GREEN BUILDING
IN SOUTH AFRICA

GUIDE TO
COSTS & TRENDS

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COMMEMORATIVE
FIRST EDITION

GREEN BUILDING COUNCIL SOUTH AFRICA

The Association of South African Quantity Surveyors

UNIVERSITEIT VAN PRETORIA
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GREEN BUILDING IN SOUTH AFRICA
GUIDE TO COSTS AND TRENDS

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FOREWORD

The establishment of the Green Building Council South Africa (GBCSA) in 2007 introduced a period of increased awareness and education in the South African built environment regarding the green building movement. With this emerged the perception that green building attracts a significant cost premium when compared to conventional construction. To address this concern, the Cost of Green Building Study Committee was established in 2014.

The purpose of the committee was to conduct research on the cost of green buildings constructed in South Africa and to determine the costs and trends associated therewith.

The committee comprised of selected members from the GBCSA, the Association of South African Quantity Surveyors (ASAQS) and the University of Pretoria (UP).

Today, we are proud to say that the research has been thorough, the outcomes have been peer reviewed and validated, and the results are highly relevant to all in the built environment.

For this, we extend a vote of appreciation to all who have been involved in a most meaningful process.

The publication of this first edition GREEN BUILDING IN SOUTH AFRICA – GUIDE TO COSTS AND TRENDS booklet, is envisaged as the first of many to come. We anticipate it being a regular and sought after publication that will keep the built environment updated on green building costs and trends.

Please receive this commemorative edition with our best wishes

GBCSA 2016 | ASAQS 2016

NOTES TO CONSIDER

The reader of this report must take note of the following assumptions and/or qualifications and use the findings of this study with due caution and discretion.

- The cost data used in the report has not been normalised to allow for differences in specification level required by the specific grade of office space provided (i.e. Premium grade, A grade, B grade, etc) other than to evaluate the effect of base building cost on green cost premiums;
- The design methodology of the study used estimated cost based on elemental estimates for projects with "Design" Green Star SA certification and final cost for projects with "As Built" Green Star SA certification. The actual cost data available did not always allow for this methodology (i.e. only final cost data may have been available for a project with "Design" certification). However this deviation is not considered to be of significance as all study projects with both estimated and final cost available indicated only very minor/insignificant differences between the estimated and final cost;
- Changes in the National Building Regulations (SANS 10400) came into effect in 2011. These changes directly addressed design aspects of buildings associated with green building design. More exacting building regulations set for conventional construction should decrease the cost premium of green building. The changes in building regulations were not specifically considered by the report other than the evaluation of certification date on green cost premiums.

INTRODUCTION

The GBCSA was established in 2007. By the end of May 2016 a total of 180 buildings had been certified by the GBCSA, whilst more than 7000 professionals had enrolled on GBCSA training courses.

The international green building industry has expanded and matured significantly during the past two decades. However a number of factors with the potential to hamper the growth of the industry have also been identified during this period. These include the perception that green building attracts a significant cost premium when compared to the cost of non-green/conventional construction. At this point, no data existed in South Africa to prove otherwise.

Therefore a research project was commissioned which set out to determine the actual costs and trends of Green building in South Africa presented in a credible, unbiased, consistent and user friendly manner. The findings in this report are based on actual case studies of office buildings that have been awarded a Green Star SA certification.

The report includes cost data on all South African office buildings certified by the GBCSA up to the end of 2014, which meet the following criteria:

- Are 4, 5 or 6 Star Green Star SA certified buildings
- Have either “Design” and/or “As Built” ratings
- Used the Green Star SA Office v1 rating tool

THE STUDY

The above criteria when applied to the GBCSA's data base of certified projects returned a sample of 54 office buildings for study purposes. The buildings are owned by 34 different companies. All the owners were contacted and they agreed to participate. Their prior approval was secured before including the financial detail of their buildings in this study.

The analysis of the cost data and presentation of the findings is based on the ASAQS's *"Guide to Elemental Cost Estimating 2013"* and the GBCSA's *"Green Star SA Office v1"* rating tool.

