

GREEN STAR RATING

is it

Pain or Glory?

HENRI GOOSEN

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is it

PAIN OR GLORY?

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Declaration by Student

I, the undersigned, hereby confirm that the attached treatise is my own work and that any sources are adequately acknowledged in text and listed in bibliography.

Signature of acceptance and confirmation by Student

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Abstract

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The Green Building Council of South Africa (GBCSA) has developed a rating tool called 'Green Star SA – Office v1'. This is a comprehensive evaluating system for rating the environmental design and performance of South African buildings.

Green Star was only introduced toward the end of 2008. The treatise aims to investigate the validity of a South African system of this nature. An overview of both Green Star rating and the Green Building Council of South Africa is included.

Since 1994 the building industry has accelerated at a rapid rate and its future looks promising. However, the question to ask is: does the South African building industry really need an environmental rating system?

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CHAPTER 1

INTRODUCTION

GREEN STAR SOUTH AFRICA – OFFICE v1

1.0 Background

A typical situation in South Africa

It is mid morning 15 February 2009, Morgan Pretorius is fuming. He feels irate, to say the least. Imagine that: both the data analyst as well as his personal assistant has declared they are going to work for the opposition! Not for bigger salaries, mind you. Why? Simply because the other company has a far better building. Those were the words they used: a far better building! Morgan did some homework and has to admit there are some features that would be nice to have. He's not certain, though, that he would change jobs for that. He starts jotting down his thoughts.

The building in question has no air conditioning whatsoever. Envelope insulation utilizes thermal air mass, controls air leakage and ensures ventilation. This has further been achieved by solar shading on east and west facing walls. He was told that the roof and large exterior balconies are made of material avoiding unwanted heat gains. What nonsense!

In addition, the building has lots of plant cover on the sides and on the roof. His (ex) PA became almost lyrical about birds and small animals that can be seen through huge north-facing windows. So what.

The analyst raved about a device that analyses air samples for traces of bacteria, chemicals, mould and other pollutants. He even added that from now on he would be inhaling clean healthy air instead of the gung that is rhythmically spewed out by the air conditioners in Morgan's office block. That hurt.

Morgan is intrigued, however, by the carbon dioxide sensors that control energy use in the building. All this is edified by solar panels and ghastly windmills – unsightly protrusions as far as he is concerned. Yet, he has heard from other sources that the opposition is saving

hugely on water and electricity bills. Apparently they are harvesting rain and dew off the structure and channeling it to kitchens and hand basins. Grey water from the latter is used for an outside irrigation system. Waterless toilets have been installed. Yuk.

Morgan Pretorius feels a headache coming. What is wrong with the world nowadays? Why change systems and structures that have worked for decades – centuries, if the truth be told? Who cares about a healthy environment when they're only there to make money? His father and grandfather worked in large offices that were hazy from everyone's cigarette smoke. They were happy . . . weren't they . . . ?

The above abstract is a typical situation of a South African man wondering why people want to work in buildings with 'green' characteristics. Moreover what are 'green' characteristics? The thoughts and feelings of Morgan Pretorius have undoubtedly crossed the minds of several other South Africans too.

The following Treatise attempts is to investigate these common questions. The Green Building Council of South Africa has developed a tool to measure how green a building is. The tool is called Green Star SA. This investigation will endeavor to prove if the rating tool can answer Mr. Pretorius questions.

1.1 OVERVIEW

This is the 21st Century; everything is moving at a rapid rate and accelerating! Each day more people are born; new inventions and increasing pressure are placed on Mother Nature to accommodate everything man throws at her... Towards the end of the 20th century the hole in the ozone layer was on everybody's mind. "Well" experts say that 'hole' is now smaller, so we can relax, right? Can we? Consequent to the ozone scare (western) populations have become far more environmentally conscious. The latest (modern) buzz word is "GREEN"!

Everyone is going green, from car manufacturers to holiday destinations. What does 'going green' involve? The truth is many people don't know! This dissertation will look at 'green buildings' or more specifically, how one can distinguish a green building from a non-green building.

The Green Building Council of South Africa (GBCSA) has developed a rating tool called 'Green Star SA – Office v1'. This is a comprehensive rating system for evaluating environmental design and performance of South African buildings. The rating tool will enable stakeholders in the industry to determine the environmental impact of their developments and receive recognition for their design contribution. Green Star SA is a voluntary green building rating system comprised of eight categories including energy, water, materials, emissions etc. The Green Building Council of South Africa became the thirteenth full member council of the World Green Building Council in September 2008. The rating tool was launched in November 2008.

The Green Building Council addresses major issues – excess energy consumption and related CO₂ emissions from burning fossil fuels, air pollution, water and land, the depletion of natural resources and disposal of waste. Buildings consume 40-50% of the world's energy through their construction and ongoing operation. Buildings built according to green principles, can reduce the energy consumption significantly, as well as reduce water usage and reduction in run off to sewer and solid waste. By promoting green principles in buildings, the GBCSA can have a major impact on resource consumption and combating global warming.

The Green Star rating tool recognizes and rewards initiatives that reduce the environmental impact of development. Points awarded are divided into eight categories where development has met initiatives. A total score for each category is calculated and weighting is applied to this score that considers and reflects the geographical location of the project and the environmental impact.

Projects can achieve the following rating:

- 4 Star Green Star Certified Rating recognizes and rewards – “best practice”
- 5 Star Green Star Certified Rating recognizes and rewards – “South African Excellence”
- 6 Star Green Star Certified Rating recognizes and rewards – “World Leadership”

The GBCSA has four key objectives that address these aims discussed in the previous paragraph.

- Promoting green building practices in the commercial property industry.
- Facilitating the implementation of green building practice by acting as a recourse centre.
- Enabling the objective measurement of green building practices by developing and operating a green building rating system.
- Improving the knowledge and skills base of green building in the industry by enabling and offering training and education.

The GBCSA also has secondary objectives, which will be described later in the study. The GBCSA is concerned with the future of the building industry. Their view is that the current way man is operating (construction or the operations of buildings) is harmful to the environment and that change is needed.

“THE SOUTH AFRICAN PROPERTY INDUSTRY IS POISED TO EMBRACE GREEN BUILDING AND THE GREEN BUILDING COUNCIL IS LEADING THE SHIFT” (NORBERT SASSE, CEO – Growthpoint

Properties, 2008)

1.2 MAIN PROBLEM

Green Star SA Rating; Pain or Glory?

The GBCSA developed a tool called Green Star South Africa – Office v1. The Green Star rating tool sets standards and benchmarks for green buildings and allows for an objective assessment of “how green a building is”.

A comprehensive investigation into the rating tool of these so called ‘green buildings’. The rating tool rates buildings and registration fees contribute to additional costs in erecting a building. The question is: does this tool add value to the building, its surroundings and the occupants? Is it really worth while spending money to use the tool and implementing standards and principles set by the GBCSA?

What are the real issues in South Africa at present? Electricity and water shortages, transportation issues and more. Do green buildings contribute towards the current issues? Moving outside the borders of South Africa, will the same buildings contributing towards the combat against global warming?

The main problem in this treatise is; ***Green Star SA Rating; Pain or Glory?***

1.3 SUB PROBLEMS

1.3.1 What do the Green Star SA – Office v1 processes involve?

1.3.2 How ‘easily’ are the processes applied?

1.3.3 Is there really a need for an environmental rating system in buildings?

1.3.4 Is there a future for green buildings and rating systems?

1.4 HYPOTHESES

- 1.4.1 Green Star SA – Office v1 involves a step by step process, where every little detail of a building is investigated - from building materials used to the distance occupants must walk from their cars to the office and much more.
- 1.4.2 The Green Star rating tool clearly divides the different assessment credits up into categories. When designing or constructing a building the involved parties must ascertain that points are scored in each category to ensure Green Star certification. This should not be too difficult as the assessment criteria are known beforehand and designer and contractor can prepare themselves accordingly.
- 1.4.3 The Green Star rating system is a fairly new concept for South Africa, and when people on the street and even in the construction industry are asked if they have heard of this term, many admit they have not. Green buildings are also a new concept for South Africans. Green Star rating will allow people to rate and compare buildings with each other. In time the public will be sufficiently educated to appreciate the advantages of one project over another, especially in light of its environmental and sociological impact.
- 1.4.4 As more buildings are successfully developed with the use of the Green Star rating tool, South Africans will soon become familiar with the concept.

1.5 DELIMITATIONS

The GBCSA launched the Green Star Rating tool in South Africa in November 2008. It is thus difficult to make a fair judgment on the progress or success of the tool so far. Currently there are six buildings in the certification process. The council hopes to certify the first building towards the middle of 2009. One has therefore look at success Green Star had in the other twelve countries where it is been implemented and make predictions to the impact and success it will have in South Africa.

1.6 DEFINITIONS AND TERMS

- GBCSA: Green Building Council of South Africa
- BREEAM: Building Research Establishment's Environmental Assessment Method
- LEED: Leadership in Energy and Environmental Design
- CASBEE: Comprehensive Assessment System for Building Environmental Efficiency

Definition of a green building according to the GBCSA:

A green building is a building which is energy efficient, resource efficient and environmentally responsible – it incorporates design, construction and operational practices that significantly reduce or eliminate its negative impact on the environment and its occupants. Building green is an opportunity to use resources efficiently and address climate change while creating healthier and more productive environments for people to live and work in. (*GBCSA, 2009*)

1.7 ASSUMPTIONS

The world population at large is very aware of the careless methods used by former generations – their total disregard for preserving land, water and climate change are the main topics on many agenda. Rating the environmental effectiveness of a building, thereby saving energy should create a new trend in property development. (*Opinion of author, 2009*) Competition will ensue between companies regarding the rating of their office building(s). This will create a healthy and beneficial trend towards energy reduction in South Africa.

1.8 IMPORTANCE OF STUDY

The built environment and construction industry are responsible for approximately 40 percent of resource consumption, 30 per cent of the world's energy consumption (*Roodman and Lenssen, 1995*) and between 10 - 40 per cent of the World's waste generation (*Kibert, 2000*). This includes construction and operation of buildings. With almost a third the world's energy used in buildings and nearly half of the resources used in buildings, it seems clear that change is needed, and it must happen fast. At the time of this essay, the world is going through an economical crisis. The current economic crisis is foremost in many people's minds at present. One would imagine that financial survival scores more points than the environmental impact of buildings. In short: is there room for Green Star when so many other issues are at stake?

This study proposes to determine that, as well as why companies should have to go through the process to determine their green rating. Will this tool add value to the building industry?

1.9 RESEARH METHODS

- **GRAHAM, P.** 2003. *Building Ecology - First Principles for a Sustainable Built Environment*. Oxford: Blackwell Science.
- Personal Interviews with various personnel at the Green Building Council of South Africa
- Case Studies (Jason Buch, Marlon Kobacker)
- Academic Journals
- News paper articles and various opinions of people concerning the topic.
- Attending the Green Star Rating SA conference held in Johannesburg in April 2009
- Internet

“We need to pass an energy policy that works with automakers to raise fuel standards, and makes corporations pay for their pollution, and oil companies invest their record profits in a clean energy future — an energy policy that will create millions of new jobs that pay well and can’t be outsourced. That’s the change we need.” Barack Obama, 2009



CHAPTER 2

THE GREEN STAR SA RATING TOOL PROCESS

“A building environmental performance assessment method has a vital role to play in the implementation and realization of sustainable development. It must be integrated into the whole process of planning, design, construction, operation and maintenance of a building project. It is capable of providing market incentives for high environmental performance; prompting more environmentally sound building design, and suggesting environmental performance targets for the building and other related industries”

(Lead Liew, Vale et al, 2001).

2.0 Introduction

This chapter will give an overview of rating assessment systems or more particularly, the Green Building Council of South Africa’s Green Star SA assessment rating system. The objective is to provide the reader with a general background and understanding of the GBCSA’s Green Star SA processes and procedures.

This chapter will focus more on providing information, rather than asking question, the proceeding chapter will focus on asking questions concerning the assessment of sustainable buildings using the Green Star SA assessment procedures.

The following will be addressed in this chapter. Typical elements of a green building programme and rating assessment systems in general. The focus is then moved to the GBCSA’s Green Star SA rating. The following will be addressed under this heading, the project certification process, benefits of certification and the fees involved in the certification of a project with the Green Building Council South Africa. After the certification process is explained, there will be looked at the GBCSA Green Star SA rating tool called Office v1. A comprehensive study can be done on explaining each credit used in the tool. However for the purpose of this dissertation a summarized table containing all the categories and credits used in this rating tool was included. The changes made from the Australian rating tool are also discussed. In 2008 the South African National Standard created the SANS 204 standard under the title “Energy efficiency in buildings”. A brief discussion on SANS 204 is included.

The chapter concludes with a brief summary and conclusion, and ending off with a test of the hypothesis.

What is a Green Building

“A green building is a building which is energy efficient, resource efficient and environmentally responsible- which incorporates design, construction and operational practices that significantly reduce or eliminate its negative impact on the environment and its occupants. Building green is an opportunity to use resources efficiently and address climate change while creating healthier and more productive environments for people to live and work in“. (GBCSA, 2009)

2.1 Elements of a Green Building Programme

There are various different components or contents that define green building, they are generally consistent throughout. *(Lead Liew, Vale et al., 2001; NAHB, 2002)* The level of detail required often varies. Yet all have the same broad outline, and form a simple checklist. *(EBN, 1999)*

Table 1 shows the contents of a typical green building programme.

