessment;
- 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;

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Eco-0 Conditional Requirement

- Where the development is located within 100 metres of a watercourse(s), 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;
- The curriculum vitae of the ecologist, with reference to registration with the South African Council for Natural Scientific Professions (SACNSP) in accordance with the Natural Scientific Professions Act, 2003 (Act 27 of 2003).

Extract(s) from Environmental Impact Assessment report (if required for development) that clearly demonstrates that the site was adequately assessed, complies with all Credit Criteria and that a positive Record of Decision (RoD) was issued for the site, listing the conditions of the RoD (if any).

Watercourse Management Plan prepared by a suitably qualified and experienced wetland ecologist, clearly including;

- A defined management objective to protect the watercourse(s);
- A description of the ecological value(s) of the watercourse(s);
- A list of risks and threats to the conservation of the watercourse(s) 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 on-going quarterly monitoring, annual reporting and management of the watercourse ecosystem for a minimum of five years; and
- Details regarding the operational timeframe of the Watercourse Management Plan (minimum of five years).

Statement of confirmation from the development owner in the form of signed correspondence, clearly confirming;

- The commitment to implement the Watercourse Management Plan for at least 5 years from project completion; and
- Describe the resources that will be allocated over the life of the plan to ensure successful implementation.

ADDITIONAL GUIDANCE

Please refer to the Green Star SA – Multi Unit Residential v1 Land Use & Ecology - Conditional Requirement & Eco-4 Calculator Guide for Additional Guidance.

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Eco-0 Conditional Requirement

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.

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.

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Eco-0 Conditional Requirement

REFERENCES & FURTHER INFORMATION

Please refer to the Green Star SA - Multi Unit Residential Land Use & Ecology - Conditional Requirement & Eco-4 Calculator Guide for references and further information.

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Eco-1 Topsoil

POINTS 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:

During construction;

- All topsoil impacted is separated and protected from degradation, erosion or mixing with fill or waste;

  AND

At project completion;

- At least 75% (by volume after excavation) of all protected topsoil remains on site;

  AND

- Protected topsoil retained is spread over impacted areas to a minimum depth of 200mm and a maximum depth of 600mm;

  AND

- Any remaining protected topsoil is transported to the nearest land holding of the same soil classification that requires rehabilitation and is deposited under the supervision of an ecologist;

Where no topsoil existed on the site at the time of site purchase, or 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.

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Eco-1 Topsoil

POINTS AVAILABLE 1

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
1. Short report 2. Tender drawing(s) 3. Extract(s) from tender documentation 4. Topsoil Management Plan Where credit claimed 'Not Applicable': 5. Short report 6. Tender drawing(s)	1. Short report 2. As Built drawing(s) 3. Topsoil Management Plan 4. Statement of confirmation Additionally where topsoil transported offsite: 5. Land holding receipt(s) Where credit claimed 'Not Applicable': 6. Short report 7. As built drawing(s)

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

- Quantifying the amount (volume and depth) of topsoil on the site at time of purchase and describing the method used for assessment, with reference to supporting documentation;
- Defining the areas of topsoil that are impacted by construction activities and demonstrating with calculations, the 'Before' and 'After' site conditions that account for all topsoil on the site;
- Describing how the integrity of the site's topsoil specifically within the impacted area is protected throughout construction works, with reference to the Topsoil Management Plan;
- Describing the measures used to ensure topsoil integrity where transportation offsite is required, with reference to the Topsoil Management Plan;
- Clearly demonstrating that the Credit Criteria is met for the project.

Where credit claimed 'Not Applicable':

- Clearly demonstrating, with reference to supporting documentation, that no topsoil was impacted by the construction activities and that the existing landscaped area is unchanged (in size and characteristics) from the final landscape;

  OR

- Clearly demonstrating, with reference to supporting documentation, that no topsoil existed on the site at time of site purchase.

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Eco-1 Topsoil

POINTS AVAILABLE 1

Tender / As Built drawing(s) clearly marked up to show;

- The total landscape area and characteristics (i.e. location and depth of topsoil);
- The location of all areas where topsoil was disturbed and/or redistributed;
- Where topsoil is redistributed, to what depth the topsoil is redistributed.

Extract(s) of tender documentation clearly demonstrating the contractual requirement for topsoil management as referenced in the short report, and the implementation of a Topsoil Management Plan.

Topsoil Management Plan prepared by a suitably qualified professional in accordance with the Additional Guidance.

Statement of confirmation from the Contractor in the form of signed correspondence, confirming that the Topsoil Management Plan was adhered to throughout the construction process and the Credit Criteria was achieved.

Land holding receipt(s) clearly demonstrating that any topsoil transported off site was delivered to the appropriate land holding facility as detailed in the Topsoil Management Plan.

ADDITIONAL GUIDANCE

Pre-existing contaminated topsoil is excluded from this credit and must not be included in the topsoil calculations.

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.

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.

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.

Topsoil Management Plan & correct topsoil management

The Topsoil Management Plan must be prepared by a suitably qualified professional and be based upon 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.

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Eco-1 Topsoil

POINTS AVAILABLE 1

The correct implementation of a topsoil management plan will demonstrate that the integrity of the site's topsoil was not compromised during construction works. A project-specific topsoil management plan should include (at minimum):

- The methodology for determining quantity and quality of topsoil;
- Locations of on-site stockpiles or appropriate off-site land holdings;
- Specifically define all suitable topsoil occurring within the impacted area of construction, and 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 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.

Topsoil transportation and relocation

Transportation of excess topsoil must be in a method and to a nearby area that ameliorates soil loss or contamination. Areas for topsoil relocation must be within the same soil classification as the impacted area as described by the South African Council for Geoscience. Areas should be selected that require proactive soil conservation practices and where topsoil depth is not currently over 600 mm.

Externally sourced topsoil

The importation of topsoil is not rewarded by this credit as it may compromise the topsoil's ecological integrity. Projects that substitute topsoil from the site with other topsoil and where in situ topsoil has been removed from site cannot claim this credit.

Non-permanent topsoil

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.

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Eco-1 Topsoil

POINTS AVAILABLE 1

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.

Conservation is necessary because soil formation is a slow process. One centimetre of soil takes between 100 and 400 years to develop.

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

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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

Up to two points are available as follows:

One point is awarded where:

- The project is a refurbishment, redevelopment or a building extension (within the same site);

An additional point is awarded where:

- The point above is achieved;

  AND

- The project site is located within a municipally approved urban edge.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
1. Short report Where additional point claimed: 2. Extract(s) from relevant planning authority documentation	1. Short report Where additional point claimed: 2. Extract(s) from relevant planning authority documentation

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by confirming that the project is a refurbishment, redevelopment or

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extension (within the same site), with reference to 'Site documentation' provided in the 'General' section of the submission;

Extract(s) from relevant planning authority documentation that clearly demonstrates the location of the project site and that it is located within the municipal approved urban edge.

ADDITIONAL GUIDANCE

For a new development, the documentation current at the time of site purchase must clearly demonstrate that the existing development footprint represented not less than 75% of the site area. Please refer to the Glossary for the definition of development footprint.

Previously developed land

Previously developed land is defined as either of the following:

- Land with any permanent structure (building or car park); or
- Land with any impervious or semi-impervious surfaces (paved or unpaved car parks).

'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 or dwelling including yards and paved surfaces.

The definition excludes:

- 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).

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 determine the alignment and status of an urban edge within a municipality, the project team may need to contact the relevant planning authority and seek applicable documentation which identifies this boundary.

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Eco-2 Reuse of Land

POINTS AVAILABLE 2

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

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Eco-3 Reclaimed Contaminated Land

POINTS 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, in accordance with the National and Provincial legislation and standards.

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.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
1. Extract(s) from Site Contamination Survey Report	1. Extract(s) from Site Contamination Survey Report
Where credit claimed 'Not Applicable' (refurb/extension only):	Where credit claimed 'Not Applicable' (refurb/extension only):
2. Short report	2. Short report

Extract(s) from Site Contamination Survey Report prepared by a suitably qualified environmental scientist that:

- Describes the location of the site, the scope of the survey and the methodologies used or contaminants tested for;

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Eco-3 Reclaimed Contaminated Land

POINTS AVAILABLE 2

Where no contamination identified:

- Confirming that no presence of contamination (regardless of extent, concentration, toxicity or otherwise) requiring remediation as determined by the relevant national, provincial or local authorities, was identified on the site;

Where contamination identified:

- Identifying the type and extent of contamination on the site;
- Outlining all available decontamination options, and proposing the remediation strategy where required;
- Where encapsulation recommended, clearly identifying, with robust and valid justifications, that no other remediation options exist for this site, thus encapsulation represents a reliable method to ensure no further propagation of the contamination.
- Describing the remediation strategy used;
- Confirming that the site has been decontaminated in accordance with the National and Provincial legislation and standards applicable to the contamination type;

Short report prepared by a relevant project team member confirming that the development is a refurbishment or building extension, with reference to 'Site documentation' provided in the 'General' section of the submission.

ADDITIONAL GUIDANCE

Contamination is defined in the National Environmental Management: Waste Act 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 Hazardous Materials while this credit 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 must be 'significant'. This means that there must be substantial recommendations for containment and/or removal in the site contamination report.

Encapsulation is only an acceptable form of remediation if there are technically no other remediation options.

Remediation of the environment refers to 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 Act 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.

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Eco-3 Reclaimed Contaminated Land

POINTS AVAILABLE 2

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.

Please note the contamination resulting from this development (e.g. with asbestos from demolition of the existing buildings) cannot contribute to this credit.

The statement 'prior to construction' as stated in the Credit Criteria refers to construction of actual building structures, not to the beginning of any construction works on the project (e.g. land clearing). Therefore, if remediation occurs during earthworks or any other stages during the construction phase of a project prior to the building of any structure, it is still considered as 'prior to construction'.

The submission must clearly demonstrate 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 Act (2008); and
- As a result of decontamination, the site was certified as uncontaminated and satisfactory for use.

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 Act, 2008.
http://www.info.gov.za/view/DownloadFileAction?id=97351

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Eco-4 Change of Ecological Value

POINTS AVAILABLE 4

AIM OF CREDIT

To encourage and recognise developments that maintains or enhances the ecological value of their site.

CREDIT CRITERIA

Up to four points are awarded where:

- The outcome of the ecological assessment of the site indicates that;
  - For greenfield sites, the site has no threatened or vulnerable species or sensitive ecological units;

    OR
  - For reused (i.e. brownfield) sites, threatened or vulnerable species or sensitive ecological units are to be adequately protected if present.

  AND
- There is no net reduction of native vegetation (where present);

  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 awarded are determined using the Green Star SA Multi Unit Residential v1 Change of Ecological Value Calculator.

