



How to make your building project more sustainable

QUICK GUIDE TO

GREEN DESIGN ATTRIBUTES

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QUICK GUIDE TO GREEN DESIGN ATTRIBUTES
How to make your building more sustainable

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Davis Langdon, an AECOM company, is a Founder Member (Category Silver) of the Green Building Council of South Africa.



FOUNDING MEMBER : CATEGORY SILVER



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INTRODUCTION

*The earth does not
belong to man,
man belongs to the earth.
All things are connected...
Man did not weave
the web of life,
he is merely a strand in it.
Whatever he does
to the web,
he does to himself.*

– Chief Seattle 1854
(Source: Monica Sheehan, 2008)

Davis Langdon, an AECOM company, is a proud Founder Member (Category Silver) of the Green Building Council of South Africa (GBCSA). As part of our commitment to sustainable construction practices, in line with the concerns expressed above, we have initiated this Guide to Green Design Attributes.

The quick guide broadly comprises the environmental impact categories identified by the GBCSA, including most credit-earning attributes. Brief descriptions have been given including an indication of cost, advantages, disadvantages and potential employer incentives for implementation.

It is our intention that this guide will contribute to assist our clients' and colleagues' objectives to create more sustainable buildings.

ENVIRONMENTAL IMPACT CATEGORIES

Green Star SA rating tools include nine separate environmental impact categories:

- Management
- Indoor Environment Quality
- Energy
- Transport
- Water
- Materials
- Land Use and Ecology
- Emissions
- Innovation

The above categories are divided into credits, each of which addresses an initiative or attribute that improves, or has the potential to improve a design, project or building's environmental performance. Points are awarded in each credit for actions that demonstrate that the project has met the overall objectives of Green Star SA and the specific aims of the Green Star SA rating tool.

Once all credits in each category are assessed, a percentage score for the category is calculated. A Green Star SA environmental weighting factor is then applied to each of the project's category scores to reach a single score.

GREEN STAR SA

The GBCSA has adopted the Australian Green Star System and has adapted it to suit South African circumstances. The Green Star SA Office tool rating system was launched in November 2008 and the Green Star SA Retail tool rating system was launched in April 2010. The Green Star Multi Unit Residential PILOT tool is now available, while other tools are currently being developed.

Unless otherwise stated herein, the total cost, or the cost per unit, is based on a Grade 'A' office park in the Gauteng region of South Africa with a total rentable area of 5000m².

This guide does not contain an exhaustive list of green design attributes available to score points in order to achieve a determined star rating for an intended development; nor does it set out the points scoring mechanisms, accreditation processes and the like. The reader is referred to the Green Building Council of South Africa for comprehensive information available in this regard.



MANAGEMENT



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Through the Management category, the Green Building Council of South Africa (GBCSA) promotes the adoption of sound environmental principles from project inception, design and construction phases, to commissioning, tuning and operation of the building and its systems. Management initiatives may include engaging a professional with a thorough understanding of green building principles and Green Star SA; recycling, demolition and construction waste; managing construction activities to minimise pollution and maximise soil and air quality protection; enhanced commissioning and tuning of building systems.

MANAGEMENT

ATTRIBUTE: GREEN STAR ACCREDITED PROFESSIONAL

DESCRIPTION

Green Star Accredited Professionals have a detailed understanding of the Green Star rating system and the Green Star office design rating tools. They can assist the project team with the integration of Green Star SA objectives.

NOTES

To become an Accredited Professional it is necessary to attend a GBCSA-accredited course and pass the exam. The formal accreditation process has been introduced in South Africa. A project specific assessment fee for projects seeking a Green Star rating would also be necessary upon registering a project.

PROS

- The Green Star tool makes points available where it is demonstrated that at least one of the principal participants in the design team is a Green Star Accredited Professional and is engaged to provide sustainability advice throughout the design and delivery period
- The design is on track from day one to achieve the objectives set

CONS

- Project teams should be aware that the Accredited Professional needs to be on board as part of the project team from inception and be engaged throughout
- Additional fees

OTHER INFORMATION

The aim is to encourage and recognise the adoption of environmentally sustainable design principles from the earliest project stages, throughout design and construction.

KEY DRIVERS

Promoting change in the industry through the application of sustainable building technologies and ideas.

MANAGEMENT

ATTRIBUTE: COMMISSIONING

DESCRIPTION

The phase during which the capabilities of the system are demonstrated in the final operational configuration under defined operating conditions. During commissioning, both verification and validation tests should be performed on the complete system.

CAPEX COST RANGE

R1 000 000 – R1 500 000

NOTES

Based on the inclusion of an independent commissioning agent.

PROS

- Ensures systems operate to design intent specification and operational requirements and comply with relevant regulations
- Potentially lower operating costs and emissions

CONS

- The period allotted to commissioning in construction programmes is often inadequate to fully fine-tune the building to its best performance
- Higher initial costs

OTHER INFORMATION

Ongoing commissioning is fundamental to ensure safe, efficient and cost effective operation of systems during a building's lifetime.

KEY DRIVERS

Reduced life cycle costs.

MANAGEMENT

ATTRIBUTE: BUILDING TUNING

DESCRIPTION

The implementation of commissioning initiatives that ensure optimum occupant comfort and energy efficient services performance throughout the year.

CAPEX COST RANGE

R300 000 – R500 000

PROS

- Ensures occupant comfort
- Ensures good facilities management principles
- Cost effectiveness
- Long term financial advantages

CONS

- Occupant's discomfort during first year season change

KEY DRIVERS

Should be employer driven.

MANAGEMENT

ATTRIBUTE: INDEPENDENT COMMISSIONING AGENT

DESCRIPTION

Steps taken to ensure that buildings are designed with regard to future maintenance and are appropriately commissioned before practical completion.

CAPEX COST RANGE

R150 000 – R300 000

NOTES

Based on the principle of replacing an in-house team member with an external expert.

PROS

- Effective service by independent consultant should be cost effective
- Set effective facility management on good footing from the outset
- Ensures consistent commissioning procedures throughout all professions
- Life cycle cost advantages evident

CONS

- Cost of the fees only

KEY DRIVERS

Should be employer driven.

ATTRIBUTE: ENVIRONMENTAL MANAGEMENT

DESCRIPTION

The adoption of a formal environmental management system according to established guidelines during construction.

CAPEX COST RANGE

R50 000 – R250 000

PROS

- Sound environmentally–friendly principles are applied from inception to completion
- Unquantifiable long term benefits
- Reduced waste generation and disposal expenses

CONS

- None, apart from minor cost expenses

KEY DRIVERS

Should be employer driven where not imposed by the authorities.

MANAGEMENT

ATTRIBUTE: WASTE MANAGEMENT

DESCRIPTION

Implementation of management practices that minimise the amount of construction waste going to disposal.

CAPEX COST RANGE

Minor cost implication.

PROS

- Materials are recycled rather than used for landfill
- Cost savings are evident
- Rehabilitation of filled land more effectively managed

CONS

- None

OTHER INFORMATION

Traditionally, the bulk of construction waste has gone to landfill. This occurs despite the fact that much of the waste can be considered as a valuable resource for reuse or recycling.

KEY DRIVERS

Should be employer driven as contractors prefer to use new materials for their convenience.

ATTRIBUTE: AIRTIGHTNESS TESTING

DESCRIPTION

Airtightness relates to the amount of air loss from inside a building via small gaps in the external building envelope. The air loss can be very subtle, going unnoticed by the building occupants.

CAPEX COST RANGE

Project specific – there may be additional costs incurred in additional details for airtightness and in testing the building's airtightness upon completion.

PROS

- Performance of air-conditioning not compromised
- Reduces energy and greenhouse gas emissions
- Can reduce ingress of outside noise
- Less likelihood of internal change from high humidity outside air

CONS

- Additional cost

KEY DRIVERS

Reduces base building operational energy and greenhouse gas emissions.

ATTRIBUTE: INTEGRATED DESIGN APPROACH

DESCRIPTION

The site, structures, engineering systems and end use of the building are viewed as one 'whole building' rather than as separate independent systems. The Integrated Design Process (IDP) brings together key stakeholders and professionals to work collaboratively at the start of a project, with a clear vision of client and team goals.

CAPEX COST RANGE

Project specific, but can produce significant cost savings.

NOTES

Provided all stakeholders are willing and committed to contribute to the process.

PROS

- IDP allows the design team to identify and understand the design objectives of each party, and provides a forum to take advantage of complementary systems and design principles that can satisfy multiple goals
- Potential cost savings
- Reduces waste frequently associated with modifying shell and core projects

CONS

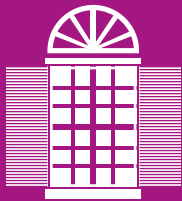
- Potential longer design process, which is good, but has a time implication

OTHER INFORMATION

'Collaborative thinking' - promoting fresh ideas from the outset with no preconceived design strategies.

KEY DRIVERS

Aim is to promote integrated thinking and a co-ordinated design approach.



INDOOR
ENVIRONMENT
QUALITY



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Through the Indoor Environment Quality (IEQ) category of Green Star SA, the GBCSA targets the wellbeing of the occupants. The credits address how the HVAC system, lighting, indoor air pollutants and some building attributes contribute to a good indoor environmental quality. Comfort factors addressed within this category are external views, individual climate control and noise levels. Health issues such as minimisation of indoor Volatile Organic Compounds, Asbestos and Formaldehyde emissions as well as mould prevention are addressed in this category.

ATTRIBUTE: VENTILATION RATES

DESCRIPTION

Natural ventilation relies on non-mechanical means to provide air movement; this may occur via the flow of air from outside into a building using air movement, or through the natural convection of warm air rising and drawing in cooler air at lower level vents.

CAPEX COST RANGE

R450 – R750/m²

ASSUMPTIONS

Large range depending on application. In some instances, the Capex for natural ventilated solution can be greater than mechanical due to the high cost of windows with opening sections / openings and thermal chimneys.

PROS

- Not affected by mechanical / electrical failure
- Energy / fuel conservation and cost saving
- Reduced greenhouse gas emissions
- Improved Indoor Air Quality (IAQ)

CONS

- Unpredictable and unreliable, will be variable across the floor plate
- Lack of control – depending on the elements

OTHER INFORMATION

Integrated natural ventilation may in some cases have a higher Capex, albeit significantly less operational costs.

KEY DRIVERS

Provide increased outside air rates and a healthy indoor environment.

Reduced baseline operating energy costs.

Improved environmental conservation – reduced greenhouse gas emissions.

ATTRIBUTE: MIXED MODE VENTILATION

DESCRIPTION

Mixed Mode Ventilation refers to a hybrid approach to space conditioning that uses a combination of natural ventilation and mechanical systems. This approach is common where there is an aspiration for naturally ventilated buildings, but the unpredictability and unreliability of natural ventilation in isolation requires the addition of a supplementary 'mode' of ventilation to provide reliability in the conditioned space temperature control.