Table 1: Typical Elements of Green Building Programme

Site Development	Energy Efficiency (Site)
Energy Efficiency (Envelope)	Energy Efficiency (HVAC)
Energy Efficiency (Appliances/Lighting)	Resource Efficiency (Design)
Resource Efficiency (Material Selection)	Indoor Air Quality
Water Efficiency	Waste Management
Landscaping	Land Development
Home Owner’s Manual	Business Operation

Source (NAHB, 2002)

2.2 Rating Assessment systems

The assessment of the entire built project as a whole must be the aim of any building environmental rating system directed within an integrated sustainability framework.

Once the construction and occupancy is completed, the building has moved from a conceptual project to a functioning product. This is at the point when the building begins to be used and all the different systems are put to work. The actual performance can now be measured against the assessment.

The actual rating now becomes most useful. By assessing the both constructed building systems and how the user or occupant operates the building systems, as well as their behavioral habits, a true reading or reflection of the building environment is achieved.

Many rating systems miss this one critical issue, they are developed to give assessment through the design and construction phases, but neglect to give an actual assessment of the operations of the building when it is in use.

(Vale, Vale et al., 2001)

The table below lists EBN's priority list for sustainable buildings. Any comprehensive rating system should include this in the assessment of a building.

Table 2: EBN's Priority List for Sustainable Building

<ol style="list-style-type: none">1. Save Energy: Design and build energy-efficient buildings2. Recycle Buildings: Utilize existing buildings and infrastructure instead of developing open space.3. Create Community: Design communities to reduce dependence on the automobile and to foster a sense of community4. Reduce Material Use: Optimise design to make use of smaller spaces and utilize materials efficiently5. Protect and Enhance the Site: Preserve or restore local ecosystems and biodiversity6. Select Low-impact Materials: Specify low-environmental impact, resource-efficient materials7. Maximize Longevity: Design for durability and adaptability8. Save Water: Design buildings and landscapes that are water-efficient9. Make the Building Healthy: Provide a safe and comfortable indoor environment10. Minimize C&D Waste: Return, reuse, and recycle job-site waste and practice environmentalism in your business11. Green Up Your Business: Minimize the environmental impact of your own business practices, and spread the word <p style="text-align: right;"><i>(EBN, 1999).</i></p>

2.3 Green Star SA Project Certification

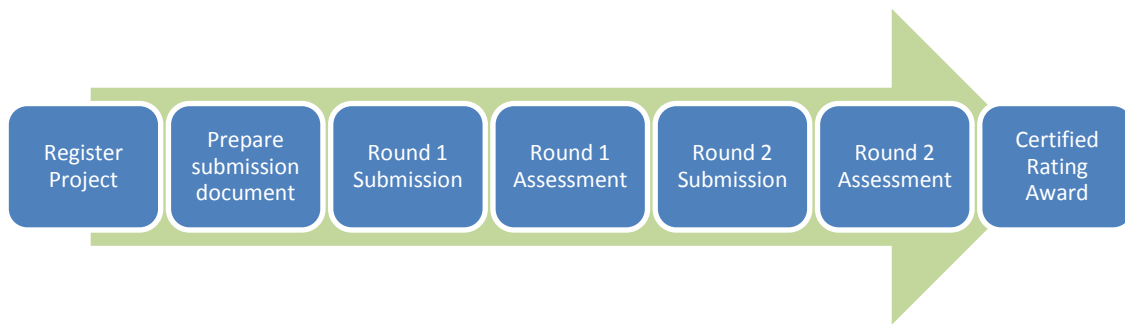
2.3.1 Design vs. As Built Certification

The Green Star SA rating tool offers two different certifications namely “design” and “As built”. The “Design” certification is submitted at the end of the design phase of the project. The intention of the project can then be marketed as a Green Star SA certified building.

At the end of construction the project can apply for “As built” certification. This will certify that all strategies were incorporated into the finished building or product.

The two types of certification are found on a similar basis but are completely separate. The “Design” certification is not a prerequisite for “As built” certification. *(GBCSA, 2009)*

Figure 1: The Certification Process explained



(Source: GBCSA, 2009)

Step 1: Register Project

The first step in the certification process is to register the project. If the building project is registered with the Green Building Council of South Africa (GBCSA), it declares the intention to pursue certification under a specific rating tool.

An executed certification agreement is sent to the owner upon registration. This must then be sent to the GBCSA to finalise a project registration. Part one of certification fee (50%) is paid upon registration of a project. (See fees page 17)

Step 2: Prepare Submission document

Once a project is registered, the following must be prepared by the project team to satisfy Green Star SA credit requirements;

- Documentation
- Drawings
- Calculations

The Green Star SA Technical Manual outlines all the relevant documentation requirements. All documentation for all claimed credits must adhere to these requirements. No points will be awarded by any assessor if all of the above requirements are not met.

Once all relevant documentation is gathered and in place, the application is ready for submission to the GBCSA. It must be submitted as following: one (1) hard copy and four (4) digital copies.

Step 3: Round 1 Submission

Once all the project documentation is submitted, an estimated time of six weeks is required for the GBCSA to do the assessment and give results.

The Project contact must inform the GBCSA at least four weeks before submission of a project. This is done through a special 'Submission Notification Form'. The project team must also complete and provide with submission the 'pre-submission' check list or *Green Star SA Pre-Submission Checklist* set out by the GBCSA.

Part two of the fee (50%) must be paid before submission. (See fees page 17)

Step 4: Round 1 Assessment

The GBCSA assessment panel reviews the submission. Recommendations will be made to the project team. The GBCSA assessment panel consists of one or more third party assessors and an independent chair.

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

Step 5: Round 2 Submission

If the project team wishes to do so after receipt of round 1 assessment results, the project documentation may be resubmitted for credits. Each project may only be resubmitted once. The resubmission may include;

- Additional/revised documentation to demonstrate fulfillment of credit criteria
- Alteration to design
- Credit Interpretation Requests (CIRs) to clarify alternative compliance

A Credit Interpretation Request is submitted to the GBCSA if a project team wishes to advocate for an alternative yet equivalent method of meeting the Aim of Credit. Each Technical Manual outlines a number of options for meeting the Aim of Credit, but if the project team has developed an alternative design solution or an alternative form of documentation, it may wish to submit a CIR. If the CIR is granted, it will be made available to every registered Green Star SA project and be incorporated into subsequent versions of the Green Star SA rating tools. (*GBCSA, 2009*)

As per step 3 a submission notification form must be used to notify GBCSA. The project team must complete a round 2 checklist.

Step 6: **Round 2 Submission**

Assessment of Round 2 submission will follow the same procedure as per Round 1 Assessment.

Step 7: **Certified Rating Award**

The project team is notified of their score based on the recommendation of the Assessment panel.

If a certified rating is awarded, the project team receives:

- A certificate award letter
- Marketing kit and relevant Green Star SA logo

If the project team is not satisfied with their rating, an appeal can be made, but this is only awarded in limited circumstances.

2.4 Benefits of Green Star SA certification

Green Star SA certification recognises projects that demonstrate leadership in environmental building design and construction.

Obtaining 4, 5 or 6 Star Green Star SA Certification will enable a project to:

- Gain market recognition as a leader in the green building industry;
- Achieve a competitive advantage by promoting the building as environmentally and workplace friendly;
- Validate achievement through third party assessment;
- Have the right to promote a Green Star SA rating and use a Green Star SA certified logo

(GBCSA, 2009)

2.5 Fees for registering a project with GBCSA

The table below indicates the fees involved to register a project with the GBCSA

Table 3: GBCSA Registration fees

Project area GFA (m2)	Member fees	Non-member fees
<2 500 m2	R 30 000	R 36 000
2 500 – 4 999 m2	R 39 400	R 47 280
5 000 – 9 999 m2	R 46 500	R 55 800
10 000 – 19 999 m2	R 60 800	R 72 960
20 000 – 39 999 m2	R 82 300	R 98 760
40 000 – 69 999 m2	R 110 900	R 133 080
> 70 000 m2	R 130 000	R 156 000

Source: GBCSA, 2009

What is a Rating Tool?

A green building rating tool sets standards and benchmarks for green building and enables an objective assessment to be made as to how "green" a building is. The rating system sets out a "menu" of all the green measures that can be incorporated into a building to make it green. Points are awarded to a building depending on to which measures have been incorporated and after appropriate weighting, a total score is arrived at, which determines the rating. (GBCSA, 2009)

2.6 The GBCSA Green Star SA rating tool – Office v1

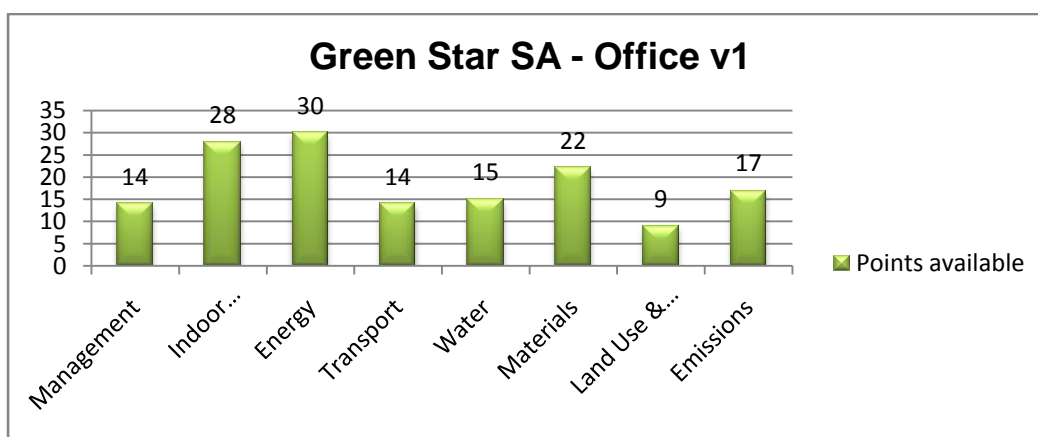
Categories included in the rating tool

There are nine categories namely;

1. Management
2. Indoor Environmental Quality (IEQ)
3. Energy
4. Transport
5. Water
6. Materials
7. Land Use & Ecology
8. Emissions
9. Innovations

Each of these nine categories is divided into credits. There are points available for each credit and each credit has the potential to improve environmental performance. The sum of all the points for each credit will demonstrate that the project has met the overall objectives of Green Star SA.

Figure 2: Points available in each Green Star credit



(Source: GBCSA, 2009)

A percentage score is calculated for each category and weighing factors are then applied. The weighing factor demonstrates the importance of the different environmental concerns

in each tool's specific market sector. For this reason not all the categories have a similar weighing factor.

Category 9, the Innovation, does not have a weighing factor. However, five points are available to contribute to the projects overall score. The Innovation category is to encourage the development and spread innovative technologies, design and processes. This can improve the building's environmental performance.

The following table is a summary of the different categories and credits included in the Green Star SA rating tool – Office Design v1.

Table 4: GBCSA's Green Star rating categories and credits

Category	Title	Credit No.	Points Available	Weighting
Management				
	Green Star SA Accredited Professional	Man-1	2	
	Commissioning Clauses	Man-2	2	
	Building Tuning	Man-3	2	
	Independent Commissioning Agent	Man-4	1	
	Building User Guide	Man-5	1	
	Environmental Management	Man-6	2	
	Waste Management	Man-7	3	
	Air tightness Testing	Man-8	1	
			14	9%
Indoor Environmental Quality				
	Ventilation Rates	IEQ-1	3	
	Air Change Effectiveness	IEQ-2	2	
	Carbon Dioxide Monitoring and Control	IEQ-3	1	
	Daylight	IEQ-4	3	
	Daylight Glare Control	IEQ-5	1	
	High Frequency Ballast	IEQ-6	1	
	Electric Lighting Levels	IEQ-7	1	
	External Views	IEQ-8	2	
	Thermal Comfort	IEQ-9	2	
	Individual Comfort Control	IEQ-10	2	
	Hazardous Materials	IEQ-11	1	
	Internal Noise Levels	IEQ-12	2	
	Volatile Organic Compounds	IEQ-13	3	
	Formaldehyde Minimization	IEQ-14	1	
	Mould Prevention	IEQ-15	1	
	Tenant Exhaust Riser	IEQ-16	1	
	Environmental Tobacco Smoke (ETS) Avoidance	IEQ-17	1	
			28	15%

Energy				
Conditional Requirements	Ene-	0		
Greenhouse Gas Emissions	Ene-1	20		
Energy Sub-metering	Ene-2	2		
Lighting Power Density	Ene-3	4		
Lighting Zoning	Ene-4	2		
Peak Energy Demand Reduction	Ene-5	2		
		30		25%
Transport				
Provision of Car Parking	Tra-1	2		
Fuel-Efficient Transport	Tra-2	2		
Cyclist Facilities	Tra-3	3		
Commuting Mass Transport	Tra-4	5		
Local Connectivity	Tra-5	2		
		14		9%
Water				
Occupant Amenity Water	Wat-1	5		
Water Meters	Wat-2	2		
Landscape Irrigation	Wat-3	3		
Heat Rejection Water	Wat-4	4		
Fire Systems Water Consumptions	Wat-5	1		
		15		14%
Materials				
Recycling Waste Storage	Mat-1	2		
Building Re-use	Mat-2	5		
Re-used Materials	Mat-3	1		
Shell & Core or Integrated Fit-out	Mat-4	1		
Concrete	Mat-5	3		
Steel	Mat-6	3		
PVC Minimization	Mat-7	1		
Sustainable Timber	Mat-8	2		
Design or Disassembly	Mat-9	1		
Dematerialization	Mat-10	1		
Local Sourcing	Mat-11	2		
		22		13%
Land Use & Ecology				
Conditional Requirements	Eco-1	0		
Topsoil	Eco-2	1		
Re-use of Land	Eco-3	2		
Reclaimed Contaminated Land	Eco-4	2		
Change of Ecological Value	Eco-5	4		
		9		7%
Emissions				
Refrigerant/ Gaseous ODP	Emi-1	1		
Refrigerant GWP	Emi-2	2		
Refrigerant Leaks	Emi-3	2		
Insulant ODP	Emi-4	1		
Watercourse Pollution	Emi-5	3		

	Discharge to Sewer	Emi-6	5	
	Light Pollution	Emi-7	1	
	Legionella	Emi-8	1	
	Boiler and Generator Emissions	Emi-9	1	
			17	8%
Innovation				
	Innovative Strategies & Technologies	Inn-1	5	
	Exceeding Green Star SA Benchmarks	Inn-2	5	
	Environmental Design Initiatives	Inn-3	5	
			5	Innovation is not weighted

(GBCSA, 2009)

2.7 Changes from Australia

The current Green Star SA rating tool is based upon the Green Building Council of Australia's Green Star – Office Design v3 and As-Built v3 rating tool. The GBCSA compiled a team that consisted of local and international industry professionals to evaluate each credit and adapt them to fit South African standards, conditions and needs.