The study focused on two primary aspects:

1. THE GREEN DESIGN PENETRATION

This indicates the extent to which the *"Green Star SA Office v1"* rating tool has introduced green design into the different elements of a project, expressed as a percentage (%) of total project cost. For example a penetration factor of 45 % would indicate that green design has been integrated into 45 % of the total project budget.

2. THE GREEN COST PREMIUM

The green cost premium is defined as the additional cost of green building over and above the cost of conventional construction, expressed as a % of the total cost of the project. For example, a green building project which costs R100 million in total and includes green building costs of R3 million over and above the cost of conventional construction, is considered to have a green cost premium of R3m/R100m x 100/1 % = 3 %;

The above two primary aspects were then analysed in terms of the following:

- **Certification level**
  Evaluating green building costs in terms of the three different certification levels i.e. 4 Star, 5 Star, or 6 Star Green Star SA certification;
- **Location**
  Evaluating the effect of location on green building costs. Building costs often vary between different provinces in South Africa;
- **Construction area**
  Evaluating the effect of the size of a building on the green building cost premium (GBCP). Larger projects often attract more competitive building rates compared to smaller projects, due to economies of scale. Larger construction companies may achieve higher levels of efficiency/productivity. However, mega projects (i.e. major sport stadiums or power stations) may restrict effective competition which in turn may result in higher building costs;
- **Base building cost**
  Evaluating the effect of base building cost (R/m^2) on GBCP. A project with a higher base building cost could expect to have a lower green cost premium. However, a project with a low base building cost could expect to have a higher green cost premium. The study evaluated the effect of base building cost on the GBCP;

- **Vertical façade ratio**
  Evaluating the effect of the vertical façade:construction area ratio on the GBCP. The interaction between a building and the physical environment takes place to a large degree via the vertical façade of the building. Therefore, the vertical façade area is closely associated with green building design. The study evaluated the effect of façade:construction area ratio on the GBCP;
- **Certification date**
  Evaluating the effect of time/maturity of the green industry on the GBCP. Green building has introduced new concepts to the construction industry. Over time, the risks associated with new green concepts are seen to be reducing and is being replaced by greater certainty in terms of green design and costs related thereto. The study evaluated the effect of time on the GBCP;
- **Tenant mix**
  Evaluating the effect of single corporate vs generic tenant mix on the GBCP. The majority of the office buildings certified by the GBCSA were buildings designed for single, corporate tenants. Corporate clients tend to place a high value on marketing and public image and should therefore be inclined to spend more on their buildings. The study evaluated the effect of tenant mix on the GBCP;

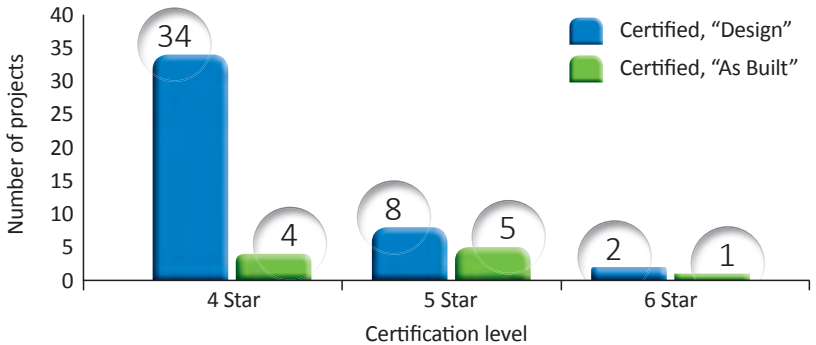
- **Certification rating**
  The Green Star SA Office v1 tool allows for "Design" and "As Built" Green Star SA certification rating. The study evaluated the effect of the certification rating mix on the GBCP.
- **Rating tool categories**
  Evaluating the GBCP in terms of the categories of the Green Star SA Office v1 tool. The Green Star SA Office v1 tool consists of nine different categories and a total of 69 credits. The tool therefore offers many design alternatives when pursuing Green Star SA certification. The study evaluated the portion of the GBCP spent on each of the categories of the Green Star SA rating tool.

SAMPLE PROFILE

The study sample of 54 projects provides a sample profile which can be used as a background to provide context for the study results which follow.

The study sample is made up of 38 projects (70,3 %) with a 4 Star Green Star SA certification, 13 projects (24,1 %) with a 5 Star Green Star SA certification and 3 projects (5,6 %) with a 6 Star Green Star SA certification (see Figure 1).