CAPEX COST RANGE

R300 – R1 000/m²

ASSUMPTIONS

Large range depending on application – in some instances the Capex for natural ventilated solution can be greater than mechanical ventilation.

PROS

- Maximises comfort while avoiding significant energy use and operating costs associated with year round mechanical air-conditioning
- Provides flexibility and choice for building occupants
- Reduced energy and greenhouse gas emissions

CONS

- Natural ventilation may not be desirable in some locations e.g. due to acoustic reasons
- Building security may be compromised with windows with opening sections
- Systems can be complex
- Potential to add costs and complexity in design

OTHER INFORMATION

Mixed mode system can provide a backup solution to natural ventilation, which can be unreliable and unpredictable. Economy cycles could be a good alternative.

KEY DRIVERS

The provision of clean / fresh air and healthy indoor environment, reduced energy and greenhouse gas emissions.

ATTRIBUTE: DISPLACEMENT VENTILATION

DESCRIPTION

Displacement ventilation contributing to air change effectiveness normally provides conditioned air at low level, typically via a raised floor or wall grille. The air is then extracted at high level, to provide displacement air flow. 'Fresh' ventilated air is introduced at low velocity, typically at around 19°C.

CAPEX COST RANGE

R8 000 000 – R10 000 000 (R1 300 – R1 600/m²)
(Extra cost R300 – R600/m²)

PROS

- Improved air quality and higher comfort levels
- Enables individual control of air via vents in the false floor that can be easily moved around the floor
- Energy and greenhouse gas emissions reduced
- Increased outside air rates on some systems

CONS

- Additional cost associated with raised floor systems
- The system typically operates within a wider temperature band than conventional systems
- Significant temperature gradient between feet and head can lead to discomfort on poorly designed systems
- Air terminals fixed position

OTHER INFORMATION

The uniform air flow associated with displacement air provides excellent contamination removal from the occupied spaces.

KEY DRIVERS

Provides increased outside air rates and promotes a healthy indoor environment at reduced costs.

ATTRIBUTE: WIND CATCHERS

DESCRIPTION

Wind catcher systems collect prevailing wind and direct the air flow down into the room below, providing fresh supply of air for natural ventilation. Some systems are divided internally into quadrants so that the leeward side of the system acts as a passive stack for removing stale air from the room.

CAPEX COST RANGE

R100 – R350/m²

NOTES

Large range depending on application – in some instances the Capex for natural ventilated solution can be greater than mechanical ventilation.

PROS

- Simple historical techniques being reintroduced
- Suitable for large open spaces with high ceilings

CONS

- Reliant upon weather conditions that may be unreliable and unpredictable
- Air flow may be difficult to regulate / direct on very windy days
- Depends on air quality from outside (e.g. next to undesirable industry)

OTHER INFORMATION

Wind-catchers have been used for centuries in the Middle East and other locations.

KEY DRIVERS

Delivery of a healthy environment at reduced energy costs.
Reduced greenhouse gas emissions.

ATTRIBUTE: COMPUTATIONAL FLUID DYNAMICS ANALYSIS

DESCRIPTION

Computational Fluid Dynamics (CFD) is a modelling system that uses numerical methods and algorithms to solve and analyse the problems that involve fluid flows. CFD analysis is used early in the design phase of a project to predict indoor air quality distribution patterns and total energy consumption, etc.

CAPEX COST RANGE

R200 000 – R250 000

NOTES

Based on the inclusion of thermal modelling / imaging on a typical 2 000m² office development.

PROS

- Integrated design solution
- Visual flow patterns – no guessing

CONS

- Depending on data availability
- May have a high modelling cost

OTHER INFORMATION

Specialised modelling technique, usually undertaken by a suitably qualified engineer.

KEY DRIVERS

To improve air change, distribution effectiveness and optimisation.

ATTRIBUTE: CARBON DIOXIDE MONITORING AND CONTROL

DESCRIPTION

Carbon dioxide monitors are usually wall-mounted in the area served. They may be found as an integrated solution with natural ventilation systems to automatically increase fresh air when CO₂ levels get too high. They can also be used in mechanically ventilated buildings with sensors located in the return ducts for continuous monitoring and adjustment of the outside air ventilation rates. They are also used in car parks.

CAPEX COST RANGE

R80 000 – R120 000

NOTES

Part of a Building Management Systems (BMS) monitoring a 2 000m² car park.

PROS

- Can automatically adjust ventilation supply rates and provides alarm when stipulated CO₂ levels are exceeded
- Detects indoor air quality problems
- Reduces energy
- Increases productivity of occupants

CONS

- Initial installation and ongoing maintenance costs

OTHER INFORMATION

Fresh air contains approximately 350 – 400 parts per million (ppm) levels of CO₂ concentration. The link to Sick Building Syndrome for example, can have substantial effects on the well-being of occupants, and subsequently their productivity.

KEY DRIVERS

To improve the indoor air quality control within occupied spaces and to optimise car park ventilation systems.
Detection of potentially hazardous situations.

ATTRIBUTE: NATURAL SUNLIGHT

DESCRIPTION

Sun shafts or tubes are a means of providing sunlight (daylight) to areas without windows – typically consisting of a reflective surface-finished tube that transmits sunlight down into a room below.

CAPEX COST RANGE

R2 000 – R12 000 each

ASSUMPTIONS

Based on a standard 250mm to 350mm diameter installation.

PROS

- Can be virtually no limit to the number of bends
- Reduces greenhouse gas emissions
- Reduces artificial lighting operating costs
- Cost effective and easy to install
- In summer on an overcast day the light tube can deliver daylight equivalent to approximately 300 watts
- In full winter sun the light tube can provide approximately 500 watts plus of natural daylight to area served

CONS

- The length of the tube does impact on the amount of light transmitted, with approximately 6% light losses for each metre run of pipe
- In addition, a 12% reduction is likely for each 45° elbow fitted in the pipe's running length
- Limited effectiveness on overcast days
- Potential additional cleaning costs (minimal)
- Potential heat gains in buildings

OTHER INFORMATION

For bathrooms there are pipes available combining both lighting and ventilation.

KEY DRIVERS

The provision of good levels of daylight for building occupants. Reduced energy costs.

ATTRIBUTE: LIGHT SHELVES

DESCRIPTION

A light shelf is a passive architectural device that permits daylight to enter deep into a building by reflecting light from its upper surface to the ceiling and then down again, deeper into the floor plate.

CAPEX COST RANGE

R1 000 – R3 600+ /m (depending on specification)

NOTES

Light shelves may be internal or external and can serve a dual purpose as a sunshade.

PROS

- Enhances daylight quality
- Increases occupancy comfort and potential productivity
- Conserves energy by allowing perimeter lighting to be dimmed or switched off

CONS

- Increased capital cost
- Increases maintenance requirements
- Requires open plan office arrangement
- Can complicate window cleaning
- Additional light control needed in building

OTHER INFORMATION

Light shelves can have the added benefit of reducing direct sunlight lighting levels closest to the window, where typically high levels of natural light may impact comfortable working conditions.

KEY DRIVERS

Improved natural lighting levels to a greater proportion of the floor plan.

Reduced day lighting costs.

ATTRIBUTE: DAYLIGHT GLARE CONTROL

DESCRIPTION

Glare relates to difficulty seeing in the presence of bright light, such as direct or reflected sunlight. Glare is commonly overcome in offices through the use of tinted glazing, external shading, or the provision of manual or automated blinds and / or screens.

CAPEX COST RANGE

Project specific – but in the medium to high cost range.

NOTES

The use of external sunshades is becoming increasingly common on new buildings, used to reduce glare and the heat load on the building facade.

PROS

- Reduced energy consumption costs
- Reduced eye strain through elimination of direct sun penetration

CONS

- Can add cost due to ongoing operation and maintenance requirements
- High capital cost of sunshade / automated blinds

OTHER INFORMATION

Technological advances in glazing properties are also assisting in the minimisation of glare.

KEY DRIVERS

Reduced discomfort caused by glare from natural light or reflections.

Increased occupant comfort and productivity.

ATTRIBUTE: LOW-E GLAZING

DESCRIPTION

High performance glazing within the facade which allows as much daylight as possible into the building whilst minimising the transmission of solar heat gain.

CAPEX COST RANGE

6mm Annealed glazing	R 450/m ² of facade
Comfort low-E glazing	R 900/m ² of facade
Double glazed	R1 500/m ² of facade

PROS

- Lower 'U' value and lower Solar Heat Gain Coefficient (SHGC)
- Less heat loss / gain
- Energy savings
- Reduced greenhouse gas emissions
- Reduced glare

CONS

- Initial capital investment

OTHER INFORMATION

Glazing technologies are improving all of the time, with some glazing incorporating solar collector properties.

KEY DRIVERS

Reduction in operational energy and greenhouse gas emissions.

ATTRIBUTE: HIGH FREQUENCY BALLASTS

DESCRIPTION

Improving the workplace amenity by avoiding low frequency flicker that may be associated with fluorescent lighting.

CAPEX COST RANGE

None – standard practice.

PROS

- Avoids low frequency flicker in luminaries providing better indoor environment
- Reduces energy and greenhouse gas emissions
- No stroboscopic effects as with conventional fluorescent luminaries in the presence of rotating equipment

CONS

- None

OTHER INFORMATION

Due to differing tube sizes and fittings, it is currently problematic to retrofit existing fluorescent light fittings with T5 high frequency tubes.

KEY DRIVERS

Lower energy requirements and improved internal lighting.

ATTRIBUTE: EXTERNAL VIEWS

DESCRIPTION

The utilisation of the building design to maximise the potential for external views from within the building. This visual connection to the external environment has the benefit of reducing eyestrain for building occupants, contributing to a better working environment.

CAPEX COST RANGE

No additional cost.

NOTES

With careful design consideration, the maximisation of available external views can be achieved with no additional cost on new building projects, but may require expensive building planning on other projects.

PROS

- Provides better working environment
- Enables building occupants to enjoy the available distant views, reducing eyestrain from constant close work

CONS

- Opportunities may be limited depending on building location and surrounding structures
- An open plan floor plate layout is preferable to maximise opportunities to access views
- More difficult to achieve good views on some existing buildings

OTHER INFORMATION

Where external views are not available, the use of central atria / voids can also be used.

KEY DRIVERS

Improved working environment.

ATTRIBUTE: INDIVIDUAL COMFORT CONTROL

DESCRIPTION

Implementation of designs that facilitate control of thermal comfort.

CAPEX COST RANGE

R150 – R400/m²

PROS

- Contribution to well-being in the workplace and productivity levels
- Effective energy use
- Fewer tenant trouble calls

CONS

- Minor additional costs

OTHER INFORMATION

Individual control of the workstation provides a sense of personal recognition that is viewed as positive by staff towards management.

KEY DRIVERS

Employer driven from the inception stages.
Increased occupant comfort and productivity.