GBCSA added five new credits, especially formulated to meet the South African context. The five new credits are.

Table 5: Credits changed from Green Star Australia

1. Man - 8 : Air tightness testing	To address the issues of air leakages in buildings.
2. IEQ – 17 : Environmental Tobacco Smoke (ETS) Avoidance	For prohibiting smoking anywhere in the building.
3. Tra – 5 : Local connectivity	Intention to reward development that enables people to drive less and walk more, through location in an area with mix of uses and/or a certain level of density.
4. Mat – 11 : Local Sourcing	For sourcing materials both extracted and manufactured close to the site, to address the embodied energy associated with transportation of materials and as a means for the tool to support SA business.
5. Emi – 9 : Boiler and Generator Emissions	To reward projects that install low-polluting boilers and generators, protecting the local air quality.

(Source: GBCSA, 2009).

2.8 The South African National Standard

SANS 204-1: 2008

Energy Efficiency in buildings

The aim of the following part of this chapter is to see what the South African National Standard (SANS 204) says about Energy efficiency in buildings. Does Green Star SA incorporate these standards in their rating tool?

Scope of SANS 204

SANS 204 specifies the requirements for the design and operation of energy efficient buildings. (*SANS 204, 2008*)

Verification of Compliance

On completion of a project the responsible person shall provide a certificate to the local authority one year after completion of the project, and periodically thereafter as determined by the local authority. This certificate will verify that the building meets the requirements of this part of SANS 204 (*SANS 204, 2008*)

Such certificate shall state

- a) That appropriate design details and building techniques have been used and that the work has been carried out in compliance with provisions of SANS 204
- b) A commissioning plan was used to show that every energy system has been inspected and commissioned in an acceptable sequence
- c) That the energy consumption, load factor and power factor of the building, after occupancy of one year, is in accordance with that of SANS 204.

Energy efficiency certificate for environmentally controlled buildings

Certification

The Building Energy Efficiency Certificate, Energy Passport or Label is a system to certify the energy efficiency of an existing, new or envisaged building in an objective and consistent manner.

It account for the following aspects of a building:

- Shape
- Orientation
- Fabric, including thermal resistance, bridges and storage, window design and air tightness.
- Technology for heating, cooling, hot water and artificial lighting.

Is the Information required by SANS 204 provided by Green Star SA rating tool?

The following table outlines the primary information required by SANS 204 in column one and states if that information is available when a building is rated with the Green Star SA rating tool.

Table 6: Information required by SANS 204

INFORMATION REQUIRED BY SANS 204	INFORMATION AVAILABLE FROM GREENSTAR SA RATING TOOL
The annual energy usage per square meter of a conditional area	YES
The primary use and the CO ₂ emissions	YES
The address of the building	YES
Building use (office, hotel, residence etc)	YES
A breakdown of energy services (heating, hot water, Cooling, lighting) and energy carrier (coal, oil, gas, electricity, Solar, wind. Hydro, etc)	YES
Suggestions on potential energy efficiency improvements	YES

(Source: SANS 204, 2008)

Aims of the energy certificate

- Inform prospective tenant and buyers of the buildings about the energy costs.

- b) Create investor incentives
- c) Initiate activities through independent guidance
- d) Support optimal execution through informed choices and reference system
- e) Protect the consumer

(SANS 204, 2008)

2.10 Summary

The Green Star SA is a voluntary green rating system comprised of eight categories including management, energy, indoor environmental quality, transport, water, materials, land use and ecology, emissions and innovation in which a building's environmental performance can be improved. The tool sets out specific criteria (credits) in each category, and buildings are awarded points for the credits they meet. The total number of points determines the buildings rating, which can be four, five or six star.

The tool is based on Australia's 'Green Star' system customised for South African use by a team of local and international consultants and the GBCSA's Technical working group.

(eProp, 2008)

The objectives of Green Star SA can be summarized as following

- Establish a common language and standard of measurement for green buildings
- Promote integrated, whole-building design
- Raise awareness of green building benefits
- Recognise environmental leadership
- Reduce the environmental impact of development

(GBCSA, 2009)

2.11 Conclusion

According to Vale (2008) many rating systems miss the point that they are to give assessment through the design and construction phases, but neglect to give an actual assessment of the operations of the building when it is in use.

In the Green Star SA process at the end of construction, the project can submit for “As built” certification. This will certify that all strategies were incorporated into the finished building or product.

Once a building project is certified and giving a rating, should the rating system include future continuous assessment to ensure requirements are still met after one or ten years.

In the proceeding chapters, the focus will move to assessment of the procedures explained in this chapter, investigating at the financial implications when designing a building and incorporating Green Star SA assessment criteria. A peek into the future of green Star SA will also be addressed.

2.12 Testing the Hypothesis

The hypothesis

Green Star SA – Office v1 involves a step by step process, where every little detail of a building is investigated - from building materials used to the distance occupants must walk from their cars to the office and much more.

The hypothesis stated above is not exactly wrong, but incomprehensive. The Green Star SA-Office v1 is a step by step process for the assessment of the sustainability of buildings. When the process was investigated, it was found that Green Star is more than a simple step by step procedure with a result. Green Star SA is concerned with a whole building design. By dividing the assessment criteria up into nine categories, and each category further into credits, a very thorough and comprehensive assessment can be done on the “green-nes” of the whole building.

“On a practical level, this encompasses the use of design, materials and technology to reduce energy and resource consumption and create improved human and natural environments. Specific green building measures include careful building design to reduce heat loads, maximise natural light and promote the circulation of fresh air; the use of energy-efficient air-conditioning and lighting; the use of environmentally friendly, non-toxic materials; the reduction of waste, and the use of recycled materials; water-efficient plumbing fittings and water harvesting; the use of renewable energy sources; and sensitivity with regard to the impact of the development on the environment.” *(GBCSA, 2009)*

CHAPTER 3

HOW 'EASILY' IS THE PROCESS APPLIED?

Is the implementation of the Green Star SA rating tool a paved road?

Management and Organization is a key aspect of sustainable construction and the subject must engage not only technical issues but social, legal, economic and political matters as well

(CIB, 1999)

3.0 Introduction

In the previous chapter, the processes involved with Green Building Council of South Africa's assessment of sustainable buildings were discussed. This chapter aims to investigate the challenges involved with the implementation of Green Star principles from a designer and contractor's point of view.

As consideration of sustainability is starting to move into the mainstream of commercial developments, the prediction is that in South Africa the implementation of building rating systems such as Green Star will become more and more commonly used not only as a guide but a minimum criteria. *(Tredrea, Mehrtens, 2008)*.

Following the launch of the Green Building Council of South Africa's Office v1 rating tool in November 2008, there has been limited research specifically focusing on identifying the challenges for industry professionals and project teams to achieve the desired Green Star rating for a building. For this study, the bulk of the information was gathered from research based on the implementation of the Green Star Council of Australia's (GBCA) Office v2 rating tool. The GBCA's tool was launched in 2003, and several projects have been certified using this tool. The GBCSA's Office v2 rating tool is directly based on that of the GBCA's Office v2 rating tool. It could therefore be assumed that research on the GBCA is relevant to that of the GBCSA.

This chapter is divided into four main headings. Firstly Sustainable construction in general will be discussed; secondly, the discussion moves towards challenges faced by the project team and contractor when implementing the Green Star principles. Following the challenges,

insights from a survey done in Australia are examined. The chapter ends with findings that became a unifying theme in facilitating of Green Star compliance.

3.1 Sustainable Construction

3.1.1 Overview

There are many disciplines involved in sustainable construction as well as activities related to building; these form a complex web of disciplines and responsibilities. They involve spanning urban planning, landscaping, building design, the manufacture of products, construction, refurbishment, operation, maintenance, demolition and recycling. (*Lead Liew, Vale et al, 2001*)

Bringing all or many of these disciplines into a more unified and coordinated process, i.e. within a sustainable framework can be a difficult task.(GSA, 2000) All key actors in the product supply chain must be understood and be involved in supplying a sustainable product.

An Environmental Management System is a way of guiding an organization to achieve and sustain performance in accordance with established goals in response to constantly changing regulations, environmental risks and social, financial, economic and competitive pressures. (*Tamura, 2000*) An EMS will require that all issues in achieving sustainability be identified and will systematize the response and actions to achieving lasting and meaningful change.

Beyer (2002) created a table that illustrates the Environmental Management systems for a hypothetical building company. (Refer to table 7, page 29)

Table 7: Direct and indirect environmental impacts associated with building and construction.

Direct and Indirect Environmental Impacts Associated with Building and Construction		
Sector Component Environmental Impact.	Component Element	Environmental Impact
Planning and Development	Planning policy Subdivision Development Development approval	<ul style="list-style-type: none"> · Greenfield development · Urban sprawl · Lack of integrated planning · Small influence over infill · BAU
Design	Architectural form Materials selection	<ul style="list-style-type: none"> · Large ecological footprint · High embodied energy · Poor thermal qualities/high operational energy · High resource use · Toxic or non-benign materials · Poor recyclability
Materials Directly from manufacturer or from suppliers	Mining operations & timber logging Manufacture fabrication and distribution	<ul style="list-style-type: none"> · Habitat or eco-system destruction · Air, water and land pollution · Associated resource use and energy intensity
Construction Methods Include materials and equipment selection and method of construction	Materials & methods during construction	<ul style="list-style-type: none"> · High labour cost · Material use and waste · Poor workmanship · High resource use and waste, i.e. Energy and water · Destruction of vegetation and habitat · Land, air and water pollution
Occupant Behavior Influenced by: Urban form Local potential Building design Internal fit out	Eco sphere and local area biota Material goods Services (energy, water)	<ul style="list-style-type: none"> · Land, air and water pollution · Degradation of local area · Energy use of fixed and transferable appliances · Water use · Material goods including furnishings and fittings · Food consumption & waste

Source: Beyer, 2002

3.1.2 Barriers to Progress

It is essential to identify the current state of play in the sector if there is to be an orchestrated and unified move towards sustainability; As a starting point, identifying the barriers to change will give insight for moving forward. The International Council for

Research and Innovation in building Construction (CIB) report lists the main barriers to progress in terms of process and management issues as:

- Professional and institutional inertia defending the status quo
- Lack of understanding of the problem among construction professionals
- Inadequate or defective vehicles for participation by the stakeholders
- Market delay
- Insufficient data
- Lack of communication between sectors that do exist
- Lack of client buy-in
- Political insecurity (government electoral periods limit the horizon)

(CIB, 1999, Beyer, 2002)

3.1.3 Sustainable construction not an easy ride

The organization for Economic Co-operation and Development (EOCD, 2003) identified some of the characteristics of the global construction industry which may prevent the successful implementation of sustainable construction, including extent supply chains, discrepancy between owners and users, spatially fixed nature products and production processes, the heterogeneity of buildings and high capital costs.

Ang and Gray (2006) investigated why progress in the implementation in ecological sustainable development (ESD) in Australia had been slow to date, despite the extensive literature indicating that it is considered to be critical for the industry and its users.

These inhibitors are summarized in table 8, page 31.

Table 8: Inhibitors to the implementation of ESD in the construction industry

Inhibitors to implementation of ESD in the construction industry
A lack contractor knowledge about construction impacts and sustainability, which is exacerbated by a lack of sustainability performance guidelines, too few benchmarks and existing standards.
A persistent preconception that sustainability will increase construction costs.
Sustainability being considered by developers, owners and contractors as too difficult or too much extra work.
Contractors not considering sustainability as part of their responsibility in the delivery process.
The limited availability of sustainability products and materials, with the market not yet supporting the manufacture of sustainable building products.
A lack of understanding of embodied energy and water in materials substituted by contractors.
The absence of uniform environmental rating systems for products and construction materials.