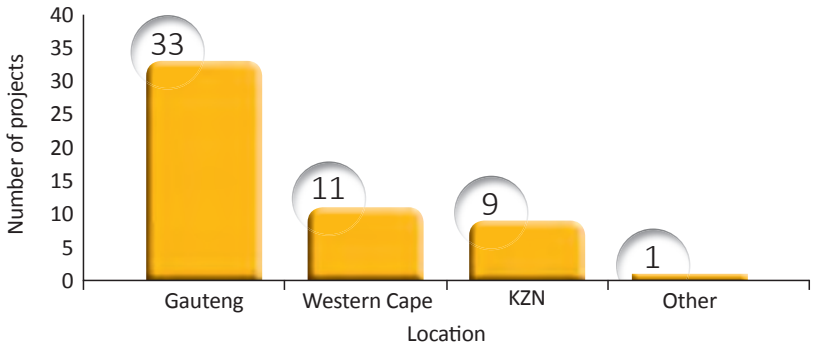
FIGURE 1 GBCSA CERTIFIED PROJECTS 2009 - 2014



SAMPLE PROFILE continued

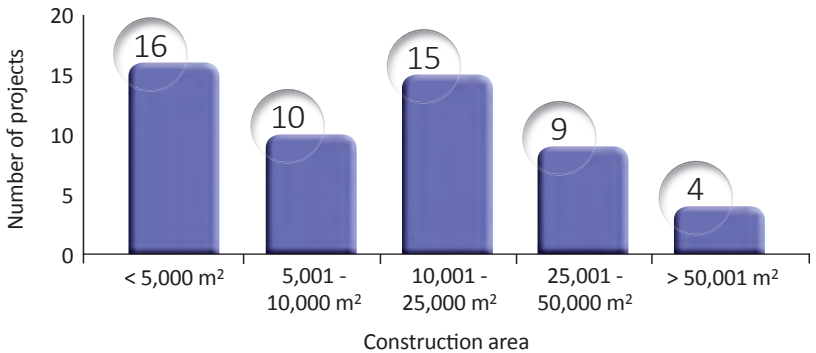
Of all certified projects in the sample a total of 33 projects (61,1 %) are located in Gauteng with 11 projects (20,4 %) from the Western Cape and 9 projects (16,7 %) from Kwazulu-Natal (see Figure 2).

FIGURE 2 PROJECT LOCATION



The construction area of the sample projects varied between 858 m² and 74,244 m². To evaluate the effect of construction area on the green building cost premium, a total of five categories were determined to stratify the sample – projects with a construction area of:
less than 5,000 m²; 5,001 m² – 10,000 m²; 10,001 m² – 25,000 m²; 25,001 m² – 50,000 m² and more than 50,000 m². The detail of the number of projects in each size category is detailed in Figure 3.

FIGURE 3 PROJECT SIZE



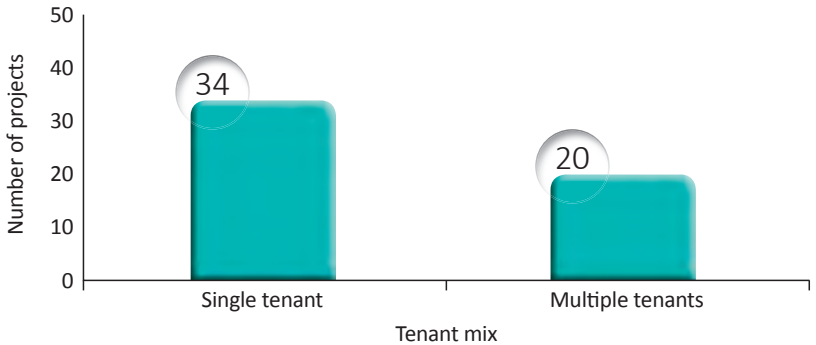
SAMPLE PROFILE continued

The number of projects certified per year clearly indicates the growth in green building in South Africa (see Figure 4).

FIGURE 4 PROJECTS CERTIFIED PER YEAR

The majority (63 %) of certified buildings in the sample are occupied by single, corporate tenants (see Figure 5).

