



WESSA

PEOPLE CARING FOR THE EARTH

GREEN BUILDING PRACTICES



Compiled by WESSA Northern Areas

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1.Introduction

Green building is the practice of increasing the efficiency of buildings and their use of energy, water and materials, and reducing building impacts on human health and the environment, through better siting, design, construction, operation, maintenance, and removal – the complete building life cycle.

According to the US Green Building Council (www.usgbc.org): “The built environment has a profound impact on our natural environment, economy, health and productivity.”

In the United States, for example, buildings account for:

- 65% of electricity consumption,
- 36% of energy use,
- 30% of greenhouse gas emissions,
- 30% of raw materials use,
- 30% of waste output (136 million tons annually), and
- 12% of potable water consumption.

Breakthroughs in building science, technology, and operations are available to designers, builders, and owners who want to build green and maximize both economic and environmental performance.

Benefits of Green Building

Environmental benefits:

- Enhance and protect ecosystems and biodiversity
- Improve air and water quality
- Reduce solid waste
- Conserve natural resources

Economic benefits:

- Reduce operating costs
- Enhance asset value and profits
- Improve employee productivity and satisfaction
- Optimize life-cycle economic performance

Health and community benefits:

- Improve air, thermal, and acoustic environments
- Enhance occupant comfort and health
- Minimize strain on local infrastructure
- Contribute to overall quality of life

South Africa has recently (2008) established its own Green Building Council. The aim of this organization is to promote Green Building Standards in South Africa.

Moves towards energy efficient buildings in South Africa have already begun. The Department of Minerals and Energy has initiated a project that will see the retrofitting of 106 000 government buildings to increase energy efficiency. BP designed their Headquarters in Cape Town incorporating many energy efficient technologies and other aspects such as rain water harvesting.

Legislation regarding energy efficiency is also becoming prevalent with talk of including stringent legislation into the National Building Regulations. Already in Cape Town a by-law has been passed stating that “any new building or addition to a building, must have solar water heating as opposed to conventional water heating.” With this in mind it is obvious that incorporating green building design into new buildings will save the enormous cost of retrofitting buildings at a later stage.

2. Aspects of Green Building to consider

2.1 Building Design

This is the most important part of the process. A well designed building will eliminate the need for “add on” technologies for heating, cooling and light.

Climate-Sensitive Building Design

A house or a building can be thought of as being an envelope, which shelters an indoor space from the weather outside. The objective of the envelope is to maintain a comfortable inside environment. One approach is to build the building and then force the inside temperature to be comfortable by using fans, heaters, air conditioners, window louvers or computerised control schemes. A better way is to design the building with more consideration for its environment so that the need for active space heating or cooling by mechanical or electrical means is substantially reduced, if not totally eliminated.

Technology Description

The principles applied in climate-sensitive design are based on the idea of using natural conditions to the best advantage. The principles of orientation, heat storage and cooling can be combined with specific building materials to achieve climate-sensitive design. Energy-efficient housing design principles encompass all the available techniques of creating a ‘healthy’ interaction between indoor and outdoor climate conditions in buildings. This would include the use of passive solar design strategies to make houses more energy-efficient and simultaneously increase thermal comfort in the houses, but also water conservation, use of renewable energies, greening activities and the use of energy-efficient stoves.

Solar passive design principles include design and orientation of the house, and the building material used (that is mass, glazing, insulation, use of daylight, ventilation and othersystems which might be required).

Orientation

The sun rises daily in the east and sets in the west. In summer in South Africa, it will pass almost directly over-head at noon, whilst in winter its path will be low in the northern sky. This is true for any location south of the equator, and the further south you go, the lower the sun will be in the northern sky – north of the equator the sun follows a path that is low in the southern sky. Therefore, to let the sun inside the house in winter, most windows should be on the northern side. Windows on the east and west tend to lose more heat than they gain in winter and they can cause overheating in summer since they receive hot morning and afternoon sun. A roof overhang over northern windows shades the windows in summer while allowing sunshine in during winter, due to the lower position of the sun in the sky – the sun shines in under the overhang to heat the inside of the house.

