

Green Star SA-Ghana

LOCAL CONTEXT REPORT

Applying Green Star SA in Ghana

Revision 2



One Airport Square, Ghana, Accra – developed by Actis – 4 Star Green Star SA-Ghana – Office v1 rating (first Green Star certified building in Ghana)

Revision 1 (Issued in Nov 2012)

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1. Executive Summary

This report has been produced by the Ghana Green Building Council (GhGBC) and reviewed and approved by the Green Building Council South Africa (GBCSA), with a revision done by the GBCSA (revision 2). It is a local context report that allows for the adoption of the Green Star SA certification scheme in Ghana being certified by the GBCSA in collaboration with the GhGBC. The GBCSA would manage and facilitate the certification through its existing established certification processes, but call the tool Green Star SA-Ghana. The GBCSA will use the opportunity to allow capacity to grow in Ghana, by allowing selected Ghanaian professionals to be trained up as Green Star SA-Ghana assessors (who would join the GBCSA assessor teams on Ghanaian projects). The GBCSA would also deliver the Green Star SA Accredited Professional course in Ghana in collaboration with the GhGBC and allow Ghanaians to take the Green Star SA AP online exam.

This report applies to the Green Star SA – Office v1.1 tool as well as rating tools for Green Star SA - Retail Centre v1, Green Star SA – Multi Unit Residential v1 & Green Star SA - Public & Education Building v1, and considers the applicability of these tool in Ghana. Included in the report is a background analysis of Ghana, as well as a credit by credit analysis. This considers the applicability of each credit to the Ghanaian context.

The original report (revision 1, issued in 2012) covered various changes to the Green Star SA – Office v1 tool to accommodate for the local Ghanaian context – these changes included:

- Reference to the local context – such as Ghanaian rainfall data (Wat-1) and bio regions (Eco-4)
- Adjustment of the environmental weightings – with more focus on water due to the prevalence of hydroelectricity in Ghana
- The addition of a water conditional requirement – for a minimum level of water efficiency
- The inclusion of the private mass transport network in Ghana in Tra-4 Commuting Mass Transport
- Mandatory CIRs by projects for Ene-0 and Eco-0
- An ecologist should be appointed to assist with the development of suitable bio-regions for Eco- 4.
- The PVC credit is proposed to be omitted from the Green Star SA tool used in Ghana.

Revision 2: Summary of Changes made to the Local Context Report Revision 1	
1.	Credits, where relevant and applicable to Ghana, were added to the report for Green Star SA - Retail Centre v1, Green Star SA – Multi Unit Residential & Green Star SA - Public and Education Building v1 tools. (MAN-14: Life Cycle Costing, Public and Education Building tool (PEB), this credit even in South Africa is a stretch and as such the credit is omitted for projects in Ghana, however projects could choose to target the credit under the Innovation category)
2.	Office projects in Ghana now must use the Green Star SA – Office v1.1 as the base reference tool for Office projects in Ghana (i.e. registration under Office v1 is no longer available) – except for Ene-0 and Ene-1, where Ghanaian office projects can still apply the Office v1 Energy Modelling Protocol because it is less stringent than Office v1.1. Refer to the Ene-1 section of this report. Refer to the GBCSA website for a list of changes between Office v1 and Office v1.1 here: https://www.gbcsa.org.za/wp-content/uploads/2013/05/Green-Star-SA-Office-v1.1-summary-of-changes-updated-June-2015.pdf

Where projects wish to apply other standards than those in the Green Star SA tool, a CIR must be submitted to the GBCSA.

The below summary Table 1 indicates the credits which require Credit Interpretation Requests (CIR's), Technical Clarifications (TC's) or adaptations for any projects in Ghana.

CREDIT	REQUIREMENT
IEQ-01: Ventilation Rates	Should the project team wish to use an alternative standard then they should submit a CIR to the GBCSA.
IEQ-3: Carbon Dioxide Monitoring and Control	A CIR should be submitted to the GBCSA should the project team wish to use the CIBSE Guide B2 to assess the natural ventilation design of the building rather than SANS 10400-O.
IEQ-9: Thermal Comfort	Should the project team wish to use an alternative approach then they should submit a CIR to the GBCSA.
IEQ-11: Hazardous Materials	A CIR should be submitted, to be assessed by the GBCSA, should the project team wish to use an alternative set of Occupational Health and Safety (OH+S) regulations.
IEQ-12: Internal Noise Levels	A CIR should be submitted, to be assessed by the GBCSA, should the project team wish to use an alternative set of standards.
IEQ-22: Universal Access - MULTI UNIT RES	Where projects wish to apply other standards than those in the Green Star SA tool (SANS 10400-S), a CIR must be submitted to the GBCSA.

ENE-0 & ENE-1: Conditional Requirement & Greenhouse Gas Emissions	<p>Conditional Requirement, therefore all projects must submit a CIR and receive a final ruling before Round 1 can be submitted to the GBCSA.</p> <p>Changes to the Green Star SA – Office v1 Energy Modelling protocol should be motivated by the registered project via a mandatory CIR.</p> <p>Office v1.1 rating tool be applied to all other credits, calculations and protocols except the Energy modelling protocol for the ENE-0 and ENE-1: Greenhouse Gas Emissions credit, where the Office v1 Energy modelling protocol will be applicable to Ghanaian projects.</p>
ENE-7: Hot Water Energy Use - MULTI UNIT RES	<p>Ene-7 the Green Star SA Multi Unit Residential v1 Hot Water Calculator would need to be adapted to reflect the relevant fuel factors in Ghana.</p> <p>This would be project-specific and a mandatory CIR would need to be submitted to confirm applicability.</p>
TRA-1: Provision of Car Parking	<p>This credit refers to South African Department of Planning guidelines for the minimum and maximum values. Where these are not available, the technical manual refers to a set of alternative compliance requirements.</p>
TRA-4: Commuting Mass Transport	<p>Tra-4 to be kept in its current form, except that projects may use Tro-tro's in place of Taxi's in the calculator</p>
TRA-5: Local Connectivity	<p>A CIR should be submitted, to be assessed by the GBCSA, should the project team wish to use an alternative set of standards to SANS 10246.</p>
WAT-1: Occupant Amenity Water / WAT-1: Potable Water – PEB	<p>The project team should submit rainfall values relevant to their site to the GBCSA such that these values can be entered in the potable water calculator.</p> <p>Due to the shortage of water in Ghana, a new conditional requirement has been incorporated into this category. Project teams must achieve at least 1 point in the potable water calculator in Wat-1 to be eligible for a Green Star SA rating²⁴.</p> <p>²⁴ Information on how to do this can be found in the GBCSA Potable Water and Sewerage Calculator Guide, available from the GBCSA website.</p>
ECO-: Conditional Requirement	<p>Conditional Requirement, therefore all projects must submit a CIR and receive a final ruling before Round 1 can be submitted to the GBCSA.</p> <p>A mandatory CIR will be required to assess the project's compliance with this Conditional Requirement based on site ecological maps, to ensure approval of this conditional requirement prior to the Round 1 submission.</p>
ECO-2: Reuse of Land	<p>Eco-2 to be kept in its current form, however the second point of Eco-2, relating to an "approved urban edge", is omitted from the tool.</p>
ECO-3: Reclaimed Contaminated Land	<p>A mandatory CIR will be required to assess the project's compliance with this credit.</p> <p>If the project team wish to designate the land as contaminated, they must submit a report from a suitably qualified professional stating how it is contaminated. The report must also outline how the site will be decontaminated. The project team must refer to</p>

	<p>the UNIDO Contaminated Site Investigation and Management Toolkit available from: <a href="http://www.unido.org/fileadmin/user_media/Services/Environmental_Management/Stoc
 holm_Convention/POPs/toolkit/Contaminated%20site.pdf">http://www.unido.org/fileadmin/user_media/Services/Environmental_Management/Stoc holm_Convention/POPs/toolkit/Contaminated%20site.pdf</p> <p>Project teams may wish to refer to the guidelines outlined in IEQ-11.</p>
ECO-4: Change of Ecological Value	A mandatory CIR must be submitted to the GBCSA by projects to determine which South African bio-region is most applicable to the project.
EMI-5: Watercourse Pollution	A CIR should be submitted should the project team wish to use an alternative standard for the management of emissions
EMI-9: Boiler and Generator Emissions	A CIR should be submitted should the project team wish to use an alternative standard for the management of emissions.

Table 1: Credits requiring Credit Interpretation Requests (CIR's), Technical Clarifications (TC's) or adaptations

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3. Acronyms

Below is a list of acronyms used in this report, for the reader's reference

	Acrony	Definition, where applicable
British Standard	BS	
Building Research Establishment Environmental Assessment Method	BREEAM	Environmental building certification system in the UK
Chartered Institute of Building Services Engineers	CIBSE	British Industry Association
Credit Interpretation Request	CIR	This is a special request by a project team to alter a particular credit in Green Star for the purpose of that project only
Environmental Management Plan	EMP	
Environmental Tobacco Smoke	ETS	
Forestry Stewardship Certification	FSC	
Global Warming Potential	GWP	
Environmental Protection Agency	EPA	
Ghana Green Building Council	GhGBC	
Green Building Council of Australia	GBCA	
Green Building Council of South Africa	GBCSA	
GreenStar Accredited Professional	GSAP	
Indoor Environment Quality	IEQ	
Leadership in Energy and Environmental Design	LEED	Environmental building certification system in the US
Non Government Organisation	NGO	
Occupational Health and Safety	OH+S	
Ozone Depleting Potential	ODP	
Polychlorinated Vinyl Chloride	PVC	
South Africa National Standard	SANS	
Volatile Organic Compounds	VOCs	

Table 2: Acronyms

4. Introduction

This report has been produced by the Ghana Green Building Council (GhGBC) and reviewed and approved by the Green Building Council South Africa (GBCSA), with a revision done by the GBCSA (revision 2). It is a local context report that allows for the adoption of the Green Star SA certification scheme in Ghana being certified by the GBCSA in collaboration with the GhGBC. The GBCSA would manage and facilitate the certification through its existing established certification processes, but call the tool Green Star SA-Ghana. The GBCSA will use the opportunity to allow capacity to grow in Ghana, by allowing selected Ghanaian professionals to be trained up as Green Star SA-Ghana assessors (who would join the GBCSA assessor teams on Ghanaian projects). The GBCSA would also deliver the Green Star SA Accredited Professional course in Ghana in collaboration with the GhGBC and allow Ghanaians to take the Green Star SA AP online exam.

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As it may take some time for the GhGBC to develop its own rating tool or customize the Green Star Office, Retail Centre, Multi-unit Residential & Public and Education Building tools specific to Ghana (and requires that a Green Star license agreement to be signed by the GhGBC with the GBCSA), this report considers modifications to the Green Star SA – Office v1.1 tool as well as Green Star SA v1 rating tools for Retail Centre, Multi-unit Residential & Public and Education Building tool. This would provide the marketplace with an interim tool. It would also allow the GhGBC to leverage the expertise already attained by the Green Building Council South Africa (GBCSA).

This local context report is not the same as GhGBC owning and managing its own rating tool and certification process, but could ultimately lead to that (via a Green Star license agreement), if the local GhGBC developed capacity to do so. This local context report allows GBCSA to certify buildings in Ghana via the GBCSA's existing certification processes and structures in collaboration with the GhGBC - the GBCSA remains the certifying body for Green Star SA-Ghana, whilst allowing capacity in Ghana to be built.

4.1 Green Star and Green Star in Ghana

Green Star is an environmental certification scheme, originally developed by the Green Building Council of Australia (GBCA). Green Star was then adopted by the Green Building Council South Africa (GBCSA) for use in South Africa (Green Star SA). Further information on Green Star and Green Star SA can be found respectively at www.gbca.org.au and www.gbcsa.org.za.

The Board of Directors of Ghana Green Building Council have previously undertaken a detailed study of the globally available building rating tools. The decision to adopt the Green Star system for projects in Ghana was the outcome of this assessment.

Details of this assessment can be provided on request.

As a member of the World Green Building Council and its Africa Network of Green Building Councils (ANGBC), the Green Building Council of South Africa (GBCSA) has expressed a willingness to allow the rating of Ghanaian buildings under the Green Star SA rating system.

4.2 Ghana Green Building Council

The GhGBC was registered with the Registrar General's Department in August 2009, with the following stated mission:

To transform the built environment in Ghana towards sustainability through the way our communities are planned, designed, constructed, maintained and operated.

More information on GhGBC can be found at www.ghgbc.org

4.3 Disclaimer

There is a wide disparity of construction in Ghana. In the capital, Accra, a high rise world class office building might be right next to a dirt road with informal housing. This report has focused on the very top end of the Ghanaian market – which is often required to meet stringent environmental standards from funding donor bodies. It is likely that another intermediate rating tool could be relevant to components of the marketplace where existing Green Star criteria are not applicable.

In addition, note that this report does not negate the need for a possible future Technical Working Group process to produce a future version of a Green Star Ghana tool. Rather the report should serve as a context analysis for this group. Note that the research sources for this report do not extend beyond Accra, Ghana.

The resources provided in Section 6 include manufacturers, suppliers and consultants which may be of use to project teams applying Green Star in Ghana. Inclusion of these companies within this report in no way provides endorsement of the GhGBC of either the companies or their associated products.

5. Background – General

Ghana's population is almost 25 million. Located in West Africa, 51% of its population is urban, with an urbanization rate of 3.4% each year¹.