FIGURE 5 TENANT MIX



CERTIFICATION LEVEL

The study revealed that the application of the Green Star SA Office v1 tool to pursue Green Star SA certification resulted in the introduction of green design elements accounting for an average of 42,7 % of the budgets of projects included in the sample. For some projects more than 70 % of the budget included green design elements. No clear correlation was apparent between the different levels of certification and the green design penetration achieved (see Table 1).

TABLE 1 GREEN DESIGN PENETRATION – CERTIFICATION LEVEL

Certification level – Green design penetration (%)	MIN	AVERAGE	MAX
TOTAL	**17,6 %**	**42,7 %**	**73,5 %**
4 STAR	17,6 %	43,5 %	73,5 %
5 STAR	22,2 %	39,7 %	57,9 %
6 STAR	42,7 %	44,3 %	45,9 %

LOCATION

The average green design penetration of projects from the Western Cape was slightly higher than that of the projects from other provinces (see Table 2).

TABLE 2 GREEN DESIGN PENETRATION – LOCATION

Location – Green design penetration (%)	MIN	AVERAGE	MAX
TOTAL	**17,6 %**	**42,7 %**	**73,5 %**
GAUTENG	17,6 %	41,8 %	73,5 %
WESTERN CAPE	31,3 %	46,0 %	63,5 %
KZN	33,7 %	40,4 %	47,6 %

CERTIFICATION LEVEL

The average green building cost premium achieved by the projects sampled (as expressed by the median*) was 5,0 % of the total project cost. The lowest cost premium reported was 1,1 % and the highest was 14,2 %. Both Table 3 and Figure 6 indicate the positive correlation between green cost premium and certification level.

*see note overleaf for definition of median

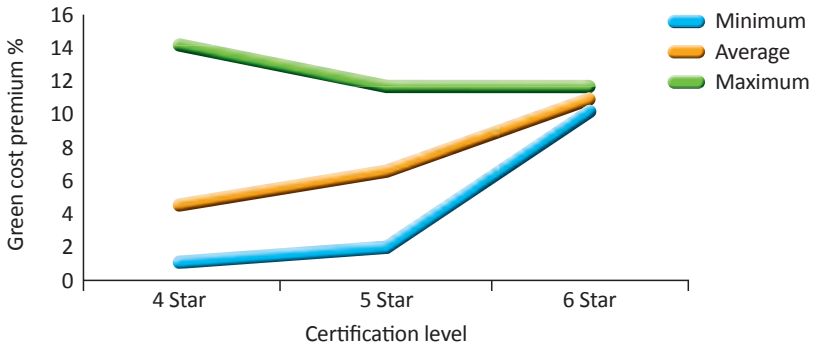
TABLE 3 GREEN COST PREMIUM – CERTIFICATION LEVEL

Certification level – Green cost premium (%)	MIN	AVERAGE	MAX
TOTAL	**1,1 %**	**5,0 %**	**14,2 %**
4 STAR	1,1 %	4,5 %	14,2 %
5 STAR	2,0 %	6,6 %	11,7 %
6 STAR	10,2 %	10,9 %	11,7 %

CERTIFICATION LEVEL continued

NOTE: *The choice of indicator for the central tendency of the data (to describe the average green building cost premium) was the median. The median is the midpoint of a frequency distribution or the numerical centre of a set of data. Since the data sample was slightly right skewed (0,389), the median was chosen as the preferred indicator over the arithmetic mean as it is less sensitive to skewed data.*

FIGURE 6 GREEN COST PREMIUM – CERTIFICATION LEVEL



LOCATION

The average green cost premium of 6,9 % for projects in the Western Cape was slightly higher when compared to the projects from other locations (see Table 4).