(Source: Ang & Gray, 2006)

3.1.4 Overcoming barriers

Overcoming such barriers requires awareness, commitment by all, education to all parties involved, integration of project teams and continuous monitoring of construction performance. *(Hood & Starring, 2007)*

3.2 The Challenges of Sustainable Construction

3.2.1 Challenges

There are a number of challenges all industry professionals involved in a project face, when associated with the achievement of Green Star credits. Their responses to these challenges are vital to the success of achieving desired Green Star rating. (*Tredrea, Mehrtens, 2008*).

Owen (2006) outlined the opportunities and complexities of gaining Green Star rating. These include the problematic use of Green Star as compliance tool rather than a tool to encourage environmental innovation, and the necessity for approximately 150 pieces of separate documentary evidence to fulfill Green Star accreditation requirements for a five star building.

It must be noted that the GBCSA is not in a position to provide design advice or recommend any specific product, technology or organization. The GBCSA's role is to identify best practice standards across environmental issues related to building, and not to prescribe solutions to these issues. It is up to the design team on each project to determine the most appropriate design strategies for each project. (*Interview; J. Buch, 2009*)

3.2.2 Management of documentation

Management of documentation on Green Star projects requires particular consideration. The traditional paper based system has many constraints towards successful document control on a project. (*Wakefield, 2005*). The additional documentation required for Green Star compliance, means contractors may benefit from a review of their procedures to ensure that they are capable of obtaining, collating and submitting information.

An approach to be considered to overcome this potential problem is the utilization of a Web Based Communication System (WBCS) – this will assist the communication between project participants and improve document control. (*Tredrea, Mehrtens, 2008*)

3.2.3 Financial Burden

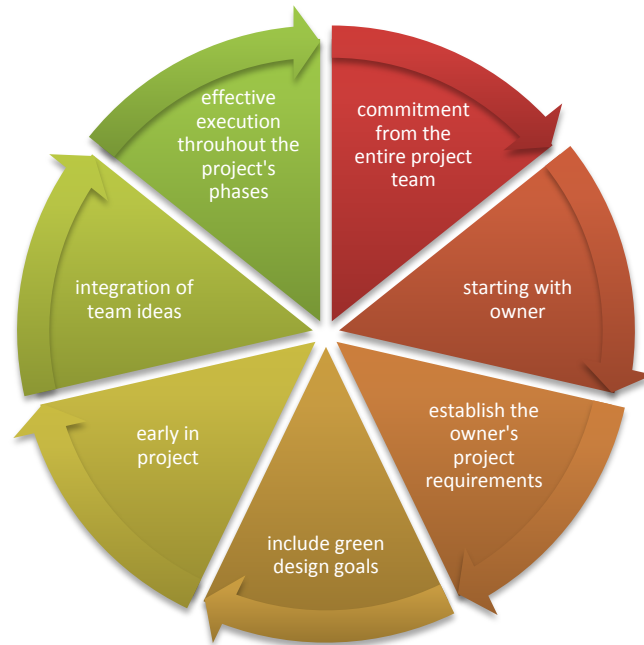
Owen (2006) further identified the financial burden of committing to Green Star project and noted that the cost for certification payable to the council for independent third party verification of documentation is only a small part of the total cost of pursuing a rating. The major cost is consumed in the consultant fees required to gather the volumes of evidence required for certification. (*Tredrea, Mehrtens, 2008*)

3.2.4 New Concept

As the implementation of Green Star rating tools is a relatively new concept, many of the challenges are new to the project team members, including the head contractors. According to Owen (2006) the substantial intellectual, financial and time commitments required from all members of the project team determine that everyone must be aware of the opportunities and the complexities of undertaking a Green Star project.

Ashrae (2006) identified the following key aspects as essential in the successful 'green' project: commitment from the entire project team, starting with the owner; establishing the owner's project requirements, including green design goals, early in the project; integration of team ideas; and, effective execution throughout the project's phases—from pre-design through to the end of its useful service life (*ASHRAE, 2006*)

Figure 3: Key aspects identified as essential in the successful 'green project'



Source: (Tredrea et al, 2008)

3.3 Related Research

Tredrea and Mehrtens (2008) conducted a survey on four projects in Australia that achieved Green Star ratings. The aim of the survey was to identify specific aspects of the rating tool that posed a direct challenge to the head contractor when implementing these Green Star standards in the construction processes.

It must be noted that the Green Building Council of South Africa's (GBCSA) rating tool – Office v1, is based on that of the Green Building Council of Australia's (GBCA) rating tool – Office v3. Although there are various changes implemented in the GBCSA's office v1 (refer to previous chapter page 21 for changes made), the core of the rating tool stayed the same. It could therefore be assumed that the results from this survey would also be applicable on the implementation of a GBCSA project.

3.3.1 The Survey

The methodology for this study consisted of a survey of selected head contractors, utilizing questionnaires and semi-structured interviews, followed by structured interviews with selected subcontractors. The data was collected from head contractors who had experience in facilitating an Office As-Built v2 Green Star projects. (Similar to GBCSA's As-Built v1) The above data was obtained from 4 projects. Refer to table 9 (below) for the projects involved in the survey.

Table 9: The Projects used in the Australian survey

	Office Building	Green Star rating
Project A	The Victoria Square 1 (VS1) building, located on the corner of Angas Street and Victoria Square, Adelaide	VS1 will be South Australia's first six Green Star office building. It is the first project Australia committed to a six star Design, As-Built v2 and Fit-out rating. This building was under construction at the time of the survey and due for completion September 2008.
Project B	City Central Tower 1, located at 11-29 Waymouth Street, Adelaide	South Australia's first office building to achieve a 5 star Green Star rating – Office Design v2, and at the time of the survey had been submitted but was yet to be awarded an As-Built rating. The building was completed in 2006.
Project C	Forestry SA Building, located in Mount Gambier	The first regional project in South Australia to achieve a 5 Star Green Star - Office Design v2 Rating, awarded in December 2006. At the time of the survey, the submission for an Office As-Built v2 rating was being compiled for submission
Project D	The Santos Building, part of the Flinders Link Development located on Flinders Street Adelaide	South Australia's first building to achieve 5 Star Office Design v2 rating and 5 Star Green Star As-Built v2 rating, awarded in 2007

(Source: Tredrea, Mehrtens, 2008)

A questionnaire was developed to determine which of the Green Star credits are not directly associated with design and posed a direct challenge to the head contractor. Analysis of that data provided information which formed the basis for subsequent semi-structured interviews where it was expanded and discussed in more detail. The survey respondents were the head contractors Green Star coordinator on each project. These respondents had both knowledge and experience of the challenges associated with implementation of the Green Star rating tool and what is necessary to achieve compliance. *(Tredrea, Mehrtens, 2008)*

3.3.2 Results and Analysis from Survey

Table 10 represents the Green Star credits that are not a design element and pose a direct challenge for the head contractor.

Table 10: Green Star credits that are not a design element and pose a direct challenge for the head contractor

Green Star credits that are not a design element and pose a direct challenge for the head contractor			
Category	Credit no.	Credit Name	Identified by project
Management	Man-1	Green Star SA Accredited Professional	A, B, C, D
	Man-2	Commissioning Clauses	A, B, C, D
	Man-3	Building Tuning	A, B, C, D
	Man-4	Independent Commissioning Agent	A, B, C, D
	Man-5	Building User Guide	A, B, C, D
	Man-6	Environmental Management	A, B, C, D
	Man-7	Waste Management	A, B, C, D
Indoor Environmental Quality	IEQ-13	Volatile Organic Compounds	A, C, D
	IEQ-14	Formaldehyde Minimization	A, C, D
Materials	Mat-2	Building Re-use	A, C, D
	Mat-3	Re-used Materials	A, C, D
	Mat-5	Concrete	A, B, C, D
	Mat-6	Steel	A, C, D
	Mat-7	PVC Minimization	A, B, C, D
	Mat-8	Sustainable Timber	A, B, C, D
Land Use & Ecology	Eco-3	Re-use of Land	A, C, D
	Eco-5	Reclaimed Contaminated Land	A, B, C, D
Emissions	Emi-7	Light Pollution	A, C, D
	Emi-9	Boiler and Generator Emissions	A, B, C, D

(Source: Tredrea, Mehrrens, 2008)

The management section of Green Star rating tool was the only environmental category where all credits were identified as posing a direct challenge to the head contractor.

Throughout the interviews the parties involved indicated that there were many challenges associated with the implementation of Green Star that are not specifically related to the specific credits. These factors include:

- Lack of information
- Resistance from subcontractors
- Obtaining and collating of documentation.

These factors pose significant challenges to facilitating the achievement of a Green Star As-built rating. The Management and Materials categories within the Green Star Office As-Built

v2 rating tool (GBCA) contain credits that represent the most significant challenges for head contractors. *(Tredrea, Mehrtens, 2008)*

Table 11 represents a summary of challenges identified throughout the survey that posed challenges to the head contractors.

Table 11: Challenges to head contractors

Head contractor lacks the knowledge required to achieve credits.
Minimal or nonexistent relationship with GBCSA
Implementation of effective management systems
Understanding costs of Green Star and knowing what to allow in tender.
Managing education and information to the project team.
Ensuring progress and compliance on future Green Star projects.
Overcoming resistance from sub contractors and suppliers.
Sourcing materials and managing documentation to ensure compliance

(Source: Tredrea, Mehrtens, 2008)

3.3.3 Subcontractors

The survey indicated that resistance by subcontractors to comply with their specific Green Star requirements posed one of the most significant challenges associated with the implementation of Green Star. *(Tredrea, Mehrtens, 2008)*

Interviews with various supervisors for service subcontractors were included in the survey. It was argued that the head contractors must understand the challenges experienced by the subcontractors.

One of these challenges is that subcontractor's experience resistance from suppliers. The results further indicated that the resistance from subcontractors is not a result of a negative attitude but rather a lack of understanding and knowledge of exactly what is required and the costs associated with compliance.

3.4 Findings

The following findings became a unifying theme in facilitating of Green Star compliance:

1. Strong and effective management
2. Communication essential
3. Contract documentation consistent on all levels
4. The need for provision of education for head contractor
5. Access to quality information from a Green Star consultant or accredited Green Star professional with mechanisms in place to evaluate the quality and effectiveness of the advice given.
6. Promotion of Green Star principles on all levels

The success of a head contractor in retaining an increase in his/her market share, and capitalizing on market opportunities, could be improved by the ability to successfully facilitate and implement the achievement of a project to a Green Star rating.

3.5 Summary

The development and implementation of Green Star in Aiming to certify a building presents particular challenges to the contractor and the project team. The findings indicate that the Management and Materials categories of the Green Star rating Office rating tool pose the most challenges for the head contractor. The head contractor must ensure as early as possible in the project that he is able to determine and implement the requirements necessary to satisfy Green Star and comply with the associated criteria. There are several challenges faced by the contractor (refer to table 11, page 38). Effective management systems are of utmost importance to the head contractor successfully achieving Green Star compliance. Resistance from subcontractors is another challenge faced by the head contractor.

3.6 Conclusion

Compliance with Green Star or any future equivalent is likely to become normal practice throughout the industry. This chapter identified a number of challenges for the projects team and the head contractor facilitating the achievement of a Green Star rating for a building. There is a belief that once resources have been allocated, effective management systems implemented and the decision has been taken to possibly sacrifice profit in the short term, the potential exists to increase profitability. Head contractors with a proven ability to facilitate the achievement of a Green Star rating in a cost effective manner will have credentials that are more likely to lead to pre-qualification for future building work on buildings seeking a Green Star rating. *(Tredrea, Mehrtens, 2008)*

The next chapter will focus on the financial implications when facilitating the achievement of Green Star rating for a building.

3.7 Testing the Hypothesis

The hypothesis

The Green Star rating tool clearly divides the different assessment credits into categories. When designing or constructing a building the involved parties must make sure that points are scored in each category to ensure Green Star certification. This should not be 'too' difficult, as the assessment criteria is known beforehand and the designer and contractor can prepare themselves accordingly.

The hypothesis was partially correct. It was identified in this chapter that the project team and the head contractor are faced with a number of challenges when facilitating the achievement of a Green Star rating for a building. It is evident that this could be a daunting task. Although the assessment criteria is known beforehand, implementing Green Star principles is still a very challenging task, but through good management, effective document control, good communication, education to the project team and contractors and commitment from the entire project team most, of these barriers can be overcome. The

question is the implementation of Green Star a paved road? The study indicates that the roughness of the 'road surface' is determined by the project team and contractor.

CHAPTER 4

IS THERE REALLY A NEED FOR AN ENVIRONMENTAL RATING SYSTEM IN BUILDINGS?

In every country the construction industry is both a major contributor to socio economic development and a major user of energy and natural resources; therefore, its involvement is essential to achieve sustainable development in our society

(UNEP-IETC, 2002)

4.0 Introduction

In the previous chapter, the challenges involved with the implementation of Green Star principles from a designer and contractor's point of view were discussed. The aim of this chapter is to investigate the need for an environmental rating system.