ATTRIBUTE: INTERNAL NOISE LEVELS

DESCRIPTION

Buildings that are designed to maintain internal noise levels at an appropriate level.

CAPEX COST RANGE

Costs minimal, depending on design.

PROS

- Contribution to tenant satisfaction and well-being in the workplace
- Compliance with sound health and safety standards

CONS

- Additional costs of acoustic treatment

KEY DRIVERS

Employer driven.
Good architecture.

ATTRIBUTE: VOLATILE ORGANIC COMPOUNDS

DESCRIPTION

Volatile Organic Compounds (VOC's) are normally given off in the form of gasses by new products and materials (i.e. paint, carpets, adhesives). The gasses emitted can cause headaches / irritation and generally pollute the atmosphere in a building.

CAPEX COST RANGE

Low cost impact.

NOTES

Many products are now available in a low VOC form.

PROS

- Products classified non-toxic are available
- Maximise indoor air quality
- Reduced risk of Sick Building Syndrome

CONS

- Some sealant and adhesive applications of low VOC products are problematic to source
- Detailed research of alternate products may be required by design teams

OTHER INFORMATION

Many types of low VOC carpets are available at no additional cost.

KEY DRIVERS

Reduced exposure to airborne pollutants, and improved occupant health and well-being.

Reduced greenhouse gas emissions.

ATTRIBUTE: FORMALDEHYDE MINIMISATION

DESCRIPTION

Formaldehyde is a chemical used widely by industry in the manufacturing of building materials. For example, pressed wood products are made using adhesives that contain Urea-Formaldehyde (UF) resins. Formaldehyde emissions can be toxic, allergenic and carcinogenic and may cause irritation to skin, the throat and eyes if present in the atmosphere.

CAPEX COST RANGE

Minimal cost implication.

NOTES

The specification of low emission formaldehyde in composite wood products in building projects is leading to minimal additional cost.

PROS

- Better air quality both in the short and long term, as the emission of gas can occur over prolonged periods

CONS

- May cause watery eyes, plus burning sensations in the throat and nose

OTHER INFORMATION

Interesting fact – in the 70's many homeowners had Urea-Formaldehyde Foam Insulation (UFFI) installed in wall cavities as an energy conservation method.

KEY DRIVERS

Better air quality for building occupants and those working in the composite wood product industries.

ATTRIBUTE: MOULD PREVENTION

DESCRIPTION

Indoor Air Quality (IAQ) deals with the health and comfort provided by the air inside buildings. The IAQ may be compromised by microbial contaminants (mould, bacteria), chemicals, allergens, etc. contained within the air, which can affect the health of people or animals.

CAPEX COST RANGE

Project specific, but extra cost may vary from R50 – R150/m².

OPERATIONAL BENEFITS

Potential productivity benefits.

PROS

- Better IAQ provides a better working environment for tenants
- Potentially increases efficiency through better productivity

CONS

- The correction of poor indoor air quality in existing buildings may be costly and disruptive

OTHER INFORMATION

Remember: “Hot feet and cool heads” can be the best learning environment.

First stage evaporation cooling consumes huge amounts of water for cooling.

KEY DRIVERS

The effective delivery of clean air through reduced mixing with indoor air pollutants in order to provide a healthy indoor environment.

Reduced sick building syndrome.



ENERGY



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Through the Energy category, the GBCSA targets an overall reduction in energy consumption. Such reduction has an impact on greenhouse gas and other emissions associated with energy generation from fossil fuels. Reductions in energy consumption can be achieved through more efficient use of energy in buildings. Reductions in emissions and capacity may also be achieved through generation of energy from alternative sources.

ENERGY

ATTRIBUTE: SITE ORIENTATION

DESCRIPTION

Good building orientation increases the energy efficiency of a building, making it more comfortable to occupy and cheaper to run. A well designed building will take advantage of the sun in winter, shield it in summer and take advantage of cooling summer breezes by way of cross ventilation.

CAPEX COST RANGE

Site specific.

OPERATIONAL BENEFITS

Higher HVAC costs are associated with buildings with high glazed proportion with east / west facing aspects.

PROS

- Integrated design approach
- Maximise daylight, natural ventilation and acoustic potentials
- Generally no additional cost implications
- Energy use savings can be incurred

CONS

- Opportunities may be limited by site shape, size and surrounding conditions

OTHER INFORMATION

Careful building orientation on a site is good architecture in its simplest form.

KEY DRIVERS

Improved indoor environment quality with reduced energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: GREEN POWER

DESCRIPTION

Green Power is the generic name given to electricity generated from clean, renewable energy sources. Green power sources can include solar (photovoltaic and thermal), wind power, new hydro on existing dams, biomass, wave energy and landfill gas.

CAPEX COST RANGE

(Based on Australian practice in Australian Dollars (\$) as South African data is not available)

- Based on a domestic tariff consuming approximately 5 000kW's of electricity per annum
- Usage of 20% wind green power can be an additional cost of \$2–4m²/annum
- 100% wind green power can be an additional \$10–12m²/annum
- 100% solar green power can be an additional cost of \$12–14m²/annum

PROS

- Reduces greenhouse gas emissions
- Users can demonstrate a commitment to the environment
- No capital cost involved for users

CONS

- Consumers typically pay a premium over and above non-green power sources
- Power generator systems (i.e. solar panels) may take up space and impact on animal, plant and human environments
- Subject to planning approvals
- Increased capex for developer
- Increased maintenance costs of systems

OTHER INFORMATION

Its usage is increasing – as the affordability of this product increases more people will use it.

KEY DRIVERS

Promotes reductions in greenhouse gas emissions.

ENERGY

ATTRIBUTE: WIND TURBINES

DESCRIPTION

Wind power generated through the use of a turbine, usually mounted on a tower / roof. The turbine collects wind energy and converts it to electricity. Can be utility wind farm or local private turbine.

CAPEX COST RANGE

R200 000 000 – R250 000 000

(R15 000 000 – R18 000 000 / turbine installed) for large scale wind farms. This would apply to areas such as the Western Cape.

ASSUMPTIONS

Based on 14 no. x 1 300kW (1.3MW) turbines (each of which can serve typically 80 – 100 houses) installed on an 18MW farm.

PROS

- Clean, renewable energy source
- Suitable for small and large scale applications
- With economies of scale and rising energy costs, wind energy is expected to be cost competitive in 10–15 years

CONS

- Depending on its application, structural strengthening may be required
- Acoustics; nuisance to neighbours
- High capital cost
- Vibration if attached to a building may also be a consideration
- Needs to be turned off if wind speed is too high

OTHER INFORMATION

Restricted application with regard to buildings.

KEY DRIVERS

The provision of renewable energy and reduced greenhouse gas emissions.

ENERGY

ATTRIBUTE: PHOTOVOLTAICS

DESCRIPTION

Photovoltaic panels (commonly referred to as PV panels) consist of technology that produces electric power directly from sunlight. A common application is in a solar powered pocket calculator. Use of the technology has increasing application on buildings.

CAPEX COST RANGE

R70 000 – R100 000 (R300 – R400/m²). Rates based on a typical house of 200m².

ASSUMPTIONS

Based on 1.2 – 1.4kW home starter installation comprising typically six panels on northern roof, inverter and AC/DC circuit breakers.

PROS

- Clean energy source – which requires no fuel and produces no emissions
- As technology continues to improve, current drawbacks are reduced
- Suitable for remote locations

CONS

- PV panels currently have a medium to long payback period, which makes them unattractive to purchasers. It is anticipated that this will reduce with technological advances and increased efficiency of the system
- Lack of suitable economical energy storage systems for use when the sun is not producing electricity

OTHER INFORMATION

Photovoltaic is the world's fastest growing energy production technology with some reports detailing production doubling every two years.

KEY DRIVERS

The provision of renewable energy and reduced greenhouse gas emissions.

ENERGY

ATTRIBUTE: SOLAR HEATING – HOT WATER

DESCRIPTION

Solar hot water systems use collectors or panels to absorb energy from the sun. Water is heated as it passes through the collectors which are usually mounted on a roof. The water then flows into an insulated storage tank ready for use.

CAPEX COST RANGE

R12 000 – R30 000 based on a water capacity size of 90 – 300L.

OPEX

Significantly reduced operating costs.

ASSUMPTIONS

Based on 6kW installation, which can typically serve one house.

OPERATIONAL BENEFITS

Typically 60% of domestic hot water requirements can be provided 'free' by solar hot water heating.
Payback typically around 10 years.

PROS

- Can produce between 50 – 90% of hot water requirements
- Low operating costs
- Solar is cheaper than gas which is cheaper than electricity
- Reduces greenhouse gas emissions
- Can be employed for hot water and radiator or underfloor heating
- Initial cost is high, but payback period is short

CONS

- Need to install a back-up system; i.e. a gas-fired booster system or electricity powered system for use on colder cloudy days
- May affect aesthetics of building

OTHER INFORMATION

In passive systems, water flows unassisted between the collectors and the tank.

In active systems, water is pumped between the collectors and the tank.

KEY DRIVERS

The provision of renewable energy and reduced greenhouse gas emissions.

ENERGY

ATTRIBUTE: TROMBE WALLS

DESCRIPTION

A trombe wall is a sun-facing wall built from a material that has thermal mass properties (such as stone, concrete, adobe or water tanks), which when combined with an air space, insulating glazing and vents forms a large solar thermal collector, for the provision of warm air.

CAPEX COST RANGE

R2 500 – R6 000/m² of facade.

ASSUMPTIONS

Costs are based on elevation area (the smaller the structure the higher the cost).

PROS

- Thermal mass, good insulation properties
- Lower energy consumption and greenhouse gas emissions
- Especially suitable for smaller buildings including houses

CONS

- Increased capital cost
- Difficulty in regulating air flow. A supplementary system may be required for consistent warm air provision throughout the year

OTHER INFORMATION

Grants may be available to offset some of the additional costs.

KEY DRIVERS

Minimise operational energy consumption and reduce greenhouse gas emissions.

ENERGY

ATTRIBUTE: LOW NITROUS OXIDE BOILERS

DESCRIPTION

A low nitrous oxide (Nox) burner is a type of gas burner that significantly reduces the formation of oxides in nitrogen. Nitrogen is a major contributor in the formation of greenhouse gases and photo-chemical smog.

CAPEX COST RANGE

R100 000 – R200 000

ASSUMPTIONS

Based on 50kW output natural gas fired boiler.

PROS

- Burner designs generally suitable for new or retrofit applications
- Very low Nox emissions
- Reduces greenhouse gas emissions and photo-chemical smog

CONS

- Not commonly implemented within projects due to higher capital and operational costs

KEY DRIVERS

Reduction in greenhouse gas emissions.

ENERGY

ATTRIBUTE: COMBINED HEAT AND POWER SYSTEM

DESCRIPTION

Plant designed to produce both heat and electricity from an energy source. The benefit of the system is that heat which would ordinarily have been wasted as a by-product of the electricity generation is harvested and used elsewhere within the building. Combined heat and power plants may also deliver excess power to the electricity grid. Tri-generation plant produces heat, cooling and electricity from an energy source.