5.1 Local Environment

Climate

The climate in Ghana is considered tropical. It is comparatively dry along the south-east coast, hot and humid in the south-west and hot and dry in the north. There are two major seasons, the rainy and the dry season. Ghana is also subject to a dry dusty wind event called the Harmattan which blows along the north-west coast of Africa from December to March.

The mean minimum rainfall is 900mm/year occurring around the south-eastern part of Ghana (Accra- Aflao). The mean maximum rainfall is about 2000mm/annum, occurring in the south-western portions (Axim). Mean minimum temperatures range from 21°C - 23°C. Mean maximum temperatures range from 30°C - 35°C².

Land Use and Environmental Regions

About 26.7% of land in Ghana is either arable or contains permanent crops¹. There are six vegetation zones in Ghana. These are the savannah, forest-savannah transitional zone, the semi-deciduous forest zone, and the rainforest zone².

5.2 Key Legislative Bodies for the Environment

The peak environmental body in Ghana is the Environment Protection Agency (EPA)³. The EPA considers itself the leading public body for protecting and improving the environment in Ghana.

Ghana has passed a number of pieces of legislation pertaining to the environment. Full text of this legislation can be found on the Ghana Legal Environment Information website⁴.

Additional information and a general overview of the environmental situation in Ghana can be found as part of the UN's Agenda 21 project⁵.

5.3 Infrastructure

Electricity Supply and Infrastructure

In the year 2009, the last date for which energy statistics have been made publicly available⁶, around 75% of electricity supplied in Ghana came from hydroelectric plants. The rest came from thermal plants which operate on a mix of diesel, clean coal, natural gas and crude oil⁷. In 2008 electricity constituted 6.5% of total energy consumption in Ghana, compared with 77% by wood fuel⁸. The electricity grid emissions factor in 2008 was 0.563 tCO₂/MWh⁹.

Electricity supply in Ghana fluctuates with frequent power outages. Most buildings are fitted with diesel stand-by generator set which serves to both bolster the grid electricity supply to the building, but also power critical loads when the power is out.

The Ghana Government has made some moves to improve energy efficiency in Ghana – with its bio-energy policy¹⁰ and the introduction of energy efficient appliance regulations in 2009¹¹.

Water Supply and Infrastructure

Potable water supply in Ghana fluctuates with frequent outages. Most buildings are fitted with large water storage tanks which are filled with rainwater, water tankers or the portable water from the mains.

These tanks serve as reserves to the mains water supply to the building and provide potable water to occupants when the mains are off. This is also the case for sewerage infrastructure across Ghana where septic tank systems serviced by de-sludging tankers are often used to treat sewerage¹².

Ghana Government priorities to date are more focused on improving access to water than efficiency of use¹³.

5.4 Key Environmental Issues

Key environmental issues in Ghana, as determined by the CIA¹⁴, are as follows:

- Recurrent drought in north severely affects agricultural activities
- Deforestation – The World Bank estimates that as much as 75% of Ghana's forest cover has been destroyed by logging, much of it illegal
- Overgrazing
- Soil erosion
- Poaching and habitat destruction threatens wildlife populations
- Water pollution
- Inadequate supplies of potable water

The areas where buildings in Ghana could have the most impact on these key issues are through reduced use of water, improved rain water storage and usage system, managing water outflows through treated stormwater and sewerage and incorporating sustainably sourced timber.

¹ Information sourced from the CIA World Factbook <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>

² Information sourced from Ghana Environmental Protection Agency – State of Ghana's Environment http://www.oceandocs.net/bitstream/1834/409/1/04h_ghana.pdf

³ EPA website: <http://www.epa.gov.gh/>

⁴ GhanaLEX website: <http://www.epa.gov.gh/ghanalex/>

⁵ Agenda 21, Ghana website: <http://www.un.org/esa/agenda21/natlinfo/countr/ghana/natur.htm>

⁶ Ghana Energy Commission, Energy Statistics (2000-2009) http://www.energycom.gov.gh/pages/docs/energy_statistics.pdf?keepThis=true&TB_iframe=true&height=550&width=800

⁷ Ghana Energy Commission, Technology Catalogue (September 2004) <http://new.energycom.gov.gh/downloads/Technical%20Reports/Technology%20Catalogue.pdf>

- ⁸ Ghana Energy Commission, Annual Report 2007 – 2008
<http://new.energycom.gov.gh/pgs/linksinfo.php?recordID=4>
- ⁹ Ghana Energy Commission, Annual Report 2007 – 2008
<http://new.energycom.gov.gh/pgs/linksinfo.php?recordID=4>
- ¹⁰ Ghana Energy Commission, Draft Bioenergy Policy (August 2010)
<http://new.energycom.gov.gh/downloads/BIOENERGY.pdf>
- ¹¹ Ghana Energy Commission, Ghana Appliance Energy Efficiency Standards and Labelling Program
<http://new.energycom.gov.gh/downloads/General%20Documents/Ghana%20Appliance%20energy%20efficiency>
- ¹² Adu-Ahyiah et al (2006) Small Scale Wastewater Treatment in Ghana (a Scenario) Available from:
<http://www.vateknik.lth.se/exjobb/E314.pdf>
- ¹³ For more information see the Water Resources Commission of Ghana: <http://www.wrc-gh.org/ghanaswaterresources.html>
- ¹⁴ Information sourced from: <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>

5.5 Green Buildings in Ghana

Taken from the WGBC Expression of Interest for the GhGBC:

Ghana like all other developing nations is trying to rise up to the challenge of sustainability brought about by global warming. Until recently there was lack of awareness about matters concerning sustainable development, but now some organizations and non-governmental organizations have taken some initiatives which propose green buildings as partly solutions to the climate change. The continued adoption of green building on a global scale seems promising as more and more countries and building organizations seek to establish standards and incentives to promote sustainable building practices.

The overall experiences in terms of green building design and construction is on the ascendency in Ghana. Government has a policy on sustainable development, and over the years has developed programmes to achieve the goal of sustainable development. The Environmental Protection Agency was established in 1994 with its mandates as issuing environmental permits, requesting environmental impact assessments for development programmes, providing information on the environment, and serving enforcement notices. The EPA also issues guides and provides training in procedures on these matters.

A further effort to achieve sustainability was the launching of Ghana Sustainable Development Action Plan in 2009. The move is to focus on the sustainable consumption and production programmes as well as policies which will manage resources for the benefit of the present and future generations.

There is also The Natural Resources Environmental Governance (NREG) programme, under which the government is adapting and pursuing policies which would help manage natural resources.

The Energy Commission –the Energy regulator in Ghana is preparing a Renewable Energy (RE) policy and regulatory framework and drafting a Renewable Energy law between 2009-2010. The intent is to provide a level playing field that will attract potential developers of

Renewable Energy production and to provide a framework for climate change mitigation in Ghana.

Ghana is endowed with abundant Renewable Energy resources including solar, wind, biomass and hydro which can be developed to supplement the traditional sources of energy for the country. However this comes along with the challenge of capacity building, investment capital, and non-availability of market for sustainable technologies, this has often results in most projects been done on pilot basis.

Ghana government relies mostly on external donor and that is sometimes insufficient for projects, and most non-governmental agencies do not have the capacity to raise funds for projects.

Interest in green buildings has increased over the years as awareness on issues of climate change gaining ground in the country; more people in the construction industry are addressing sustainability issues in their designs, planning not only for new construction of the built environment, but also in retrofits of existing buildings.

The market for green building materials is rather growing at a slow pace towards the transformation as items such as solar and insulation is heavily taxed. In spite of all the constraint government is developing policies that stakeholders hope will subsidise green building materials and technologies.

6. Applying Green Star SA to Ghana – General

This section outlines the application of Green Star SA to Ghana from a general perspective.

It considers the typical project delivery, relevant building codes and standards, the eligibility requirements in Green Star SA, the conditional requirements and the environmental weightings of the tool.

6.1 Typical project delivery

The professionals contacted for this research noted the following about project delivery in Ghana:

- Permission to build is typically sought from the local planning authority and the Town and Country Planning during schematic design.
- A tender set and an as built set of documentation will normally be produced

Each of these items fits well with the current format of the Green Star and Green Star SA certification process.

6.2 Building Codes and Standards

Ghana is in the process of finalizing its Building Code. What is in place now is the Ghana Building Regulation which was published in 1989 and aims to “guide the comprehensive development of both rural and urban areas in Ghana”. It lists out requirements for:

- The application of the Regulation;
- Plot development;
- Site preparation and landscape development;
- Materials;
- Structural stability;
- Structural fire precautions;
- Access accommodation;
- Air movement and ventilation;
- Thermal insulation;
- Heaths, chimneys and heat producing appliances;
- Sound insulation;
- Pest control;
- Drainage;
- Sanitary conveniences;
- Refuse disposal;
- Water supply;
- Lighting and electrical insulation; and
- Requirement for rural development.

The Ghana Standards Board is responsible for the development of standards in Ghana. However, there will often be no relevant Ghanaian standard. For example, there is no standard dictating minimum outside air levels. Where Ghanaian standards are not available, professionals will use the most applicable international standard, i.e. British Standards.

The professionals interviewed for this research noted that the standard used often depends on the training of the individual. The most common application was the relevant British standard – that is the Chartered Institute of Building Services Engineers standards (CIBSE) or British Standard (BS)) is used.

As such, the changes to Green Star SA for Ghana require the adoption of British standards wherever appropriate – in the short term, where the Green Star SA tool is applied with minor modifications through the GBCSA, these standards have not been changed, it is required that projects motivate via a CIR for the use of alternative standards where they might feel this appropriate.

6.3 Eligibility requirements

No adaptations shall be made to the Spatial Differentiation, Space Use and Timing of Certification eligibility criteria of the Green Star SA rating tools. Conditional Requirements eligibility criterion are included in the credit by credit review.

6.4 Conditional requirements

There are currently two conditional requirements in Green Star South Africa. If projects do not achieve these conditional requirements then they cannot achieve a Green Star rating. These are Eco-0, which prescribes the minimum ecological constraints for the building and the minimum energy efficiency which the building must achieve.

These two requirements are considered appropriate for the Ghanaian context. Details on how they can be adapted for Ghana can be found in Section 7 of this report.

It is required that in the Ghanaian context the Green Star SA tool also include a minimum water efficiency requirement. It is required that this be at the level of 1 point in the Wat-1 Potable Water Calculator.

6.5 Environmental weightings and applicability to Ghana

The Green Star and Green Star SA tool incorporates environmental weightings for each of the categories. For Green Star in Australia these were based on a variety of sources:

- The OECD Sustainable Buildings Project Report
- Australian Greenhouse Office, Environment Australia, CSIRO, the Cooperative Research Centre for Construction, and the Commonwealth Dept. of Environment and Heritage
- A national survey conducted by the Green Building Council of Australia, which informed the development of the tool and assisted in assessing regional variation.

The GBCSA then took these weightings and made some adjustments for the South African context.

The weightings below are the author's opinion of relevant environmental weightings for the Ghanaian context. Note the following:

- The weightings generally follow those adopted in South Africa
- Energy is weighted comparatively less due to the use of more carbon efficient hydroelectric power in Ghana (see Section 4)
- Water and Materials have been weighted higher due to shortages in Ghana (see Section 4)

Category	GBCSA Office	GhGBC Office	GBCSA PEB	GhGBC PEB	GBCSA Retail	GhGBC Retail	GBCSA MURT	GhGBC MURT
Management	9	9	11	11	10	10	7	7
IEQ	15	15	15	15	10	10	14	14
Energy	25	20	25	20	25	20	28	23
Transport	9	9	11	11	12	12	6	6
Water	14	18	12	16	15	19	12	16
Materials	13	14	12	13	13	14	17	18
Land Use and Ecology	7	7	7	7	7	7	9	9
Emissions	8	8	7	7	8	8	7	7
Total	100	100	100	100	100	100	100	100

Table 3: Comparison of Weightings (%) with different Environmental Rating tools

7. Applying Green Star SA – Credit by Credit

This section outlines the application of Green Star SA to Ghana, credit by credit.

- Application of the Green Star SA – Office v1.1 tool as well as Green Star SA v1 rating tools for Retail Centre, Multi-unit Residential & Public and Education Building.
- This has been included as an interim measure and attempts to limit the number of changes to the overall tool. It includes suggestions of where the project team might submit a Credit Interpretation Request (CIR) to the GBCSA where an alternative standard may be appropriate to their project.

Each credit is reviewed in the following way:

- Aim of the credit,
- Discussion, which outlines the views of the Ghanaian professionals contacted as part of this research,
- Requirements for the adoption of the Green Star SA tool,
- Resources, which includes changes to the references listed in the technical manual as well as relevant Ghanaian manufacturers, suppliers and consultants.




A full list of the professionals contacted for this research can be found in Section 9 of this report.

The details of each credit have not been provided. This section must be read in conjunction with the Green Star SA – Office v1.1 Technical Manual as well as Green Star SA v1 Technical Manuals for Retail Centre, Multi-unit Residential & Public and Education Building (available by order from www.gbcsa.org.za.)

The Green Star SA – Office v1.1 tool as well as Green Star SA v1 rating tools for Retail Centre, Multi-unit Residential & Public and Education Building, have been assessed for relevance on a credit by credit basis. Each credit's applicability to the Ghanaian context is discussed and requirements are made of where the project team must submit a Credit Interpretation Request (CIR) to the GBCSA where an alternative standard may be better suited.

Credit by credit review

For each credit reviewed as part of this report, the credits are colour coded in accordance with the changes required for applicability to the local context:

	The credit should be kept in its current form and no adjustments need to be made.
	The credit requires a CIR or TC or adaptation to ensure relevance to the Ghanaian context.
	The credit should be omitted and made 'not applicable' for the Ghanaian application of the tool.