Globally, during construction and life-cycle, buildings consume between 40% and 50% of the world's energy produced, about 30% of resources, 20% of available water, and about 23% of the world's greenhouse gas emissions – more than any other single sector. Buildings also produce about 30% of the world's waste. *(Douglas, 2009)*

It is evident that change is needed. The implementing of green building practices could make significant positive differences on resource consumption and combating global warming. *(Van der Merwe, 2009)*

The question still arises; is there a need for an environmentally sustainable rating system? If there is no means of performance measurement, nothing can stop property developers from marketing their products as environmentally or 'eco-friendly', because how can they be proved wrong? There are also limited ways in which the prospective and current occupants of buildings can measure the comfort levels, the impact the building has on the environment, etc.

With the Green Star certification of a building, both the developer and the occupant benefits through knowing exactly what the environmental performance of the building is.

This chapter will start by focusing on the need for buildings that are environmental friendly. Then the focus move towards the need for an environmental rating system. An example of a six star Green Star certified building will also be discussed.

4.1 Impact one building has on the environment

4.1.1 Overview

The Simmons College School of Management and Academic Building in the United States, located one single building to determine the impact a single building can have on the environment.

The chosen building chosen was a state-of-the art 'green' facility that was conceived as being a truly sustainable building, located on the Simmons Academic campus. This building provides office and teaching space in a five storey, 66 000 square feet (6132m²) construction.

This building is Simmons first building constructed in accordance with the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) standards. Similar to the Green Star Rating systems LEED guidelines rate a project in several categories. (Simmons, 2009)

Table 12: LEED categories

LEED categories:
Sustainable Sites
Water efficiency
Energy & Atmosphere
Materials & Resources
Indoor Environmental Quality
Innovation and Design

(Source: LEED, 2009)

"The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council (USGBC), provides a suite of standards for environmentally sustainable construction." (Wikipedia, 2009)

In the next section the negative impact buildings in the current practice have on the environment will be discussed. The information was obtained from the Simmons Business School and will be discussed in accordance with LEED categories.

4.1.2 The Negatives with current Practice

4.1.2.1. Sustainable Sites (Land use and ecology)

Building developments and construction processes are often destructive to local ecologies. These construction activities can have the following negative effects on Mother Nature;

- Impinge on productive agricultural land
- Reduce open land and space
- Have impact on the vegetation and natural wildlife
- Storm water runoff can pollute and harm aquatic life

(Simmons, 2009)

“Buildings, not cars, produce the most CO₂ in the U.S. The average new house is 45 percent bigger than it was 30 years ago.” (National Geographic, 2009)

4.1.2.3. Water

According to Simmons (2009) the United States uses approximately 1287 billion liters of fresh water daily to support residential, commercial, industrial, agricultural and recreational activities. This water is withdrawn from rivers, streams and reservoirs. This accounts for approximately one-quarter of the U.S.A.’s total water supply of renewable fresh water. Of this water, almost 65% is discharged into rivers, streams etc after it has been used. The Americans currently extract 14000 billion liters of water per year; this is more than they return to the natural water system, The result: creating a deficit that is impacting the long-term water supply and ecosystems.(Simmons, 2009)

4.1.2.3. Energy

In the U.S. buildings consume approximately 37% of the energy and 68% of electricity produced annually. Combustion of fossil fuels produces about 75% of the country’s energy. Fossil fuels such as oil and coal are most frequently used for the production of electricity. All

of these fuels require extraction, transportation, refining, power generation and distribution processes that result in a variety of environmental impacts. In the United Kingdom approximately 80% of the energy is produced from fossil fuels and the remaining 20% is derived from a combination of nuclear fission and renewable sources, such as wind farms. (Simmons, 2009)

“If half of all light bulbs in the United States are converted to compact fluorescents, the U.S. will reduce CO₂ from lighting by 42.4 million tons per year, or 36 percent.” (National Geographic, 2009)

4.1.2.4. Materials

When designing or constructing a sustainable building the choice of building materials should be very carefully chosen. The reason for this is that the material that arrives on site has gone through various phases and processes before arrival. These include extraction, processing, and transportation, all contributing to the environmental impact. It is therefore possible to choose an ‘environmentally –friendly’ material for your building, but the process the materials undergone actually caused more damage.

In the U.S.A. about 40% of the country’s total solid waste, is as result of construction and demolition activities. (Simmons, 2009)

“If US home owners turn off their computers when not in use, the U.S. will cut their CO₂ impact by 8.3 million tons a year, or 50 percent.” (National Geographic, 2009)

If one million people replaced one incandescent lamp with a Compact Fluorescent light bulb (CFL), more than 200 000 tons of CO₂ emissions will be eliminated in a year. (Consol, 2009)

4.1.2.5. Indoor Environmental Quality

According to the American Environmental Protection Agency, Americans spend on average 90% of their time indoors, where pollution levels may be two to five times and, occasionally, more than 100 times higher than outdoor levels. The World Health Organization (WHO) states that most of an individual’s daily exposure to many air pollutants comes through inhalation of indoor air. Many of these cause health reaction. Major health disasters, such as outbreaks of Legionnaires disease and “sick building syndrome”, have highlighted the importance of indoor environmental quality for owners and occupants. Studies show that indoor environmental quality significantly impacts occupants’ mood, cognitive retention,

health and productivity. Other indoor environmental factors include access to sunlight, views to outside and thermal and acoustic comfort. (*Simmons, 2009*)

4.2 Is the Green Star Rating system a money making scheme?

According to a survey by the Green Building Council of Australia a section of the market-place believe the green star rating system is a money making scheme.

There could be reasons for these opinions. The Green Star certification has financial implications and is an extensive process that is time-consuming.

It must be taken into account that before the green star environmental rating system was introduced, the property industry had no way to define or measure 'green' performance – and as result, no way to manage risks or ensure that green buildings make money. There was no way to stop property owners from advertising their property or buildings as green. (*Madew, 2009*)

According to Romily Madew (2009), Chief executive officer of the Green Building Council of Australia, the certification process is a stringent and demanding process; the result has genuine meaning in the market place.

Madew also states that, from the GBCA, Green Star has some definite advantages that could be difficult to measure in financial terms but will have tremendous benefits. Some of the advantages include;

- Marketing
- Leasing productivity
- Return on investment
- Free publicity through green star certification and subsequent environmental awards.
- Keeping up to date with the latest trends.

According to Madew many certified buildings in Australia have long waiting lists for prospective tenants, and the lists are becoming even longer, with people becoming more environmental aware. Since the Green Star launch in 2003 11 percent of Australia's

commercial office buildings are now Green Star certified. With these figures in mind property developers should re-think their marketing strategy. (Madew, 2009)

“In the future we’ll see the rating tools being used to validate reductions in greenhouse gas emissions to earn carbon credits, obtain tax concessions to qualify for dense bonuses or other trade-offs – in other words, rating your building can make you money.” (Madew, 2009)

4.3 The rest of the world is concerned

In 2009, The World Business Council for Sustainable Development (WBCSD) launched a project called Energy in Buildings (EEB). The EEB project is tackling the urgent environmental issues the world is facing at the moment; a four year project that envisions a world where buildings consume zero net energy. The mission is to:

- Lead market transformation of buildings’ energy use
- Stimulate innovations & new business models affecting market demand and supply chain
- Broadly communicate this transformation

The EEB focuses on four key sub-sectors that collectively use more than half of all energy in buildings – single-family homes, multi-family homes, offices and retail. The WBCSD have developed a unique simulation model that is able to analyze the energy use of thousands of building types and millions of existing and new buildings between now and 2050. It takes into account the regional differences such as climate and building design. The model projects the market response to a mix of financial, technical, behavioral and policy instruments.

All the goals of the EEB are incorporated in the Green star rating system. It could therefore be beneficial for current and prospective property developers to be pro-active and incorporate these standards in the design of their projects from the beginning, rather than have to spend vast amount of money later to change designs.

The EEB roadmap for transformation of energy use in buildings is identified in figure 3, page 48. The roadmap involves short and medium term milestones, all working towards the 2050

objective. Note that this is only a broad outline of the levers. The detailed EEBs roadmap for transformation of all the different milestones and objectives can be obtained from the World Business Council for Sustainable Development.

Figure 4: The EEB’s Roadmap for Transformation



Source: WBCSD, 2009

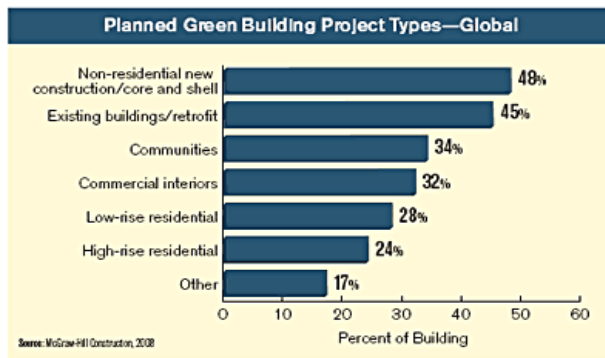
4.4 From the World Green Building Council

According to the World Green Building Council report on Trends (2009) research indicates that green buildings have become a global phenomenon, with 53% of respondents expecting to be dedicated to green on over 60% of their projects in the next five years.

The Council further indicates that green has become very visible in construction markets in every global region, with 32% of construction industry professionals estimating that green already make up over 10% of the domestic construction output.

Figure 4 indicates the planned green building projects types.

Figure 5: Planned Green Building Project types - global



4.5 The City of Cape Town green building Guidelines

The City of Cape Town has launched its Draft 1 Green Building Guidelines. The aim of these guidelines is to promote the resource efficient construction of new or renovated buildings in Cape Town.

The City of Cape Town's Energy and Climate Change Strategy underscores the City's determination to ensure access to affordable, clean and secure sources of energy to underpin sustainable economic development and to protect our environment. This coincides with the global agenda to tackle climate change by reducing greenhouse gas emissions, as well as the demand for energy.

These guidelines incorporate principles of sustainability into the lifecycle of buildings including materials, manufacture, design, construction and operation enables designers and developers to minimize the environmental impact of a development at little or no cost. Many sustainable interventions actually save money through lower water and electricity bills, less maintenance and the improved health of inhabitants.

According to the communication department of Cape Town Environmental Resource Management (2008) this document is currently a guideline; in the long-term the City will work towards design manuals and legislation to ensure the implementation of green buildings. The Green Building Guidelines document is aligned with the *Green Building Council of South Africa*. It is envisaged that the City of Cape Town will incorporate the Green Star Rating system in the future.

If Cape Town is setting the trend, one can predict that the other major cities in South Africa will follow shortly. Just another reason for developers to consider Green Star certification.

Source: Communication Department, City of Cape Town, 2008

4.6 A Green Star Certified Building

An example of what it's all about

Below is an example of a state of the art green building. The Gauge is situated in Australia and is the first building to be awarded a six star green star rating.

Figure 6: The Gauge - Australia



Source: Google images, 2009

In May 2008, The Gauge achieved a **6 Star Green Star Certified Rating** for its design, and in June it became the first building to receive the ESD Award of Excellence by VicUrban, which signifies World's Best Practice in Ecologically Sustainable Development, under the Melbourne Docklands ESD Guide. (The Gauge, 2009)

In October 2008, The Gauge won the prestigious Charter Keck Cramer Property Development Award at the Australian Property Institute Excellence in Property Awards (Victorian Division) and was commended for the Colonial First State Global Asset Management Environmental Development Award. In November, The Gauge won the *BPN Environ Sustainability Award* in the Large Commercial category.

The Gauge responds to the two significant environmental challenges facing Australia; greenhouse gas emissions and water supply.

It is anticipated that water saving initiatives in The Gauge's design will reduce potable water consumption by a further 30 per cent when compared with typical existing 5 Star Green Star rated buildings, while the focus on energy efficiency coupled with the on-site cogeneration system will reduce greenhouse gas emissions by over 30 per cent when compared with typical 5 Star Green Star buildings.

Address

825 Bourke Street
Melbourne VIC

Certified Thu 18 Dec 2008

Green Star Score 80

Building Type New Build

Owner

Australian Prime Property Fund (APPF)

Commercial Developer

Lend Lease Development

ESD/Green Star Consultant

Lend Lease design

Architecture

Lend Lease design

Architect

Darren Kindrachuk, Lend Lease design

Project Management & Construction

Bovis Lend Lease

Table 13 below, summarizes the category achievements of the Gauge.

Table 13: The Gauge Project Achievements

Category Achievements
Management
Comprehensive commissioning of all services
Diversion of 94 percent of construction waste from landfill
Provision of Building Users Guide to enable the building to achieve its intended environmental performance
Base building and tenancy sub-metering. Monthly reporting.
Indoor Environment Quality
Single pass air conditioning with 100 percent fresh air supply
Chilled beam air conditioning providing radiant supply
White noise system throughout with zoning and frequency flexibility available
Electric, internal solar blinds on north and west facades with occupant override
Glare control provided by double layer facade shading
Optimisation of artificial lighting levels within the occupied space
Individual task lighting controlled by the occupant in the Lend Lease fitout
Maximisation of natural light through low tint full floor to ceiling glazing, two full height atriums and a segmented core with windows.
Energy
Passive chilled beam technology providing space cooling
Heat recovery via return air from office spaces
Natural gas fired cogeneration unit located on the roof of the building generating more than 25 percent of the base building's energy demand
Heat by-product used for domestic hot water and space heating
Efficient lighting design- 1.95W/m2/100lux

Office lighting zoning- switched zones of no more than 100 square meters

Localised task lighting at workstations

In-slab radiant heating on ground floor

Heat extracted from exhaust air at the top of the atrium to pre-heat air supply in winter months

Base building and tenancy sub-metering

Transport

Bicycle racks, lockers and showering facilities for 72 office employees

Bicycle storage for 12 visitors to the building

Limited car parking spaces

30 percent of parking spaces are for small cars or motorcycles

Excellent links to public transport.