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Eco-4 Change of Ecological Value

POINTS AVAILABLE 4

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
1. Short report 2. Calculator extract 3. Extract(s) from Ecologist report 4. Tender drawing(s) Additionally for reused sites where threatened or vulnerable species are present: 5. Endangered Species Protection Plan	1. Short report 2. Calculator extract 3. Extract(s) from Ecologist report 4. As Built drawing(s) Additionally for reused sites where threatened or vulnerable species are present: 5. Endangered Species Protection Plan

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by;

- Clearly identifying all land types present on the site at time of purchase and indicating the area they occupy, with reference to 'Site documentation' provided in the 'General' section of the submission;
- Clearly identifying all land types on the site and indicating the area they occupy for the proposed/as built cases, with reference to supporting documentation.
- Clearly identifying the inputs to the Change of Ecological Value Calculator based on extract(s) of ecologists report.

Calculator extract from the Green Star SA Multi Unit Residential v1 Change of Ecological Value Calculator that clearly demonstrates the inputs used, consistent with supporting documentation, and the resulting calculator output.

Extract(s) from Ecologists report prepared by a suitably qualified registered ecologist that includes:

- 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 (as input into the Calculator);
- Justifying the selection of a brownfield site and selecting the urban area 'vegetation type' (where applicable);
- Confirming or refuting the presence of threatened or vulnerable species on the site;

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- Where project claims to create land types with ecological value of 25 or greater, confirming ecosystem viability by demonstrating that measures are in place to ensure installed landscape will function as intended, including but not limited to:
  - Maintenance requirements;
  - Irrigation requirements and schedules; and,
  - Any temporary physical interventions (e.g. fencing);

Tender / As Built drawing(s) clearly identifying all land types present on the site in accordance with the Change of Ecological Value Calculator and indicating the area they occupy.

Endangered Species Protection Plan prepared by a suitably qualified registered ecologist for protecting the existing threatened or vulnerable species that includes:

- 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.

ADDITIONAL GUIDANCE

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 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.

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;
- Rehabilitate or create wetland or riparian areas;

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- 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 to that of the building and paved footprint.

Please refer to the 'Green Star SA Multi Unit Residential v1 Land Use & Ecology - Conditional Requirement and Eco-4 Calculator Guide' for further Additional Guidance and information.

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 is indicated in the charts on the following pages.

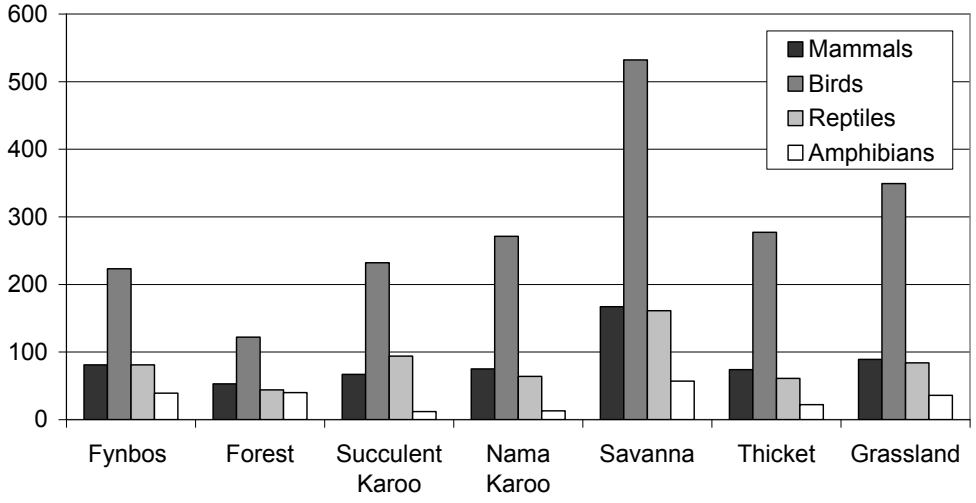

Figure Eco-4.1: *Fauna species richness per taxonomic group of the biomes of South Africa*

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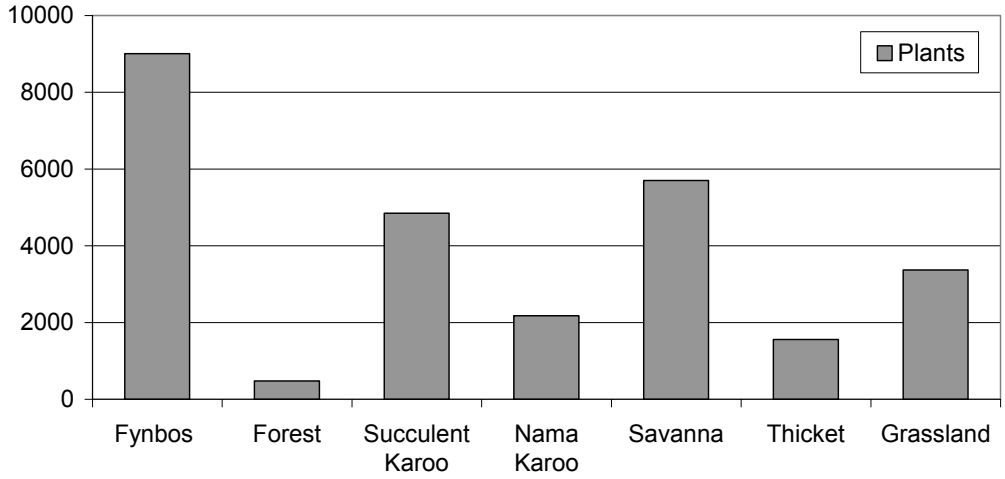

***Figure Eco-4.2**: Flora species richness per taxonomic group of the biomes of South Africa (from Endangered Wildlife Trust (2002)).*

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

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

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Eco-5 Urban Heat Island

POINTS AVAILABLE 2

AIM OF CREDIT

To reduce 'urban' heat islands and minimise impacts on microclimates, humans and wildlife habitats.

CREDIT CRITERIA

Two points are available independently as follows:

One point is awarded where for the site hardscape:

- Any combination of the following strategies are used for 50% of the site hardscape:
  - Provide shade using vegetation;
  - Provide shade using structures with;
    - A solar reflectance index (SRI) of ≥ 29.

      OR
    - Are covered by solar energy systems.
  - Use hardscape materials with an SRI of ≥ 29.
  - Use an open-grid pavement system (at least 50% pervious).

  OR

- The total site hardscape represents 10% or less of the total landscape area.

Where the total building footprint represents greater than 80% of the total site area, this point is 'Not Applicable' and is excluded from the points available, used to calculate the Land Use & Ecology category score.

One point is awarded where for roofs:

- For a minimum of 75% of the total roof plan area, all roofing materials have a solar reflectance index (SRI) of:
  - ≥ 78 for low-sloped roofs (≤10^{o} pitch)

    OR
  - ≥ 29 for steep-sloped roofs (>10^{o} pitch).

  OR
- For a minimum of 50% of the total roof plan area, a vegetated roof is installed.

  OR

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Eco-5 Urban Heat Island

POINTS AVAILABLE 2

- For the building roof plan area, the project installs roofing meeting the SRI requirements and vegetated roof surfaces that, in combination, meet the following criteria:

$$\frac{\text{Roof plan area meeting minimum SRI}}{0.75} + \frac{\text{Plan area of vegetated roof}}{0.5} > \text{Total roof plan area}$$

Where the total building footprint represents 20% or less of the total site area, this point is 'Not Applicable' and is excluded from the points available, used to calculate the Land Use & Ecology category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Tender drawing(s) 3. Extract(s) from tender documentation Where credit(s) claimed 'Not Applicable': 4. Short report 5. Tender drawing(s)	1. Short report 2. As Built drawing(s) 3. Manufacturer product datasheet(s) Where credit(s) claimed 'Not Applicable': 4. Short report 5. As Built drawing(s)

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by;

- Describing what strategies have been implemented;
- Demonstrating that the sum of the qualifying area meets the Credit Criteria requirements, with reference to the supporting documentation;
- Where SRI compliant hardscape or roofing, or open-grid pavement system, references to tender documentation (Design) or manufacturer product datasheets (As Built);

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Eco-5 Urban Heat Island

POINTS AVAILABLE 2

Additionally where shade by vegetation claimed:

- Solar shade modelling results or calculations in accordance with the Additional Guidance, justifying the area claimed as shaded by vegetation and clear assumptions (where necessary) of vegetation size.

Where point(s) claimed 'Not Applicable':

- Demonstrating through calculations that the credit(s) are 'Not Applicable', with reference to supporting documentation.

Tender / As Built drawing(s) marked up to clearly demonstrate:

- All hardscape, landscape and building footprint areas, indicating extents of shading provided by vegetation or structures (where applicable);
- All roof areas, identifying roof types and extents (where applicable).

Extract(s) from tender documentation clearly demonstrating a contractual requirement for the application of the hardscape, landscape and roof initiatives as referenced in the short report.

Manufacturer product datasheet(s) for each nominated product or material, clearly demonstrating:

- The solar reflectance index values for the product/materials and the applicable standard tested to (where applicable);
- The pervious percentage for open-grid pavement systems (where applicable).

ADDITIONAL GUIDANCE

Strategies for mitigating heat island effect include using materials with higher solar reflectance properties in the site and roof design, providing shaded areas, and reducing hardscape surfaces. Note that each surface may only be counted once, even if it meets multiple criteria. For example, a 10 square metre area of paving with complaint SRI value, 60% pervious and shaded only counts as 10 square metres.

Hardscape surfacing refers to non-roof hard surfaces: total site area less building footprints and vegetated areas (i.e. softscape). Please refer to the definitions provided in the glossary.

Shading

Landscape features such as trees, large shrubs and vines can reduce heat islands by shading buildings and pavements from solar radiation and cooling the air through evapotranspiration. Trellises and other exterior structures can support vegetation to shade parking lots, walkways and plazas. Deciduous trees allow solar heat gain during winter months while providing shade during the hot summer months. Newly installed landscape features must provide the desired level of shading within 5 years of being planted. These must be in place at the time of building occupancy.

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Vegetation shading is calculated at 10h00, 12h00 and 15h00 on the summer solstice (21 December), with the arithmetic mean of these three values used as the effective shaded area;

Where tree planting is not possible, consider using architectural shading devices and structures to block direct sunlight. Shading from both architectural devices/structures and solar energy panels are calculated from a direct overhead aerial perspective. The architectural devices/structures must have an SRI of at least 29, but solar energy system installations, including photovoltaics, of any SRI value can contribute to shading hardscape and roof surfaces.

Solar reflectance for hardscape

Hardscape materials vary in their ability to reflect light and radiation. Dark paving materials generally have low reflectance and consequently low SRI values. Table Eco-5.1 provides the Solar Reflectance Index (SRI) for standard paving materials.

Material	Emissivity	Reflectance	SRI
Typical new grey concrete	0.9	0.35	35
Typical weathered grey concrete	0.9	0.20	19
Typical new white concrete	0.9	0.70	86
Typical weathered* white concrete	0.9	0.40	45
New asphalt	0.9	0.05	0
Weathered asphalt	0.9	0.10	6

*Reflectance of surfaces can be maintained with cleaning. Typical pressure washing of cementitious materials can restore reflectance close to original value. Weather values are based on no cleaning.