All credits for new building tool credits have been included within the table below. All credits applicable to Green Star SA Office v1.1 tool as well as Green Star SA v1 rating tools for Retail Centre, Multi-unit Residential & Public and Education Building have been included within revision 2 of the local context report.

Ghanaian projects would also be required to use the latest Green Star SA TCs, CIRs and Errata relevant to rating tools, published on the GBCSA's website, which represent the current version of that specific tool.

7.1 Management

	AIM OF CREDIT	DISCUSSION	REQUIREMENT
	<p><u>MAN-1: Green Star SA Accredited Professional</u></p> <p>To encourage and recognise the engagement of professionals who can assist the project team with the integration of Green Star aims and processes throughout design and construction phases.</p>	<p>A shortened version of the Green Star Accredited Professional (GSAP) course was presented to several audiences in Ghana. These included the One Airport Square design team and employees of Twum Bofo & Partners, ARQ Engineering and Arthro Synergieo. In all places the material was well received and understood.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>MAN-2: Commissioning Clauses</u></p> <p>To encourage and recognise commissioning and handover initiatives that ensure that all building services can operate to optimal design potential.</p>	<p>In relation to the first point – most buildings in Ghana are not commissioned to the standards listed. Most top tier consultants and contractors in Ghana are however, aware of these standards.</p> <p>Most consultants and contractors use the British standards in their design so would be more familiar with CIBSE than ASHRAE.</p> <p>In relation to the second, additional point – it was agreed by those contacted that this information would not be difficult to provide.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>MAN-3: Building Tuning</u></p> <p>To encourage and recognise commissioning initiatives that ensure optimum occupant comfort and energy efficient services performance throughout the year.</p>	<p>Building tuning to this standard is not normally conducted in Ghana.</p> <p>There is however, a 6-12 month defects liability period on most top tier projects. During this period consultants and contractors must warrant the performance of the building and return to rectify any issues with performance. As such it would be possible to extend this existing appointment to include recommissioning</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

	<p>of the building over a 12 month period.</p> <p>Note that that recommissioning would be well suited to buildings which have a specific mode of operation for the Harmattan winds. As noted in Section 5, the Harmattan is a dry and dusty trade wind which affects Ghana.</p> <p>Resources</p> <p>None.</p>	
<p><u>MAN-4: Independent Commissioning Agent</u></p> <p>To ensure buildings are designed with regard to future maintenance and are correctly commissioned before handover.</p>	<p>None of the professionals contacted were aware of anyone providing independent commissioning services in Ghana.</p> <p>It was explained that an independent experienced Ghanaian contractor could be appointed to fulfill this role. It was then agreed that this would be possible in the Ghanaian context.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>MAN-5: Building User's Guide</u></p> <p>To encourage and recognise information management that enables building users to optimise the building's environmental performance.</p>	<p>When this credit was presented to Arthro Synergeio it was noted that the Building User's Guide would have been particularly useful for some of the projects they had worked on. The employees gave examples of where tenant behaviour had compromised the performance of the building. They noted that this could have been avoided had the tenants understood how to use the building correctly.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

<p><u>MAN-6: Environmental Management</u></p> <p>To encourage and recognise the adoption of a formal environmental management system in line with established guidelines during construction.</p>	<p>At present, basic environmental management plans (EMPs) are provided on some projects but not others.</p> <p>The Environmental Protection Agency (EPA) in Ghana requires projects to submit a statement of intent before construction. The form can be viewed here:</p> <p>http://epaghanaeia.org/forms/create/2. This asks for information on waste management provisions and general information on the site. After this they may be required to undertake a screening, or an initial environmental assessment. This may then require the project team to produce an environmental management plan. This report may include measures to mitigate impact during construction.</p> <p>Professionals contacted for this research noted that this report could be amended to meet the requirements of this credit. Note however, that it is rare that the EPA would follow up and check that the actions in the EMP followed had been taken.</p> <p>The Environmental Assessment Regulations 1999, guides the environmental assessment process in Ghana. Schedule 1 specifically excludes buildings (Section 23), except where the agency identifies a significant environmental impact. In addition, the regulation does not provide specific instruction as to the form of the EMP, rather stating that the EMP:</p> <p><i>shall be a document in such form as shall be determined by the Agency.</i></p> <p>It should be noted however, that most large commercial buildings projects will either be identified as having a significant impact, or the relevant planning authority will require a plan be produced. As such an EMP would have to be produced.</p> <p>As Ghanaian's tend to use British standards in building design.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
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	<p>Projects may prefer to reference BREEAM Man-03 Construction Site Impacts. This credit refers to an Environmental Checklist in section 2.2.5 of the England and Wales Environment Agency's 'Building a Better Environment, a guide for developers'. This checklist however, is less comprehensive than the NSW checklist. Thus, it is required that the NSW checklist continue to be referenced.</p> <p>As to the second point, the author was unable to find a building contractor which was ISO 140001 certified. The professionals contacted for this research also did not know of any companies which had been certified.</p> <p>This standard has been adopted in its entirety for use in Ghana by the Ghana Standards Board. Other companies in Ghana have been certified, such as Unilever Ghana and Newmont Gold Ghana Ltd.</p>										
	<p>Resources</p> <table> <tr> <th>Item</th><th>Details</th><th>Website / Contact Details</th></tr> <tr> <td>Regulation - Environmental Assessment Regulations, 1999</td><td>Note the explicit exclusion of construction of buildings – Schedule 1, Item 23.</td><td>http://www.epa.gov.gh/ghanalex/acts/Acts/ENVIRONMENTAL%20ASSESSMENT%20REGULATION,1999.pdf</td></tr> <tr> <td>Government Organisation - Ghana Environmental Protection Agency</td><td>The Environmental Protection Agency is the leading public body for protecting and improving the environment in Ghana.</td><td>http://www.epa.gov.gh/</td></tr> </table>		Item	Details	Website / Contact Details	Regulation - Environmental Assessment Regulations, 1999	Note the explicit exclusion of construction of buildings – Schedule 1, Item 23.	http://www.epa.gov.gh/ghanalex/acts/Acts/ENVIRONMENTAL%20ASSESSMENT%20REGULATION,1999.pdf	Government Organisation - Ghana Environmental Protection Agency	The Environmental Protection Agency is the leading public body for protecting and improving the environment in Ghana.	http://www.epa.gov.gh/
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Government Organisation - Ghana Environmental Protection Agency	The Environmental Protection Agency is the leading public body for protecting and improving the environment in Ghana.	http://www.epa.gov.gh/									

Guideline - Construction Statement of Intent	EPA requirement for building construction in Ghana	http://epaghanaeia.org/for ms/create/2	
Table 4: Resources for Man-6			
MAN-7: Waste Management To encourage and recognise management practices that minimise the amount of construction waste going to disposal.		At present basic waste management process are followed on some projects, but not on others. Scrap metal can be sold to resellers and some plastics can be recycled for reuse. As to general waste however, there is little evidence that it is currently recycled.	The credit should be kept in its current form and no adjustments need to be made.
Resources			
Item	Details	Website / Contact Details	
Waste Company– Zoomlion	Largest waste management company in Ghana. Is currently undertaking some recycling programs.	http://www.zoomlionghana.com/	
Waste company– Blowplast Recycling	Recycles plastic products in Ghana	http://keepghanaclean.org/	
Government organisation – Abuja Environmental Protection Board	Aims to set up a waste recycling project	http://www.ghanamma.com/2011/05/01/waste-recycling-will-generate-employment-%E2%80%93agency/	
Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board	

Table 5: Resources for Man-6

MAN-8: Airtightness Testing

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

The professionals conducted for this research indicated that they were not aware of any air tightness tests conducted on buildings in Ghana.

In addition, it was noted that air infiltration was typically an energy issue in very cold climates, where there is a significant difference between inside and outside temperatures. The maximum average temperature in Ghana is around 35oC, 11oC higher than an internal space temperature of 24oC. By contrast, a cold climate might experience temperatures around -10 oC. This is around 30oC lower than an internal space temperature of 21oC.

When the author contacted the GBCSA, they also noted that this credit was introduced into Green Star South Africa to reduce energy consumption during winter, but also to avoid cool air-conditioned air leaking out of buildings in the hot summers . In South Africa temperatures reach as low as -2oC in winter in some areas, is often lower than 10oC. Summer temperatures in South Africa range from between 25- 40 oC . South African buildings were considered to be particularly leaky due to the poor construction quality, and thus air-tightness was felt to be relevant to South Africa. Ghana's lowest average minimum temperature by contrast is 20 oC, but has high summer temperatures. Ghana's construction quality is similar if not worse than South Africa's

Resources

None

The credit should be kept in its current form and no adjustments need to be made.

<p><u>MAN-9: Waste Recycling Management Plan – RETAIL CENTRE</u></p> <p>To encourage and recognise management systems and building infrastructure that facilitate the reduction of the overall operational waste generation and disposal.</p>	<p>It is believed that through the development of management systems that facilitate the reduction of the overall operational waste generation and disposal, this credit will encourage the development and growth of these facilities in retail centres in the country.</p> <p>As such, the credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>MAN-10: Building Management System – RETAIL CENTRE & PEB</u></p> <p>To encourage and recognise the incorporation of Building Management Systems to actively control and maximize the effectiveness of building services.</p>	<p>Building Management Systems are computer based control systems installed in buildings to control and monitor the building’s mechanical and electrical equipment as well as the water systems. Ideally the BMS, especially on large building projects, is a central integrated system monitoring and controlling the building. However on smaller projects where a single BMS system is not appropriate there is still benefit in installing smaller separate control systems that are linked to a central location to enable effective monitoring and control by the building facilities management team.</p> <p>Although BMS’s are not commonly installed in retail centres, public and education buildings in Ghana, it is believed that the expertise exist within the country to incorporate Building Management Systems to actively control and maximize the effectiveness of building services. As such, the credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>MAN-11: Green Lease - RETAIL CENTRE</u></p> <p>To encourage and recognise initiatives taken by the building owner to encourage improved environmental behavior by tenants of the retail centre</p>	<p>Through the establishment of a contractually-binding tenancy lease agreement that requires the tenants of a retail centre to participate in the following environmental initiatives:</p> <ul style="list-style-type: none"> • Electrical energy monitoring and reporting (minimum quarterly) and have submitted an energy management plan at the beginning of each year; • Water monitoring and reporting (minimum quarterly) and have submitted a water management plan at the beginning of each year; • Waste reduction/recycling monitoring and reporting (minimum 	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

	<p>quarterly) and have submitted a waste management plan at the beginning of each year;</p> <ul style="list-style-type: none"> • The preparation of a procurement policy at the beginning of each year regarding the use of environmentally friendly consumables (cleaning products, toiletry products, paper and plastic consumable products) and the building owner being required to report back to the tenants on the buildings' performance relating to energy, water, waste and procurement policies on an annual basis, market transformation within retail centres in Ghana would occur through this credit. <p>This credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	
<p><u>MAN-12: Common Property Rules – MULTI UNIT RES</u></p> <p>To encourage and recognize developers who embed legal and contractual environmental management initiatives within the formal management structures of the development.</p>	<p>Through the establishment of legal and contractual environmental management initiatives embedded within the formal management structures of the development, it is believed that within the rules of the development, the Management Entity committing to environmental initiatives would be beneficial to the common property areas of multi-unit residential developments.</p> <p>This credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>MAN-13: Learning Resources - PEB</u></p> <p>To encourage and recognise sustainability initiatives implemented in the development as learning resources for building users and visitors.</p>	<p>This credit has been developed to educate building occupants on how the sustainability initiatives implemented in the building work, and the associated environmental benefits of these initiatives.</p> <p>Making sustainable building initiatives and features visible and interactive can provide a valuable education and learning opportunity for building users to develop awareness about the building's impacts on the natural environment and resources. By incorporating important concepts such as energy, water and material efficiency, public and education buildings can become interactive learning tools in public and education buildings.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

		The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.	
	<u>MAN-14: Life Cycle Costing - PEB</u> To recognise and encourage the development of a Life Cycle Cost (LCC) analysis to consider environmentally sustainable attributes in assessing improved design, specification and through-life maintenance and operation.	This credit even in South Africa is a stretch and as such the credit is omitted for projects in Ghana, however projects could choose to target the credit under the Innovation category.	Man-14 credit is omitted.
	<u>MAN-15: Maintainability - PEB</u> To encourage and recognise building design that facilitates on-going maintenance, and minimises the need for on-going building maintenance throughout a building's lifecycle.	<p>Public buildings can be complex structures with a variety of attributes which require a significant amount of maintenance. The design of these types of buildings should reflect the need for such maintenance by providing suitable access to facilities managers.</p> <p>When designed and managed accordingly, public buildings can minimise maintenance and operational costs, while also minimally impacting their occupants. As such, this credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	The credit should be kept in its current form and no adjustments need to be made.