CAPEX COST RANGE

Depends on proportion of building power that is generated and building size.

PROS

- Can significantly reduce heat energy costs
- Not subject to transmission losses from power station
- Reduces greenhouse gas emissions
- Increases efficiency up to 80%

CONS

- Electricity and heat demands must be balanced and simultaneous
- High end of term replacement costs
- High capital costs
- Higher than standard system maintenance costs

OTHER INFORMATION

Fuel cell technology is under development that could permit a freezer chest sized fuel cell to power an entire home. Fuel cells produce electricity through a chemical reaction rather than burning fuel.

KEY DRIVERS

The provision of renewable energy and reduced greenhouse gas emissions.

ATTRIBUTE: STAND-ALONE POWER SYSTEMS

DESCRIPTION

Stand-Alone Power Systems (SAPS), formerly known as Remote Area Power Supply Systems (RAPS), are used where it is difficult to connect to the electrical grid. A SAPS can be designed to suit the locality and loads required, combining renewable energy sources and conventional generating systems.

CAPEX COST RANGE

R180 000 – R275 000 (R900 – R1 400/m² house size of 200m²)

ASSUMPTIONS

Based on 12kW installation which can serve typically one house.

PROS

- A viable option where the cost of connection to the standard electricity grid is high, or where in remote locations this connection may be unavailable
- Can be more reliable in some rural areas where power from the grid cannot be relied upon

CONS

- Fuel sources may be unreliable, e.g. fixed overhead installations fail and bulk fuel deliveries may have access problems
- Relatively high capital cost

OTHER INFORMATION

A SAPS is suitable for use if you are not connected to the electricity grid and you need to generate your own power.

KEY DRIVERS

The provision of energy alternatives and reduced greenhouse gas emissions.

ENERGY

ATTRIBUTE: CONDENSING BOILERS

DESCRIPTION

A high efficiency heating hot water boiler. Condensing boilers achieve a high level of efficiency by removing the heat from the fuel as it is used and by cooling the products of combustion normally discharged up the flue.

CAPEX COST RANGE

R120 000 – R180 000

ASSUMPTIONS

Based on 50kW output gas fired (natural) boiler.

PROS

- Typically, up to 15% higher efficiency than traditional boilers
- Uses less fuel and generates less carbon dioxide; cuts running costs
- Suitable for gas fired applications (natural gas)

CONS

- Needs a larger heat exchanger than traditional boilers, thus larger plant space and higher capital cost
- Condensate removal requires use of materials not normally found in traditional boilers hence higher costs
- A mechanical boost fan is needed to exhaust the flue gases to the atmosphere due to lower flue gas temperature

OTHER INFORMATION

Indications are that typical payback periods of around four years are common for this type of boiler (over and above conventional systems).

KEY DRIVERS

Reduce base building operational energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: ABSORPTION CHILLERS

DESCRIPTION

An absorption chiller is essentially a chiller that uses a heat source such as a gas burner or high temperature water to provide the energy needed to drive the cooling system rather than being dependent on electricity to run the chiller compressors.

CAPEX COST RANGE

R1 250 000 – R1 750 000 (R500 – R700/m²) based on 2 500m² commercial development.

ASSUMPTIONS

Based on 350kW chiller.

PROS

- Popular where electricity is unreliable, costly or unavailable (e.g. uses natural gas)
- Less plant space required than traditional system
- Can operate on waste heat
- Can operate on cleaner energy source (e.g. natural gas)
- Can be used with solar panels

CONS

- Direct gas fired units require an exhaust stack to vent combustion products
- Maintenance costs are higher than a traditional system
- Higher capital cost

OTHER INFORMATION

With the addition of Absorption Chillers to Co-Gen (CHP) plants, the installations are referred to as Tri Generation. Works well where process rejection heat is employed.

KEY DRIVERS

Reduce building operational energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: VARIABLE SPEED DRIVES

DESCRIPTION

Variable Speed Drives (VSD) are electrical components added to motors on such items as pumps and fans. Instead of constant air and/or water being reticulated through a system with dampers/valves to limit the volume of air and/or water, a variable speed drive will adjust the power input to fan and/or pump appropriately to match the air/water volume requirements.

CAPEX COST RANGE

R10 000 – R100 000 depending on capacity.

NOTES

R1 200/kW based on 55kW installation
R4 500/kW based on 2kW installation

PROS

- Improves control
- Reduces energy and greenhouse gas emissions
- Assists in correct commissioning
- Reduced inrush current on starting when compared to direct on line motor starter method
- Reduced maintenance on motor bearings due to reduced inertia on starting

CONS

- Moderate cost depending on motor size

OTHER INFORMATION

The use of VSD is an efficient method resulting in minimal waste energy.

KEY DRIVERS

Assists in reducing the base building operational energy and associated greenhouse gas emissions.

ENERGY

ATTRIBUTE: HEAT RECOVERY

DESCRIPTION

The capture and recovery of heat from other plant processes which is then used elsewhere. Recovery equipment can be located in ducts, pipelines and plant that capture the heat rejected. For example, pre-cooling inlet fresh air with exhaust air, thus saving energy.

CAPEX COST RANGE

Project specific.

ASSUMPTIONS

Installations would normally form part of the HVAC installations equipment such as air handling plant, etc.

PROS

- Reduced greenhouse gas emissions
- Improves overall efficiency and energy use

CONS

- Viable payback may not be achievable in smaller installations
- Higher capital cost than traditional systems

OTHER INFORMATION

Other examples include the recovery of heat in hot exhausts from ovens or furnaces that can be used to provide space heating and devices such as heat recovery wheels.

KEY DRIVERS

Design features that help to minimise operational energy consumption and reduce greenhouse gas emissions.

ENERGY

ATTRIBUTE: DESTINATION CONTROL

DESCRIPTION

Passenger lifts using destination control enable passengers to select their preferred floor level after which they are then allocated to a specific lift in the lift bank. Since the destination is known in advance, new opportunities to optimise the travel routes of the lift become available, minimising waiting times and energy use during peak periods in a building.

CAPEX COST RANGE

Small additional cost depending on the lift numbers and system selected.

ASSUMPTIONS

Whilst available for new build installation, destination controls can be retrofitted on existing installations.

PROS

- Passengers can be subject to access restrictions on certain floors
- Reduce energy costs particularly during peak demand
- Potential time saving for passengers

CONS

- Not yet available from all manufacturers
- Time delays in buildings with a split lift system

OTHER INFORMATION

Lifts equipped with destination control have been successfully operated abroad for many years, providing significant benefits to building users.

KEY DRIVERS

Improved lift service and reduced energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: BUILDING MANAGEMENT SYSTEM

DESCRIPTION

A Building Management System (BMS) automates and takes control of the engineering services installations. It controls the facilities necessary for maintaining a comfortable environment and other operating systems.

CAPEX COST RANGE

R90 – R120/m²

PROS

- Of imperative value to improve energy efficiency and reduce energy use and costs
- Vital operational tool
- Can provide proactive response and assist trace problems

CONS

- Technology upgrades
- Proper systems are expensive

OTHER INFORMATION

BMS services are used extensively to control and monitor other building functions including electrical services, lifts, lighting, access control and HVAC. End users needs to be properly briefed with regard to what the BMS will do and if it should be a validating BMS or not.

KEY DRIVERS

To increase base building operational efficiency and reduce greenhouse gas emissions.

ENERGY

ATTRIBUTE: EXTERNAL SHADING

DESCRIPTION

External shading of buildings can be achieved in many ways, with either vertical or horizontal sun shading, or an additional skin filtering light into the building. Shading may also be achieved via roof overhangs, trees, a window shade or blind, etc.

CAPEX COST RANGE

R500 – R1 500/m² of facade.

ASSUMPTIONS

The more extensive the use of sunshades, the higher the cost.

PROS

- Reduction in energy costs and greenhouse gas emissions
- Visual properties of the sun shading can become an integral feature of the facade
- Less glare for occupants from glazing
- Contribution to tenant satisfaction

CONS

- Needs to be evaluated with benefits that may be lost with natural daylight provision
- High capital cost

KEY DRIVERS

Reduces glare, energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: DOUBLE SKIN FACADE

DESCRIPTION

A double skin facade is a facade which, in its simplest form, comprises two facade layers. Each of these facades is commonly called a skin. A ventilated cavity having a width that can range from several centimetres to metres is located between these skins.

CAPEX COST RANGE

R1 500 – R5 000/m² of facade.

ASSUMPTIONS

Costs are based on elevation area – the smaller the structure, the higher the cost. Costs vary with the complexity of the facade.

PROS

- Can be combined with automated equipment
- Reduced energy consumption, greenhouse gas emissions and glare can result in reduction of cooling plant capacity

CONS

- Careful consideration from integrated solution needs to assess the impact on the estimation of plant capacity
- High additional capital cost
- Long payback period

OTHER INFORMATION

May require an additional access walkway for maintenance between the inner and outer skins.

KEY DRIVERS

To reduce base building operational energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: INSULATION

DESCRIPTION

Materials used to prevent the movement of heat from one space to another; usually used to prevent heat losses in winter and heat gains in summer. Insulation in buildings can be found in cavity walls and roof voids. Insulation is also required on thermal equipment, pipes and ducts.

CAPEX COST RANGE

R150 – R250/m²

PROS

- Lower energy consumption costs
- Long life with low maintenance
- Reduction in greenhouse gas emissions

CONS

- Marginal capital cost increase over previous minimum insulation standards

OTHER INFORMATION

Vapour sealing of insulation on cool pipes, etc. is of importance.

KEY DRIVERS

Reduces base building operational energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: PHASE CHANGE MATERIALS

DESCRIPTION

Phase change materials are those that change phases at a specific temperature (i.e. water to ice at 0°C). Materials with a phase change point close to the desired room temperature, which can be used either to reduce temperature fluctuations within a room or to store energy in a phase change process (usually melting), and re-releasing to the system when its temperature falls below the transient point.

CAPEX COST RANGE

Project specific.

NOTES

Considered as 'innovative' technologies in commercial applications, the systems are usually in the high capital cost range, and need careful consideration prior to implementation.

PROS

- Will reduce peak demand
- Materials may be storage based; latent heat stores for active solar systems
- Can result in cooling plant capacity

CONS

- Higher capital cost
- Specialised maintenance required
- Large plant space required
- Additional weight added to building

KEY DRIVERS

Reduces operational energy consumption, peak loads and greenhouse gas emissions.

ATTRIBUTE: THERMAL MASS

DESCRIPTION

Thermal mass refers to any mass used to absorb and hold heat. Materials with a high 'specific heat' like stone, ash-fill, concrete or water work best. In many cases the thermal mass material is required to be exposed, thus there may be no requirement in certain situations for suspended ceilings and the like.