Table Eco-5.1 *Solar Reflectance Index for standard paving materials (from LEED, 2009).*

Light coloured concrete weathers over time and inadequate maintenance will result in lower SRI values as time goes on. Where projects have existing grey concrete hardscapes that are older than one year, documentation must demonstrate that the weathered surfaces have been sufficiently cleaned and lightened to qualify for the default SRI values listed in Table Eco-5.

Micro-surfaces and coatings over tar paving can be used to meet the required SRI value for this credit. Coatings and integral colorants can be used in cement or insitu concrete slabs, as well as precast concrete parking surfaces to improve solar reflectance.

The solar reflectance index (SRI) is calculated from emissivity and solar reflectance values. Various testing methods are available for measuring emissivity and solar reflectance. Visible reflectance correlates to solar reflectance, but the two quantities are not equal because solar gain covers a wider range of wavelengths than visible light.

Emissivity is calculated according to ASTM E408 or ASTM C1371, and solar reflectance is calculated according to ASTM E903, ASTM E1918 or ASTM C1549.

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Eco-5 Urban Heat Island

POINTS AVAILABLE 2

Projects may use the SRI values for typical paving material in Table Eco-5.1 in lieu of obtaining specific SRI or emissivity and solar reflectance measurements for the listed materials

Reduce hardscape

Limiting the amount of impervious hardscape areas on the site can reduce heat island effect. For features such as parking lots, roads, and walkways, open-grid pavement systems that are at least 50% pervious and accommodate vegetation within the open cells can qualify for the credit.

Solar reflectance for roofing

A material that exhibits a visible reflectance usually has a lower solar reflectance. Table Eco-5.2 provides examples of SRI values for typical roof surfaces. These values are for reference only not for use as substitute for actual manufacturer's data.

SRI Values for Solar Infrared temperature	Solar reflectance	Infrared emittance	Temperature rise	SRI
Grey EPDM	0.23	0.87	37.8°C	21
Grey asphalt shingle	0.22	0.91	37.2°C	22
Unpainted cement tile	0.25	0.9	36.1°C	25
White granular surface bitumen	0.26	0.92	35°C	28
Red clay tile	0.33	0.9	32.2°C	36
Light gravel on built-up roof	0.34	0.9	31.7°C	37
Aluminium coating	0.61	0.25	26.7°C	50
White coated gravel on built up roof	0.65	0.9	15.6°C	79
White coating on metal roof	0.67	0.85	15.6°C	82
White EPDM	0.69	0.87	13.9°C	84
White cement tile	0.73	0.9	11.7°C	90
White coating, 1 coat 8mils	0.8	0.91	14°C	100
PVC white	0.83	0.92	7.8°C	104
White coating , 2coats 20mils	0.85	0.91	5°C	107

Information source: Lawrence Berkley National Laboratory Cool Roofing Materials Database. These values are for reference only and are not for use as substitutes for actual manufacturer data.

Table Eco-5.2 *Solar Reflectance Index (SRI) for typical roofing materials (from LEED, 2009)*

The SRI of a product may be calculated if it is not available from suppliers, using the SRI calculator developed by the Lawrence Berkley National Laboratory, where solar reflectance and thermal emittance values are entered to calculate the SRI.

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Eco-5 Urban Heat Island

POINTS AVAILABLE 2

Roofing materials with lower solar reflectance levels than those listed in the Credit Criteria may be used if the weighted rooftop solar reflectance average meets the following criteria:

$$\frac{\text{Area roof meeting minimum SRI}}{\text{Total roof area}} \times \frac{\text{SRI of installed roof}}{\text{Required SRI}} \geq 75\%$$

Equation 1 *(from LEED, 2009).*

Vegetated Roofs

A vegetated green roof is a layered system that typically consists of vegetation in a layer of growing medium underlain by a drainage system, root barrier, waterproofing barrier and insulation. Potted plants do not qualify as a vegetated roof because they do not offer the same magnitude of environmental benefits.

Vegetated/green roofs can have a significantly positive environmental impact by replacing heat absorbing surfaces with various kinds of vegetation, which cool the air through evapo-transpiration. Vegetated roofs also have some insulating benefits, retain stormwater, are aesthetically appealing, add biodiversity, act as a CO_2 sink and have a longer lifespan than conventional roofs, especially related to the waterproofing that is not directly exposed to expanding and contracting roofs due to the harsh temperature differences. Vegetated roofs can act as proper gardens and amenities, and require significant plant care and maintenance; others have plants that require little or no maintenance. Typically, all types of vegetated roofs require semi-annual inspection.

When designing green roofs, select indigenous or adapted plant species to reduce or eliminate the need for irrigation. Where irrigation is required, consider using greywater or harvested stormwater to reduce potable water use.

Methodology for calculating roof compliance

Once the roofing material's SRI value from the manufacturer has been obtained:

- Determine the total roof surface area of the project building (square metres).
- Determine the area of the roof covered by mechanical equipment, solar energy panels and accessories, and deduct these areas from the total roof surface area.
- Determine whether the areas of qualifying reflective and vegetated roofing are adequate to meet the credit requirements, using Equation 2. If more than one type of low slope or steep-slope material is used, determine the weighted rooftop SRI average and verify that 75% or more of the roof area complies with the credit requirements.

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Eco-5 Urban Heat Island

POINTS AVAILABLE 2

$$\left(\frac{\text{Area of low-slope SRI material}}{78 \times \frac{0.75}{\text{SRI value}}} + \frac{\text{Area of Steep-slope SRI Material}}{29 \times \frac{0.75}{\text{SRI value}}} + \frac{\text{Vegetated roof area}}{0.5} \right) > \left(\text{Total roof area} - \text{deducted area} \right)$$

Equation 2 *(from LEED, 2009)*

BACKGROUND

The use of dark, non-reflective surfaces for parking, roofs, walkways and other hardscapes contributes to the heat island effect by absorbing the sun's warmth, which then radiates into the surroundings. As a result, ambient temperatures in urban areas are artificially elevated, increasing cooling loads, electricity consumption and emissions of greenhouse gases and pollution. Heat islands are detrimental to site habitat, wildlife and animal migration corridors. Plants and animals are also sensitive to large fluctuations in daytime and night-time temperatures and may not thrive in areas affected by heat islands.

Causes of urban heat island effect

The urban heat island effect is a measurable increase in ambient urban air temperatures resulting in thermal gradient differences between developed and undeveloped areas. This effect forms 'islands' of higher temperatures in the landscape, and each city's urban heat islands vary based on the city structure.

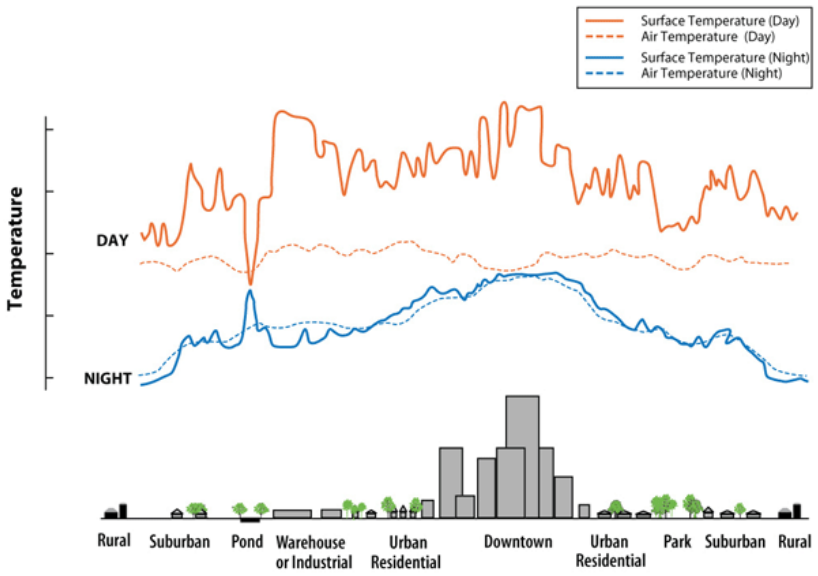

Figure Eco-6.1: *Urban heat island effect (from U.S. Environmental Protection Agency, 2009)*

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Eco-5 Urban Heat Island

POINTS AVAILABLE 2

The causes of urban heat island effect include the following:

- Buildings block surface heat from radiating into the cold night sky;
- Tall buildings provide multiple surfaces for the reflection and absorption of sunlight, increasing the efficiency urban areas are heated, and is called the 'urban canyon effect';
- Buildings block wind thereby inhibiting cooling by convection;
- Materials commonly used in urban areas, such as concrete and asphalt, have significantly different thermal bulk properties and surface radiative properties than surrounding rural areas;
- Lack of vegetation in urban areas inhibits cooling by evapotranspiration;
- Land once permeable and moist becomes impermeable and dry with urban development;
- Waste heat from concentrated automobile and air conditioning use; and
- Many forms of pollution change the radiative properties of the atmosphere.

Impacts of urban heat island effect

Elevated temperature from urban heat islands, particularly during the summer, can affect a community's environment and quality of life. While some heat island impacts seem positive, such as lengthening the plant-growing season, most impacts are negative and include:

- Increased energy consumption: Higher temperatures in summer increase energy demand for cooling and add pressure to the electricity grid during peak periods of demand.
- Elevated emissions of air pollutants and greenhouse gases: Increasing energy demand generally results in greater emissions of air pollutants and greenhouse gas emissions from power plants. Higher air temperatures also promote the formation of ground-level ozone.
- Compromised human health and comfort: Warmer days and nights, along with higher air pollution levels, can contribute to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality.
- Impaired water quality: Hot pavement and rooftop surfaces transfer their excess heat to stormwater, which then drains into storm sewers and raises water temperatures as it is released into streams, rivers, ponds, and lakes. Rapid temperature changes can be stressful to aquatic ecosystems.

Economic issues

Roofs with high SRIs or vegetative roofs can often reduce the costs associated with the operation of HVAC systems. Vegetative roofs can also assist in stormwater retention, and in some cases reduce the on-site stormwater attenuation requirements. Cool roofs that reflect the sun's radiation could cost the same as conventional roofing systems although vegetative roofs have a higher initial capital outlay. According to a report by the EPA which surveyed 10 buildings in California and Florida, cool roofs save residents between 20% and 70% of their annual cooling energy costs.

Efforts to reduce heat islands of hardscape may translate into higher initial costs for additional landscaping, open grid paving or architectural shading devices. However these items have an

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acceptable payback when integrated into a systems approach to maximising energy savings. Higher reflectance of hardscape material may enable a project to provide less artificial lighting.

Definitions and descriptions

Solar reflectance, also called 'albedo', is the ability of a material to reflect (rather than absorb) energy emitted from the sun. Solar reflectance is measured on a scale from zero to one with values approaching one as reflectance increases. As the shade of a material darkens, its reflectance typically is reduced. However, since colour is not always an accurate indicator of solar reflectance, testing is recommended to correctly characterize the attribute.