7.2 Indoor Environment Quality

	AIM OF CREDIT	DISCUSSION	REQUIREMENT
	<p>IEQ-01: Ventilation Rates To encourage and recognise designs that provide ample amounts of outside air to counteract build-up of indoor pollutants.</p>	<p>The professionals contacted for this research indicated that building design in Ghana usually did not include any connection to outside air. Often where there was a provision in the design, it was removed through the value management process.</p> <p>Where outside air provisions were provided, Ghanaian professions tended to use CIBSE Guide B2 to determine ventilation rates. Due to the low prevalence of smoking 8L/s/person, as per Table 3.2, is typically used¹⁶.</p> <p>There are provisions in Part 8 of the Ghana Building Code for outside air provision for natural ventilation. Section 8.3.1 states that</p> <p><i>... every habitable room ... shall be provided with facilities for the entry from and natural ventilation to the open air ... spaces may be deemed-to-satisfy if they are mechanically ventilated.</i></p> <p>There is no further requirement as to the quantity of outside air that must be provided.</p> <p>There are some guidelines in the code for natural ventilation. For example, the total clear area must be equivalent to at least 1/6th of the floor area. Despite this, CIBSE Guide B2 is typically referred to. As such it is required that both standards be referenced.</p> <p>¹⁶ See IEQ-17 for further discussion on smoking prevalence in Ghana.</p>	<p>IEQ-1 to be kept in its current form.</p> <p>If the project team wish to use an alternative standard then they should submit a CIR to the GBCSA.</p>

Resources

Item	Details	Website / Contact Details
Guideline - CIBSE GuideB2: Ventilation and Air Conditioning	Guide to Ventilation and Air Conditioning	Available from: http://www.cibse.org/index.cfm?go=publications.view&item=305
Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board

Table 6: Resources for IEQ-1

<u>IEQ-2: Air Change Effectiveness</u> To encourage and recognise systems that effectively deliver optimum air quality to any occupant throughout the occupied area.	IEQ-2: Air Change Effectiveness credit omitted from Office v1.1.	IEQ-2 credit is omitted.
<u>IEQ-3: Carbon Dioxide Monitoring and Control</u> To encourage and recognise the provision of response monitoring of Carbon Dioxide levels to ensure delivery of optimum quantities of outside air.	The professionals contacted for this research indicated that they were not aware of any buildings in Ghana which currently monitored carbon dioxide levels in office spaces. They did however understand how such a system would work. Note that in Ghana natural ventilation would often be designed to the requirements in the Ghana Building Code and CIBSE Guide B2 rather than SANS 10400-O.	IEQ-3 to be kept in its current form. A CIR should be submitted to the GBCSA should the project team wish to use the CIBSE Guide B2 to assess the natural ventilation design of the building rather than SANS 10400-O.

Resources

Item	Details	Website / Contact Details
Guideline - CIBSE Applications Manual AM10, March 2005	Natural Ventilation in Non- Domestic Buildings	http://www.cibse.org/index.cfm?go=publications.view&item=297
Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board

Table 7: Resources for IEQ-3

<p>IEQ-4: Daylight</p> <p>To encourage and recognise designs that provide good levels of daylight for building users.</p>	<p>The professionals contacted for this research indicated that they designed to maximise natural light, but were not aware of any buildings in Ghana which had undertaken daylight modelling.</p> <p>Note that the Ghana Buildings Code requires natural light provisions. Section 17.1.1 states</p> <p><i>... every habitable room ... shall be provided with facilities for the entry of natural light ...</i></p> <p>In addition, the total available area must be at least 15% of the total floor area. This supports the application of this credit in Ghana.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
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Resources

Item	Details	Website / Contact Details
Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board

Table 8: Resources for IEQ-4

IEQ-5: Daylight Glare Control

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

The professionals contacted for this research indicated that they designed to minimise glare, but were not aware of any buildings in Ghana which had undertaken daylight glare modelling.

The consultants contacted were aware of the Visual Light Transmission measurement of blinds. The manufacturers contacted however, were not able to verify the performance of their blinds. This may initially make documentation of this credit difficult.

Note that the Ghana Buildings Code requires 600mm eaves. Section 17.2.2 states

... all openings ... shall be protected ... by eaves ... which shall extend at least 600mm from the external wall...

This supports the application of this credit in Ghana.

The credit should be kept in its current form and no adjustments need to be made

Resources

Item	Details	Website / Contact Details
Supplier – Kimo Homes	Products have the ability to block out all sunlight	http://www.kimogroup.com/

Table 9: Resources for IEQ-5

<u>IEQ-6: High Frequency Ballasts</u> To encourage and recognise buildings that increase workplace amenity by avoiding low frequency flicker that may be associated with fluorescent lighting.	IEQ-6 High Frequency Ballasts credit omitted from Office v1.1	IEQ-6 credit is omitted.
<u>IEQ-7: Electric Lighting Levels</u> To encourage and recognise base building provided office lighting that is not over designed.	Lighting levels for office tenancy areas are typically designed to between 300 and 400 lux. The Ghana Building Code requires illumination levels in office to be maintained in accordance with an approved code of practice (Section 13.1). It does not state what level should be maintained nor the approved code of practice which should be used.	The credit should be kept in its current form and no adjustments need to be made.

Resources

Item	Details	Website / Contact Details
Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board

Table 10: Resources for IEQ-7

<p><u>IEQ-8: External Views</u> To encourage and recognise designs that provide occupants with a visual connection to the external environment.</p>	<p>The professionals contacted for this research indicated that buildings were already designed to maximise external views to the floorplate.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>IEQ-9: Thermal Comfort</u> To encourage and recognise buildings that achieve a high level of thermal comfort.</p>	<p>The professionals contacted for this study were generally not aware of thermal comfort analysis and had not conducted a study such as this previously.</p> <p>Should a project find another standard which is more suitable for use then it should submit a CIR to the relevant Green Building Council.</p> <p>Resources</p> <p>None.</p>	<p>IEQ-9 to be kept in its current form.</p> <p>Should the project team wish to use an alternative approach, then it should request this via CIR.</p>
<p><u>IEQ-10: Individual Comfort Control</u> To encourage and recognise designs that facilitate individual control of thermal comfort.</p>	<p>The professionals contacted for this research indicated that buildings in Ghana were not typically designed for individual comfort control. This is similar to building design within the author’s expertise in Australia, Mauritius and South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

		<p>Resources</p> <p>None.</p>	
	<p>IEQ-11: Hazardous Materials To encourage and recognise actions taken to reduce health risks to occupants from the presence of hazardous materials.</p>	<p>The professionals contacted for this research were not aware of any particular standards which needed to be applied in the removal of hazardous materials from the site. In addition, they noted that there was no governing body in Ghana for Occupational Health and Safety.</p> <p>In the absence of a national health and safety policy in Ghana, the 'Factories, Offices and Shop' Act 1970, Workmen's Compensation Law Act 187 (1987) and the Labour Act 651 (2003) are the main legislative documents. The Factories, Offices and Shops Act does not refer to specific materials, it only notes the following:</p> <p><i>There shall, so far as is reasonably practicable, be provided and maintained safe means of access to every place at which any person has time to work, and every place shall, so far as is reasonably practicable, be made and kept safe for any person working there.</i></p> <p>In addition, from the EPA:</p> <p><i>In Ghana the principal means that we use to regulate building projects is the Ghana Environmental Assessment Regulations, 1999 (LI 1652). These regulations have provisions that touch on issues relating to hazardous waste disposal. With regards disposal of hazardous wastes we do not have adequate facilities in Ghana for that. There is however one company in the Western Region (Zeal Environmental Technologies Limited), which has the capacity to treat hazardous wastes. In the case of asbestos, the EPA requires</i></p>	<p>IEQ-11 to be kept in its current form.</p> <p>A CIR should be submitted, to be assessed by the GBCSA, should the project team wish to use an alternative set of Occupational Health and Safety (OH+S) regulations.</p>

		<p><i>proponents to carefully dismantle them and contain in underground pit on site. We follow guidelines obtained from USEPA website.</i></p> <p>Note that the Ghana Building Code actually refers to the use of asbestos in buildings in Section 4.4.1.10</p> <p>– “the following materials may be used in the construction of buildings asbestos-cement products”.</p>	
Resources			
Item	Details	Website / Contact Details	
Guideline – Hazardous Waste Guideline	<p>This Technical Guidance document has been developed to provide guidance on the assessment and classification of hazardous waste based on the EU Hazardous Waste Directive.</p> <p>It is intended to provide guidance to all involved in the production, management and control of hazardous waste and to be a reference document for all legislation related to hazardous waste and its management.</p>	http://www.environmentagency.gov.uk/static/documents/GEH00603BIRB-e-e.pdf	
Article - Overview of legislation in Ghana	Articles which provide an overview of OH+S regulation in Ghana.	http://www.ghanaweb.com/GhanaHomePage/NewsArchive/artikel.php?ID=197916 http://dspace.knust.edu.gh/dspace/bitstream/123456789/1502/1/Occupational%20health%20and%20safety%20policy.pdf	

Regulation - Factory, Office and Shop Act	Regulation relating to factories, offices and shops	http://www.scribd.com/doc/38624816/Factories-Office-and-Shop-Act
Company – Vdhih	Asbestos Removal Company which operates in Ghana	www.vdhih.com/asbestos.php
Guideline - Ghana Legal Environmental Framework	Note absence of hazardous materials legislation other than mercury. Note that the mercury legislation refers to possession of mercury, rather than disposal.	http://www.epa.gov.gh/ghanalex/acts/index.html
Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board
Guidelines – US EPA Hazardous Wastes	Guidelines on hazardous waste – including international waste	http://www.epa.gov/osw/hazard/

Table 11: Resources for IEQ-11

IEQ-12: Internal Noise Levels

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

The professionals contacted for this research were not aware of the SANS 10103:2 standard. Whilst there are guidelines on external noise pollution (such as the Section 79 of the Local Government Act, 1993), the professionals noted that there is no specific standard for noise levels in office buildings in Ghana. Section 11 of the Ghana Building Code specifies that certain materials be used for walls, ceilings and floors to prevent sound transmission, but does not state the sound levels which must be achieved in the space.

IEQ-12 to be kept in its current form.

A CIR should be submitted, to be assessed by the GBCSA, should the project team wish to use an alternative set of standards.

		The standard typically used for acoustics in Ghana in the British standard BS8233:1999 “Sound Insulation and Noise Reduction for Buildings - Code of Practice”.	
Resources			
Item	Details	Website / Contact Details	
Guideline - BREEAM Scheme Document	Credit Hea-05: Acoustic Performance, contains details about the relevant British Standard, and its application for offices.	http://www.breeam.org/BR/EEAM2011SchemeDocument/	
Article	Article outlines the lack of appropriate noise legislation in Ghana.	http://www.modernghana.com/news/241417/1/noise-levels-in-accra-on-the-increase.html	
Guideline - Ghana Legal Environmental Framework	Note absence of noise control legislation	http://www.epa.gov.gh/ghanalex/acts/index.html	
Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board	

Table 12: Resources for IEQ-12

<p><u>IEQ-13: Volatile Organic Compounds</u></p> <p>To encourage and recognise specification of interior finishes that minimise the contribution and levels of Volatile Organic Compounds (VOCs) in buildings.</p>	<p>The professionals contacted for this research were somewhat aware of volatile organic compounds but were not aware of any specific products available in Ghana.</p> <p>The paint companies contacted were well aware of the standards however, and noted that most of their products complied. A review of the standards available at the Ghana Standards Board by the author revealed that there are no specific standards pertaining to VOCs in Ghana.</p> <p>Many paint, sealant and carpet products are imported to Ghana by both international and local suppliers, and as such they should be able to import low VOC products.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
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Item	Details	Website / Contact Details
Product supplier – Coral paints	Import Dulux paints into Ghana and believe they would also be able to import the low VOC varieties	0302222605 http://www.ghanaweb.com/GhanaHomePage/telephone_directory/companydetails.php?link=home&catname=12&ec1=25&lc=470&ec2=&CN=50567&Name=Coral+Paints&CD=com
Product supplier – Bamson Co Ltd	Most of their products comply with the low VOC requirements	

Resources Table 13: Recommendations for IEQ-13

IEQ-14: Formaldehyde Minimisation To encourage and recognise the specification of products with low formaldehyde emission levels.	The professionals contacted for this research were not aware of formaldehyde and why it should not be used. Some references to low formaldehyde products in Ghana were found online.	The credit should be kept in its current form and no adjustments need to be made.
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Resources

Item	Details	Website / Contact Details
Product supplier - Naja David Group	Manufacturer and exporter of wood products. Website mentions low formaldehyde products	http://www.najadavidgroup.com/contact/

Table 14: Resources for IEQ-14

	<p><u>IEQ-15: Mould Prevention</u> To encourage and recognise the design of services that eliminate the risk of mould growth and its associated detrimental impact on occupant health.</p>	<p>The professionals contacted for this research were not aware of any office buildings in Ghana which were designed to prevent mould in ductwork through direct humidity control. In addition, buildings are mostly designed without heating. This means that an additional heating system would need to be installed in a traditional cooling based dehumidification system.</p> <p>The professionals conducted for this research noted that while installing this additional system would be unlikely, it would not be impossible.</p> <p>Resources None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>IEQ-16: Tenant Exhaust Riser</u> To encourage and recognise the design of buildings with a general exhaust riser that can be used by tenants to remove indoor pollutants from printing and photocopy areas.</p>	<p>The professionals contacted for this research were not aware of any office buildings in Ghana which were designed to include this additional riser. Once it was explained how it would work it was noted that this would not be difficult to include.</p> <p>Resources None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