Water

Black water sewage treatment system on site

Water treated within building is re-used for toilet flushing

High efficiency fixtures and fittings in toilets

Cooling tower control systems limit water wastage

Fire system tank enables collection and re-use of fire system water

Rainwater capture for irrigation of adjacent parkland

Use of lowest water consuming urinals available.

Materials

Recycled waste storage located throughout the building

Fitout integrated with base building construction to minimise waste

20 percent replacement of cement with fly-ash, an industrial waste product

High level of post consumer recycled content in majority of steel used

Avoidance of PVC pipe work

Sustainable timber used throughout, either Forestry Stewardship Council rated or post consumer recycled.

Land Use & Ecology
Re-use and remediation of a heavily contaminated industrial site
Emissions
A stormwater management system treats all stormwater leaving the site. Stormwater is collected for irrigation of the adjacent Victoria Green
Blackwater treatment system enables significant reduction of sewage delivered to sewage system
Zero ODP refrigerants and insulates
Innovation
The project was awarded four points for innovation.
Three of these points were awarded due to the project exceeding Green Star benchmarks for waste, car parking and water management.

Source: GBCA, 2009

4.7 Summary

In this chapter the question was asked; is there a need for an environmental rating system in buildings? Firstly, the negatives with regard to current practice were discussed. It could clearly be seen that man is not looking after Mother Nature and that we are in desperate need for change. The focus was then moved to the World Business Council for Sustainable Development's EEB program and future objectives it has set to bring change in the current way we are doing things. The new green building guidelines for Cape Town were also discussed; and Developers must take note, since these guidelines will most likely become the trend in South Africa as the government and local authorities are becoming more and more environmentally aware. The chapter ended with an example of a six star green star rated building in Australia, where one can see the possibilities and the difference only one building can make. Imagine the difference more buildings will make.

4.8 Conclusion

Green buildings have the potential to reduce buildings' consumption on all levels, including energy, water resources, etc. by between 30% and 70%. Green buildings can look like any other commercial property, but they perform differently. (Douglas, 2009) South Africa is struggling with a power crisis, as well as the local authority issue of water, sewerage and solid waste. It would now be more appropriate than ever to incorporate green star principles.

It has become evident in countries where green buildings are more established, such as the UK, US, and Australia, that tenants are willing to pay premium rentals for green buildings, particularly because productivity of employees increased by up to 20% in some cases. (Douglas, 2009)

According to Nicola Douglas, CEO of the Green Building Council of South Africa, many multinationals now require green buildings, and many companies regard green buildings as 'future-proofing' a building, since constructing a 'non-green' building could be viewed as a risk management issue.

At the beginning of this chapter, the question was asked if there is a need for an environmental rating system. If the facts of current practice, the trends, goals and objectives are taken into account, it is clear that globally construction is moving towards a green system. With a rating system, the performance of these green projects can be measured. Is Green Star Rating necessary? The answer seems quite evident.

The next chapter will focus on an investigation of the future for green star in South Africa. The possibility of carbon tax will also be discussed.

4.9 Testing the Hypothesis

The hypothesis

The Green Star rating system is fairly new concept for South Africa, and when one walk ask people on the street, and even people in the construction industry if they have ever heard this term, many of them shake their heads. Even green buildings are a new concept for us South Africans. With everything in this world people want to be able measure something against something else. When you walk into a grocery store and the shop owner charge you hundred rand for one liter of milk, you would certainly not buy the milk there, but rather walk to the next shop where a reasonable price is charged. The same principle can be applied with the rating of green buildings, if the building had been given a four star rating, the buyer and the occupier have a very good idea what to expect from the building.

The above hypothesis was fairly true and it is evident in this chapter that the globally and in South African building trends are moving towards 'green' construction. As explained in the hypothesis above, if a building does not have a green rating, the user would not honestly know if it is really a green building? Many people may believe that rating these new 'green' buildings is a waste of time and money. These individuals certainly have the right to their opinion, however in the future green buildings would be advertised, sold and rented out according to their 'environmental awareness' rating. Property developers should therefore consider re-thinking their marketing strategy.

CHAPTER 5

THE FUTURE OF GREEN BUILDING AND THE ROLE OF RATING SYSTEMS.

Global warming is the latest scare; definite change is needed in the building environment. What role do environmental rating systems play in the future within the changing environment?

“We have a new generation of buildings coming up, where sustainability is thought of from the start”

(Noir, 2009)

5.0 Introduction

The previous chapter focused on the need for environmental rating systems in buildings. The aim of this chapter is to investigate the future role of environmental systems. How far have current and future trends have in the building environment developed and what will legislation be in the future?

Green building is a rational response to two driving forces – firstly, a new set of resource constraints facing the globe and secondly, a demand for healthier, more productive environments for users. Green building is a natural evolution of the building sector, responding to an emerging set of economic forces. It is not a passing fad but the way things will have to be done in future. *(Kerswill, 2009)* “Property owners can take a leadership position or can be dragged along by the trend, but there are risks to not responding”. *(Kerswill, 2009)*

The chapter is divided into seven main headings. The main topic that will be discussed is as follows; Reasons for sustainable building in the future, The view of the different enterprises in South Africa, From down under, What has been happening in South Africa?, Carbon Tax, Technology, Green Status of the stadia for the World Cup.

5.1 Reasons for Sustainable Building in the future

Economically, sustainable buildings are the future. According to a study done by Jonathan Smith in New Zealand in 2008, there are some definite reasons for this.

5.1.1 Economic reasons

Table 14: Economic reasons

Economic Reasons
Lower operating costs
Lower lifetime costs
Higher building value
Enhanced marketability
Helping to transform the market
Increase staff productivity and retention
Higher return on investment
Reduced liability and risk

(Source: Smith, 2008)

The study showed that according to Australia, New Zealand and the United States, 'lowering operating costs' is the most important economical reason in sustainable buildings, followed by 'lower lifetime costs' as second most important. Least important proved to be 'reducing risk and liability'. *(Smith, 2008)*

5.1.2 Environmental reasons

Table 15: Environmental reasons

Environmental Reasons
Protection of the environment
Reduction in climate change and emissions
Minimising ecological impact of buildings
Scarcity of natural resources
Improving indoor environmental quality
Waste reduction

(Source: Smith, 2008)

The most important environmental reason for sustainable building according to Australia and New Zealand is 'minimizing ecological impact on building'. The United States is most concerned with 'protection of the environment'. Improving indoor environmental quality turned out to be the least important reason. (Smith, 2008)

5.1.3 Social reasons

Table 16: Social reasons

Social Reasons
Greater health and well-being
Improved focus and healing environments
Tenant productivity
Support for the economy
Moral imperative of being 'green'
Aesthetically pleasing

(Source: Smith, 2008)

In this particular survey it is evident that all three countries believe that 'greater health and well being' is the most important social reason for sustainable building. The United States also value 'improved focus and healing environmental'. The least important social reason is 'aesthetically pleasing'. (Smith, 2008)

5.2 A view on the future of different enterprises in South Africa

5.2.1 Government

The greening of departmental headquarters is expected to accelerate the growth of the green building industry in South Africa. Examples include the new Department of International Relations head office, the new Department of Water and Environmental Affairs head office, the provincial legislature building in Pietermaritzburg and the municipal head office for Pretoria, known as Munitoria. (Van der Merwe, 2009)

According to Eric Noir (2009), WPS Green by Design director, there has been a definite movement towards sustainable building in government bids. The design and financial feasibility has played a big role in the assessment and awarding of these bids.

5.2.2 Banking Sector

The banking sector in South Africa has been the frontrunner in getting head offices 'greened'. Noir, (2009) predicts until 2011 sustainability will play a big role as differentiator in the market, as companies are trying to find new ways of operating. The ones with sustainability high on their agenda will be the ones who come out on top.

Presently phase two of the Nedbank's head office in Sandton, which is currently under construction, is one of the first two projects registered to be Green Star SA rated, upon completion for both 'Design', and 'As-built'. The new Absa Campus West in Johannesburg's central business district is also in the process of registering to be rated as an 'as built' development, upon completion. (Van der Merwe, 2009)

5.2.3 Property development companies

According to Tyrone Govender (2009), director of Growthpoint industrial division, green buildings have become a requirement when attracting both national and international corporate as customers. This is because awareness of 'green' is very strong internationally. Govender also states that from a business aspect, incorporating sustainability cannot be ignored, as it will considerably increase the risk of losing international business.

5.2.4 The Retail sector

According to Jason Buch (2009), technical manager of the Green Building Council of South Africa, the GBCSA is currently working on a pilot rating tool focusing on the retail sector. The Council aims to release the pilot version at the end of 2009 and launch the final tool in early 2010. The tool will again be based on the Australian Green Building Council's rating system.

5.2.5 The Supplying Sector

Green Building's focus is on sustainable and locally manufactured building materials and manufacturers in South Africa must be able to supply these products. (Van der Merwe, 2009) In South Africa there has been a lot of reluctance from suppliers. Buch, (2009) predicts that there will be a change in the supply when there is an increase in demand.

Big paint manufacturers have started producing nontoxic and low-volatility organic compound (VOC) paints that comply with GBCSA standards. The Cement and brick industry has indicated that products will move in an environmental friendly direction. There is a serious need for transformation in the steel and aluminum sectors, from a recycled, energy consumption and pollution perspective. (Buch, 2009)

“Sustainable buildings are intrinsically more economic to run over their whole lifetime. They reduce waste and are much more efficient in their use of key resources such as land, energy, water and materials. They can also be healthier and more comfortable, and support greater productivity, with improved levels of natural light, cleaner air and a higher degree of personal control. They are also adaptable and durable enough to meet the requirements for flexibility and needs of future generations of building occupiers”.

(New Zealand Ministry for the Environment, 2008)

5.3 From down Under

The Australian Green Building Council Office rating tool was launched in 2003. The Green Building council of South Africa office rating tool is based on the Australian version. Next section progress by the Australian has council made from the launch in 2003 will be discussed.

According to Romilly Madew (2009), chief executive officer of the GBCA, prior to 2003 the majority of buildings were constructed without taking into account any neither water nor, energy consumption or improving to the indoor environmental quality or performance of buildings. Introduction of GBCA increased the number of commercial properties taking environmental factors into account.

Since the launch of the Australian Green Building Council in 2003, 510 projects have applied for registration, and 53 have already achieved a 4, 5, or 6 Star Green Star rating. The council has over 600 members. (Madew, 2009) According to Madew the Green Star tool which can be downloaded from the council's website, has been downloaded around 40 000 times.

There has been an impact on the environment since 2003, with on average a reduction of 85% in energy use compared to conventional buildings. The reduction in water consumption has been around 60%; up to 69% of waste has been diverted away from landfill and a reduction in emissions, equivalent to removing 3250 cars permanently off the road. (Madew, 2009)

5.4 What is happening in South Africa?

5.4.1 Current projects in South Africa with the aim of Green Star rating

Currently in South Africa there are various projects working towards Green Star standards. Five projects have formally registered with the GBCSA's Green Star Office v1. They include the Bartholomew, Pegasus and Falcon Building office developments in Menlyn, Pretoria, Nedbank building in Sandton and the Lincoln in Durban.

Table 17: Green Star Registered Projects in South Africa

Building	Location	Completion
Bartholomew	Menlyn Maine, Pretoria	-
Pegasus Building office development	Menlyn, Pretoria	2011.
Falcon Building office development	Menlyn, Pretoria	2011
Nedbank Phase II building	Sandton	2010
Lincoln on the Lake	Durban	2009

(Source: News24, 2009; Berry, 2009)

5.4.2 Lincoln on the Lake

The next section will focus on what is to be achieved with the construction of this new building in Kwa-Zulu Natal. The principles in both the design and construction of Lincoln on the Lake include environmental consciousness.

Figure 7: Lincoln on the Lake



Source: www.lincolnonthelake.co.za

Table 18: Principles of Lincoln on the Lake

Lighting	Lighting is controlled by an individually addressable lighting control system with motion and daylight sensing switches to monitor movement and light levels respectively.
Indoor Environmental Quality	Fresh air supply is 150% that of the lowest permissible ventilation rate legislated in the national building standard SANS 10400-O to ensure good environmental quality.
Indoor Environmental Quality	CO ₂ sensors are located at all return points to air-conditioning systems to monitor levels. This ensures delivery of optimum quantities of outside air.
Indoor Environmental Quality	Paints with low volatile organic compound (VOC) levels are used. VOCs are organic compounds that produce vapors at room temperature. Exposure to high concentrations of these vapors is a concern because the health implications are consistent with the effects of sick building syndrome.
Water usage	Water collected from rainwater harvesting is used for toilet flushing, which reduces the demand for potable water for flushing.
Water usage	80% of the routine fire protection system test water is captured and stored on site for re-use.
Water usage	Efficient fixtures, such as dual flush toilets, low-flush urinals, low-flow shower heads and electronically controlled taps with flow restrictors are used to reduce consumption of potable water.
Building Materials	20% of the contract value represented by materials used in the project has been sourced from within 400km from the site.
Alternative Transportation	5% of car parking spaces are dedicated for use by alternative fuel vehicles and a further 5% of car parking spaces are dedicated for motorbikes, mopeds and scooters.
Alternative Transportation	Bicycle storage facilities are provided for 6% of the building staff. The building includes showers, change facilities and lockers for cyclists.