Emissivity, also called 'thermal emittance', or is defined as the ability of a body to release heat. Similar to solar reflectance, thermal emittance is measured on a scale from zero to one, with a higher value implying a larger release of absorbed energy. However, materials exhibiting low emissivity can still remain relatively cool in sunlight if their solar reflectance is exceptionally high.

The solar reflectance index is essentially a combination of the two above characteristics. It is defined by the Cool Roof Rating Council (CRRC), and is calculated as 'the ratio of the reflected flux to the incident flux.' Essentially, it is the ability of a material to reject solar energy, and is expressed on a scale from 0 to 100.

REFERENCES & FURTHER INFORMATION

Intergovernmental Panel on Climate Change, Land-Surface Air Temperature
http://www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg1/052.htm#2221

Lawrence Berkeley National Laboratory, Heat Island Group
http://heatisland.lbl.gov/

LEED (2009),'LEED Reference Guide for Green Building Design and Construction', U.S. Green Building Council.
http://www.usgbc.org/DisplayPage.aspx?CategoryID=19

U.S. Environmental Protection Agency (2009), Heat Island Effect
http://www.epa.gov/heatisld/

Cool Roofs
http://www.coolroofs.org

ENERGY STAR® Roofing Products
http://www.energystar.gov

LBNL SRI Calculator
http://coolcolors.lbl.gov/assets/docs/SRI%20Calculator/SRI-calc10.xls

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Eco-6 Outdoor Communal Facilities

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise designs which enable residents to engage in a broad range of outdoor activities in common areas.

CREDIT CRITERIA

Up to two points are awarded where:

- The project includes qualifying communal facilities (as listed below), within the project site, awarded as follows:
  - Three facilities for one point;
    OR
  - Six facilities for two points;

  AND
- A minimum of 25% of the development footprint is communal space within which the communal facilities are provided.

Qualifying communal facilities are as follows:

Garden waste composting facility

One cubic ($1m^3$) metre of composting bins for every $500m^2$ of landscaped area (including garden plots and lawns), with a minimum overall composting volume of one cubic metre ($1m^3$) for the development. Refer to Additional Guidance for further details.

Communal or individual garden plot(s)

Residents must have unimpeded physical access to and from the plot(s). Sufficient plot(s) to allow for at least 25% of the occupants to be allocated an individual plot that has a minimum area of $2m^2$. Plots must be conveniently located. Refer to Additional Guidance for further details.

Playground(s)

One playground to be provided for every 200 occupants that is sufficiently large to allow play by groups of at least 20 children and include play and climbing apparatus. Refer to Additional Guidance for further details.

Open active play area(s)

Areas for active play should be a minimum of $200m^2$ or 25% of the building footprint, whichever is the greater. Refer to Additional Guidance for further details.

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Eco-6 Outdoor Communal Facilities

POINTS AVAILABLE 2

Outdoor exercise station(s)

Must include as a minimum three separate equipment items for exercise. Refer to Additional Guidance for further details.

Outdoor swimming pool

Provide an outdoor swimming pool in a communal location accessible to all residents. Refer to Additional Guidance for further details.

Contemplative seating

Provide at least two different quiet contemplative seating areas with views of landscaping or natural vegetation, sized to accommodate 5% of occupants. Refer to Additional Guidance for further details.

Braai & outdoor dining facility

Provide designated outdoor braai and dining area(s) that accommodate six people or 10% of the occupants, whichever is greater. Refer to Additional Guidance for further details.

Car wash facility

Provided in a convenient location and accessible by all occupants. Refer to Additional Guidance for further details.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
1. Short Report 2. Extract(s) from tender documentation 3. Tender drawing(s)	1. Short Report 2. As Built drawing(s) 3. Statement of confirmation

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

- Nominating the number of occupants catered for by the development as per the 'Building Input' page of the rating tool spreadsheet;
- Demonstrating, via calculations, that 25% or more of the development footprint is communal space within which the communal facilities are provided;

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Eco-6 Outdoor Communal Facilities

POINTS AVAILABLE 2

- Listing the each outdoor communal facility claimed and describing how it meets the Credit Criteria, with supporting calculations where necessary;

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the communal facilities as referenced in the short report and appropriate signage (where necessary).

Tender / As Built drawing(s) marked-up to clearly show the location and particulars (e.g. area, seating, shade, signage) for each communal facility (as applicable), and that 25% of the development footprint is communal space within which the communal facilities are provided.

Statement of confirmation from the Management Entity, in the form of signed correspondence confirming the provision of all communal facilities as referenced in the short report.

ADDITIONAL GUIDANCE

Communal facilities can be new (i.e. provided by the project) or incorporate established facilities and amenities provided they meet the Credit Criteria. Communal facilities not within the project site (i.e. community facilities) must not contribute to the Credit Criteria, however these may be claimed under Tra-5 Local Connectivity.

Communal indoor amenities (e.g. indoor pool or gym) provided within the development, accessible to occupants only, must not be claimed within the scope of the Credit Criteria. Such facilities, however, may be claimed in Tra-5 Local Connectivity. The intent of this credit is to promote outdoor facilities.

The outdoor communal facilities can be located either on the ground level or above ground level. Multiple communal areas can contribute to the total required area or capacity (e.g. seating in multiple locations).

Pathways leading to and from the various outdoor communal facilities may be included in the calculation of the minimum 25% of the total development footprint to be developed as outdoor communal facilities. Driveways leading to and from buildings and other types of facilities must not be included. For the purpose of calculations, the number occupants assumed must be that indicated on the 'Building Input' page of the Green Star SA Multi Unit Residential rating tool.

Garden waste composting facilities

All compost facility designs should separate leachate from stormwater, where located on hardscape. Signage must be provided explaining the communal nature of the facility, and how to use and maintain it appropriately, which must be reflected in the tender documentation.

Communal or individual garden plot(s)

The garden plots must be conveniently located, within unimpeded access. It must be evident that the plots are allocated for the use of occupants for gardening purposes (i.e. growing vegetables or herbs, flowers etc.). Multiple plots or a single plot may be provided, provided the minimum area requirement is met.

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Eco-6 Outdoor Communal Facilities

POINTS AVAILABLE 2

Playground(s)

Play and climbing apparatus include such items as swings, jungle gyms, slides, balance beams, ropes, "foofy" slides, etc. Playground areas are to be exclusively for play, and may need to be designed accordingly or be fenced off. The playgrounds must be designed to accommodate children aged 1-12 and ensure the safety of children in the event of a fall. Playgrounds should comply with '*SANS 51176 SERIES: Playground equipment and surfacing*'.

Open active play area(s)

Includes open areas for group and/or individual play such as running, jumping, chasing, ball games, sporting activities, and areas for wheeled toys such as bike pathways. Areas for active play should be a minimum of 200m^2 or 25% of the building footprint, whichever is the greater. This may include lawn areas or hardscape areas (e.g. tennis courts or basketball hoops etc).

Outdoor exercise station(s)

An outdoor exercise station provides apparatus (usually simple in nature) to facilitate exercise mainly for use by adults. Some examples would be, but not limited to, bars for pull-ups, varying height steps for jumps, and toe-restraints for sit-ups. Apparatus may be located along a running path or trail as 'exercise stops.' Instructions must be signposted for all of the exercise facilities.

Outdoor swimming pool

Must be outdoor, and must comply with all applicable standards and legislations with regards to public pool safety and be signposted accordingly.

Contemplative seating

Areas chosen for seating should enable quiet contemplation. Quiet areas are defined as locations which are a minimum of 25 meters away from roads, driveways etc., and which are a minimum of 10m away from other sources of noise such as laundries etc. This seating does not contribute to the requirements of the outdoor dining or braai areas.

Braai & outdoor dining facility

The braai and outdoor dining facility must provide a seat and table space per each person accommodated. The braai must be capable of safely containing a fire source. Lighting must include, but not limited to, at least one light fixture for general area illumination. Signage must be provided explaining the communal nature of the facility, and how to use and maintain it appropriately.

Car wash facilities

The facility must be located in a communal area where it can be conveniently accessed by all occupants, provided with a tap and hose, and is either;

- A hardscape area provided with a sediment trap, is drained to sewer, and is appropriately covered and graded to avoid ingress of stormwater.

  OR

- A vegetated landscape area specifically intended to be accessible by vehicles for this purpose with hardscape provided for a standard vehicle track.

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Eco-6 Outdoor Communal Facilities

POINTS AVAILABLE 2

BACKGROUND

Sustainable communities are places that people like living in, and want to stay in. They are neighbourhoods with real character and a sense of place (CABE Space, 2005).

The underlying premise of a multi unit residential project is that it creates the physical setting for families to make homes and build sustainable communities. The measure of the project's sustainability must then include the success of the project to make people feel at home and part of a community.

There is a growing body of evidence that demonstrates how communal green spaces can offer lasting economic, social, cultural and environmental benefits. These benefits include increasing the value of homes; improving the image of an area and attracting investment; contributing to the protection of biodiversity; and promoting exercise and other activities beneficial to the health of residents (CABE Space, 2005). Outdoor communal facilities are not only a good way to use the available space in a residential development in the most efficient way, but can contribute significantly to the wellbeing, and sense of community experienced by residents.

In 2004, the Commission for Architecture and the Built Environment (CABE) Space published 'The Value of Public Space', a collation of research that highlighted a wide range of benefits that outdoor communal facilities can offer. The contributions included:

- A Merseyside study that showed how the presence of trees and green spaces can make places pleasantly cooler in summer and reduce surface water run-off;
- Findings showing that community gardens and urban farms increase social inclusion by providing opportunities for interaction;
- Conclusions suggesting that providing multiple types of outdoor facilities can help to stimulate different kinds of activity in the shared space throughout the day. For example, it is important to provide many different activity zones within parks for both active and passive uses, in order to encourage use by as diverse a range of people as possible; and
- Work highlighting the importance of providing homes with access to high-quality private spaces as well as public spaces. In areas of high density development, semi-private communal spaces should also be considered (CABE Space, 2005).

Design plays a large part in whether a space feels private, communal or public. The distinction between public and private can be indicated by boundaries, such as fences and walls; planting, such as hedges or trees; water features; changes in surface treatment; planting; or the design and orientation of buildings (CABE Space, 2005).

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Eco-6 Outdoor Communal Facilities

POINTS AVAILABLE 2

REFERENCES & FURTHER INFORMATION

Commission for Architecture and the Built Environment (CABE) Space (2005), 'Start with the park', England.
http://www.cabe.org.uk

Woolley, H. and Rose, S. (2004), 'The Value of Public Space: How High Quality Parks and Public Spaces Create Economic, Social and Environmental Value', Commission for Architecture and the Built Environment (CABE) Space.
http://www.cabe.org.uk/default.aspx?contentitemid=475.