<p><u>IEQ-17: Environmental Tobacco Smoke (ETS) Avoidance</u></p> <p>To encourage and recognise the air quality benefits to occupants by prohibiting smoking inside the building.</p>	<p>The professionals contacted for this research were not aware of any office buildings in Ghana which were designed to include ETS avoidance policies. They noted that these would not be difficult to provide as the prevalence of smoking in Ghana is low. A representative national household survey recently estimated prevalence to be around 0.9% in men and under 0.1% in women¹⁷.</p> <p>¹⁷ Owusu-Dabo et al (2009) <i>Smoking in Ghana: A review of Tobacco Industry Activity</i>; Tobacco Control 2009; Volume 18, Pages 365-370. Also available from: http://tobaccocontrol.bmj.com/content/18/3/206.abstract</p> <p>Resources</p> <p>None</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>IEQ-18: Places of Respite and Connection to Nature – RETAIL CENTRE</u></p> <p>To encourage and recognise developments that create approximately designed areas where retail centre staff and visitors can relax in a place of respite which has a connection to nature.</p>	<p>Places of respite which have a connection to nature provide retail centre staff and visitors with approximately designed areas in which to relax and decrease stress levels commonly induced by excessive time spent confined indoors.</p> <p>Where the place of respite is outdoors, the area should have low noise exposure (from traffic and building services, shading to at least 35% of its area; and be screened from significant prevailing winds. Where the place of respite is indoors, the area should have a Daylight Factor (DF) of at least 2.5% and meet the credit criteria of IEQ-01. This can be achieved within the Ghanaian context and, with the minor changes for IEQ-01, the credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

	<p><u>IEQ-19: Private Outdoor Space - MULTI UNIT RES</u></p> <p>To encourage and recognize dwelling designs which improve the health and wellbeing of the occupants by providing private outdoor space.</p>	<p>Private outdoor spaces accessible for private use by the dwelling occupants only, directly adjacent to, and accessible from, the associated dwelling and at least 1m2 per occupant or at least 6m2 improve the health and wellbeing of the occupants in multi-unit residential developments as it provides the occupants with private places of respite in nature.</p> <p>The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>IEQ-22: Universal Access - MULTI UNIT RES</u></p> <p>To recognize design that provides universal access, to and within dwellings, to meet the changing needs of occupants.</p>	<p>Facilities for persons with disabilities within multi-unit residential developments are often neglected resulting in difficulties for occupants within the developments who have differing needs.</p> <p>Where projects wish to apply other standards than those in the Green Star SA tool (SANS 10400-S), a CIR must be submitted to the GBCSA. IEQ-22 should be kept in its current form and no adjustments need to be made.</p>	<p>IEQ-22 to be kept in its current form.</p> <p>Where projects wish to apply other standards than those in the Green Star SA tool (SANS 10400-S), a CIR must be submitted to the GBCSA.</p>
	<p><u>IEQ-23: Stairs - PEB</u></p> <p>To encourage and recognise designs that promotes the wellbeing of occupants by encouraging the use of stairs as an alternative to vertical transportation by lift.</p>	<p>Lifts in multi storey buildings is often the main form of vertical transport. This can largely be attributed to the fact that stairs are 'hidden' away and used for emergencies only. By making stairs more prominent their use could be more attractive with added health benefits as a result.</p> <p>Provision of attractive stairs promotes the use of stairs and thereby giving occupants the option to improve their physical well-being. Provided that cognisance is made for the provision for persons with disabilities, designs that promote the use of stairs within public and education buildings can easily be achieved within the Ghanaian context.</p> <p>The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

7.3 Energy

	AIM OF CREDIT	DISCUSSION	REQUIREMENT
	<p><u>ENE-0: Conditional Requirement</u> To encourage and recognise designs that minimise the greenhouse gas emissions associated with operational energy consumption, and maximise potential operational energy efficiency of the base building.</p>	<p>There are no specific energy efficiency requirements in either the Ghana Building Code or by the Energy Commission, aside from the Ghana Appliance Energy Efficiency Standards and Labelling Programme for room air conditioners and CFLs¹⁸.</p> <p>None of the professionals contacted were aware of any project in Ghana which had previously undertaken energy modelling. Previously donor funding was received energy modelling. As such it is likely that other projects would also have had energy modelling requirements. An example may be The Netherlands Embassy in Accra which has LEED certification.</p> <p>The UK Building Code Part L will not be relevant in Ghana due to the climatic conditions. In addition, Ghanaian professionals do not have experience with the South African Standards. It is therefore required that ASHRAE 90.1-2007 be adopted as the relevant standard for this tool. Note that the author was not able to review this standard and as such it should be reviewed by a suitably qualified professional before it is adopted as part of the tool (a CIR should be submitted to the GBCSA). Climate conditions for Ghana are needed for this since conditions would differ in Ghana.</p> <p>It should be noted that the Ghana Building Code has the following specific provisions for building fabric, from Part9:</p> <ul style="list-style-type: none"> - Walls must have a U value less than 0.3 - Roofs must have a U value less than 0.25 - Shading must be provided over a windows to a minimum of 	<p>Conditional Requirement, therefore all projects must submit a CIR and receive a final ruling before Round 1 can be submitted to the GBCSA.</p> <p>Office v1.1 rating tool be applied to all other credits, calculations and protocols except the Energy modelling protocol for the ENE-0 and ENE-1: Greenhouse Gas Emissions credit, where the Office v1 Energy modelling protocol will be applicable to Ghanaian projects.</p> <p>Changes to the Green Star SA – Office v1 Energy Modelling protocol should be motivated by the registered project via the mandatory CIR.</p>

	<p>600mm</p> <ul style="list-style-type: none"> - Where possible fenestration should be located on the north and south of the building, where possible. <p>Note that there is no specific performance requirement for fenestration. The building code also specifies minimum practice for daylight and natural ventilation, both of which will reduce energy consumption in the building. Despite these requirements many buildings in Ghana are not built in compliance with the code.</p> <p>The GBCSA require projects to submit a mandatory CIR for Ene-0/1, and thus no specific changes to the tool at this stage have been made for these credits.</p> <p>Note that the COP of 2.8 used for the notional building (Section 5.4 of the protocol) is the same as that required for room air conditioners in the Ghanaian Appliance Energy Efficiency and Labelling Programme.</p> <p>The fuel factors in the calculator should be amended and provision should be allowed for alternative sources of fuel – such as diesel generators. Further to this for, the Ghana Energy Commission should be contacted by the GhGBC to better understand the calculation methodology for the Grid Emissions Factor in their annual report. That is, which of the three scopes (Scopes 1, 2 and 3²⁰). Once this is better understood then a standardised list of emissions factors for different fuel types should be developed and provided to project teams.</p>	
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	Section	Green Star SA Protocol	Possible Green Star SA-Ghana Protocol change	Justification	
	Section 4.1: Model Notional SANS204 Building	Title	Model Notional ASHRAE 90.1 Building	SANS 204 is not relevant in Ghana	
	Section 4.1: Model Notional SANS204 Building	“generally as defined by SANS 204-3:2008 ... deemed to comply clauses”	“generally defined by ASHRAE 90.1 deemed to comply clauses. Note that the Energy Cost Budget Method in Section 11 cannot be used.”	SANS 204 is not relevant in Ghana	

	Section 5.1: General modelling parameters	N/A	Add a line into the table which states that all energy in the notional building shall be supplied by mains electricity.	The modelling protocol does not clearly state the energy source	
	Section 5.2: Building Envelope	"Fabric based on SANS204-3"	"Fabric based on ASHRAE 90.1 and the Ghana Building Code – whichever is higher"	SANS 204 is not relevant in Ghana	

	Section 5.2: Building Envelope	<p>“Windows U value 5.6 and SHGF 0.77 (clear single glazing, timber framed). Windows to be distributed on all sides of the building such as to achieve compliance with the SANS204-3 formula.</p> <p>Rooflights at 10% of floor area, with U value 2.5 and SHGF 0.35.</p> <p>Walls insulated to R = 2.2. Roof insulated to R = 2.7 to 3.7 depending on climatic zone”</p>	<p>“The building fabric must comply with ASHRAE 90.1 and the Ghana Building Code— whichever value is higher”</p>	<p>SANS 204 is not relevant to Ghana. Wall, window and roof U values have been obtained from the Ghana Building Code.</p>	
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	Section 5.3: Internal Design Criteria	"Notional SANS 204 building"	"Notional ASHRAE 90.1 Building"	SANS 204 is not relevant in Ghana	
	Section 5.3: Internal Design Criteria	"24°C in summer 20°C in winter"	"Minimum 24°C"	Heating is not typically provided in office buildings	
	Section 5.4: HVAC Systems Simulation	"Notional SANS 204 building"	"Notional ASHRAE 90.1 Building"	SANS 204 is not relevant in Ghana	
	Section 5.4: HVAC Systems Simulation	"Heating is to be provided ... as per the actual design"	"No heating is to be provided"	Heating is not typically provided in office buildings	

Section 5.4: HVAC Systems Simulation	“perSANS 204-3:2008” (occurs twice)	“perASHRAE 90.1”	SANS204 is not relevant to Ghana
Section 5.4: HVAC Systems Simulation	“To satisfy SANS204-3”	“To satisfy ASHRAE 90.1”	SANS204 is not relevant to Ghana
Section 6.1: Extract and Miscellaneous Fans	“perSANS 204-3:2008” occurs twice	“perASHRAE 90.1”	Section 6.1: Extract and Miscellaneous Fans
Section 10: Fuel factors	“An average fuel factor for South African mains electricity is used by the calculator, which is defined	“An emissions factor of 0.563	Section 10: Fuel factors

Table 15 Recommendations for Ene-0/ 1

Resources

Item	Details	Website / Contact Details
High performance glazing supplier – Royal Aluminium	Synergy glass product is a high performance single glazed product, available in Ghana.	http://www.royalalu.com/
Environmental NGO – Energy Foundation	The Energy Foundation is an NGO which seeks to improve energy efficiency in Ghana.	Ernest Asare (+233) 3025156102 easare@ghanaef.org
Technical Report – SWERA	Outlines the existing solar and wind resources in Ghana.	http://new.energycom.gov.gh/downloads/Technical%20Reports/SWERA%20-%20National%20Report.pdf
Weather Data	Historical and TMY weather information for Ghana	http://swera.unep.net/index.php?id=data_search&action_method=external_archive_query&datatype=4,70&geo_area=-1&energycategory=87&orderby=geoarea
Technical Standard – ASHRAE90.1	Energy Standard for Buildings Except Low Rise Residential	http://www.ashrae.org/technology/page/548

Table 16: Resources for Ene-0

	<p><u>ENE-1: Greenhouse Gas Emissions</u> To encourage and recognise designs that minimise the greenhouse gas emissions associated with operational energy consumption.</p>	<p>Refer to the Discussion in Ene-0.</p> <p>Resources</p> <p>Refer to resources in Ene-0, Table 15 and 16.</p>	<p>Conditional Requirement, therefore all projects must submit a CIR and receive a final ruling before Round 1 can be submitted to the GBCSA.</p> <p>Office v1.1 rating tool be applied to all other credits, calculations and protocols except the Energy modelling protocol for the ENE-0 and ENE-1: Greenhouse Gas Emissions credit, where the Office v1 Energy modelling protocol will be applicable to Ghanaian projects.</p> <p>Changes to the Green Star SA – Office v1 Energy Modelling protocol should be motivated by the registered project via the mandatory CIR.</p>
	<p><u>ENE-2: Energy Sub-metering</u> To encourage and recognise the installation of energy sub-metering to facilitate on-going management of energy consumption.</p>	<p>The professionals contacted for this research noted that most office buildings in Ghana are provided with a main electricity meter and separate (single) meters for tenancies. They would not be provided with meters for substantive uses, nor would they provided with separate meters for tenant lighting and power.</p> <p>In addition, building management systems are available in Ghana, but are rarely installed.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>ENE-3: Lighting Power Density</u> To encourage and recognise designs that provide artificial lighting with</p>	<p>The professionals contacted for this research noted that efficient lighting design in Ghana could be as low as $8W/m^2$ for office</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

	minimal energy consumption.	<p>plates. Whilst most lighting was designed to 15W/m^2, lower levels were achievable using currently available technology.</p> <p>Resources</p> <p>None.</p>	
	<p>ENE-4: Lighting Zoning</p> <p>To encourage and recognise lighting design practices that offer greater flexibility for light switching, making it easier to light only occupied areas.</p>	<p>The professionals contacted for this research noted that lighting design in Ghana often incorporated lighting zones of 100m^2. There was some knowledge of individually addressable lighting systems, but no knowledge of any building in Ghana which had incorporated this type of system.</p> <p>Resources</p> <p>None.</p>	The credit should be kept in its current form and no adjustments need to be made.
	<p>ENE-5: Peak Energy Demand Reduction / ENE-5 Maximum Electrical Demand Reduction - PEB</p> <p>To encourage and recognise designs that reduce peak demand on energy supply infrastructure.</p>	<p>Running on stand-by generation is a fact of life in rural and urban Accra. At the time of writing, the author was being supplied by electricity from stand-by generation.</p> <p>As such, Ghanaians understand the need to reduced peak demand on energy supply infrastructure. Care should taken that project teams in Ghana understand that:</p> <ol style="list-style-type: none"> (1) Load lopping cannot be used. The author was required to re-explain this concept on many occasions – even to those relatively well versed in the Green Star system. (2) Stand-by generators can only be used where they are “designed and integrated for the purpose of peak energy demand reduction and can be activated automatically and without causing a blackout”, as stated in the technical manual. 	The credit should be kept in its current form and no adjustments need to be made.