TABLE 4 GREEN COST PREMIUM – LOCATION

Location – Green cost premium (%)	MIN	AVERAGE	MAX
TOTAL	**1,1 %**	**5,0 %**	**14,2 %**
GAUTENG	1,1 %	6,0 %	12,2 %
WESTERN CAPE	1,7 %	6,9 %	14,2 %
KZN	3,6 %	4,5 %	8,4 %

CONSTRUCTION AREA

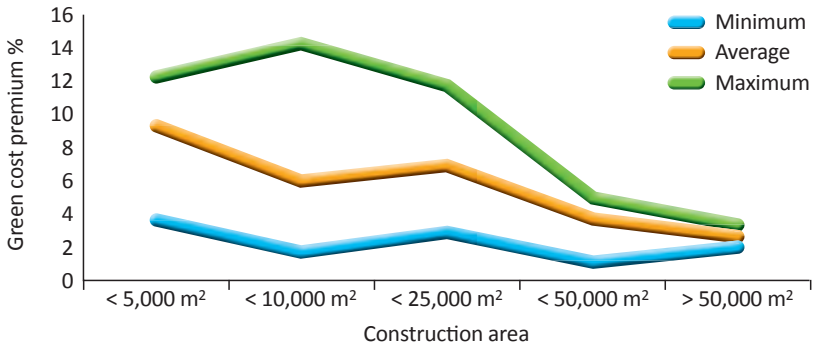
Both Table 5 as well as Figure 7 confirm the strong negative correlation between green cost premium and construction size. The larger projects managed to achieve a Green Star SA certification at a much lower average green cost premium when compared to smaller projects.

TABLE 5 GREEN COST PREMIUM – CONSTRUCTION AREA

Construction area – Green cost premium (%)	MIN	AVERAGE	MAX
TOTAL	**1,1 %**	**5,0 %**	**14,2 %**
< 5,000 m²	3,6 %	9,3 %	12,2 %
< 10,000 m²	1,7 %	6,0 %	14,2 %
< 25,000 m²	2,9 %	6,9 %	11,7 %
< 50,000 m²	1,1 %	3,7 %	5,0 %
> 50,000 m²	2,0 %	2,6 %	3,3 %

CONSTRUCTION AREA continued

FIGURE 7 GREEN COST PREMIUM – CONSTRUCTION AREA



BASE BUILDING COST

The base building cost has been calculated as the total project cost minus the basement cost divided by the office construction area. To allow for the time value of money, all costs were escalated to December 2014. The base building cost of the project sample ranged from R8,220/m² to R23,431/m² with an average cost of R12,849/m². To evaluate the relationship between base building cost and green cost premium, the base building cost range was split into five categories that are all defined in relation to the

...continued overleaf

TABLE 6 GREEN COST PREMIUM – BASE BUILDING COST (AT 12/2014)

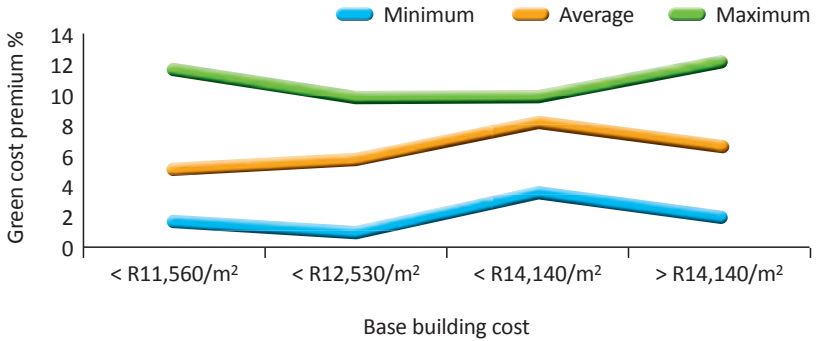
Base building cost (R/m²) – Green cost premium (%)	MIN	AVERAGE	MAX
< R11,560/m²	1,7 %	5,1 %	11,7 %
< R12,530/m²	1,1 %	5,8 %	9,8 %
< R14,140/m²	3,6 %	8,2 %	10,0 %
> R14,140/m²	2,0 %	6,6 %	12,2 %

BASE BUILDING COST continued

average cost. The categories are – much lower (< R11,560), lower (R11,561 – R12,530), similar (R12,531 – R13,170), higher (R13,171 – R14,140) or much higher (> R14,141) than the average base building cost.

The study revealed a marginally positive relationship between base building cost and green cost premium. Buildings with a higher base building cost also had on average a slightly higher green cost premium (see Table 6 and Figure 8).