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Eco-7 Urban Consolidation

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise designs which make use of compact development patterns to increase land utilisation efficiency.

CREDIT CRITERIA

One point is awarded where:

- The development achieves no less than the benchmark net dwelling unit density as stipulated in Table Eco-7.1.

  AND

- The development has achieved building plan approval from the relevant local planning authority.

The net dwelling unit density is calculated using the Green Star SA 'Net Density Calculator'.

Where the development site is outside a municipally approved urban edge, or where no urban edge is defined, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Land Use & Ecology score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure that it readily confirms compliance. 1. Short report 2. Calculator extract 3. Plan approval documentation Where credit claimed 'Not Applicable': 4. Short report	Submit all the evidence and ensure that it readily confirms compliance. 1. Short report 2. Calculator extract 3. Plan approval documentation Where credit claimed 'Not Applicable': 4. Short report

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Eco-7 Urban Consolidation

POINTS AVAILABLE 1

Short report prepared by a relevant project team member, describing how the Credit Criteria have been met by confirming:

- The development's storeys and (where applicable) the calculations used to derive the area-weighted average storey; and,
- The development's nominated site area, clearly identifying the inclusion or exclusion of areas of the site (where applicable), with reference to 'Site documentation' provided in the 'General' section of the submission.

Where credit claimed 'Not Applicable':

- Justification, with reference to supporting evidence, that the development site is located outside a municipally approved urban edge, or that no urban edge is defined.

Calculator extract from the Green Star SA Multi Unit Residential v1 Net Density Calculator, demonstrating the inputs used and the net density of the development.

Plan approval documentation from the relevant local planning authority clearly demonstrating that the design has been granted planning approval, in the form of (both);

- The relevant local planning authority approval letter;

  AND

- Drawing(s) indicating the number of dwellings and clearly stamped as 'Approved' by the relevant local planning authority.

ADDITIONAL GUIDANCE

Although there are various measures for densification, for the purposes of Green Star SA, the measure of net dwelling unit density is adopted as it better relates to the density of specific multi unit residential developments, as opposed to gross dwelling unit density which is applicable for neighbourhoods, suburbs or districts.

The definition of 'net dwelling unit density' is the total number of dwelling units per hectare of nominated site area:

$$Net\ Dwelling\ Unit\ Density = \frac{Total\ Dwelling\ Units\ (du)}{Nominated\ Site\ Area\ (ha)}$$

The 'Nominated Site Area' is the private erf area (defined for the purpose of Green Star SA) less the area of public streets and public rights of way. The nominated site area must include all landscape (i.e. hardscape and softscape). Public streets are those accessed by all members of the public and maintained by the municipality. Private streets (i.e. those used by

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occupants and invited visitors only, and maintained by the body corporate, home owners association or management entity) must be included in the nominated site area.

Any area of the site where development is prohibited as mandated by a requirement of the Relevant Planning Authority, or any Provincial or National legislation, such as areas of high ecological or social/historical value (e.g. sensitive biodiversity areas, archaeological ruins, culturally important structures etc.), should be excluded from the calculation of 'Nominated Site Area'.

For developments where the site area is outside a municipally approved urban edge, or where no urban edge is defined, and the credit is claimed as 'Not Applicable', the supporting documentation as referenced in the short report must satisfy the Assessors that the approval of 'Not Applicable' is warranted.

The net dwelling unit density benchmark applicable to a particular development is based upon the total number of storeys of the development.

Within the 'Net Density Calculator', project teams must select the number of storeys of the development, reflecting that of the design approved by the relevant local planning authority.

The net dwelling unit density benchmarks are provided in Table Eco-7.1.

Storeys	Minimum net du/ha
1	35
2	57
3	78
4	100
5	125
6	150
7	175
8	200
9	225
10	250
11	275
12	300
13	325
14	350
≥ 15	375

Table Eco-7.1 *Net dwelling density benchmarks*

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Eco-7 Urban Consolidation

POINTS AVAILABLE 1

For the purposes of Green Star SA, a development's total storeys are defined as all storeys that are:

- Above ground only (below ground gross floor area is not to be included);
- Inclusive, in part or in full, of residential gross floor area; and,
- Inclusive, in part or in full, of any ancillary gross floor area which serves the residential dwelling units (e.g. car parking, storage, plant area, etc.).

Storeys which include gross floor area for non-residential space types (e.g. office, retail, etc.) are to be excluded for the purpose of this credit.

Where a development consists of multiple individual buildings, each with a different number of storeys, an area-weighted average may be used in the 'Net Density Calculator', rounded down to the nearest whole storey. For projects where this scenario is applicable, it is required that the calculations are provided within the short report.

BACKGROUND

Urban form influences the ways cities function and can create or mitigate social, economic or environmental problems.

The growth of cities within the 20th century, particularly within South Africa, North America and Australasia, has been characterised by low density urban sprawl; individual detached dwellings on large blocks, supported by the automobile and vast networks of roads and freeways. The historical key drivers of urban sprawl have been abundant oil at low prices, population and economic growth, increases in income and living standards, availability of land and generational changes in housing preference.

Research completed by the World Bank on 120 cities throughout the world indicates that globally the population density of cities is falling. Although throughout the last two decades urban populations have been increasing at a rate of 1.7% per annum, the urban footprint of cities has been increasing at a rate of 3.3% annually, resulting in an annual decrease in urban population densities of 2.2%.

The extent of urban sprawl against the backdrop of sustainable development deemed necessary to mitigate climate change and other environmental stresses, has raise questions regarding the sustainability of this urban form.

The City of Cape Town (2009) has identified the following challenges posed by urban sprawl to the sustainability of South Africa's Mother City:

- Land of high agricultural value on the urban edge is rapidly being consumed by urban development;
- Valuable biodiversity resources and areas of scenic and amenity value are being threatened;

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Eco-7 Urban Consolidation

POINTS AVAILABLE 1

- Fragmented and dispersed urban activity patterns are resulting in long travel distances and reducing the viability of public transport systems;
- Increased traffic congestion and road-based transport is leading to increases in greenhouse gas emissions and other environmental pollution consequences;
- Sprawl threatens the place-making qualities and urban vibrancy of neighbourhoods, districts and the city as a whole;
- Low-density development increases the cost of infrastructure provision; and,
- The inefficiency caused by urban sprawl has serious economic implications through limiting access to opportunities, causing operational inefficiencies and wastage of supporting economic resources.

As a reaction to urban sprawl, the 'Compact City' model of development has emerged from an appreciation of the older European cities where higher population and employment densities were viewed as having advantages over those low density cities. Although there are several variants of the compact city model, the core theme through all is a consolidation or densification of existing urban areas. This may take the form of;

- Increasing housing densities on the urban fringe and concentrating development around activity centres and major public locations, or improving public transport to development areas; or,
- Promoting urban consolidation (an intensification of development and activity) within the existing metropolitan area to reduce the level of further development on the urban fringe (with limited attention to efficient form or transport issues); or,

Densification and urban consolidation, however, are not 'one size suits all' planning strategies as higher-density developments must not negatively impact on urban environments and must ensure a range of opportunities are provided. In the context of South African cities, three types of generic building forms have been identified as a means of accommodating higher densities (from City of Cape Town, 2009):

- Single detached tower block buildings surrounded by open space;
- A traditional street layout with attached row/terrace housing; and,
- A perimeter block or courtyard building design enclosing and open space.

Densification does not imply high-rise buildings, nor is it the single cause of poor quality living environments or overcrowding, and appropriate incremental densification does not necessarily lead to loss of area or neighbourhood character.

Densification can be achieved by low-rise flats, second dwellings, town house/group housing schemes, subdivisions and erf consolidations with redevelopment at higher densities. There are many established suburbs within South African cities that already achieve higher densities with diversity of residential erf sizes and housing types.

Table Eco-7.2 (over page) provides an overview of some dwelling unit densities for a range of specific multi unit residential developments and suburbs within South Africa and comparisons to international examples.

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Location	Approximate Density (du/ha)
Sea Point (Cape Town)	58.7 (gross)
Durbanville	3.9 (gross)
Average informal settlement	100 (gross)
Springfield Terrace, Woodstock (3 storeys)	166 (net)
Forty on Oak, Melrose Arch (5 storeys)	129 (net)
Rustenberg Square, Rondebosch (4-5 storeys)	107 (net)
CoCoon Eco Lofts, Cape Town (3 storeys)	91 (net)
Eccleston/Warwick Squares, London	125 – 200 (net)
Old quarter, Amsterdam	75 – 100 (net)
Historic centre, Berne	100 – 200 (net)
Mykonos, Greece	200 (net)

Table Eco-7.2 *Local and international examples of net densities (adapted from City of Cape Town, 2009)*

REFERENCES & FURTHER INFORMATION

City of Cape Town (2009),'Cape Town Densification Strategy Technical Report – Draft 1', Spatial Planning and Urban Design Department, City of Cape Town.
http://www.capetown.gov.za/en/sdf/Documents/Densification_Strategy_web.pdf

City of Cape Town (2010),'Cape Town Spatial Development Frame Work Technical Report – Final Draft', Spatial Planning and Urban Design Department, City of Cape Town.
http://www.capetown.gov.za/en/Water/WaterservicesDevPlan/Documents/WSDP_2011_2012/Full_SDF_Technical_Report_2010_ss.pdf

Department of Transport (2009),'Macro-Urban Form, Transport Energy Use and Greenhouse Gas Emissions: An Investigation for Melbourne', Victorian Government, Australia.
http://www.transport.vic.gov.au/__data/assets/pdf_file/0016/31345/MacroUrbanFormReport_2009.pdf

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Emissions

The credits in the Emissions Category target the environmental impacts of a development's emissions or substances emitted from the site (excluding greenhouse gas emissions which are dealt with in the Energy category). The Green Star SA rating tools target emissions including and relating to watercourse pollution, light pollution, ozone depletion and sewerage.

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

Light travelling up into the night sky 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 the manufacture of insulation materials, deplete the ozone layer when emitted to atmosphere[16]. Long-term damage to the Earth's stratospheric ozone layer will expose living organisms to harmful radiation from the sun.

[16] *Chlorofluorocarbons, Ozone Hole Watch, http://www.nas.nasa.gov/About/Education/Ozone/cfc.html*

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Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise the selection of refrigerants and other gases which do not contribute to long-term damage to the Earth's stratospheric ozone layer.

CREDIT CRITERIA

One point is awarded where:

- For qualifying equipment provided, all refrigerants/gases have an Ozone Depletion Potential (ODP) of zero;

  OR

- No qualifying equipment is provided.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms.
1. Short report 2. Extract(s) from tender documentation Additionally where refrigerants/gases are specified: 3. Evidence of properties Where no qualifying equipment provided: 4. Short report	1. Short report 2. Extract(s) from Commissioning Report(s) 3. Manufacturer product datasheet(s) 4. Evidence of properties Where no qualifying equipment provided: 5. Short report

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

- Providing a tabulated summary of each qualifying equipment within the development, and the type and mass of refrigerant/gas charge in each;
- Confirming that all refrigerants/gases have an ODP of zero.