CAPEX COST RANGE

R500 000 – R1 000 000

ASSUMPTIONS

The additional mass finish to the underside of a slab will vary depending on thickness, finish and profile.

PROS

- In a building, thermal mass absorbs, stores and later releases significant amounts of heat or cooling to provide 'free' heating or cooling
- Ceiling services have been simplified or eliminated on some projects, e.g. no requirement for void fire protection and detection
- Reduces peak heating and cooling loads
- Reduces peak demand, energy usage and greenhouse gas emissions

CONS

- Concealment of engineering services may be an issue if ceiling thermal mass is used
- Acoustic aspects may be costly to overcome if false ceilings are eliminated
- Capital cost

OTHER INFORMATION

Integrated design combining thermal mass and insulation, along with ventilation and considered building orientation, will assist in creating a well designed building.

South African surveys indicate that rock storage may be a viable option for office park developments.

KEY DRIVERS

Promote design features that help to minimise operational energy consumption and greenhouse gas emissions of the base building.

ENERGY

ATTRIBUTE: ACTIVE CHILLED BEAMS

DESCRIPTION

Chilled beam with mechanical ventilation function. Chilled water is reticulated via beams (pipes) located at high level. Cool air falls to the occupied zone below and the displaced hot air rises. This then passes over the chilled beams/pipes again and the cycle continues.

CAPEX COST RANGE

Project specific, but approximately R500/m² net extra cost.

ASSUMPTIONS

Based on 350kW chiller.

PROS

- Reduced plant space and riser requirements
- Reduced energy and greenhouse gas emissions
- Reduced floor to floor requirement when compared with traditional Variable Air Volume (VAV) installations

CONS

- Where space heating is also required, the space heating needs to be a separate system
- Higher capital cost

OTHER INFORMATION

Provides a very energy efficient method of cooling indoor occupant space.

KEY DRIVERS

Reduce base building operational energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: PASSIVE CHILLED BEAMS

DESCRIPTION

Chilled beams without mechanical ventilation function, e.g. reliant on natural convection for air movement. Chilled water is reticulated via beams (pipes) located at high level. Cold air drops to cool the occupied zone below and the displaced hot air rises to be chilled by the beams/pipes again, continuing the cycle.

CAPEX COST RANGE

Project specific, but in the order of R500/m² net extra cost for a commercial office block.

PROS

- Silent cooling principle
- Can be integrated into service rafts to conceal services where a suspended ceiling is not required
- Reduced floor to floor requirement when compared with traditional Variable Air Volume (VAV)

CONS

- Can be an extremely quiet system which can be disconcerting. Artificial background noise known as white noise may be required to provide a controlled level of ambient noise
- Higher capital cost

OTHER INFORMATION

Provides a very energy efficient method of cooling indoor occupant space.

KEY DRIVERS

To reduce base building operational energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: BIOMASS

DESCRIPTION

Biomass relates to the use of organic matter as a fuel source. The organic biomass material should be available on a renewable basis, and ideally a by-product of another process. Biomass includes forest and mill residues, agriculture crops and wastes, wood and wood wastes, animal wastes, livestock operation residues, aquatic plants, fast growing trees and plants and municipal industrial waste.

CAPEX COST RANGE

R1 200 000 – R1 800 000

NOTES

Based on 250kW output biomass boiler, including fuel storage and delivery systems.

PROS

- Carbon neutral
- Can reduce landfill
- Can be extremely cost effective
- Environmentally friendly

CONS

- Where no freely available biomass fuel source is available the supply chain has tracked the rate of increase in fossil fuel prices
- Larger physical size of the plant requires fuel storage and handling systems

OTHER INFORMATION

Biomass boilers are not modular and it may prove more economical outside of the heating season to use an alternative fuel source, e.g. for domestic hot water.

KEY DRIVERS

Reduce building operational energy and greenhouse gas emissions.

ENERGY

ATTRIBUTE: ENERGY SUB-METERING

DESCRIPTION

The installation of energy sub-metering to facilitate ongoing management and monitoring of energy consumption.

CAPEX COST RANGE

R50 000 – R100 000

PROS

- Effective mechanism for monitoring and control of energy consumption
- Difference in energy use by multi-tenants is possible
- Effective facilities management tools
- Detect faulty installations

CONS

- Minor cost implications

OTHER INFORMATION

Consumption of electricity is the largest contributor of greenhouse gas emissions arising from office buildings. Successful management of such consumption is imperative.

KEY DRIVERS

Employer driven.

ENERGY

ATTRIBUTE: LIGHTING POWER DENSITY

DESCRIPTION

Light Emitting Diodes (LED's) are bright, efficient and quick to react making them a perfect choice for a wide range of effects. LED converts electrons (electric current) to photons (light).

CAPEX COST RANGE

R100 – R250/m²

ASSUMPTIONS

Generally LED lighting systems can be double the cost of neon or cold cathode-type lighting systems and can range in the order of R500 – R900/m run.

PROS

- Increased lamp life (50 000 run hours) – 10 years compared to a fluorescent tube which is typically 9 000 hours
- Special lighting effects
- Low energy option
- Reduced power factor correction required

CONS

- Higher capital costs

OTHER INFORMATION

Energy efficient, brightness and directional control meaning light pollution can be significantly reduced.

KEY DRIVERS

Lighting design that reduces pollution from the unnecessary spillage of light into the night sky and onto neighbouring property.

ENERGY

ATTRIBUTE: LIGHTING ZONING

DESCRIPTION

Use of automatic switching, occupancy sensing and lighting dimming controls. Lighting control systems range from simple measures such as localised manual switches positioned closely to the area they control, to more complex automatic systems based on time control, occupancy sensors or photo-electric daylight linking mood settings, all of which can be monitored and controlled from a central facility.

CAPEX COST RANGE

R300 000 – R1 000 000

PROS

- Greenhouse gas emissions reduction
- Flexibility of lighting
- Excellent after-hours operational characteristics
- Higher quality building environments
- Energy savings
- Reduced internal heat gains leading to reduction in space cooling requirements
- Daylight harvesting
- Better occupancy control

CONS

- Capital cost implications

OTHER INFORMATION

It is more cost effective to turn a switch off when not in use.

KEY DRIVERS

To reduce energy and greenhouse gas emissions while improving lighting in occupied areas.

ENERGY

ATTRIBUTE: PEAK ENERGY DEMAND REDUCTION

DESCRIPTION

Power Factor Correction (PFC) equipment improves the efficiency of electrical devices by converting the power to a more useable and efficient form to reduce peak energy demand.

CAPEX COST RANGE

R70 000 – R400 000 depending on capacity.

ASSUMPTIONS

R650/kW based on 600kW installation

R750/kW based on 100kW installation

PROS

- Reduces maximum demand costs charged by electrical utility
- Reduces greenhouse gas emissions
- Reduces peak demand

CONS

- Capital cost is higher than standard installation

OTHER INFORMATION

Power companies can require customers with high loads to maintain power factors above (usually 0.9 or higher), or be subject to, additional charges.

Ice storage on the HVAC system is deemed more effective than PFC. It costs approximately R500 – R600/kWh thermal or approximately R1 500 – R1 800/kWh electrical. If the electrical load is reduced by 1 kW for 6 hours, the cost difference is $6 \times R1\ 800 = R10\ 800$.

KEY DRIVERS

Reduces peak demand of electricity and costs.

ENERGY

ATTRIBUTE: GROUND SOURCE HEAT PUMPS

DESCRIPTION

Ground source heat pumps use an underground loop which transfers heat or cold from the earth into a building to provide space heating / cooling and, in some cases, to pre-heat domestic hot water. Ground source heat pumps, air source and water source heat pumps are also available.

CAPEX COST RANGE

R1 250 000 – R1 750 000

ASSUMPTIONS

Based on 12kW installation that can serve typically one house.

PROS

- Can be a good option where gas is not available
- Reduced greenhouse gas emissions
- Suitable for areas with extreme temperature
- Better combined with under floor heating as it operates at a lower temperature

CONS

- Ground conditions may not be suitable
- High capital cost
- Lack in contractors' ability to install system

OTHER INFORMATION

To be a 100% renewable energy option, consider buying green electricity and/or installing a solar PV to power the compressor and pump as part of the system. Works well for small to medium establishments. Geothermal water can be used to pre-treat fresh air. There are currently only a few specialist contractors available in South Africa.

KEY DRIVERS

The provision of energy alternatives and reduced greenhouse gas emissions.

ENERGY

ATTRIBUTE: COAL RANK

DESCRIPTION

There are two main ways of classifying coal – by rank and by type. Higher rank coals are typically harder and stronger and often have a black lustre. Anthracite is at the top of the rank scale and has a higher carbon and energy content and lower level of moisture.

OPERATIONAL BENEFITS

The coal mines are located mainly in the north-eastern area of South Africa, in the province of Mpumalanga, where a large number of open-pit and underground coal mines are in operation. Coal reserves in South Africa, as everywhere else, are not endless and with current expectations, by 2040 only 7 billion tons will be left of a current estimated reserve of 34 billion tons.

PROS

- Black coal has higher carbon and energy content
- Black coal has lower moisture content
- Relatively cheap and affordable energy source
- Black coal has lower emissions than brown coal

CONS

- All fossil fuels are finite resources
- Economy is depending on finite resources
- Emissions generated in production of electricity are the hub of the world global warming problem

OTHER INFORMATION

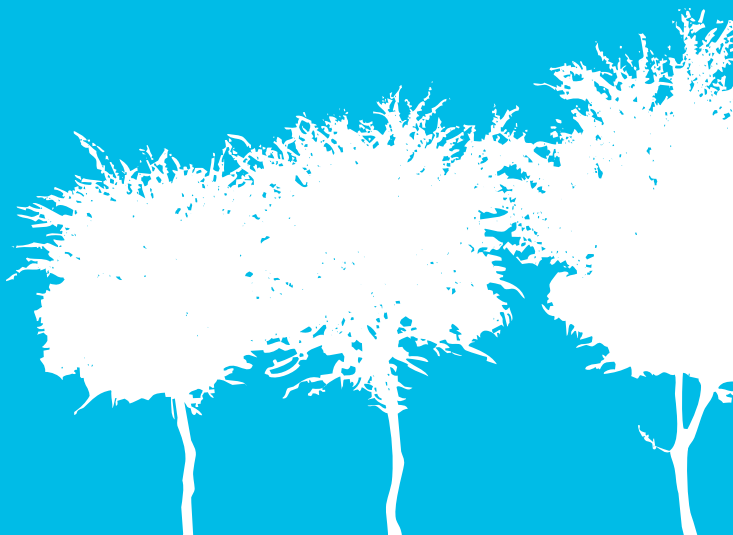
40% of all electricity generated worldwide is produced from coal. More than 90% of electricity produced in South Africa is from coal fired power stations. 66% of world steel production is depending on coal. This aspect falls outside the control of the development team of buildings.

KEY DRIVERS

Alternative power generation sources, including clean coal, are required to reduce greenhouse gas emissions.