FIGURE 8 GREEN COST PREMIUM – BASE BUILDING COST (AT 12/2014)



VERTICAL FAÇADE RATIO

The ratio of vertical façade:construction area of the sample projects varied from 0,27:1 to 0,79:1 with an average of 0,47:1. To evaluate the relationship between façade ratio and green cost premium, the façade ratio range was split into five categories that are all defined in relation to the average ratio. The categories are – much lower (< 0,38:1), lower (0,38 – 0,44:1), average (0,45 – 0,50:1), higher (0,51 – 0,56:1) or much

...continued overleaf

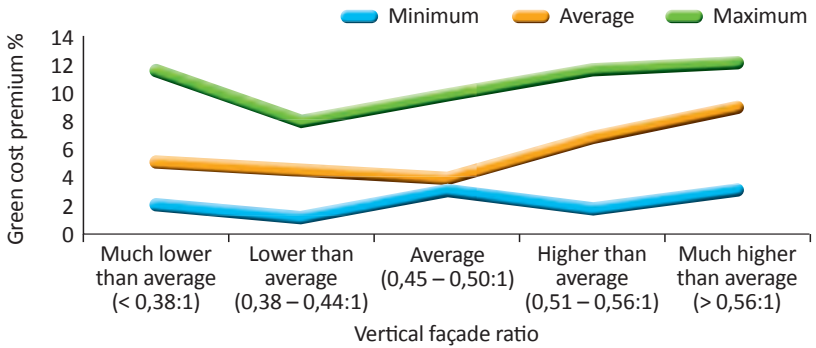
TABLE 7 GREEN COST PREMIUM – VERTICAL FAÇADE RATIO

Vertical façade ratio – Green cost premium (%)	MIN	AVERAGE	MAX
Much ↓ than average (< 0,38:1)	2,0 %	5,2 %	11,7 %
↓ than average (0,38 – 0,44:1)	1,1 %	4,5 %	8,2 %
Average (0,45 – 0,50:1)	2,9 %	3,8 %	10,0 %
↑ than average (0,51 – 0,56:1)	1,7 %	6,7 %	11,7 %
Much ↑ than average (> 0,56:1)	2,9 %	9,3 %	12,2 %

VERTICAL FAÇADE RATIO continued

higher (> 0,56:1) than the average ratio. Table 7 and Figure 9 indicate the correlation between vertical façade ratio and green cost premium. Buildings with an above average vertical façade:construction area ratio also tend to have a higher green cost premium.

FIGURE 9 GREEN COST PREMIUM – VERTICAL FAÇADE RATIO



CERTIFICATION DATE

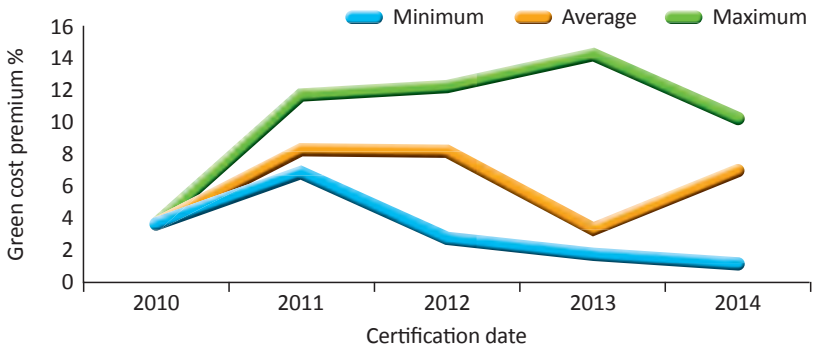
The study points to a maturing of the South African green industry over time. Table 8 and Figure 10 indicate as a general trend that since 2011, green cost premiums appear to be declining.