Source: Berry, 2009

This table clearly shows that Lincoln on the Lake has taken many environmental considerations into account. The project is set to be completed at the end of 2009.

5.5 Carbon Tax

According to a paper published by Deloitte in 2008, both on a per capita basis and from an emissions perspective, South Africa is one of the world's worst polluters. Despite being a signatory to the 1997 Kyoto protocol on reducing global greenhouse gas (GHG) emissions, South Africa is a 'non-Annex 1' country (largely developing countries) which means it has no explicit emissions reduction targets. There is, however, increasing international pressure for the big polluters in the 'non-Annex 1' group – China, India, Brazil, South Africa – to take mitigation actions of their own. On home soil pressure is also being felt with the current energy crisis in South Africa. A reevaluation of South Africa's energy policy is desperately needed.

Currently, the two main environmental taxes used in South Africa are the electricity levy and the fuel levy. These two levies effectively form the bulk of the current environmental tax system. The findings from a study done by Deloitte, believe that both these levies do not fulfill the majority of requirements for a "good tax" and alternative approach to reducing GHG emissions should be considered. Overall, the finding by Deloitte is that the current environmental taxes (electricity and fuel levies) are ineffective as tools to address the key problem of GHG emissions. Cap-and-trade is overall a superior approach and is increasingly seen internationally as the way forward. (Deloitte, 2008)

In November 2008, Martinus van Schalkwyk, Environmental Affairs and Tourism Minister announced that cabinet has mandated the National Treasury to investigate the possible imposition of a tax on carbon dioxide (CO₂) emissions as part of South Africa's voluntary commitment to climate-change mitigation. (Creamer, 2008)

The Tax could initially be introduced at low levels, but escalate to higher levels by 2012 or 2018. The minister also indicated that the National Treasury was likely to introduce a

'cap-and-trade' mechanism, involving a combination of financial penalties and incentives.

Under a cap-and trade system, government could set a limit, or cap, on the amount of CO₂ that can be emitted, and companies needing to increase their emissions would have to buy credits from those who pollute less. (Creamer, 2008)

At present, South Africa's CO₂ emissions stand at about 800-million tons a year, which is likely to climb to above 1 200-million tons by 2025. Should the country succeed in reducing its absolute emissions from 2030, the Department of Environmental Affairs and Tourism (DEAT) believes South Africa's absolute emissions could fall again to below 600-million tons by 2050. (Creamer, 2008)

To achieve this, DEAT is proposing that the country adopt a so-called "Reach for the Goal" strategic option, which entails not only the adoption of carbon-friendly technologies, but also regulatory mechanisms, such as mandatory targets for energy efficiency as well as changes to building standards, to enforce the adoption of green-building

The conclusion from the information above is that the South African government is under huge pressure locally and internationally to cut the total emissions. The introduction of the 'cap-and-trade' system could potentially cost or save companies large sums of money depending on the nature of their emissions.

Therefore, designing and constructing a building according to the Green Star standards could save buildings large sums of money or even 'make money' by selling carbon credits to other companies. Not only can these Green Star accredited buildings save money but also contribute towards the Department of Environmental Affairs and Tourism's 'Reach for a Goal' strategy. (Author's own opinion

5.6 Technology

5.6.1 BMS Systems

Saving energy, improving services and optimizing resources can be implemented with intelligent solutions. In commercial buildings there are multiple systems used by large numbers of groups of people. These systems can be very time consuming and require a large staff to control efficiently. One way to control these environments efficiently is by using a Building Management System (BMS). *(Olejnik, 2008)*

BMS systems are computerized systems, comprised of hardware and software, providing rich visual tools to control, monitor, diagnose and report on building performance. With the implementation of SANS 204 and Green Star rating standards in buildings, BMS is an excellent way to control diverse groups of systems smartly. A good BMS installation will provide an overall view of the building's performance. This enables reliable money savings, happy occupants, productive workers and less impact to the planet. An effective BMS system could lead to a better Green Star rating and would attract better tenant occupancy. *(Olejnik, 2008)*

Experts agree that effective BMS installation should focus on core systems that include the following:

- A building's mechanical and electrical equipment (ventilation, heating, cooling, lighting, power systems, CO₂/O₂ levels, fire systems) and
- Security systems

By deploying a BMS system, based on open, IT-friendly standards – BMS will enhance broader environmental savings as well as improve security and facilitate management. *(Olejnik, 2008)*

With intelligent energy management a business can save operational costs by 25% - 35% on a monthly basis. With municipal rates continuously on the rise and Eskom predicting sharp increases in electricity supply rates over the next few years, solutions such as BMS could outweigh the initial costs. (*Olejnik, 2008*)

Implementing a BMS system in a building can make a considerable contribution to the sustainability of the building and would definitely play a huge role in the Green Star accreditation process of the building. (derived from previous research)

5.7 Green Status of the Stadia for the 2010 World Cup

South Africa is hosting the 2010 FIFA World Cup Soccer tournament. The host nation must create the infrastructure to be able to successfully host such a large event. Ten stadiums will be used during the event. These include the upgrade of current stadiums and constructing of new ones.

The Department of Environmental Affairs and Tourism (DEAT) commissioned a consulting team to undertake a review of the greening status of stadia in Cape Town and Durban. The review lists all the greening initiatives included in the design for stadia relating to water, energy, waste, materials and rates these against the criteria of 'good practice', 'best practice' and 'cutting edge'. (*DEAT, 2008*)

Cutting edge initiatives include:

- ⇒ A hybrid pitch, which is a combination of synthetic and natural grass requiring 50% less irrigation (potential saving of R78, 975 per annum)
- ⇒ Water-cooled variable refrigerant cooling system
- ⇒ Carbon dioxide monitors in the parking garage to switch fans on only when required,

⇒ Low emitting finishes

Best practice initiatives include:

⇒ Rainwater harvesting from detention pond for irrigation (potential saving of R187, 725 per annum)

⇒ A mesh fabric facade, combined with insulated panels that reduces heat gain while allowing breezes through for natural ventilation

⇒ Purchase of 'green energy' for stadia

⇒ Re-use of demolition material from the old stadium.

(DEAT, 2008)

Stadium specific recommendations are made for further greening and these are prioritised as 'must have', 'should have' and 'nice to have'. For example, for Green Point Stadium the Review recommends the inclusion of 'must have' features, namely a Building Management System (BMS) and sub-metering of water and electricity allowing monitoring of consumption. The list of 'should have's' include a sewer treatment facility, solar water heaters, intelligent or drip irrigation systems and recycled plastic seating. Waterless urinals and PV for lighting are listed as 'nice to have's'. The proposed initiatives are assessed in terms of their environmental impact (resource conservation), economic feasibility and barriers to practical implementation. (DEAT, 2008)

5.8 Growth of Green Building Councils across the Globe

There has been a great response to sustainable building practices right across the world. Although the growth of other green building councils is not part of this study, the table below indicates the immense growth sustainable rating councils have had since the World Green Building Council was launched in 1998.

5.8.1 Green Building Councils across the globe

The World Green Building Council (2009) has indicated that the following councils have already been established across the globe:

Africa

- **Mauritius :** Mauritius (Associated group)
- **South Africa :** Green Building Council of South Africa

Asia

- **China :** China Green Building Council (Associated group)
- **Hong Kong :** Hong Kong Green Building Council (Associated group)
- **India :** Indian Green Building Council (Established GBC)
- **Indonesia :** Indonesia (Prospective GBC)
- **Israel :** Israel (Emerging GBC)
- **Japan :** Japan Sustainable Building Consortium
- **Jordan :** Jordan (Prospective GBC)
- **Korea :** Korea Sustainable Building Council (Associated group)
- **Malaysia :** Malaysia Green Building Council (Associated group)
- **Qatar :** Qatar (Prospective GBC)
- **Saudi Arabia :** Saudi Arabia (Prospective GBC)
- **Singapore :** Singapore (Prospective GBC)
- **Taiwan :** Taiwan Green Building Council (Established GBC)
- **United Arab Emirates :** Emirates Green Building Council (Established GBC)
- **Vietnam :** Vietnam Green Building Council (Emerging GBC)

Europe

- **Austria :** Austria Green Building Council (Associated group)
- **Bulgaria :** Bulgaria Green Building Council (Associated group)
- **Croatia :** Croatia Green Building Council (Associated group)
- **Czech Republic :** Czech Green Building Council (Associated group)
- **France :** France GBC (Prospective GBC)
- **Germany :** German Sustainable Building Council (Established GBC)
- **Greece :** Greece Green Building Council (Associated group)
- **Hungary :** Hungary Green Building Council (HuGBC)
- **Italy :** Italy Green Building Council (Emerging GBC)
- **Montenegro :** Montenegro Green Building Council (Associated group)
- **Netherlands :** Dutch Green Building Council (Emerging GBC)
- **Poland :** Polish Green Building Council - PLGBC (Emerging GBC)
- **Romania :** Romania Green Building Council (Emerging GBC)

- **Russian Federation :** Russia Green Building Council (Associated group)
- **Spain :** GBC España (Emerging GBC)
- **Sweden :** Sweden Green Building Council (Associated group)
- **Turkey :** Turkey (Prospective GBC)
- **United Kingdom of Great Britain & Northern Ireland :** U.K. Green Building Council

North America

- **Canada :** Canada Green Building Council (Established GBC)
- **Costa Rica :** Costa Rica (Prospective GBC)
- **Mexico :** Mexico Green Building Council (Established GBC)
- **Panama :** Panama Green Building Council (Associated group)
- **United States of America :** U.S. Green Building Council (Established GBC)

Oceania

- **Australia :** Green Building Council Australia (Established GBC)
- **New Zealand :** New Zealand Green Building Council (Established GBC)

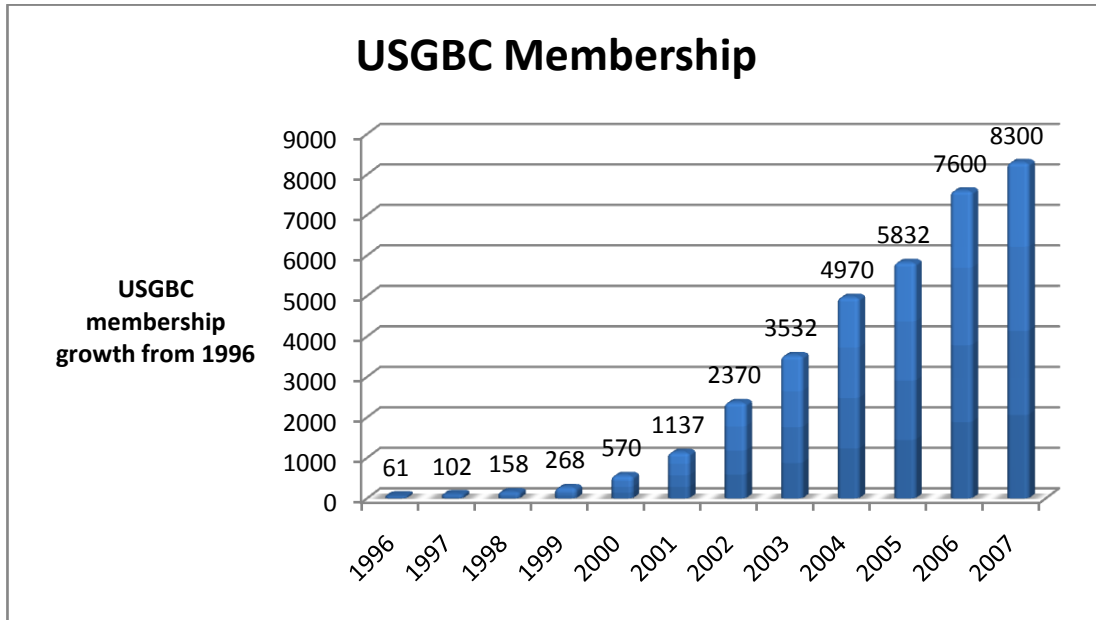
South America

- **Argentina :** Argentina Green Building Council (Established GBC)
- **Brazil :** Green Building Council Brazil (Established GBC)
- **Chile :** Chile (Prospective GBC)
- **Colombia :** Colombia Green Building Council (Emerging GBC)
- **Uruguay :** Uruguay (Prospective GBC)

5.7.2 Green Building Council growth internationally

Green Building Council's right over the world has experienced large increase in membership numbers which has led to the expansion of green buildings in the market.