TRANSPORT



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- 70 Commuting Mass Transport
- 71 Local Connectivity

Through the Transport category the GBCSA promotes the reduction in automotive commuting by simultaneously discouraging it and encouraging use of alternative transportation.

ATTRIBUTE: MAXIMUM CAR PARKING

DESCRIPTION

Developments that facilitate the use of alternative modes of transportation for commuting to work.

CAPEX COST RANGE

No additional cost. Less parking spaces reduce capital cost.

PROS

- Public transport is supported
- Green living through ISO 14001 is supported
- Significant fuel savings
- Car pooling programmes are promoted
- Support of alternative modes of transport
i.e. walking or cycling

CONS

- Minimum requirements of authorities must be adhered to
- The demographics of South Africa restricts implementation

KEY DRIVERS

Reducing emissions.

Reduction of energy usage.

TRANSPORT

ATTRIBUTE: FUEL-EFFICIENT TRANSPORT

DESCRIPTION

Developments that accommodate the use of more fuel-efficient vehicles for work commuting.

CAPEX COST RANGE

None.

PROS

- Smaller cars generate less emissions
- Encourages the use of hybrid cars
- Encourages the use of motorbikes and scooters
- Encourages car park users to think about the choices they make in car selection

CONS

- Motorcycling in South Africa can be dangerous

KEY DRIVERS

Reducing emissions.

ATTRIBUTE: CYCLIST FACILITIES

DESCRIPTION

'Secure' bicycle storage is dedicated and under cover. In addition, accessible showers plus changing facilities with secure lockers or equivalent should be located adjacent to the storage facilities – the number of which are calculated depending on project criteria.

CAPEX COST RANGE

R100 000 – R200 000 per 20 cycle rack, including ancillary facilities.

NOTES

Assumes the inclusion of showering facilities for between 3 – 6% of staff numbers respectively. Typical Grade A building. Will replace car parking spaces. Secure locking of bicycles to be provided.

PROS

- Promotes better health and well-being
- Encourages the use of alternative modes of transport
- Reduces emissions from cars
- Endorsed by tenants
- Contributes to ISO 14001 accreditation
- Improved body health

CONS

- Takes up space, which could be used for other purposes
- Additional construction costs
- Cycling on South African roads can be dangerous

OTHER INFORMATION

Cyclist facilities are becoming increasingly sought after by many office workers seeking an alternative to cars and public transport.

KEY DRIVERS

Encourage cyclists and reduce emissions.

TRANSPORT

ATTRIBUTE: COMMUTING MASS TRANSPORT

DESCRIPTION

Developments that accommodate the use of mass transport for work commuting. Choice of the right site with the required location is key.

CAPEX COST RANGE

Minimal – it indicates a saving if compared to the provision of parking.

PROS

- Cost savings
- Fuel savings
- Traffic improvement

CONS

- Cannot be implemented if development is poorly located

OTHER INFORMATION

In South Africa private transport trips over long distances are often preferred over public transport.

KEY DRIVERS

Commuting mass transport is in the national interest and should be promoted by employers.

ATTRIBUTE: LOCAL CONNECTIVITY

DESCRIPTION

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

CAPEX COST RANGE

None.

PROS

- Short walking or travelling trips to work improve traffic flow
- Fuel savings
- Cost savings

CONS

- Cost of creation of green open spaces
- Cost of links to amenities

OTHER INFORMATION

People who drive to work still benefit from walking to or from the office to carry out errands during the day.

KEY DRIVERS

Should be driven by developers.



WATER



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Through the Water category the GBCSA addresses the reduction of potable water use through efficient design of building systems, rainwater collection and water reuse.

WATER

ATTRIBUTE: RAINWATER HARVESTING

DESCRIPTION

Rainwater harvesting collects water from building roofs or clean hardstand areas. Installations may comprise interconnecting rainwater downpipes to storage tanks which can then be used for irrigation purposes, and may also be reticulated to toilet cisterns within the building. Separate cold water pipework reticulation is required.

CAPEX COST RANGE

Low R12 000 (domestic) to high R1 500 000+ (commercial) cost range based on domestic house size of 200m² and commercial development of 5 000m².

NOTES

Can be applied in many situations and therefore has a wide cost range.

PROS

- Reduces potable water consumption
- Reduces stormwater provisions

CONS

- Requires separate pipework and reticulation to appliances served
- Very long payback period
- Not all locations in South Africa are viable due to low rainfall

OTHER INFORMATION

Being used in domestic situations for irrigation purposes.

KEY DRIVERS

Reduce the potable water consumption of building occupants.

WATER

ATTRIBUTE: GREY WATER

DESCRIPTION

Grey water is waste water generated from domestic processes such as washing dishes, laundry and bathing, but not toilet waste water. Grey water is given its name from its cloudy appearance and its status from being neither fresh nor heavily polluted. Grey water can be recycled in storage tanks and then re-used for irrigation and flushing of toilets. Depending on how well the water is treated, grey water in general cannot be reticulated to sinks, basins and the like.

CAPEX COST RANGE

Low R50 000+ (domestic) to high R1 500 000+ (commercial) cost range based on domestic house size of 200m² and commercial development of 5 000m².

NOTES

Can be applied in many situations and therefore has a wide cost range.

PROS

- Grey water comprises 50–80% of residential waste water produced
- Recycling content saves use of potable water for flushing cisterns and the like
- Potentially suitable for use in cooling towers
- Suitable for landscape irrigation

CONS

- Water comprising high levels of toxic chemicals from household cleaners and food residues may be considered 'dark grey' or black water
- Separate piping system required to reticulate grey water to toilets and other equipment
- Stringent requirements of authorities restrict applications
- Potential contamination

OTHER INFORMATION

Can significantly reduce water consumption.

KEY DRIVERS

Promotes the reduction in potable water consumption of building occupants.

WATER

ATTRIBUTE: WATER EFFICIENT FIXTURES AND FLOW RESTRICTORS

DESCRIPTION

Flow restrictors may be used in older installations to restrict flow of water. Typically used in showers and tap ware. New buildings should be fitted with water efficiency labelled fixtures.

CAPEX COST RANGE

Minimal additional cost per fixture.

NOTES

If provided fixtures are appropriately specified at the outset, there should be no additional cost. Flow restrictors are also suitable for retro-fit installations.

PROS

- Significant savings on water use
- Save up to 60% on domestic water heating costs

CONS

- Minimal cost

OTHER INFORMATION

Water efficiency labelling and standard scheme showerheads use only 7 litres of water/minute. Some old style showerheads can use 20 litres of water/minute.

KEY DRIVERS

Reduction of potable water consumption of building occupants.

WATER

ATTRIBUTE: WATERLESS URINALS

DESCRIPTION

Waterless urinals do not require water for flushing. They are similar in appearance to traditional urinals and are connected to the building plumbing waste system. Each urinal consists of two main components – a seal trap and air seal. “Water” flows through the trap where it is immersed through a floating layer of sealant liquid.

CAPEX COST RANGE

R1 000 – R3 000 per fixture including labour and excluding pipework.

OPERATIONAL BENEFITS

Whilst the additional capital costs associated with waterless urinals are minimal, the saving associated with the water and drainage infrastructure requires to be evaluated against the additional maintenance costs.

PROS

- Reduced water consumption
- No mechanical parts
- Saving on piping

CONS

- User reluctance
- Maintenance costs are higher
- Potential odours

OTHER INFORMATION

In retro-fits, some remodelling may be required to lower drain lines to facilitate trap installations.

KEY DRIVERS

The reduction in potable water consumption by building occupants.

WATER

ATTRIBUTE: BLACK WATER

DESCRIPTION

Black water (waste) is a relatively recent term used to describe water containing waste from toilets/urinals. It is also known as brown water, foul water or sewerage. Black water can be treated and converted to grey water and held in storage tanks. The reconditioned water (grey water) can be used for toilet flushing, landscape irrigation and in cooling towers. In locations where on-site black water treatment is generally not permitted, consideration should be given to contacting local authorities to investigate the benefits of on-site water treatment for the project and local infrastructure.

CAPEX COST RANGE

Commercial situations – R3 000 000+

ASSUMPTIONS

High capital cost due to treatment plant and dual pipework reticulation required.

PROS

- Recycling content saves use of potable water
- Can be used for toilet flushing, landscape irrigation & cooling tower make-up water
- Fertilizer for farming

CONS

- High capital cost prevents commercial viability
- Very slow payback period
- Stringent authority requirements restrict applications

OTHER INFORMATION

The local water authority requirements and regulations regarding black water treatment should be investigated.

KEY DRIVERS

Reduction in potable water consumption.

ATTRIBUTE: COMPOSTING TOILETS

DESCRIPTION

A system that converts human waste into a fertiliser or usable soil. Composting toilets use biological processes to deal with the disposal and processing of human waste into organic compost material. These fixtures are generally found in remote areas where connection to the utility waste drainage infrastructure is not readily available.

CAPEX COST RANGE

R50 000 – R250 000 per stand-alone toilet and associated works.

NOTES

Single composting toilet with basic weatherproof structure.

PROS

- Ease of installation in any location
- Does not have to be connected to sewer
- Reduced water usage

CONS

- If a problem arises, can be out of order for considerable time
- Not suitable for major buildings
- Has higher maintenance costs, e.g. not self cleaning
- Stringent authority requirements restricts applications

OTHER INFORMATION

Frequently used in national parks, etc.

KEY DRIVERS

Promote the use of innovative initiatives that improve development's environmental impact.

WATER

ATTRIBUTE: WATER METERS

DESCRIPTION

A water meter can assist in the monitoring and tracking of water usage. Regular reading of water meters can assist in the detection of water leakage within buildings and identify high water usage areas.

CAPEX COST RANGE

R50 000 – R70 000

PROS

- Ease of detection of water leakage, especially during out of hours periods when water use should be minimal
- Can be included in the BMS of major buildings
- Relatively cheap and easy to install depending on meter's capability
- Identifies high water usage areas

CONS

- Minor cost increase

OTHER INFORMATION

Overall water consumption data can also be obtained from the utility bills.

KEY DRIVERS

Reduction in water usage.

ATTRIBUTE: LANDSCAPE IRRIGATION

DESCRIPTION

Implementation of systems that aim to reduce the consumption of potable water for landscape irrigation. Rainwater or grey water is available for this purpose.

CAPEX COST RANGE

Minimal.

PROS

- Evident
- Reduced operating costs

CONS

- None

OTHER INFORMATION

Introduction of 'xeriscape gardens', defined as water-conserving gardens requiring no additional watering, should be promoted.

KEY DRIVERS

Reduced use of potable water for landscape irrigation.

WATER

ATTRIBUTE: HEAT REJECTION WATER

DESCRIPTION

Implementation of systems that reduce potable water consumption from heat rejection systems such as evaporative cooling for air-conditioning.

CAPEX COST RANGE

Medium to high capital cost.