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Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

Where no qualifying equipment provided:

- Confirming that no qualifying equipment is provided, with details of the alternative equipment (where applicable);

Extract(s) from tender documentation clearly demonstrating the contractual requirement for any qualifying equipment provided to only contain refrigerant/gas with an ODP of zero.

Evidence of properties of the refrigerant/gas clearly demonstrating for each refrigerant/gas referenced in the short report, the generally accepted ODP as published within reputable sources (see References).

Extract(s) from Commissioning Report(s) demonstrating that qualifying equipment has been installed, commissioned and operate as intended by the design.

Manufacture product datasheet(s for each qualifying equipment as referenced in the short report, clearly identifying the equipment, the type and mass of refrigerant/gas charge.

ADDITIONAL GUIDANCE

For the purposes of the Emi-1 credit, qualifying equipment is considered as refrigerant-based refrigeration and heat-pump equipment, and gaseous fire suppression equipment provided within the scope of the main contract of the development, and includes, but is not limited to;

- Air conditioning equipment (including reverse-cycle heat pumps), unitary or otherwise;
- Heat-pumps for domestic hot water generation;
- Refrigerators and freezers;
- Condensing clothes dryers; and,
- Fire suppression equipment.

Such equipment provided with dwellings or common areas must be included. It must be clear from the documentation that all qualifying equipment has been accounted for, the refrigerant/gas type(s) identified and quantified, and the refrigerants/gases demonstrated as compliant with the Credit Criteria.

Where qualifying equipment is not provided, the short report must describe the alternative equipment provided (e.g. domestic hot water heat-pump is not provided as heating provided by gas boilers), or explain that no alternatives are provided (e.g. dwellings are not provided with heating or cooling, no fire suppression systems).

Hand-held fire extinguishers are excluded from the scope of the Credit Criteria.

For refurbishments and redevelopments, existing equipment which is to be reused must comply with the Credit Criteria.

Table Emi-1.1 (over page) provides ODP for some commonly used gases.

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Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

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
HFC227ea (FM200)	0
IG541	0
CO_2	0
Air	0
Water	0

Table Emi-1.1: *ODP of some common refrigerants and 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 within qualifying equipment.

BACKGROUND

Building services have an impact on the amount of damage done to the ozone layer from Chlorofluorocarbons (CFCs) and Hydrochloroflourocarbons (HCFCs). These substances are used as refrigerants and 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

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Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

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.
BS EN378-1:2000 Refrigerating systems and heat pumps – Safety and environmental requirements – Part 1: Basic requirements, definitions, classification and selection criteria, BSI, 2000.

Institute of Refrigeration
http:www.ior.org.uk

F-gas regulations
http://ww2.defra.gov.uk/environment/quality/air/fgas/

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH) (2003), Refrigerant Selection Guide 2003. Melbourne.
http://www.airah.org.au

United Nations Environmental Program, Ozone Secretariat.
www.unep.org/ozone

US Environmental Protection Agency
http://www.epa.gov/ozone/

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Emi-2 Refrigerant GWP

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise the selection of refrigerants which have reduced contribution to climate change from the release of refrigerants to the atmosphere.

CREDIT CRITERIA

Up to two points are awarded where:

- The minimum percentage (by mass) of the total refrigerant charge of qualifying equipment that have a Global Warming Potential (GWP100) of 10 or less, is awarded as follows;
  - 50% (by mass) for one point;
    OR
  - 100% (by mass) for two points

  OR
- Two points are awarded where no refrigerants are used at all.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation Additionally where refrigerants specified: 3. Evidence of properties	1. Short report 2. Extract(s) from Commissioning Report(s) 3. Manufacturer product datasheet(s) 4. Evidence of properties

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

- Providing a tabulated summary of the qualifying equipment within the development, and the type and mass of refrigerant charge in each;
- Confirming that all refrigerant(s) have an GWP 10 or less;

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Emi-2 Refrigerant GWP

POINTS AVAILABLE 2

- Demonstrating through calculations that the applicable Credit Criteria is met.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for any qualifying equipment provided to only contain refrigerant with a GWP of 10 or less.

Evidence of properties of refrigerant clearly demonstrating for each refrigerant referenced in the short report, the generally accepted GWP (100 year) as published within reputable sources (see References).

Extract(s) from Commissioning Report(s) demonstrating that qualifying equipment has been installed, commissioned and operate as intended by the design.

Manufacture product datasheet(s for each qualifying equipment as referenced in the short report, clearly identifying the equipment, the type and mass of refrigerant charge.

ADDITIONAL GUIDANCE

For the purposes of the Emi-2 credit, qualifying equipment is considered as refrigerant-based refrigeration and heat-pump equipment provided within the scope of the main contract of the development, and includes, but is not limited to;

- Air conditioning equipment (including reverse-cycle heat pumps), unitary or otherwise;
- Heat-pumps for domestic hot water generation;
- Refrigerators and freezers; and
- Condensing clothes dryers.

Such equipment provided with dwellings or common areas must be included. It must be clear from the documentation that all qualifying equipment has been accounted for, the refrigerant type(s) identified and quantified, and the refrigerants demonstrated as compliant with the Credit Criteria.

Where qualifying equipment is not provided, the short report must describe the alternative equipment provided (e.g. domestic hot water heat-pump is not provided as heating provided by gas boilers), or explain that no alternatives are provided (e.g. dwellings are not provided with heating or cooling).

For refurbishments and redevelopments, existing equipment which is to be reused must comply with the Credit Criteria.

Table Emi-2.1 provides GWP100 for some commonly used gases.

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Emi-2 Refrigerant GWP

POINTS AVAILABLE 2

Refrigerant/Gas	Global Warming Potential (GWP100)
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
IG541	0
CO_2	1
Air	0
Water	<1

***Table Emi-2.1**: Global Warming Potential of some common refrigerants and gases*

The 100-year Global Warming Potential is considered for the purpose of the Green Star SA – Multi Unit Residential 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).

BACKGROUND

The use of Chlorofluorocarbons (CFCs) and Hydrochloroflourocarbons (HCFCs) as refrigerants has been addressed under the International Montreal Protocol, and subsequent phase-out programs have resulted in the removal of these substances from the market. However, the replacements currently favoured by the industry are Hydrofluorocarbons (HFCs) which have a high global warming potential (GWP).

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Emi-2 Refrigerant GWP

POINTS AVAILABLE 2

The GWP provides a measure of the potential for damage that a chemical has relative to one unit of Carbon Dioxide, the primary greenhouse gas. Figures in excess of 3000 times are not uncommon amongst some refrigerants currently specified. Their long half-life is a major contributory factor in this.

Hydrocarbons and ammonia-based refrigerants have low or zero GWP. As such they are preferable long-term options. These refrigerants are gradually becoming available and are valid alternatives to HFCs.

Note that if using Ammonia refrigerant, a Health & Safety risk assessment must be carried out since it is corrosive and hazardous if released in large quantities. However, due to its pungent smell, leaks are normally detected before they reach hazardous concentrations.

REFERENCES & FURTHER INFORMATION

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

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Emi-4 Insulant ODP

POINTS 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 composition of all insulation materials in the development.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation	1. Short report 2. Statement of confirmation Where insulants manufactured with blowing agents used: 3. Manufacturer product datasheet(s)

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

- Listing all insulation applications proposed within the development, confirming for each application that the Credit Criteria is met with reference to the supporting documentation;

  OR

- Confirming that no insulation material is proposed within the development.

Extract(s) from tender documentation where the requirements for insulants are stipulated, clearly demonstrating the requirement for all insulants to not contain in either manufacture or composition, ozone-depleting substances.

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Emi-4 Insulant ODP

POINTS AVAILABLE 1

Manufacturer product datasheet(s) for each applicable (i.e. non-woven insulation) product referenced in the short report, clearly demonstrating that the product is free of ozone-depleting substances in both manufacture and composition.

Statement of confirmation from the Contractor, in the form of signed correspondence, confirming that application of all insulants as referenced in the short report and that the Credit Compliance is met.

ADDITIONAL GUIDANCE

The scope of the Credit Criteria addresses insulants manufactured using blowing agents only (e.g. rigid polystyrene, rigid polyurethane, polyolefins etc.).

Fibre-based woven insulation products (e.g. glass fibre, mineral wool, polyester etc.) and foil insulation are not within the scope of the Credit Criteria as these products are not manufactured using blowing agents. As such, manufacturer product datasheets are not required for fibre-based woven insulation nor foil insulation products.

Common applications of applicable insulation include, but are not limited to;

- Thermal insulation;
    - Chilled/hot water pipework;
    - Refrigerant pipework;
    - Ductwork;
    - Thermal storage vessels;
    - Fabric applications (walls, roofs, floors);
- Acoustic insulation.

Electrical conductivity insulation (e.g. wire or cable sheathing) is also excluded from the scope of the Credit Criteria.

All common applications of insulation should be nominated within the short report and the type of insulation used nominated.

The tender documentation must clearly stipulate all insulation to be free of ozone-depleting substances in both manufacture and composition.

BACKGROUND

Some 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.

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Emi-4 Insulant ODP

POINTS AVAILABLE 1

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.bre.co.uk/greenguide/podpage.jsp?id=2126

United Nations Environmental Program, Ozone Secretariat.
http://new.unep.org/Ozone/Treaties_and_Ratification/index.asp

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Emi-5 Watercourse Pollution

POINTS AVAILABLE 4

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 four points are awarded independently as follows:

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 reused on-site or infiltrated within the site;

  AND

- Litter is to be prevented from entering the stormwater system.

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 is to be prevented from entering the stormwater system.

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 is to be prevented from entering the stormwater system.

One point is awarded where:

- A dedicated vehicle wash-down area is provided;

  AND

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Emi-5 Watercourse Pollution

POINTS AVAILABLE 4

- Is provided with a tap and hose, and is either;
  - A hardscape area provided with a sediment trap, is drained to sewer, and is appropriately covered and graded to avoid ingress of stormwater.
    OR
  - A vegetated landscape area specifically intended to be accessible by vehicles for this purpose with hardscape provided for a standard vehicle track.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Tender drawing(s) 3. Extract(s) from tender documentation 4. Maintenance Plan(s)	1. Short report 2. As Built drawing(s) 3. Maintenance Plan(s) 4. Extract(s) from Rules

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

Where first point is claimed:

- Providing calculations to 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 prevent litter entering the stormwater system; and,
- Describing the on-going maintenance for the infiltration facility, with reference to the 'Maintenance Plan'.

Where 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;

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Emi-5 Watercourse Pollution

POINTS AVAILABLE 4

- 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 prevent litter entering the stormwater system; and,
- Describing the on-going maintenance for the attenuation and treatment facilities, with reference to the 'Maintenance Plan'.