		<p>Resources</p> <p>None.</p>	
	<p><u>ENE-6: Thermal Energy Sub-Metering – RETAIL CENTRE</u></p> <p>To encourage and recognise the installation of thermal energy sub metering to facilitate ongoing management of thermal energy consumption.</p>	<p>Sub-metering of thermal energy consumption is not a very common practice in Ghana. Most retail buildings meter energy consumption per tenant and not all substantive thermal energy uses where temperature, return temperature flow and mass flow rate are measured.</p> <p>This credit should therefore remain to encourage responsible thermal energy monitoring. The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>ENE-7: Hot Water Energy Use - MULTI UNIT RES</u></p> <p>To encourage and recognise dwelling designs that reduce greenhouse gas emissions associated with domestic hot water production.</p>	<p>Several designs within multi-unit residential developments can be incorporated to reduce greenhouse gas emissions associated with domestic hot water production. This could include the use of more efficient domestic hot water fixtures and fittings, the installation of solar or other forms of renewable energy hot water geysers or heat recovery plants.</p> <p>The reduction of greenhouse gas emissions associated with domestic hot water production should be a priority irrespective of region, such that the credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p> <p>The Green Star SA Multi Unit Residential v1 Hot Water Calculator would however need to be adapted to reflect the relevant fuel factors in Ghana. This would be project-specific and a mandatory CIR would need to be submitted to confirm applicability.</p>	<p>Ene-7 the Green Star SA Multi Unit Residential v1 Hot Water Calculator would need to be adapted to reflect the relevant fuel factors in Ghana.</p> <p>This would be project-specific and a mandatory CIR would need to be submitted to confirm applicability.</p>
	<p><u>ENE-8: Common Property Energy Use - MULTI UNIT RES</u></p> <p>To encourage and recognise designs that reduce energy use associated with common property lifts, car park ventilation and lighting.</p>	<p>It is important that the energy use associated with common property lifts, car park ventilation and common property lighting in multi-unit residential developments is reduced.</p> <p>Where projects wish to apply other standards than those in the Green Star SA tool (SANS 10400-O), a CIR must be submitted to the GBCSA.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

		The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa, therefore ENE-8 should be kept in its current form and no adjustments need to be made.	
	<u>ENE-9: Low Emission Energy Generation - MULTI UNIT RES</u> To encourage and recognise designs that incorporate on-site energy generation systems utilising renewable or low emission energy sources.	It is encouraged that designs incorporate on-site energy generation systems utilising renewable or low emission energy sources. The potential exists for co-generation or tri-generation to encourage systems utilising renewable or low emission energy sources. Up to four points can be achieved in the Ghanaian context, such that the credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.	The credit should be kept in its current form and no adjustments need to be made.
	<u>ENE-10: Energy Efficient Appliances - MULTI UNIT RES</u> To encourage and recognise initiatives which reduce energy consumption associated with major appliances.	It is encouraged that initiatives are implemented which reduce energy consumption associated with major appliances. As such, points are awarded where a minimum of two applicable appliances are provided within the scope of the main contract; and applicable appliance provided is certified with a minimum 'B' rating of the European "Energy Rating" labelling system. Appliances certified with a minimum 'B' rating of the European "Energy Rating" system can be made available in the Ghana market. This credit should therefore remain to encourage the use of energy efficient appliances. The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.	The credit should be kept in its current form and no adjustments need to be made.
	<u>ENE-11: Unoccupied Spaces - PEB</u> To encourage and recognise designs that minimise or eliminate energy use for spaces when unoccupied.	Depending on the climate of the location, HVAC systems use between 10% and 30% of the total electricity used in buildings. Therefore, by reducing the amount of energy spent on heating and cooling in a building, users can reduce both greenhouse gas emissions and operational costs significantly. Where projects wish to apply other standards than those in the Green Star SA tool (SANS 10400-O), a CIR must be submitted to the GBCSA.	The credit should be kept in its current form and no adjustments need to be made.

		The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.	
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7.4 Transport

	AIM OF CREDIT	DISCUSSION	REQUIREMENT
	<p><u>TRA-1: Provision of Car Parking</u> To encourage and recognise developments that facilitate the use of alternative modes of transportation for commuting to work.</p>	<p>This credit refers to South African Department of Planning guidelines for the minimum and maximum values. Where these are not available, the technical manual refers to a set of alternative compliance requirements.</p> <p>In Accra there are no strict requirements for car parking. Town and Country Planning checks the number of car parking that is provided and makes a ‘common-sense’ decision as to whether what has been provided is adequate. Architects typically use British guidelines to determine how many car parking would be adequate.</p> <p>Resources None.</p>	<p>Tra-1 to be kept in its current form.</p> <p>The “alternative requirements” criteria of the technical manual may be used where there no car parking guidelines are available to the project team.</p>
	<p><u>TRA-2: Fuel-Efficient Transport</u> To encourage and recognise developments that facilitate the use of more fuel efficient vehicles for work commuting.</p>	<p>This credit requires that space be dedicated to efficient forms of transport. The professionals contacted in Ghana noted that even though it is not typically provided, it would not be difficult to do so.</p> <p>Resources None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>TRA-3: Cyclist Facilities</u> To encourage and recognise developments that facilitate the use of bicycles by occupants and visitors.</p>	<p>This credit generated a fair amount of discussion amongst the individuals contacted for this research. It was noted that the only people in Ghana who ride bicycles cannot afford cars. This is very similar to arguments about bicycles that the author heard in Australia.</p> <p>A few points of interest:</p> <ul style="list-style-type: none"> - The author saw a large pack of long distance road cyclists (sports) 	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

heading down one of the main highways in Ghana

- Many people do actually ride bicycles in Accra
- There is a separate bicycle lane provided as part of the major highway network in Accra. This is apparently part of a World Bank financed urban transport project (pg 6 <http://www.eco-logica.co.uk/pdf/wtpp13.4.pdf>)
- A study of bicycle use in Accra can be found here: <http://www.centrecycling.org/docs/materials/Cycling%20in%20Ghana%20-%20An%20in-depth%20study%20of%20Accra.pdf>



Figure 1: End of the Cowbell Cycling Race in Accra²¹

Resources

Item	Details	Website / Contact Details
NGO – Centre for Cycling	The Center for Cycling Expertise (CCE) is a Ghanaian NGO set up with the primary aim of supporting and promoting sustainable Non-Motorized Transport (NMT) in Ghana.	http://www.centrecycling.org/

Table 17: Resources for Tra-3

<p><u>TRA-4: Commuting Mass Transport</u></p> <p>To encourage and recognise developments that facilitate the use of mass transport for work commuting.</p>	<p>Most Ghanaians use the private tro-tro network as a means of commuting mass transport around Accra. These tro-tros have major stations all around Accra and established routes. It must be noted that the Tro-Tros are similar to the Mini Vans operating in South Africa referred to as ‘taxis’ in South Africa. Many locals in Ghana also use shared taxis from residential areas where tro-tros are not allowed to enter.</p> <p>There is also a Public Bus service called metro mass which runs throughout much of Ghana (http://metromass.com/). The tool and calculator can thus be used in the same way as in South Africa, except that Tro-tro’s where the Green Star SA tool refers to Taxis</p>	<p>Tra-4 to be kept in its current form, except that projects may use Tro-tro’s in place of Taxi’s in the calculator</p>
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Figure 2: Tro-tro station²



Figure 3: Metro Mass Transit Ltd Bus²³

Resources

Item	Details	Website / Contact Details
Public Transport Provider – Metro Mass Ltd	Government provider of inter and intra city buses.	http://metromass.com/

Table 18: Resources for Tra-4

TRA-5: Local Connectivity

To encourage and recognise office buildings that are integrated with or built adjacent to community amenities and/or dwellings in order to reduce the overall number of automobile trips taken by building users.

Many locations around urban Accra do not have adequate pedestrian facilities. In addition Town and Country Planning have no specific requirements as to the detail of facilities which must be provided. It must only be deemed adequate. Local connectivity must be encouraged in Ghana, and applying this tool could do so.

As such this credit is well placed within the Ghanaian context.

Tra-5 to be kept in its current form.

A CIR should be submitted, to be assessed by the GBCSA, should the project team wish to use an alternative set of standards to SANS 10246.

Resources

Item	Details	Website / Contact Details
British Standard: BS 8300	Code of practice for the design of buildings and their approaches to meet the needs of disabled people.	http://www.aati.co.uk/media/regulations/BS8300.pdf

Table 19: Resources for Tra-5

TRA-6: Trip Reduction – Mixed Use – RETAIL CENTRE

To encourage & recognise retail centres that are built in mixed use areas in order to reduce the overall number of car trips taken by patrons.

Similar to TRA-5, the choice of site often depends on the availability of a suitable site. When faced with multiple options for a site, this credit aims to encourage retail developments that incorporate effective car-based trip reduction measures such as the provision of quality pedestrian, cycling and public transport access.

Mixed use development or retail centres within mixed use areas, and

The credit should be kept in its current form and no adjustments need to be made.

	<p>within walking distance, encourage shoppers and retail employees living nearby, and to made a modal switch from using cars to walking or cycling. Besides reducing congestion and pollution, walking and cycling can also bring health benefits to the public and should be encouraged.</p> <p>The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa, therefore TRA-6 should be kept in its current form and no adjustments need to be made.</p>	
<p><u>TRA-7: Vehicle Operating Emissions – RETAIL CENTRE & PEB</u></p> <p>To encourage & recognise retail centres that reduce vehicular emissions resulting from traffic congestion by upgrading road infrastructure around the centre.</p>	<p>Usually, ‘delay’ and ‘number of stops’ are used to determine the existing, existing plus development and post road improvements operational condition of an intersection. The higher the delay and number of stops the higher the CO₂ emissions per vehicle will be. Car emissions are a major source of air pollutants, such as oxides of nitrogen, particles and ozone. Poor air quality has been shown to aggravate asthma, bronchitis and cardiac problems. Carbon dioxide from vehicle emissions is also known as a contributing factor to global climate change. Road infrastructure improvements are necessary to reduce the traffic impact of the development to acceptable levels.</p> <p>The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa, therefore TRA-7 should be kept in its current form and no adjustments need to be made.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

7.5 Water

	AIM OF CREDIT	DISCUSSION	REQUIREMENT
	<p><u>WAT-1: Occupant Amenity Water /</u> <u>WAT-1: Potable Water – PEB</u></p> <p>To encourage and recognise designs that reduce potable water consumption by building occupants.</p>	<p>Water efficiency is well understood by the wet services engineers that were contacted by the author. Water efficient fixtures and fittings are available in the market place and have been installed in some buildings. The author's apartment includes dual flush toilets.</p> <p>There are some buildings which include rainwater harvesting and blackwater treatment for reuse within the building, typically for irrigation. Due to water supply infrastructure issues (see Section 5), some buildings also include holding tanks for potable water and sewerage.</p> <p>At present there is no national certification system which would allow different fixtures and fittings to be rated – such as the Water Efficiency Labelling Scheme (WELS) implemented in Australia and proposed in South Africa.</p>	<p>Wat-1 to be kept in its current form.</p> <p>The project team should submit rainfall values relevant to their site to the GBCSA such that these values can be entered in the potable water calculator.</p> <p>Due to the shortage of water in Ghana, a new conditional requirement has been incorporated into this category. Project teams must achieve at least 1 point in the potable water calculator in Wat-1 to be eligible for a Green Star SA rating²⁴.</p> <p>²⁴ Information on how to do this can be found in the GBCSA Potable Water and Sewerage Calculator Guide, available from the GBCSA website.</p>

Resources

Item	Details	Website / Contact Details
Product supplier – Aqua flow	Supplier of water efficient toilets. Note they do not supply water efficient showerheads or taps in Ghana at this point in time.	http://www.modernghana.com/GhanaHome/classifieds/show_classifieds.asp?cat_id=69&cat_which=4&sub_cat_id=77&item_id=6114&menu_id=7&sub_menu_id=719&has_price=
Product supplier – Kimo Homes	Supplier of water efficient taps, showerheads and toilets	http://www.kimogroup.com/
Environmental NGO – Waterwise	Environmental NGO working in water efficiency and water efficiency labeling in Ghana	Emmanuel Amarquaye wisewatergh@yahoo.com
Product supplier – Wetico	Suppliers of recycled water treatment systems to Ghana	Hussam Jundi +966532324812 sjundi@weticoafrica.com
Product Supplier – Polytank	Suppliers of rainwater tanks to Ghana	pt@polygroupgh.com (+233)302811556

Table 20: Resources for Wat-1

	<p><u>WAT-2: Water Meters</u> To encourage and recognise the design of systems that both monitors and manages water consumption.</p>	<p>The professionals contacted for this research noted that most office buildings in Ghana are provided with a main water meter and separate (single) meters for tenancies. They would not be provided with separate meters for substantive uses.</p> <p>In addition, building management systems are available in Ghana, but are rarely installed.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>WAT-3: Landscape Irrigation</u> To encourage and recognise the design of systems that aim to reduce the consumption of potable water for landscape irrigation.</p>	<p>The professionals contacted for this research noted that water-efficient irrigation was not a focus in office building design in Ghana. The perception was that plants which were suited to the Accra climate would need to be watered.</p> <p>A landscape contractor contacted by the author did not know of any projects in Ghana which had installed low water use plants or water efficient irrigation. He had however worked on projects which were interested in the latter. The author has noted a significant amount of water used on some developments in Accra – a large water truck comes to water the plants at the author’s hotel every day.</p> <p>Foster Osae-Akonnor of the GhGBC noted that there was a university professor in Kumasi who was researching low water use plants for use in Ghana. Also, some projects in Ghana have implemented a recycled water system specific for irrigation, such as the CFAO Motors Showroom at the corner of the Airport By-pass Road, and the south Liberation Link, Accra</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