PROS

- Reduction of potable water usage
- Lower operating costs

CONS

- High initial capital cost

KEY DRIVERS

Employer driven.

WATER

ATTRIBUTE: FIRE SYSTEM WATER CONSUMPTION

DESCRIPTION

Standards relating to fire systems require mains water to test the fire sprinkler system, which is usually wasted to sewer. This sprinkler test water can be collected, stored and re-used for other purposes, reducing potable water demand.

CAPEX COST RANGE

R100 000 – R250 000+ for commercial situations.

ASSUMPTIONS

Based installations comprising tanks and pumps delivering recycled fire water.

Costs above exclude fire water reticulation pipework to fixtures.

PROS

- Significant savings on potable water usage by recycling

CONS

- Capital cost associated with tank provision and the space required

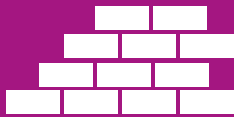
OTHER INFORMATION

Many thousands of litres of water may be saved by the re-use of fire test water.

KEY DRIVERS

The reduction in potable water consumption.

Consider alternative methods of fire protection.



MATERIALS



MATERIALS INDEX

- 86 Building Reuse
- 87 Reused Materials and Concrete
- 88 Steel
- 89 Sustainable Timber
- 90 Design for Disassembly
- 91 Local Sourcing

Through the Materials category of Green Star SA the GBCSA targets the consumption of resources through selection and reuse of materials, and efficient management practices. The basic concepts of the category are to reduce the amount of natural resources used, reuse whatever materials can be reused, and recycle whenever possible.

MATERIALS

ATTRIBUTE: BUILDING REUSE

DESCRIPTION

Developments that reuse existing buildings to minimise materials consumption.

CAPEX COST RANGE

Minimal.

PROS

- Natural resources are saved
- Lower demand for new construction materials

CONS

- Often the use of existing buildings is impractical or expensive

OTHER INFORMATION

Construction and demolition waste makes up one third of all waste generated in the world – almost half is disposed to landfill.

KEY DRIVERS

Reuse of existing buildings to maintain architectural style and mature location.

MATERIALS

ATTRIBUTE: REUSED MATERIALS AND CONCRETE

DESCRIPTION

Recycled concrete may contain a proportion of recycled aggregate to prolong the life of existing products and materials. Recycled concrete is mainly used for road fill etc. Some manufacturers also produce 'green' concrete (based on the specific cement content) available pre-mixed in a range of strengths. The addition of fly-ash adds to the inherent 'green' qualities of concrete.

CAPEX COST RANGE

Significant increase above standard concrete rates.

NOTES

Recycled concrete is marketed by a number of concrete manufacturers.

PROS

- Recycled waste to landfill
- Less virgin aggregate is required

CONS

- The recycled concrete requires an evaluation for each proposed application to confirm suitability
- Has potential to slow construction programme
- Cost

OTHER INFORMATION

Curing times for recycled concrete vary and may impact on project programmes.

KEY DRIVERS

Reduces embodied energy and resource depletion due to the use of recycled materials.

MATERIALS

ATTRIBUTE: STEEL

DESCRIPTION

The reduction of embodied energy and resource depletion associated with reduced use of virgin steel.

CAPEX COST RANGE

Minimal cost impact as most steel in South Africa has a very high recycled content.

PROS

- Reduction of steel waste going to land fills
- Reduction of emissions caused by new steel production
- Recycled steel properties seem appropriate for the purpose

CONS

- Increased steel tonnages because of mild steel used

OTHER INFORMATION

The international demand for steel has increased significantly. The high negative environmental impact of steel production requires better use of accessible material by the reuse and recycling of existing steel.

KEY DRIVERS

Environmental concerns, employer driven.
Green Star SA Star rating.

ATTRIBUTE: SUSTAINABLE TIMBER

DESCRIPTION

Sustainable forest management involves the management of all resources within forestry through an integrated planning approach and strives to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social and cultural opportunities for the benefit of present and future generations. It is of importance to notice that for a product to receive points within this credit for Forest Stewardship Council (FSC) certification, a full chain of custody must exist. Such process is described on the website of FSC (<http://www.fsc.org>).

CAPEX COST RANGE

Minimal cost implication.

ASSUMPTIONS

If provided timber products are appropriately specified at the outset, there should be no additional cost.

PROS

- Saves old forest stocks

CONS

- Limits choice of timbers

OTHER INFORMATION

The imperative necessity to conserve trees is evident, so reuse of timber or timber that has been certified environmentally and responsibly managed should be pursued.

KEY DRIVERS

Promotes environmentally responsible forest management practices.

MATERIALS

ATTRIBUTE: DESIGN FOR DISASSEMBLY

DESCRIPTION

Pre-fabrication is the practice of assembling components of a structure off-site and transporting complete assemblies or sub-assemblies to the construction site where the prefabricated units can be incorporated into the project.

CAPEX COST RANGE

Project/item specific.

NOTES

Generally off-site fabrication maximises buildability and can assist in a reduced project time and cost, producing time-related savings.

PROS

- Time and potential long term cost is saved
- Can be employed where specialised labour is required
- On-site congestion is minimised
- Material wastage is minimised

CONS

- Possible higher transportation costs
- Needs careful handling to avoid damage in transit/placement
- Difficult to achieve in practice
- May increase building leakage

OTHER INFORMATION

Designers should take full advantage of off-site pre-fabrication by planning it into the design rather than leaving it to the contractor.

KEY DRIVERS

Time and cost savings.

MATERIALS

ATTRIBUTE: LOCAL SOURCING

DESCRIPTION

The reduction of transportation emissions by using materials and products that are sourced within close proximity to the site.

CAPEX COST RANGE

Site specific.

PROS

- Reduction of transportation emissions
- Reduction of impact on traffic
- Support of local suppliers

CONS

- Additional costs
- Limited local sources
- Hassle to document

OTHER INFORMATION

Limiting the haulage of materials and thereby reducing the transportation emissions vastly improves the environmental impact of a building project.

KEY DRIVERS

Reduction in transportation emissions.
Support of local suppliers.



LAND USE
AND ECOLOGY



LAND USE AND ECOLOGY INDEX

- 94 Topsoil
- 95 Reuse of Land
- 96 Change of Ecological Value
- 97 Indigenous Landscaping

Through the Land Use and Ecology category of the Green Star SA – Office v1 rating tool – the GBCSA promotes initiatives to improve or reduce impacts on ecological systems and biodiversity. The term ‘biodiversity’ is used to describe the variety of life in an area, including the number of different species, the genetic wealth within each species, the interrelationships between them, and the natural areas where they occur.

LAND USE AND ECOLOGY

ATTRIBUTE: TOPSOIL

DESCRIPTION

Construction practices that preserve the ecological integrity of topsoil.

CAPEX COST RANGE

Minimal.

PROS

- Eliminates the need to source topsoil elsewhere for the intended project
- Preserves long-term potential of topsoil properties

CONS

- None

OTHER INFORMATION

Topsoil is a valuable and diminishing natural resource. It is an indicator of the health of the land and the long-term wealth of a nation.

KEY DRIVERS

Preservation of topsoil.

ATTRIBUTE: REUSE OF LAND

DESCRIPTION

The reuse of land that has previously been developed and where the site is within an existing municipally approved urban edge.

CAPEX COST RANGE

Minimal to medium cost range.

PROS

- Eliminates use of farm or greenfield land
- It may contain remains of infrastructure that can still be used
- Opportunity to rehabilitate land damaged through previously irresponsible development

CONS

- High cost associated with serviced and zoned land

OTHER INFORMATION

Redevelopment of previously built-upon sites will reduce the demand for greenfield space whilst at the same time improve the development potential of previously defunct industrial or landfill sites.

KEY DRIVERS

Employer driven – location of the building.
Green Star SA rating.

LAND USE AND ECOLOGY

ATTRIBUTE: CHANGE OF ECOLOGICAL VALUE

DESCRIPTION

Developments that maintain or enhance the ecological value of their sites.

CAPEX COST RANGE

Site specific.

PROS

- Evident

CONS

- Cost implication of rehabilitation/stabilisation

OTHER INFORMATION

South Africa is one of the world's most biologically diverse countries. This heritage should be preserved or improved.

KEY DRIVERS

Improvement of site ecological value driven by the employer.

ATTRIBUTE: INDIGENOUS LANDSCAPING

DESCRIPTION

Indigenous plants are those specifically native to particular places in South Africa. Sustainable landscaping is an approach to designing and constructing the landscape that surrounds our buildings with permanent indigenous plants that require little watering.

CAPEX COST RANGE

Indigenous planting can be done cost effectively depending on plant choices.

NOTES

Costs are variable depending on species, ground conditions and the apportionment of hard versus soft landscaping attributes.

PROS

- Contributes to restoring and maintaining biodiversity
- In many areas, indigenous plants can be reintroduced to sites as they were prior to development
- Saves water
- Reduced maintenance cost

CONS

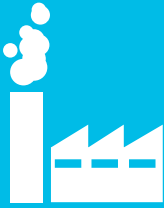
- Less plant varieties available for designers to select

OTHER INFORMATION

Indigenous plants should be selected for their drought tolerance, minimising the need for extensive irrigation systems.

KEY DRIVERS

Maintain the ecology of local areas and promote the biodiversity of the site, attracting birds and the like.



EMISSIONS



EMISSIONS INDEX

- 100 Ozone Depletion Potential
- 101 Global Warming Potential
- 102 Climate Change
- 103 Green Roofs
- 104 Green Walls
- 105 Watercourse Pollution
- 106 Light Pollution

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

EMISSIONS

ATTRIBUTE: OZONE DEPLETION POTENTIAL

DESCRIPTION

The Ozone Depleting Potential (ODP) of a chemical compound relates to the relative damage to the ozone layer in the atmosphere caused by the compound. Ozone is the gaseous layer contained within the atmosphere that protects life on earth by filtering harmful ultra-violet radiation from the sun.

CAPEX COST RANGE

Project specific.

PROS

- Hydrochlorofluorocarbons (HCFC's) refrigerants are potential replacement compounds for chlorofluorocarbons (CFC's). The latter has apparently been phased out in most first world countries – South Africa to follow soon.

CONS

- CFC refrigerants accelerate depletion of ozone layer in the earth's stratosphere
- Some insulation products have CFC's or HCFC's within the product, especially foam insulation, emitting CFC's during manufacture

OTHER INFORMATION

ODP chemicals are commonly found in refrigerants used within air-conditioning systems, as well as in some insulation products.

KEY DRIVERS

Prevent further damage to the ozone layer.

EMISSIONS

ATTRIBUTE: GLOBAL WARMING POTENTIAL

DESCRIPTION

Global Warming Potential (GWP) is the instantaneous radiative forcing that results from the addition of 1kg of a gas to the atmosphere, relative to that of 1kg of carbon dioxide. Global warming is an increase of the earth's temperature resulting in an increase in the volume of water which contributes to a rise in sea levels. Ammonia chillers are being used increasingly.