Where third 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 prevent litter entering the stormwater system; and,
- Describing the on-going maintenance for the attenuation facility, with reference to the 'Maintenance Plan'.

Where fourth point is claimed:

- Describing the location and provisions of the vehicle wash-down area;

Tender / As Built drawing(s) clearly demonstrating the stormwater systems included in the project design, including all landscaping stormwater mitigation initiatives, and/or the vehicle wash-down area.

Extract(s) from tender documentation where requirements for control and treatment of stormwater and/or vehicle wash-down discharge (where applicable) are stipulated.

Maintenance Plan(s) clearly describing the on-going maintenance requirements of the applicable infiltration, attenuation and/or treatment systems.

Extract(s) of 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.

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Emi-5 Watercourse Pollution

POINTS AVAILABLE 4

ADDITIONAL GUIDANCE

Although the first 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. For example, where the first and second points are claimed, the design runoff volume may be subtracted from the design water quality volume used to size the TSS treatment system in the second point.

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.). 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

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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."

Vehicle wash-down areas

It must be evident that a vehicle wash-down area is provided and that it is designed such that in avoids the ingress of both sediments and stormwater into the sewer system or it is specifically intended to be accessible by vehicles (i.e. not required to 'jump' a curb) and that hardscape is provided for the vehicle tracks. In the scenario where a vegetated area is provided, it is not required to provide stormwater ingress protection nor sediment trap and sewer discharge.

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*N (e.g. 3 x 5 = 15)*

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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 on the next page.

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
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

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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. 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 on-going 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.

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- **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

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.

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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;

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- **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;
- **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 aide 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

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http://www.deq.idaho.gov

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http://portal.ncdenr.org/web/wq

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http://www.sabs.co.za

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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.csir.co.za/Built_environment/RedBook/**

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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/

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Emi-6 Discharge to Sewer

POINTS 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 development's outflow to the municipal sewerage system has been reduced against an average-practice benchmark, by a minimum percentage, as determined by the Green Star SA Sewerage Calculator, awarded as follows:
  - 30% for one point;
  - 50% for two points;
  - 70% for three points;
  - 90% for four points.

An additional point is awarded where:

- At least one point above is achieved;

  AND

- Where blackwater treatment system(s) installed:
  - A Blackwater Treatment Maintenance Plan has been prepared;

    AND
  - A maintenance contract has been entered into for a minimum of five years to ensure that the blackwater treatment system(s) operate as intended by the design.

Where no blackwater treatment system(s) installed, the additional point is 'Not Applicable' and is excluded from the points available, used to calculate the Emissions Category score.

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Emi-6 Discharge to Sewer

POINTS AVAILABLE 5

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	Green Star SA – Multi Unit Residential As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Calculator extract Additionally where additional point claimed: 2. Blackwater Treatment Maintenance Plan	1. Calculator extract Additionally where additional point claimed: 2. Blackwater Treatment Maintenance Plan 3. Extract(s) of Maintenance Contract

Calculator extract from the Green Star SA Multi Unit Residential v1 Sewage Calculator, completed in accordance with the Potable Water & Sewerage Calculators Guide, clearly demonstrating the calculator results.

Blackwater Treatment Maintenance Plan clearly demonstrating a robust maintenance plan and in accordance with the Additional Guidance.

Extract(s) of Maintenance Contract for the blackwater treatment system, where it is clearly demonstrated:

- Which parties are responsible for the maintenance;
- That the contract is for a minimum of five years after commissioning; and
- That the maintenance must be completed in accordance with the Blackwater Treatment Maintenance Plan.

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 rainwater, greywater 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.

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Emi-6 Discharge to Sewer

POINTS AVAILABLE 5

The number of points achieved is determined by the Sewage Calculator from the information entered in the Potable Water 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. The Potable Water Calculator must be used in accordance with the Potable Water and Sewage Calculators Guide. All teams claiming this credit are required to comply with the requirements outlined in this guide.

All inputs into the Sewerage Calculator must be referenced consistently throughout the rest of the submission (i.e. in Wat-1 'Occupant Amenity Water') and be clearly justified by the documented design or by the as built documentation.

Blackwater Treatment Maintenance Plan

The blackwater treatment maintenance plan must include, at a minimum, the following:

- 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 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.

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

Department of Environmental Affairs
http://www.environment.gov.za/

South Africa Department of Water Affairs & Forestry
http://www.dwaf.gov.za

© Green Building Council of South Africa

Emi-7 Light Pollution

POINTS AVAILABLE 1

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 external lighting within the development , is directed at any point in the sky hemisphere without falling directly onto a non-transparent surface;

  AND

- 95% of outdoor spaces do not exceed the minimum requirements of CIBSE Lighting Guide: 1992, The Outdoor Environment for maintained illuminance levels;

OR

- No external lighting (private dwelling or common property) is provided;

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s)	1. Short report 2. Manufacturer product datasheet(s) 3. As built drawing(s)

Short report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Detailing the external lighting on the site and the areas illuminated;
- Calculations and illumination diagrams (including horizontal and vertical light distribution) to demonstrate that no light spill is impacting the night sky or neighbouring properties.
- For any façade lighting, a calculating to show that the building Luminance meets the requirements above;

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- Confirming that 95% of areas do not exceed the minimum requirements given in CIBSE LG6.

Where no external lighting provided:

- Confirmation that no external lighting is provided.

Extract(s) from tender documentation where external lighting and its design requirement(s) are identified, nominating the type, lighting distribution and quantity of each luminaire.

Tender / As Built drawing(s) marked-up to clearly show;

- The location and type of all external luminaires; and
- The area(s) that do not exceed the minimum requirements of CIBSE LG6 for illuminance levels.

Manufacturer product datasheet(s) for all relevant luminaires indicating light output levels and light distribution diagram.

ADDITIONAL GUIDANCE

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.

The following figures diagrammatically explain the concept of avoiding direct light beam escape from luminaires/fittings.

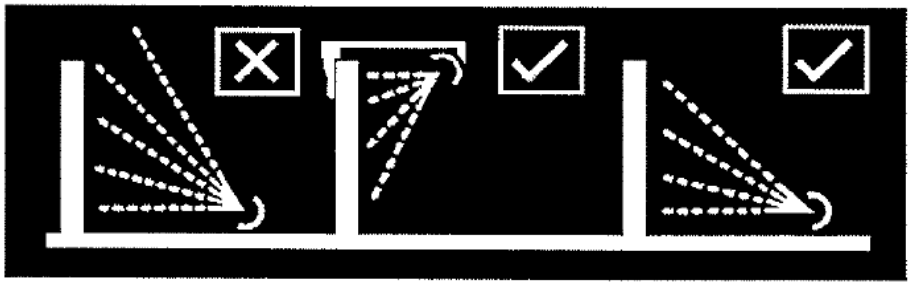

Figure Emi-7.1 *Illustration of acceptable and unacceptable external lighting to achieve this credit (from Institute of Lighting Engineers, 2005)*

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Emi-7 Light Pollution

POINTS AVAILABLE 1

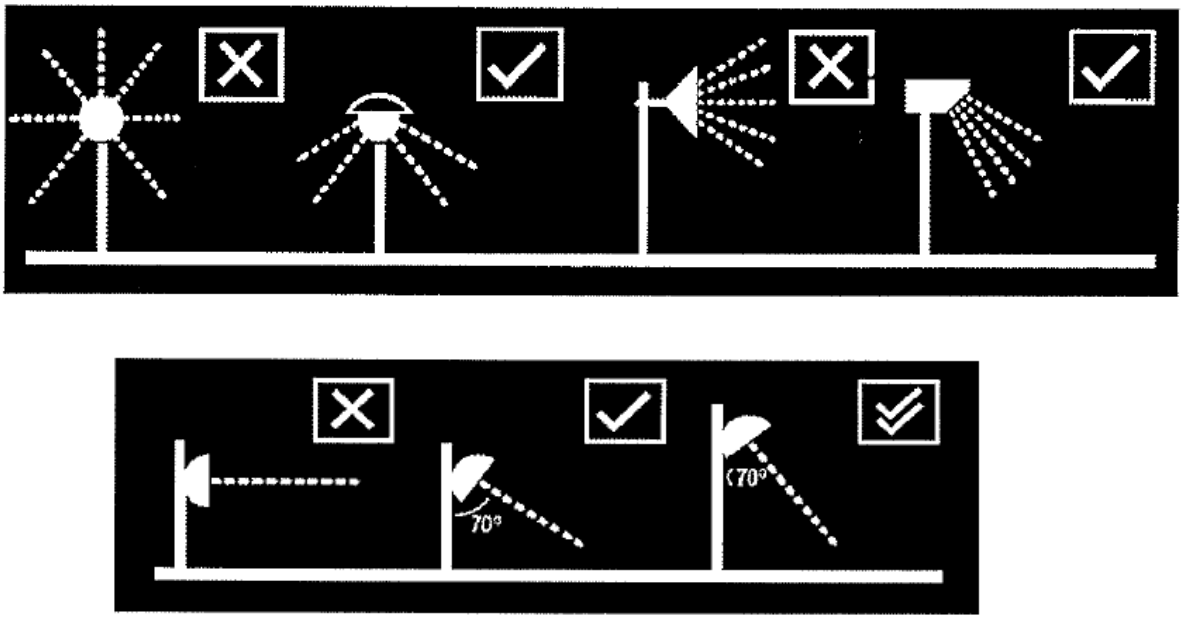

Figure Emi-7.2 *Illustrations of acceptable and unacceptable column lighting to achieve this credit (from Institute of Lighting Engineers, 2005)*

Light fittings that have an opaque canopy or polished asymmetrical reflectors will meet the requirements for the awarding of this credit.

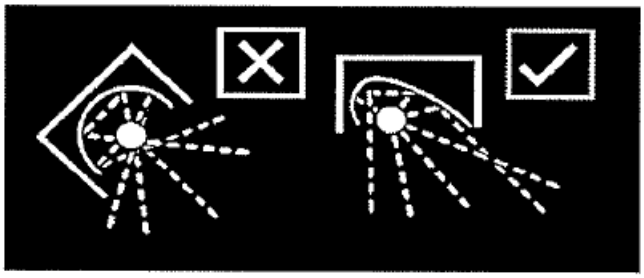

Figure Emi-7.3 *Symmetrical and asymmetrical reflectors (from Institute of Lighting Engineers, 2005)*

Reflectors for light fittings directed downwards should also be in accordance with the following diagram, where no direct light beam is permitted upwards above the horizontal plane of the light fitting:

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Emi-7 Light Pollution

POINTS AVAILABLE 1

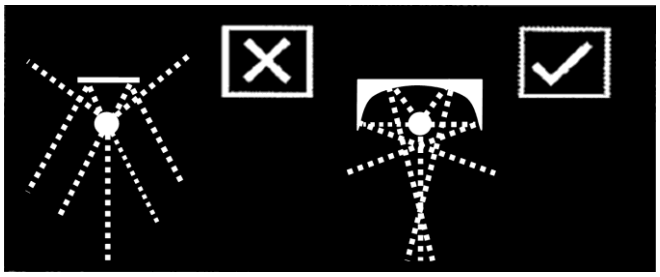

Figure Emi-7.4 *Downward facing reflectors (diagram prepared by the GBCSA)*

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.