		<p>Resources</p> <p>None.</p>	
	<p><u>WAT-4: Heat Rejection Water</u></p> <p>To encourage and recognise design that reduces potable water consumption from heat rejection systems.</p>	<p>The professionals contacted for this research noted that cooling towers were rarely used in office buildings. None of the mechanical engineers which the author spoke to had designed a cooling tower based system.</p> <p>Tenant condenser water loops, which are often connected to cooling towers in Australia, are rarely provided in Ghana.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>WAT-5: Fire System Water Consumption</u></p> <p>To encourage and recognise building design which reduces consumption of potable water for the building's fire protection and essential water storage systems.</p>	<p>The professionals contacted for this research noted that sprinklers were rarely installed in office buildings in Ghana. Sprinklers were however, often included warehouse and distribution centres. The purpose and content of this credit however, were understood.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

	<p><u>WAT-7: Potable Water Efficient Appliances - MULTI UNIT RES</u></p> <p>To encourage and recognise initiatives which reduce water consumption associated with major appliances.</p>	<p>Various initiatives can be implemented in multi-unit residential developments to reduce the water consumption associated with major appliances.</p> <p>These initiatives could include the provision of clothes washes for a minimum of 90% of dwellings or the provision of communal laundry area(s).</p> <p>These initiatives could also include the provision of dishwashers where all dishwashers provided achieve a minimum water efficiency of 7.2 litres/kg.</p> <p>Potable water efficient appliances can be made available in the Ghanaian market. This credit should therefore remain to encourage the use of potable water efficient appliances. The credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>WAT-8: Swimming Pool / Spa Water Efficiency - MULTI UNIT RES</u></p> <p>To encourage and recognise designs that reduce potable water consumption associated with swimming pools and spas.</p>	<p>Swimming pools lose water through evaporation and also through filter cleaning and backwashing.</p> <p>Therefore, to achieve this credit, for any pool within the multi-unit residential 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. Alternatively, no pool(s) and or spa(s) are provided in the development.</p> <p>As such, the credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

7.6 Materials

	AIM OF CREDIT	DISCUSSION	REQUIREMENT						
	<p><u>MAT-1: Recycling Waste Storage</u></p> <p>To encourage and recognise the inclusion of storage space that facilitates the recycling of resources used within buildings to reduce waste going to disposal.</p>	<p>The professionals contacted for this research were not aware of any projects in Ghana that specifically provided space for recycling waste storage. In addition, they noted that they were unaware of any companies that provided recycling for office buildings in Ghana. See Man-7 for further information on recycling in Ghana.</p> <p>Despite the lack of companies, it is still required that space be provided in sustainable buildings to begin driving the marketplace towards recycling.</p> <p>Note that The Ghana Building Code (1989) requires an area for refuse disposal (see Section 15) but does not refer to a specific space for recycling.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>						
	<p>Resources</p> <table><tr><th>Item</th><th>Details</th><th>Website / Contact Details</th></tr><tr><td>Regulation - Ghana Building Regulation, 1989</td><td>Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.</td><td>Available at the library of the Ghana Standards Board</td></tr></table>			Item	Details	Website / Contact Details	Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board
Item	Details	Website / Contact Details							
Regulation - Ghana Building Regulation, 1989	Aims to “guide the comprehensive development of both rural and urban areas in Ghana”.	Available at the library of the Ghana Standards Board							

Table 21: Resources for Mat-1

	<p><u>MAT-2: Building Reuse</u> To encourage and recognise developments that reuse existing buildings to minimise materials consumption.</p>	<p>The professionals contacted for this research noted that buildings in Ghana were often demolished to make way for new buildings. As such a reward for the reuse of buildings would be well placed in the Ghanaian context.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>MAT-3: Reused Materials</u> To encourage and recognise designs that prolong the useful life of existing products and materials.</p>	<p>The professionals contacted for this research were not aware of any projects in Ghana which used reused materials. This is similar to the author's experience in Australia.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>MAT-4: Shell and Core or Integrated Fit-out</u> To encourage and recognise base building delivery mechanisms that eliminate the need for immediate tenant refits.</p>	<p>The majority of top tier projects in Ghana are delivered as speculative spaces which are neither shell and core nor integrated fitout. Spaces are typically provided with ceilings, lighting, finishes and air conditioning. Note that they are typically not provided with carpet.</p> <p>It should be noted that many of the individuals contacted for this research were confused by the term integrated fitout. Many believed that if the speculative (not actual) tenancy works were integrated with the base building construction this would constitute integrated fitout.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

<p><u>MAT-5: Concrete</u></p> <p>To encourage and recognise the reduction of embodied energy and resource depletion occurring through use of concrete.</p>	<p>The structural engineers contacted for the purpose of this research were not aware of any projects in Ghana which used either flyash or recycled aggregate in their construction. In addition, they were nervous as to whether either of these opportunities should be considered in Ghana due to the inability to check the standard of the concrete being produced. Further, due to the small number of power stations in Ghana it may be difficult to source flyash to use in cement.</p> <p>The author also spoke with a concrete mixing manufacturer – Elkon. In other countries these machines have been used with recycled materials but this has not yet been the case in Ghana. In addition, the company noted that they would not invest in this type of technology in Ghana due to the low penetration of recycled materials in the market.</p> <p>Lastly Ghacem, the largest concrete manufacturer in Ghana was also contacted. At present they do not recycle aggregate, nor do they use fly ash in the production of concrete at present.</p> <p>Despite this, the credit should remain to drive the marketplace towards the use of more sustainable concrete.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
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Resources

Item	Details	Website / Contact Details
Product Supplier – Elkon Concrete Batching Plants	Work in Ghana and have undertaken recycled concrete work overseas	Serkan Ozkan serkan@elkomix.com (+90)2122889633

Table 22: Resources for Mat-5

	<p><u>MAT-6: Steel</u> To encourage and recognise the reduction in embodied energy and resource depletion associated with reduced use of virgin steel.</p> <p>Resources None.</p>	<p>The structural engineers contacted for the purpose of this research were not aware of any projects in Ghana which used recycled steel products. They noted however that as much steel used in construction is imported into Ghana it may also be possible to import recycled products.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>MAT-7: PVC Minimisation</u> To encourage and recognise the reduction in use of Poly Vinyl Chloride (PVC) products in buildings.</p>	<p>MAT-7: PVC Minimisation credit omitted from Office v1.1</p>	<p>Mat-7 credit is omitted.</p>
	<p><u>MAT-8: Sustainable Timber</u> To encourage and recognise the specification of reused timber products or timber that has certified environmentally-responsible forest management practices.</p>	<p>The professionals contacted for this study were not aware of any projects in Ghana that used sustainable timber. They were also not aware of Forestry Stewardship Certification (FSC). There are however, a number of resources available online regarding FSC in Ghana. This includes information on the Ministry of Trade and Industry. Details of these references can be found below.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

Resources			
Item	Details	Website / Contact Details	
Supplier – Samartex	Wood processing company which sources wood from FSC plantations	http://www.samartex.com.gh/	
Supplier – Logs and Lumber Limited (LLL)	Producers of FSC certified Veneer, Lumber and Moulding	http://lllghana.com/	
Supplier – Form Ghana	Aim to develop a plantation and management company which will certify products according to FSC	www.formghana.com	
Ministry of Trade and Industry	Provides a number of resources of FSC timber in Ghana	http://www.moti.gov.gh/en/eu-market-products/fsc-tropical-timber.php?target=/mnt/Target01/334883/549413/www.moti.gov.gh/web/content/media/photos/forms/FSC%20Tropical%20Timber/Market%20Intelligence	

NGO – Global Forest & Trade Network	The GFTN—a WWF-led partnership—links more than 300 companies, communities, NGOs, and entrepreneurs in more than 30 countries around the world. The goal is to create a new market for environmentally responsible forest products.	http://gftn.panda.org/about_gftn/current_participants/gftn_members.cfm?country=Ghana&countryid=6
NGO – Working Group on Forestry Certification	FSC Working Group in Ghana	http://www.fsc.org/africa.html

Table 23: Resources for Mat-8

MAT-9: Design for Disassembly

To encourage and recognise designs that minimise the embodied energy and resources associated with demolition.

The professionals contacted for this study were aware of an architect in Ghana who designed roofs which could be easily disassembled. The structural engineers contacted for this study also noted that whilst they had not seen buildings designed in this way in Ghana, it would be possible to do so – at additional cost.

This is similar to the author's experience with structural engineers in Australia.

Resources

None

The credit should be kept in its current form and no adjustments need to be made.

MAT-10: Dematerialisation

To encourage and recognise designs that produce a net reduction in the

The professionals contacted for this study noted that whilst the initiatives in this credit were unusual in Ghana, they were all

The credit should be kept in its current form and no adjustments need to be made.

	total amount of material used.	possible to achieve Resources None.	
	<u>MAT-11: Local Sourcing</u> To encourage and recognise the environmental advantages gained, in the form of reduced transportation emissions, by using materials and products that are sourced within close proximity to the site.	The professionals contacted for this study noted that most building materials (finishes) used in Ghana were imported. This would therefore make this credit well placed in the Ghanaian context. Resources None.	The credit should be kept in its current form and no adjustments need to be made.
	<u>MAT-12: Efficient Dwelling Size - MULTI UNIT RES</u> To encourage and recognise multi-unit residential developments with efficiently sized dwelling units and reduced material consumption.	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. The credit in its current form, therefore, is equally relevant and applicable in Ghanaian as it is in South Africa, with the availability of building resources and compliance with the credit criteria completed automatically by the 'Efficient Dwelling Size Calculator' within the rating tool spreadsheet.	The credit should be kept in its current form and no adjustments need to be made.

<p><u>MAT-13: Masonry - MULTI UNIT RES & PEB</u></p> <p>To encourage and recognise designs that minimise the embodied energy and resources associated with a reduction of virgin material in masonry units.</p>	<p>Reducing the mass of a masonry unit reduces the embodied energy of the product and reduces transport related greenhouse gas emissions. It also leads to reduced loading on structures, which can lead to reductions in the size of structural members. This would have a significant impact on the masonry used in multi-unit residential, public and education buildings such that the credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
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7.7 Land Use and Ecology

	AIM OF CREDIT	DISCUSSION	REQUIREMENT
	<p><u>ECO-: Conditional Requirement</u> To encourage and recognise development on land that has limited ecological value and to discourage development on ecologically valuable sites.</p>	<p>Based on an ecologist opinion the criteria listed in the updated version of this credit were also suitable for application to the Ghanaian context. There were no additional areas of ecological significance in Ghana which needed to be covered by the credit. The GBCSA would require a mandatory CIR for projects for Eco-0 to ensure approval of this conditional requirement prior to the Round 1 submission.</p>	<p>Conditional Requirement, therefore all projects must submit a CIR and receive a final ruling before Round 1 can be submitted to the GBCSA.</p> <p>Eco-0 to be kept in its current form.</p> <p>A mandatory CIR will be required to assess the project's compliance with this Conditional Requirement based on site ecological maps, to ensure approval of this conditional requirement prior to the Round 1 submission.</p>
	<p><u>ECO-1: Topsoil</u> To encourage and recognise construction practices that preserve the ecological integrity of topsoil.</p>	<p>Based on an ecologist's opinion this credit was applicable to the Ghanaian context.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
	<p><u>ECO-2: Reuse of Land</u> 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.</p>	<p>Based on an ecologist's opinion the first part of this credit was applicable to the Ghanaian context.</p> <p>There are no "approved urban edges" in Ghana and as such this will need to be further investigated for its applicability in Ghana. The second point of Eco-2, relating to an "approved urban edge", is omitted from the tool.</p> <p>Resources</p> <p>None.</p>	<p>Eco-2 to be kept in its current form, however the second point of Eco-2, relating to an "approved urban edge", is omitted from the tool.</p>

<p><u>ECO-3: Reclaimed Contaminated Land</u></p> <p>To encourage and recognise developments that reclaim contaminated land that otherwise would not have been developed.</p>	<p>Based on an ecologist’s opinion this credit is applicable to the Ghanaian context. There is however, no definition of contaminated land in Ghana, and contaminated lands are not identified by a local authority. As such, Ghanaians cannot rely on government qualification to comply with this credit.</p> <p>This is confirmed by the EPA:</p> <p><i>There is no clear definition of contaminated sites as such. Currently, Ghana is participating in GEF sponsored project under which we have developed a toolkit for identifying sites contaminated by POPs. This toolkit can be obtained from UNIDO</i></p>	<p>Projects teams targeting the Eco-3 credit are required to submit a mandatory CIR.</p> <p>If the project team wish to designate the land as contaminated, they must submit a report from a suitably qualified professional stating how it is contaminated. The report must also outline how the site will be decontaminated. The project team must refer to the UNIDO Contaminated Site Investigation and Management Toolkit available from:</p> <p>http://www.unido.org/fileadmin/user_media/Services/Environmental_Management/Stockholm_Convention/POPs/toolkit/Contaminated%20site.pdf</p> <p>Project teams may wish to refer to the guidelines outlined in IEQ-11.</p>