TABLE 8 GREEN COST PREMIUM – CERTIFICATION DATE

Certification date – Green cost premium (%)	MIN	AVERAGE	MAX
2010	3,6 %	3,6 %	3,6 %
2011	6,8 %	8,3 %	11,7 %
2012	2,7 %	8,2 %	12,2 %
2013	1,7 %	3,5 %	14,2 %
2014	1,1 %	6,6 %	10,2 %

CERTIFICATION DATE continued

FIGURE 10 GREEN COST PREMIUM – CERTIFICATION DATE



TENANT MIX

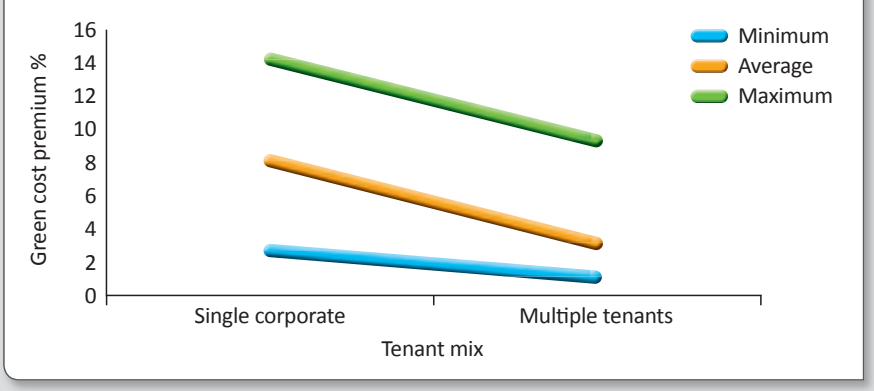
Table 9 and Figure 11 confirm that projects with a single corporate client, will on average have a higher green cost premium compared to projects with a multiple tenant mix.

TABLE 9 GREEN COST PREMIUM – TENANT MIX

Tenant mix – Green cost premium (%)	MIN	AVERAGE	MAX
TOTAL	**1,1 %**	**5,0 %**	**14,2 %**
SINGLE CORPORATE	2,7 %	8,1 %	14,2 %
MULTIPLE TENANTS	1,1 %	3,4 %	9,3 %

TENANT MIX continued

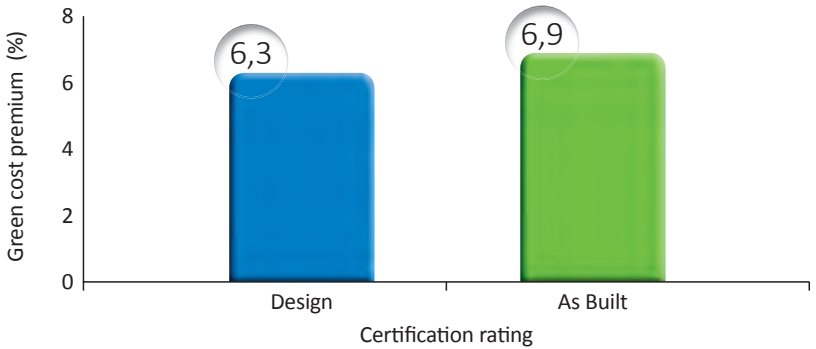
FIGURE 11 GREEN COST PREMIUM – TENANT MIX



CERTIFICATION RATING

An evaluation of the "Design" versus the "As Built" Green Star SA certification rating achieved by the sample projects, revealed that projects with a "Design" certification rating achieved an average green cost premium of 6,3 % compared to the 6,9 % achieved by projects with an "As Built" certification rating.

FIGURE 12 AVERAGE GREEN COST PREMIUM



RATING TOOL CATEGORIES

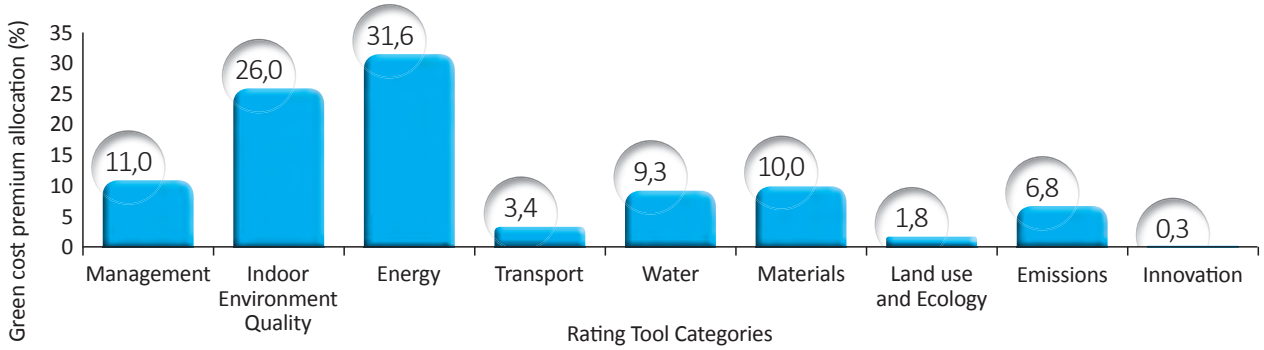
The allocation of the green cost premium to the nine categories of the Green Star SA Office v1 tool revealed that almost 58 % of the total green cost premium was allocated to only two categories namely, Energy and Indoor Environment Quality. It is notable that the five categories comprising Energy, Indoor Environment Quality, Management, Materials and Water, made up for more than 88 % of the total green cost premium allocation (see Table 10 and Figure 13).