Figure 8: Growth in the membership of the USGBC

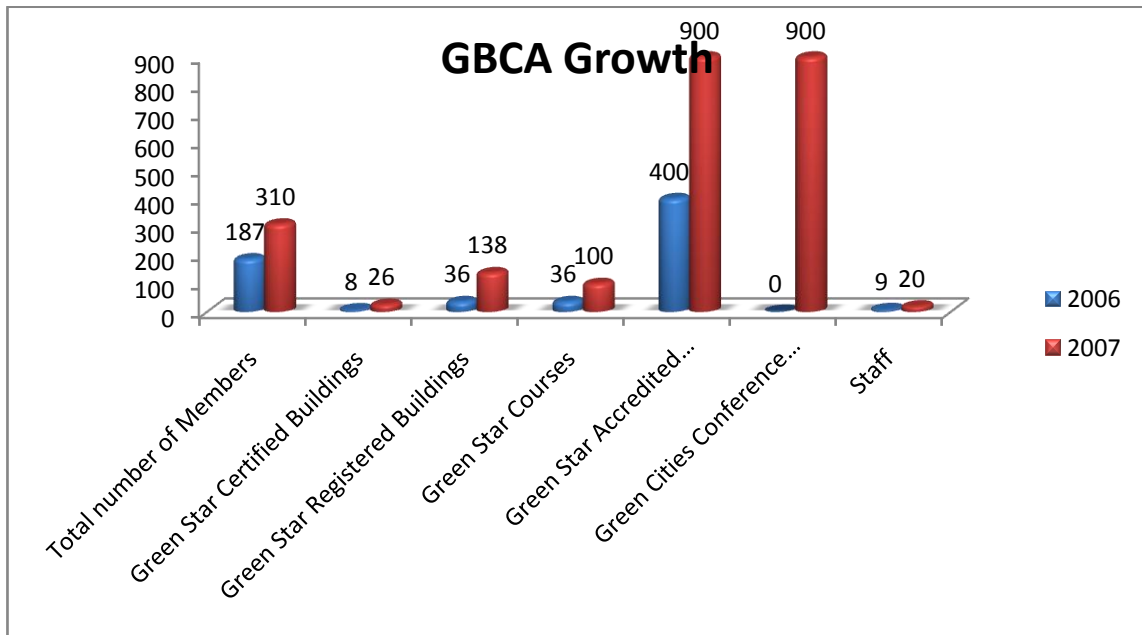


Source: (www.worldgbc.org)

Green Building Council Australia

Figure 9 compare the growth of the Green Building Council of Australia (GBCA) from 2006 to 2007 in all relevant areas.

Figure 9: GBCA Growth (Cheng, 2007)



5.9 Summary

The aim of this chapter was to discuss the future of green buildings in South Africa. The reasons for sustainable building were looked at and it was seen that there are various economical, environmental and social reasons for sustainable building in the future. The views of the different enterprises in South Africa were investigated and the results show that the norm is certainly moving towards a more sustainable approach in building projects. In Australia the response to sustainable buildings have been dramatic, with more than five hundred projects registered for registration at the Green Star Building Council. In South Africa there has also been a positive response, with five projects being constructed according to Green Star principles within the 1st year after the launch of the Green Building Council of South Africa. Carbon Tax could play a huge role in the future of buildings, with the government in the process of launching the 'cap-and-trade' system. When this system is in place sustainable buildings can save or even make large sums of money in the future. The chapter concluded with a look at the 2010 soccer world cup stadia, in their designs sustainability has played a big part.

5.10 Conclusion

There is a very exciting future for the building industry in South Africa, but this will not be achieved without some definite changes in the current practice.

Local and international pressure for sustainable building is becoming the norm and will continue to increase in the future. Some top business executives have even suggested that if sustainability is not part of the portfolio, doing international business will be a very difficult task in the future.

The message delivered at the recent SAPOA/IPD Investment Conference by Bruce Kerswill, Executive Chair of the Green Building Council of SA was, “Green buildings are the way of the future, and buildings that are not green will ultimately become obsolete”.

The next chapter will be a summary of the main topics discussed in this study from chapter one to chapter five.

5.11 Testing the Hypothesis

The hypothesis

The Green Star rating system is a fairly new concept in South Africa, but as more and more buildings is developed successfully with the use of the Green Star rating tool. This will become a very familiar trend in South Africa.

The hypothesis seems to be accurate. Building trends are increasingly shifting towards a more green approach. As the building industry becomes more exposed to sustainability practice benefits, more players will become engaged in sustainable projects. This is exactly what happened in Australia.

CHAPTER 6

SUMMARY OF DISCUSSIONS

Summary of Dissertation and Conclusion.

“The Green Building Council of South Africa initiative addresses what are becoming the major issues of our time – excess energy consumption and the related CO2 emissions from burning carbon fuels, pollution of air, water and land, the depletion of natural resources, and the disposal of waste”.

(Green Building Council of South Africa, 2009)

6.0 Introduction

This chapter intends to assess the problems and topics raised in this dissertation with the aim to determine whether the main problem posed at the beginning, was solved.

The chapter has four main headings: background, reasons for choosing Green Star rating as a topic, main sub-problem summaries and conclusions, followed by a final conclusion.

6.1 Background

At the beginning of this dissertation a fictitious scenario involving a typical South African businessman, was sketched. Morgan Pretorius is faced with many questions concerning a changing environment and the reason people are so intrigued with the new ‘green’ building norm. Many other South Africans can relate to Mr. Pretorius.

The Green Building Council of South Africa (GBCSA) has developed a comprehensive rating tool for evaluating the environmental design and performance of South African buildings: Green Star SA Office v1. Green Star SA is a comprehensive rating system for

evaluating the environmental design and performance of South African buildings. It will enable stakeholders in the industry to determine the environmental impact of their developments and to receive recognition for design contribution.

This is a voluntary rating system comprised of eight categories including energy, water, materials, emissions etc. With its launch in November 2008, GBSCA became the thirteenth full member council of the World Green Building Council.

Being very new in South Africa one would expect stakeholders to be skeptical about it, as is usually the case with a new concept.

The main question is: **“Is Green Star SA Pain or Glory?”**

6.2 Summary

6.2.1 Green Star SA Rating Process

Chapter One aimed to give an overview of rating assessment systems and more in particular, the GBSCA’s rating system. The reader is provided with general background and understanding of the Green Building Council South Africa’s Green Star SA processes and procedures, with the focus being on providing information rather than asking questions.

Points that were considered are: Elements of green building programs and rating assessment systems in general – more specifically, the mandatory elements of a comprehensive rating system. Green Star SA certification is an intensive process. Each step was discussed and summarized briefly, as well as the benefits of Green Star and obligatory fees to register a project with GBSCA.

Green Star SA is voluntary and consists of eight categories: management, energy, indoor environmental quality, transport, water, materials, land use & ecology and emissions. Innovative practices which improve or enhance a building's environmental performance are also assessed.

The tool sets out specific criteria (credits) in each category, and buildings are awarded points for the credits they meet. Total points determine a building's rating, which can be four, five or six star. A table showing each category has been included.

The tool is based on Australia's 'Green Star' system and has been customized for South Africa by GBCSA. Amended credits are indicated.

Pertinent to this issue is whether continuous assessment should be done in order to ensure that projects adhere to the standards set out for registration.

From this research it is evident that Green Star is a comprehensive environmental rating tool covering all aspects as set out at the beginning of the chapter.

6.2.2 How Viable is the Rating Process?

Chapter 2 posed this question and investigated the challenges involved with the implementation of Green Star principles from a designer and contractor's point of view.

The chapter is divided into four main headings. Sustainable construction in general; challenges faced by the project team and contractor when implementing Green Star principles; insights gained from a survey done in Australia were examined and, finally, the chapter ends with the findings that have become a unifying theme in the facilitation of Green Star compliance.

In an Australian survey aspects of the Green Star rating tool that posed direct challenges to the main contractor, are set out as follows:

- Head contractor lacks the knowledge required to achieve credits.
- Minimal or non-existent relationship with Green Star
- Implementation of effective management systems
- Understanding costs of Green Star and knowing what to allow in a tender.
- Managing education and information to the project team.
- Ensuring progress and compliance on future Green Star projects.
- Overcoming resistance from sub-contractors and suppliers.
- Sourcing materials and managing documentation to ensure compliance

The following findings appear to be general qualities necessary for Green Star compliance:

- Strong and effective management
- Communication
- Contract documentation to be consistent on all levels
- Providing education for head contractor
- Access to quality information from a Green Star consultant or accredited Green Star professional, with mechanisms in place to evaluate the quality and effectiveness of the advice given.
- Promotion of Green Star principles on all levels

It is believed that once resources have been allocated, effective management systems implemented and a decision taken to possibly sacrifice profit in the short term, the

potential exists to increase profitability in the long term. Head contractors with a proven ability to facilitate the achievement of a Green Star rating in a cost effective manner, will have credentials that are more likely to lead to pre-qualification for future building work on buildings seeking a Green Star rating.

6.2.3 Is there really a need for environmental rating systems?

Globally, during construction and life-cycle, buildings consume between 40% and 50% of the world's energy produced, about 30% of resources, 20% of available water and roughly 23% of the world's greenhouse gas emissions – more than any other single sector. Buildings also produce about 30% of the world's waste. (*Douglas, 2009*) The question remains: is there a need for an environmentally sustainable rating system?

The aim of this chapter was to investigate this.

Six main issues were discussed: the impact current practice has on the environment. Statistics of this impact on the ecology are shown. The question is asked: is Green Star SA a moneymaking scheme? This is followed by a discussion on why the rest of the world is concerned. The chapter concludes with an investigation of the City of Cape Town's new green building guidelines followed by an example of a completed Green Star certified building in Australia.

Green buildings have the potential to reduce a building's consumption on all levels (including energy, water resources, etc.) by between 30% and 70%. Green buildings can look like any other commercial property but they perform differently. (*Douglas, 2009*) South Africa is struggling with a power crisis, as well as problems with water, sewerage and solid waste. It could now be more appropriate than ever to incorporate green star principles.

In the opinion of the author, it is evident that from the research done, there is most certainly a need for sustainable rating systems to ensure good practice, save the client money and avoid false marketing or general misleading of the public.

6.2.4 What are the future of Green building and the role of environmental rating systems?

Green Star rating is currently in its first year in South Africa. This chapter endeavored to investigate the future role of environmental systems.

Green building is a rational response to two driving forces – firstly, a new set of resource constraints facing the globe and, secondly, a demand for healthier, more productive environments for users. Green building is a natural evolution of the building sector, responding to an emerging set of economic forces. It is not a passing fad, but the way things will have to be done in future. *(Kerswill, 2009)*

It was evident from research done in this chapter that most sectors in the industry are moving towards a more sustainable approach. Local and international pressure for sustainable building is becoming the norm and will continue to increase in the future. Some top business executives have even suggested that if sustainability is not part of the portfolio, doing international business will become increasingly difficult.

In comparison to some first world countries, South Africa has made a slow start but sustainability can only accelerate in the future.

Bruce Kerswell from the GBCSA said the following; “Green buildings are the way of the future, and buildings that are not green will ultimately become obsolete”.

6.3 Conclusion

The purpose of this dissertation is to give the reader an understanding and introduction to the Green Building Council of South Africa's Green Star rating tool. The discussion focused on implementation of Green Star rating in the South African property market.

The Green Star certification process was explained and this showed that there are numerous benefits to registering and certifying a project with the Green Building Council. The rating tool is very comprehensive with nine categories and almost seventy credits in total, which cover most aspects of green buildings.

There are, however, some barriers to the implementation of Green Star principles; this is mainly due to a lack of understanding and awareness of green star principles and limited understanding of the concept among industry professionals. It has been demonstrated that by applying certain principles these barriers can be overcome.

The need for sustainability in buildings is validated by the development and acceptance of green buildings that are aimed at delivering an improved product. It was seen that the main driving forces for green building are: firstly, combating global warming and, secondly, to ensure a healthier environment for occupants and users of buildings.

According to some top international businessmen and women green building will continue to accelerate in the future, not only internationally but locally too.

It is worth noting that before the Green Star environmental rating system was introduced, the property industry had no way to define or measure green performance, i.e. the impact of construction on our environment.

In conclusion, considering all the issues discussed in this dissertation, the main question of the study must be asked again: Is Green Star rating in South Africa, pain or glory? Given the research done on this topic, it is fair to state that Green Star rating is definitely more glory than pain. Modern man owes it to his environment to secure measures and criteria which will ensure that resources are preserved and looked after as best as possible. The world at large – to a larger and lesser degree – is slowly awakening to the fact that this planet is the only life-sustaining one there is and that responsible stewardship of it is no longer an option but a mandate.

May Green Star South Africa be led from glory to glory as South Africans increasingly learn and understand the dire need for buildings that no longer harm their natural surroundings.

“When you hear something, you forget it.

When you see something, you remember it.

But not until you actually do something will you understand it.”

(Chinese proverb, unknown)

6.4 Suggestions for further research

Acquiring information for this dissertation or, more specifically, Green Star practice in South Africa has been a very interesting, yet a very challenging task. With the limited time Green Star practice has been known to South African soil, limited research could be done on certified or completed Green Star projects in South Africa.

Suggestions for further research on this topic would include:

- The actual cost to certify a project with the Green Building Council of South Africa
- An investigation into completed Green Star projects, this can include the owners, occupants and general public opinion.
- An investigation and comparison of the different Green Building Councils around the Globe.

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