	Resources								
	<table><tr><th>Item</th><th>Details</th><th>Website / Contact Details</th></tr><tr><td>Toolkit – UNIDO Contaminated Site Investigation and Management Toolkit</td><td>The United Nations Industrial Development Organization (UNIDO) Expert Group on POPs has developed this comprehensive Toolkit which aims to aid developing countries with the identification, classification and prioritization of POP- contaminated sites, and with the development of suitable technologies for land remediation in accordance with best Available techniques and best environmental practices.</td><td>http://www.unido.org/fileadmin/user_media/Services/Environmental_Management/Stockholm_Convention/POPs/toolkit/Contaminated%20site.pdf</td></tr></table>	Item	Details	Website / Contact Details	Toolkit – UNIDO Contaminated Site Investigation and Management Toolkit	The United Nations Industrial Development Organization (UNIDO) Expert Group on POPs has developed this comprehensive Toolkit which aims to aid developing countries with the identification, classification and prioritization of POP- contaminated sites, and with the development of suitable technologies for land remediation in accordance with best Available techniques and best environmental practices.	http://www.unido.org/fileadmin/user_media/Services/Environmental_Management/Stockholm_Convention/POPs/toolkit/Contaminated%20site.pdf		
Item	Details	Website / Contact Details							
Toolkit – UNIDO Contaminated Site Investigation and Management Toolkit	The United Nations Industrial Development Organization (UNIDO) Expert Group on POPs has developed this comprehensive Toolkit which aims to aid developing countries with the identification, classification and prioritization of POP- contaminated sites, and with the development of suitable technologies for land remediation in accordance with best Available techniques and best environmental practices.	http://www.unido.org/fileadmin/user_media/Services/Environmental_Management/Stockholm_Convention/POPs/toolkit/Contaminated%20site.pdf							
	Table 24: Resources for Mat-9								
	<p><u>ECO-4: Change of Ecological Value</u> To encourage and recognise developments that maintain or enhance the ecological value of their sites.</p>	<p>Based on an ecologist’s opinion this credit was applicable to the Ghanaian context, but would need to be updated to adequately reflect the various bioregions in Ghana. The EPA do not currently assign ecological weightings to different bio-regions in Ghana.</p> <p>Resources None.</p>	<p>Eco-4 to be kept in its current form.</p> <p>A mandatory CIR must be submitted to the GBCSA by projects to determine which South African bio-region is most applicable to the project.</p>						
	<p><u>ECO-5: Urban Heat Island – RETAIL CENTRE</u> To recognise and reward initiatives taken to reduce the heat island effect of the buildings which impact</p>	<p>The Urban Heat Island negatively impacts not only residents of urban-related environs, but also humans and their associated ecosystems located far away from cities. In fact, UHIs have been indirectly related to climate change due to their contribution to the greenhouse effect, and therefore, to global warming. Therefore, the</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>						

on microclimates, human and wildlife habitats.	credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.	
<u>ECO-6: Outdoor Communal Facilities - MULTI UNIT RES</u> To encourage and recognise designs which enable residents to engage in a broad range of outdoor activities in common areas.	This is relevant for the Ghanaian context as it is for the South African context, as such ECO-06 should be kept in its current form and no adjustments need to be made.	The credit should be kept in its current form and no adjustments need to be made.
<u>ECO-7: Urban Consolidation - MULTI UNIT RES</u> To encourage and recognise designs which make use of compact development patterns to increase land utilisation efficiency.	<p>Urban consolidation is the process of increasing or maintaining the density of housing in established residential areas, with the aim of urban consolidation to reduce development on the fringe areas of the city.</p> <p>By making use of compact development patterns, land utilisation efficiency is increased as well as local connectivity (refer to TRA-5), trip reductions within mixed use developments (TRA-6) and the sharing of precinct bulk infrastructure, mass commuting transport systems and local amenities.</p> <p>The credit aims to encourage and recognise the efficient use of land by multi-unit residential developments. As such, the credit in its current form is equally relevant and applicable in Ghana as it is in South Africa.</p>	The credit should be kept in its current form and no adjustments need to be made.
<u>ECO-8: Community Facilities - PEB</u> To encourage and recognise integrated planning and shared land use in developments through the provision of on-site outdoor facilities for use by the local community.	This is relevant for the Ghanaian context as it is for the South African context, as such ECO-08 should be kept in its current form and no adjustments need to be made	The credit should be kept in its current form and no adjustments need to be made.

7.8 Emissions

AIM OF CREDIT	DISCUSSION	REQUIREMENT						
<u>EMI-1: Refrigerants/Gaseous Ozone Depleting Potential (ODP)</u> To encourage and recognise the selection of refrigerants and other gases that do not contribute to long-term damage to the Earth's stratospheric ozone layer.	The professionals contacted for this research were well versed in zero ODP refrigerants, and whilst they were not always used, they are available in Ghana.	The credit should be kept in its current form and no adjustments need to be made.						
Resources <table border="1"> <thead> <tr> <th>Item</th><th>Details</th><th>Website / Contact Details</th></tr> </thead> <tbody> <tr> <td>Regulation – Management of Ozone Depleting Substances and Product Regulations</td><td>None</td><td>http://www.epa.gov.gh/ghanalex/acts/Acts/MANAGEMENT%20OF%20OZONE%20DEPLETING%20SUBSTANCES%20AND%20PRODUCTS%20REGULATIONS,2005.pdf</td></tr> </tbody> </table> Table 25: Resources for Emi-1			Item	Details	Website / Contact Details	Regulation – Management of Ozone Depleting Substances and Product Regulations	None	http://www.epa.gov.gh/ghanalex/acts/Acts/MANAGEMENT%20OF%20OZONE%20DEPLETING%20SUBSTANCES%20AND%20PRODUCTS%20REGULATIONS,2005.pdf
Item	Details	Website / Contact Details						
Regulation – Management of Ozone Depleting Substances and Product Regulations	None	http://www.epa.gov.gh/ghanalex/acts/Acts/MANAGEMENT%20OF%20OZONE%20DEPLETING%20SUBSTANCES%20AND%20PRODUCTS%20REGULATIONS,2005.pdf						
<u>EMI-2: Refrigerants/Gaseous Global Warming Potential (GWP)</u> To encourage and recognise the selection of refrigerants that reduce the potential for increased global warming from the emission of refrigerants to the atmosphere.	The professionals contacted for this research were well versed in low GWP refrigerants – but noted that they are not typically used in Ghana. This is consistent with the author's experience with low GWP refrigerants in Australia Resources None.	The credit should be kept in its current form and no adjustments need to be made.						

<p>EMI-3: Refrigerant Leaks To encourage and recognise building systems design that minimises environmental damage from refrigerant leaks.</p>	<p>The professionals contacted for this research were aware of systems to monitor for refrigerant leaks and pump down refrigerants. Monitoring systems were sometimes installed, but the professionals knew of no projects which incorporated pump down.</p> <p>An air conditioning manufacturer and supplier contacted by the author believed that it was possible to include a system of this type within their design, but care should be taken to verify that the system meets all the requirements of the credit.</p> <p>Regardless, air conditioners used in Ghana are imported and these products are available internationally.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>						
<p>Resources</p> <table border="1" data-bbox="248 927 1444 1123"> <thead> <tr> <th>Item</th><th>Details</th><th>Website / Contact Details</th></tr> </thead> <tbody> <tr> <td>Product supplier – Daikin</td><td>Believes that they could provide a system which would meet the intent of this credit.</td><td>(+233) 302232443 http://www.daikin-ghana.com/</td></tr> </tbody> </table> <p>Table 26: Resources for Emi-3</p>			Item	Details	Website / Contact Details	Product supplier – Daikin	Believes that they could provide a system which would meet the intent of this credit.	(+233) 302232443 http://www.daikin-ghana.com/
Item	Details	Website / Contact Details						
Product supplier – Daikin	Believes that they could provide a system which would meet the intent of this credit.	(+233) 302232443 http://www.daikin-ghana.com/						
<p>EMI-4: Insulant ODP To encourage and recognise the selection of insulants that do not contribute to long-term damage to the Earth's stratospheric ozone layer.</p>	<p>The professionals contacted for this research were well versed in zero ODP refrigerants, and whilst they were not always used, they are available in Ghana.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>						

Resources

Item	Details	Website / Contact Details
Regulation – Management of Ozone Depleting Substances and Product Regulations	None	http://www.epa.gov.gh/ghanalex/acts/Acts/MANAGEMENT%20OF%20OZONE%20DEPLETING%20SUBSTANCES%20AND%20PRODUCTS%20REGULATIONS,2005.pdf

Table 27: Resources for Emi-4

EMI-5: Watercourse Pollution

To encourage and recognise developments that minimise stormwater run-off to, and the pollution of the natural watercourses.

The professionals contacted for this research noted that stormwater from site was rarely managed to the standard required for this credit. They also noted that they were likely to use the British standards as a guide, rather than the Australian standards.

Emi-5 to be kept in its current form.

A CIR should be submitted should the project team wish to use an alternative standard for the management of emissions.

Resources

Item	Details	Website / Contact Details
BREEAM Scheme Document	Credit Pol-03: Surface Water Run-off	http://www.breeam.org/BREEAM2011SchemeDocument/

Table 28: Resources for Emi-5

<p><u>EMI-6: Discharge to Sewer</u> To encourage and recognise developments that minimise discharge to the municipal sewerage system.</p>	<p>Refer to discussion on recycled water systems and water efficient fixtures and fittings in Wat-1.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>EMI-7: Light Pollution</u> To encourage and recognise developments that minimise light pollution into the night sky.</p>	<p>The professionals contacted for this study noted that this credit was achievable in the Ghanaian context and that the CIBSE standard referenced was the appropriate one.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>EMI-8: Legionella</u> To encourage and recognise building systems design that eliminates the risk of Legionnaires' disease (Legionellosis).</p>	<p>Refer to the discussion under Wat-4 – Heat Rejection Systems.</p> <p>Resources</p> <p>None.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>
<p><u>EMI-9: Boiler and Generator Emissions</u> To encourage and recognise the use of boilers and generators that minimise harmful emissions.</p>	<p>The professionals contacted for this research were not aware of any emissions standards for boilers and generators in Ghana.</p> <p>This was confirmed by the EPA:</p> <p><i>Ghana has draft air quality regulations that are being considered by the Attorney General's Department for promulgation into law.</i></p> <p>Note that boilers are not particularly common in office buildings in Ghana as most domestic hot water heating is done by gas.</p> <p>It should be noted that professionals would typically first refer to</p>	<p>Emi-9 to be kept in its current form.</p> <p>A CIR should be submitted should the project team wish to use an alternative standard for the management of emissions.</p>

		<p>CIBSE standards, and then to ASHRAE. BREEAM does not refer to a standard in its scheme document.</p> <p>Resources</p> <p>None.</p>	
	<p><u>EMI-10: Kitchen Exhaust Emissions – RETAIL CENTRE</u></p> <p>To encourage and reward designs that avoid kitchen exhaust fumes being expelled directly into the adjacent spaces that people occupy.</p>	<p>Kitchen exhaust emissions expelled by retail tenants directly into the adjacent spaces have a negative and unhealthy impact on the people occupying these spaces.</p> <p>The credit is equally relevant and applicable in Ghana as it is in South Africa in its current form.</p>	<p>The credit should be kept in its current form and no adjustments need to be made.</p>

7.9 Innovation

	AIM OF CREDIT	DISCUSSION	REQUIREMENT
	<p><u>INN-1: Innovative Strategies and Technologies</u></p> <p>To encourage and recognise pioneering initiatives in sustainable design, process or advocacy.</p>	<p>This credit should be kept in its current form with reference being made instead to the Ghanaian context, as opposed to the South African context.</p> <p>As such, 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 Ghanaian or in the World; or the project substantially contributes to the broader market transformation towards sustainable development in Ghana or in the World.</p> <p>Points are awarded as follows:</p> <p>One point is awarded when either of the above is true for the Ghanaian market; or</p> <p>Two points are awarded when either of the above is true for the Global market.</p> <p>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).</p>	<p>Inn-1 to be kept in its current form.</p>
	<p><u>INN-2: Exceeding Green Star SA Benchmarks</u></p> <p>To encourage and recognise projects that achieve environmental benefits in excess of the current Green Star SA benchmarks.</p>	<p>This credit should be kept in its current form with reference being made instead to the Ghanaian context, as opposed to the South African context.</p> <p>As such, up to two points can be awarded for an innovative initiative where there has been a substantial improvement on an existing Green Star SA / Green Star SA-Ghana credit, as follows:</p>	<p>Inn-2 to be kept in its current form.</p>

		<ul style="list-style-type: none"> • One point for a solution that results in the elimination of the specific negative environmental impact of the project targeted by an existing credit; and • Two points for a solution that results in a substantial (e.g. 5% or greater above 'neutral') restorative environmental impact targeted by an existing credit. <p>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).</p>	
	<p><u>INN-3: Environmental Design Initiatives</u></p> <p>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.</p>	<p>This credit should be kept in its current form with reference being made instead to the Ghanaian context, as opposed to the South African context.</p> <p>As such, 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 / Green Star SA-Ghana tool.</p> <p>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).</p>	Inn-3 to be kept in its current form.

8. References

In addition to those noted throughout this report, the following sources have been used in the compilation of this report:

Green Star SA Office v1.1 Technical Manual, 2014, GBCSA, Available via order from
<http://gbcsa.org.za>

Green Star SA Public & Education v1 Technical Manual, 2013, GBCSA, Available via order from
<http://gbcsa.org.za>

Green Star SA Multi Unit Residential v1 Technical Manual, 2011, GBCSA, Available via order from
<http://gbcsa.org.za>

Green Star SA Retail v1 Technical Manual, 2010, GBCSA, Available via order from
<http://gbcsa.org.za>

9. Contacts

The following individuals and organisations were contacted as part of this research. The author would like to thank their contribution.

Organisation	Individual(s)	Contribution Area	Contact Details
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CREE lighting	N/A	Efficient lighting products	www.creeledlighting.com/
Kimo Homes	N/A	Water efficient fixtures and fittings and blinds	http://www.kimogroup.com/
Ghana Standards	N/A	Standards in Ghana	(+233) 302-50023 http://www.gsb.gov.gh