REFERENCES & FURTHER INFORMATION

GN01 Guidance Notes for the Reduction of Obtrusive Light, 2005
Institution of Lighting Engineers
http://www.ile.org.uk

CIBSE Lighting Guide 6: 1992, The Outdoor Environment
Chartered Institute for Building Service Engineers
http://www.cibse.org

Fatal Light Awareness Program
http://www.flap.org

Lighting for Exterior Environments, 1999, Illuminating Engineering Society
http://www.iesna.org

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Emi-7 Light Pollution

POINTS AVAILABLE 1

Illuminating Engineering Society of North America
http://www.iesna.org

International Dark-Sky Association
http://www.darksky.org

International Electro technical Commission
IEC 60364-7-714 Edition 1.0 (1996-04): 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
http://www.urbanwildlands.org

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Emi-9 Boiler and Generator Emissions

POINTS 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 boiler(s) greater than 15kW capacity have NOx emissions of less than 100 mg/kWh (at 0% excess O2);

  AND

- All generator(s) comply with one of the following applicable emission standards:
  - Tier 3 Emissions Standards (United States EPA);
    OR
  - Stage IIIA Emissions Standards (European Standard);
    OR
  - TA Luft 2002 (German 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.

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation Where credit claimed 'Not Applicable': 3. Short report	1. Short report 2. Manufacturer product datasheet(s) Where credit claimed 'Not Applicable': 3. Short report

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Emi-9 Boiler and Generator Emissions

POINTS AVAILABLE 1

Short Report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by:

- Detailing each boiler and giving its capacity in kW and the applicable NO_X emission rate in mg/kWh, with reference to supporting documentation (where applicable);
- Detailing each generator and confirming that it meets the Credit Criteria with reference to supporting documentation (where applicable).

Where credit claimed 'Not Applicable':

- Confirming that there are no generators or applicable boilers within the development.

Extract(s) from tender documentation where the requirements for the boilers/generators are specified, clearly demonstrating compliance with the Credit Criteria.

Manufacturer product datasheet(s) for each boiler and generator (as applicable) clearly indicating compliance with the Credit Criteria.

ADDITIONAL GUIDANCE

If a number of different systems are installed on a project, the documentation must account for and describe all systems within the project.

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 development is not served by any boilers or generators.

The emissions must 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 NO_X emission rate must 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).

Boilers - NOX conversion factors:

Manufacturers must be asked to supply dry NO_X emissions data in mg/kWh. Where this is not possible the applicant may use the following conversion factors to convert figures in ppm, mg/m^3 or wet NO_X. It must 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 points achieved. See below for typical conversions;

- Figures in mg/m^3 must 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).

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- Figures in parts per million (ppm) must 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 NO_X values – almost all manufacturers will quote emissions in dry NO_X. However if wet NO_X figures are supplied, these must be converted to dry NO_X. This can be done by multiplying the wet NO_X figure by 1.75.

Excess Oxygen Correction: If a NO_X emission rate is quoted by the manufacturer in mg/m^3 or ppm, then it must 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 NO_X. 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:

% 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 ÷ (20.9 – x)

Where x = % excess O_2 (NOT excess air) and 20.9 is the percentage of O_2 in the air.

Generators

Please refer to the latest tables for emissions requirements from the United States EPA Tier 3 Non-Road Engine Emission Requirements (see references). 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.

The exhaust emissions limits stipulated in TA Luft 2002 meet or exceed the limits prescribed in both EPA Tier 3 and European Stage IIIA. The TA Luft 2002 emission standard, however, permits emission limit concessions to engine/generator systems which are deemed as emergency/back-up or that are used to reduced peak electrical infrastructure load for less than 300 hours per year. In this engine capacity scenario no limits apply to either carbon monoxide (CO) or nitrous oxide (NO_x). For the purposes of Green Star SA, the Project Team must demonstrate the generator(s) compliance with all applicable pollutant (i.e. CO, PM and NOx) emission limits within the TA Luft 2002 emissions standard, irrespective of 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.

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Emi-9 Boiler and Generator Emissions

POINTS AVAILABLE 1

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).

REFERENCES & FURTHER INFORMATION

British Standards EN 297:1994. A1:1995, A2:1996, A3:1996, A5:1998 and A6:2003 Gas fired 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

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Innovation

The Innovation Category is included within the Green Star SA – Multi Unit Residential v1 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 will only be awarded to three projects under the same rating tool (e.g. Multi Unit Residential) 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.

There is a maximum of five points available in total within the Innovation Category. By way of demonstration: It is possible for the same initiative to gain 4 points (a global 'first' innovation, resulting in a restorative environmental impact of greater than 5%) – note this by definition exceeds a current Green Star SA benchmark and hence cannot be outside the scope of the current Green Star SA tool. Thus it is not possible for a single initiative to obtain the full 5 points. It is possible for up to 5 initiatives to each gain a single point, for a total of 5 points within the category. These 5 initiatives could all be for eliminating the negative environmental impact targeted by an existing credit, for example. Combinations of initiatives are welcomed. A maximum of 5 initiatives can be used to claim the innovation credits, and the same initiative can be awarded in both Design and As Built certifications for the same project.

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Inn-1 Innovative Strategies and Technologies

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise pioneering initiatives in sustainable design, process or advocacy.

CREDIT CRITERIA

Up to two points can be awarded for an innovation initiative where:

- The initiative is a technology or process that is considered a 'first' in South Africa or in the World;

OR

- The project substantially contributes to the broader market transformation towards sustainable development in South Africa or in the World.

Points for this credit are allocated as:

- One point is awarded when either of the above is true for the South African market; and
- Two points are awarded when either of the above is true for the Global market

Up to five 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 five (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential 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

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Inn-1 Innovative Strategies and Technologies

POINTS AVAILABLE 2

Short Report which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative;
- Articulating the nature and magnitude of the environmental benefit achieved by the initiative(s);
- Referencing evidence and calculations, wherever appropriate, that support all claims. and
- Including any evidence necessary to demonstrate that the innovation claimed is first in the world or in South Africa (must be in the form of extracts from a peer-reviewed publication or other research acknowledgement).

ADDITIONAL GUIDANCE

Innovation points are reviewed by the Assessors, 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 whenever relevant) the environmental or advocacy benefits of the initiative. Submissions that are purely qualitative or unsupported by documented data will not be awarded Innovation points.

In reviewing the submission, the Assessors and GBCSA will consider the environmental benefit of the innovative initiative relative to existing Green Star SA – Multi Unit Residential credits where relevant.

The metric used to demonstrate environmental benefit must, where possible, be the same as the metrics used in Green Star SA.

Information provided within the Innovation Credit applications may be used by the GBCSA to review the existing credits and/or develop new credits.

BACKGROUND

Compared to peer nations in North America and Europe, less is spent on building research and innovation in South Africa. This credit recognises the value that changes in design and technology can have, in terms of increasing occupant comfort and safety, and consuming fewer resources, and aims to reward organisations that seek to improve the built environment in a unique way.

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Inn-1 Innovative Strategies and Technologies

POINTS AVAILABLE 2

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/

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Inn-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise projects that achieve environmental benefits in excess of the current Green Star SA benchmarks.

CREDIT CRITERIA

Up to two points can be awarded for an innovation initiative 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 restorative environmental impact targeted by an existing credit.

Up to five 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 five (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential 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

Short Report which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative;
- Identifying the credit for which the project claims to exceed the Green Star SA benchmark;
- Substantiating why exceeding the top benchmark has a positive environmental impact;
- Quantifying, consistent with the approach of the credit with the initial benchmark, the margin by which the benchmark is exceeded; and

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- Referencing evidence and calculations, wherever appropriate, that support all claims.

ADDITIONAL GUIDANCE

Innovation points are reviewed by the Assessors, 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 reports must distinctly justify (and quantify whenever relevant) the environmental or advocacy benefits of the initiative. Submissions that are purely qualitative or unsupported by documented data will not be awarded Innovation points.

The metric used to demonstrate environmental benefit must, wherever possible, be the same metric as the one used in the Green Star SA – Multi Unit Residential v1 credit that is being exceeded. For example if the building significantly reduced potable water consumption the metric used would 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 – Multi Unit Residential v1 credits. Category environmental weightings will also be taken into account.

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).

BACKGROUND

The Green Star SA benchmarks were in a large part based on the capacity for a four star Green Star SA certified rating to be achieved by buildings within the top 25% of the industry, based on environmental performance.

The Innovation Credit is therefore designed to encourage and recognise environmental initiatives which go beyond existing benchmarks.

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Inn-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE 2

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/

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Inn-3 Environmental Design Initiatives

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise sustainable building initiatives 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 can be awarded where:

- An initiative in the project viably addresses a valid environmental concern outside of the current scope of this Green Star SA tool.

Up to five 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 five (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Multi Unit Residential Design	**Green Star SA – Multi Unit Residential 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

Short Report which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative and proposed credit;
- Demonstrating that the proposed credit requirements have been met by the project;
- Justifying how this credit would be different to other existing Green Star SA credits, and why it deserves to be included in Green Star SA;
- Articulating the nature and quantifying the environmental benefit achieved by the initiative(s);
- Referencing evidence and calculations, wherever appropriate, that support all claims; and

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Inn-3 Environmental Design Initiatives

POINTS AVAILABLE 1

- 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.

ADDITIONAL GUIDANCE

Innovation points are reviewed by the Assessors, 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 – Multi Unit Residential 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, and why it deserves to be included in Green Star SA. 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;
- Be related to attributes, not operations; and
- Be robust.

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Inn-3 Environmental Design Initiatives

POINTS AVAILABLE 1

BACKGROUND

All Green Star SA rating tools recognise initiatives that have the potential to reduce the environmental impact of the development. Some project initiatives will provide significant environmental benefits that are not currently addressed by Green Star SA – Multi Unit Residential credits. This credit is designed to recognise such innovative initiatives.

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/

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APPENDIX A – Weightings

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.

CATEGORY WEIGHTING

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 South African Office Tool weightings and deliberating on the relative importance of issues in the South African context. The following table summarises the weightings for the South African Office, South African Retail and South African Multi Unit Residential tools.

	Green Star SA – Office v1	**Green Star SA – Retail v1**	**Green Star SA – Multi Unit Residential v1**
Management	9	10	7
Indoor Environment Quality	15	10	14
Energy	25	25	28
Transport	9	12	6
Water	14	15	12
Materials	13	13	17
Land Use & Ecology	7	7	9
Emissions	8	8	7
	100	**100**	**100**

Table App-A.1: *Comparison of Weightings (%) with different Environmental Rating tools*

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