CAPEX COST RANGE

The cost of a 250kW ammonia chiller is R2 100 000 compared to R500 000 for an HFC machine.

PROS

- Reduces global warming by use of low GWP refrigerants

CONS

- Potential lower efficiency of refrigeration equipment

OTHER INFORMATION

CFC 12 refrigerant, for example, has a GWP of 8 500, while water has a GWP of nil.

KEY DRIVERS

Selection of refrigerants that reduce the potential for increased global warming.

EMISSIONS

ATTRIBUTE: CLIMATE CHANGE

DESCRIPTION

The variation in the earth's regional and global climates over time. Said to impact weather patterns and contribute to the melting of icecaps, and rising of sea levels, etc.

CAPEX COST RANGE

Catastrophic, a heavy cost to us all.

NOTES

The effect of climate change will affect various building sectors differently.

PROS

- Employer initiatives will drive more environmentally friendly solutions

CONS

- A wide range of adverse impacts, including prolonged periods without rain, higher temperatures, melting icecaps and rising sea levels
- Will impact on all forms of life
- High costs in combating climate change

OTHER INFORMATION

A worldwide phenomenon requiring a global response.

KEY DRIVERS

Reduction in long term impacts on the earth.

EMISSIONS

ATTRIBUTE: GREEN ROOFS

DESCRIPTION

Green roofs are rooftops planted with vegetation. Typically green roofs have thick layers of soil (150–300mm or more) that can support a broad variety of plants or even tree species. Simpler green roofs would have a soil layer of 150mm or less to support turf, grass or other ground cover.

CAPEX COST RANGE

R350+/m² based on 200m² domestic houses.

NOTES

The suitability of green roofs requires evaluation for each proposed application to confirm suitability. Additional structural requirements have to be considered.

PROS

- Improves indigenous landscape
- Provides additional amenity for building occupants
- Reduces peak temperatures in non air-conditioned buildings
- Provides additional thermal property benefits
- Reduces heat island effect

CONS

- High capital cost
- Ongoing maintenance costs
- Potential leaks through roofs
- Increased water usage

OTHER INFORMATION

Careful consideration needs to be given to plant selection to ensure suitability for the long term.

KEY DRIVERS

To encourage and recognise the minimisation of ecological impact from development and to maximise the enhancement of a site for both new and existing buildings.

EMISSIONS

ATTRIBUTE: GREEN WALLS

DESCRIPTION

Green walls use climbing or potted plants as part of the facade externally, or internally as feature walls which can assist in improving indoor air quality and shading.

CAPEX COST RANGE

Project specific.

NOTES

The cost range for green walls will vary depending on the extent to which green walls are proposed and the associated structural requirements.

PROS

- Reduces maximum temperature in non air-conditioned buildings
- Can improve indoor air quality in naturally ventilated buildings
- May contribute to biodiversity targets
- Can be used as a key architectural feature

CONS

- Potential additional structural requirements
- Extra capital costs
- Maintenance of the plants over the building's lifetime

OTHER INFORMATION

Irrigation systems will also need to be considered with the design to compensate for periods of prolonged dry spells.

KEY DRIVERS

Increases the ecology and biodiversity potential of a building.

EMISSIONS

ATTRIBUTE: WATERCOURSE POLLUTION

DESCRIPTION

Swales are surface depressions enabling water to be channelled to a storage or discharge system. Swales should ideally be shallow and relatively wide, providing temporary storage for stormwater for reducing peak flows. During dry weather a swale will usually be dry.

CAPEX COST RANGE

R350 – R750+/m²

NOTES

Based on a 2 400mm wide swale, lined with large stones and extensive planting.

PROS

- Provides additional amenity for staff
- Can usually be accommodated within existing landscape budgets
- Promotes biodiversity and interest within the site
- Reduces flow to stormwater

CONS

- Will require ongoing maintenance
- Has the potential to become a collection point for surface-borne litter

OTHER INFORMATION

An alternative to gabions are porous pavements which enable rainwater to pass through and then be connected via subsoil drainage pipes.

KEY DRIVERS

Reduces peak water run-off to stormwater.

EMISSIONS

ATTRIBUTE: LIGHT POLLUTION

DESCRIPTION

Light pollution relates to stray light emitted from lighting installations and may comprise illuminated advertising signs, building and street lighting.

CAPEX COST RANGE

Minimal cost in prevention of light pollution.

NOTES

Installations that can minimise light pollution from luminaries should form part of the external lighting and power installations.

PROS

- Minimises the impact on nocturnal animals and insects
- Minimises glare
- Improved use of energy due to reduced light pollution

CONS

- Minimal downside
- Aesthetic compromise – Table Mountain not floodlit

OTHER INFORMATION

Astronomers worldwide are concerned that some stars seem to disappear in the night sky due to increasing sky glow from uncontrolled urban light.

KEY DRIVERS

Reduces light pollution, glare and associated adverse effect on animals and insects.



INNOVATION



INNOVATION INDEX

- 109 INNOVATIVE STRATEGIES AND TECHNOLOGIES
- 109 EXCEEDING GREEN STAR SA BENCHMARKS
- 109 ENVIRONMENTAL DESIGN INITIATIVES

The Innovation category is included within the Green Star SA – Office v1 rating tool as a way of encouraging, recognising and rewarding the spread of innovative technologies, designs and processes for commercial building applications that impact upon environmental performance. It encourages the demonstration of efforts to apply sustainable development principles to the wider process of designing and procuring buildings (such as collaborative working practices), as well as any positive environmental influence brought to bear on the wider geographic area in which the project is located. These efforts are recognised over and above any credit obtained in other categories.

INNOVATION

ATTRIBUTE: INNOVATIVE STRATEGIES AND TECHNOLOGIES

DESCRIPTION

To recognise pioneering initiatives in sustainable design, process or advocacy.

ATTRIBUTE: EXCEEDING GREEN STAR SA BENCHMARKS

DESCRIPTION

To recognise projects that achieve environmental benefits in excess of the current Green Star SA benchmarks.

ATTRIBUTE: ENVIRONMENTAL DESIGN INITIATIVES

DESCRIPTION

To encourage new methods of design and material use that have potential for environmental conservation. To recognise sustainable building initiatives that are currently outside of the scope of the Green Star SA rating tool but which have a substantial or significant environmental benefit.

ACKNOWLEDGEMENTS

- Technical Manual Green Star SA — Office v1 2008 published by the Green Building Council of South Africa
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- Marloes Reinink — Solid Green Consulting



CASE STUDY



AURECON OFFICE BLOCK

Century City, Cape Town



The Aurecon office block in Century City, Cape Town received a five star rating from the Green Building Council of South Africa on 19 July 2011.

CASE STUDY

AURECON OFFICE BLOCK

The Aurecon office block in Century City, Cape Town received a five star rating from the Green Building Council of South Africa on 19 July 2011. This makes this office block the first building in Cape Town to receive a GBCSA rating, as well as the first building in South Africa to achieve a five star rating.



The Aurecon building, with a total construction area of 12 190m², consists of a parking basement, parking on the podium and four levels of offices. Rabie Property Group (Pty) Ltd developed this site specifically for Aurecon (Pty) Ltd, the tenant, an international engineering company. Their colleagues in Australia are occupying offices with green star ratings so therefore it was important for the South African firm to follow suit.

The Aurecon building contains some unique features which contributed to the Green Star rating achievement. A few of these features are highlighted overleaf.

- 23% of the concrete roof area was developed into a roof garden with a barbecue and bar area, look out points and a “boma” area.
- The air conditioning system is water cooled. The water used for the cooling is treated effluent water.
- All the working stations have access to natural light. This was achieved with the introduction of additional light wells in the building. In addition to this the indoor environment quality is enhanced by making use of solar glazing to reduce sun glare in the building.
- The building caters for the needs of cyclists by providing storage facilities for bicycles and cloak rooms equipped with showers and lockers.
- A very sophisticated building management system is used enabling the occupants to minimize electricity and water usage.
- Each level is equipped with a CO² sensor in order to monitor and control the CO² levels in the building.
- 90% of the water used for irrigation is non potable water.
- More than 60% of the steel used in the building was recycled steel.
- A water harvesting system was introduced to harvest stormwater. The system consists of concrete tanks, and a pump and filter system. The harvested and recycled water is used to replenish the irrigation water supply of the building.
- Care was taken with the specification of products, specifically carpets, paint and sealants, to minimise the contribution of volatile organic compounds inside the building.
- The use of PVC had to be minimised in the building. This was achieved by using polypropylene and HDPE pipes in the plumbing system.
- Specific energy modelling was used during the design of the building to calculate the greenhouse gas emissions of the building in order to minimise these emissions.
- The building is provided with a Tier III generator which complies with the emission regulations of the GBCSA. Special sound attenuation had to be installed to ensure that the noise levels of the generator did not exceed 55dB at the boundary of the building.
- The taps at all the basins in the men’s and ladies’ rooms are equipped with movement sensors. This system minimizes the waste of water.

- Every room is equipped with movement sensors which activate lights in the room only where movement is detected. This feature minimizes the use of electricity in the building.
- Special water meters (20 in total) are installed to monitor the use of water. The system is designed in such a manner that a water leak can be detected and located easily.
- Materials sourced within a radius of 50km from the building site exceeded 10% of the value of the project. Special calculations were made to calculate the value of locally sourced materials and the contractor had to keep records of where the materials were procured.
- The building is equipped with a recycling waste system. During the construction period waste was also recycled.
- An air leakage rate of less than 15m³/hr/m² is achieved at a relative pressure of 50Pa. This level of airtightness ensures the minimization of air leakage which optimizes the effectiveness of the air conditioning system and ultimately saves energy.

The achievement of a GBCSA 5 star building did however come at a premium. The cost for achieving the 5 star rating with the GBCSA is significantly more expensive than other A grade offices and corporate offices without a GBCSA rating.

The following professional consultants were involved on this project:

Architect and Principal Agent: Maas & Coetzee (Pty) Ltd
 Quantity Surveyors: AECOM Davis Langdon SA (Pty) Ltd
 Civil Engineer: Aurecon (Pty) Ltd
 Structural Engineer: Aurecon (Pty) Ltd
 Electrical Engineer: Aurecon (Pty) Ltd
 Mechanical Engineer: Aurecon (Pty) Ltd
 Landscape Architects: Planning Partners (Pty) Ltd
 Green Consultants: PJ Carew Consulting (Pty) Ltd

The Green Star SA – Office v1 rating system made available by the GBCSA was used to calculate and achieve a Green Star rating for this project. This system provides nine categories in which points can be scored to achieve Green Star rating. The 5 star rating was achieved by scoring points under 8 of the 9 categories: Management, Indoor Environmental Quality, Energy, Transport, Water, Materials, Land Use & Ecology, Emissions and Innovation. The total points achieved out of a possible 146 were 83. The weighted points scored which culminated into the 5 star rating were 61.

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