TABLE 10 GREEN COST PREMIUM – RATING TOOL CATEGORIES

Rating tool categories	Green cost premium allocation (%)
MANAGEMENT	11,0
INDOOR ENVIRONMENT QUALITY	26,0
ENERGY	31,6
TRANSPORT	3,4
WATER	9,3
MATERIALS	10,0
LAND USE AND ECOLOGY	1,8
EMISSIONS	6,8
INNOVATION	0,3

RATING TOOL CATEGORIES continued

FIGURE 13 GREEN COST PREMIUM – RATING TOOL CATEGORIES



CONCLUSION

- Green Star SA certified buildings are currently located predominantly in Gauteng, the Western Cape and the Durban/Umhlanga area of Kwazulu-Natal;
- Green building in South Africa is growing exponentially;
- Office buildings of all sizes have successfully applied for Green Star SA certification;
- Since 2011, generic office buildings that have been developed for a multi-tenant mix, make up for 40 % of all Green Star SA certified buildings;
- The average green cost premium over and above the cost of non-green buildings is 5,0 %;
- Pursuing Green Star SA certification through the Green Star SA Office v1 tool, has resulted in an average green design penetration of 42,7 % of the total project budget;
- Higher levels of certification (4 Star, to 5 Star, to 6 Star) has resulted in a progressive increase in the green cost premium;
- The green cost premium appears to be progressively diminishing over time, largely as a result of a growing maturity in the green industry;
- Compared to smaller office buildings, large office buildings generally achieved Green Star SA certification with lower green cost premiums;

CONCLUSION continued

- Office buildings with higher vertical façade:construction area ratios tended to have higher green cost premiums;
- Office buildings that were developed for single corporate tenants attracted higher green cost premiums than buildings developed for a multi-tenant mix;
- Office buildings with higher base building costs did not necessarily achieve lower green cost premiums and
- Two categories of the Green Star SA Office v1 tool i.e. Energy and Indoor Environment Quality made up for 58 % of the allocation of the total green cost premium.

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Mr Nellis Boshoff

Dr Hoffie Cruywagen

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Mr Larry Feinberg

Mr Len Holder

Dr Deen Letchmiah

Mr Martin Smith

Mr Karl Trusler

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Absa Bank Ltd

Attacq Ltd

Chevron South Africa (Pty) Ltd

Cinzaco 128 (Pty) Ltd

City of Cape Town

Department of Environmental Affairs

Department of Public Works

Eris Property Group

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giel@caqs.co.za / guillaume@caqs.co.za
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+27 (0) 12 663 3300
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Narker & Associates

info@narker.com
www.narker.com
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www.enumerate.co.za
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vanessa@nasho.org.za
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2nd Floor, The Old Warehouse Building
Black River Office Park, 2 Fir Street
Observatory 7925

The Association of South African Quantity Surveyors

www.asaqs.co.za

T +27 (0) 11 315 4140/1/2 | **F** 086 601 7087

administration@asaqs.co.za

Suite G6, Building 27
Thornhill Office Park
94 Bekker Road, Vorna Valley 1686

UNIVERSITEIT VAN PRETORIA
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www.up.ac.za

T +27 (0) 12 420 4972 | **F** +27 (0) 12 420 3598

danie.hoffman@up.ac.za

Department of Construction Economics
Building 5, South Campus, University of Pretoria
Lynnwood Road, Pretoria 0002