Some practical advice....

The longer side of the house should be orientated east-west so that it faces north to ensure that the house receives the maximum amount of sunlight throughout the day. Internal rooms should be planned in such a way that the most frequently used rooms, such as the lounge are situated on the north side of the house;

The largest windows of the house should be fitted on the northern side;

The roof overhang on the northern side of the house should be calculated to be at an angle equal to 90° minus latitude, as measured at the windowsill. When it is not possible to make this calculation precisely, a good guideline to follow is that the overhang on the northern side of the house should at least be 400mm to 600mm in length;

A roof overhang should ideally be combined with a strip of grass or vegetation to prevent the surface from warming up.

Heat Storage

If the sun is allowed to stream in through a window, the room will warm up. If there is a concrete floor or thick walls, they too will warm up and stay warm for a long time and release heat slowly into the room after the sun has gone down. The walls and floor act as thermal mass to store the heat gained. Stone, concrete, brick, adobe and rock chips are all good thermal storage materials, which can be incorporated in walls, floors and a fireplace.

Some practical advice....

The floor slab should be constructed of a material that has a high thermal mass, e.g. brick or concrete to store heat during the day and release it at night. For this reason it is important that the floor slab is left uncovered by carpets;

If you have curtains or blinds in front of the windows, it is important that they are open during the winter day to let the sunshine in and heat the floor. The curtains should be closed once the sun goes down to keep the heat inside the room.

Insulate the building perimeter and use doors and windows that shut tightly.

Cooling a Building

Besides providing heat during winter, successful climate-sensitive buildings are cool in summer. Sufficient overhang protects the north facing windows from the high summer sun while at night, the house must be well ventilated to cool the place down. Insulation and thermal storage that retain heat in winter will keep the building cool during hot days. In very hot climates ventilation is important. For example, a front porch is used to cool the air before it circulates through the house via the windows, which open on the porch. Plants and trees are also cooling, preventing heat being reflected off bare ground while deciduous creeper growing over a porch will shade it in summer and let the sun through in winter when the leaves fall.

Building Materials

The skin of a building is made up of various materials, which may reflect, absorb, store, transmit or resist heat. In winter, retarding heat loss is as important as admitting sunlight, so the roof needs insulation, normally in the form of a ceiling with additional bulk insulation on top. A wide variety of commercial insulation materials are available on the market (like Isothem www.isothem.co.za), or in low-income houses, a layer of crumpled newspaper is better than no insulation at all, but fire risks should be considered. Curtains help to insulate windows while in very cold climates people use double-glazing (two sheets of glass with a gap between them) to reduce heat loss through windows. Similarly, a double wall (a double brick wall with an air gap in between) can be used to prevent losses and gains through walls. The shape of a building is also important from an energy point of view. A tall, slender building has a high surface area to volume ratio. Ideally a building should be compact, with a low surface area to volume ratio, since the building's surface is the element through which the heat transfer occurs.

Some practical advice....

Ceiling insulation will reduce the need for heating the home and could reduce energy costs by 50% (www.isothem.co.za)

Walls can be insulated with a non-conducting material such as polystyrene sheets. Plastering is also regarded as the most effective method of insulating walls as it improves the moisture resistance of a wall; see a product called 'Isoboard'.

Mud bricks are an excellent source of insulation, as are most forms of traditional building material such as thatch roofs and clay walls and floors.

In South Africa, window and door frames are most often made of steel except in the coastal areas where rust is a problem and wood is the material of choice. Wood in fact provides a better insulation than steel.

Climate-sensitive design principles can be incorporated to varying degrees in office buildings, social housing, private homes as well as apartment buildings and townhouses. Incorporating energy efficient design principles, especially in the delivery of low-cost housing, would have numerous benefits to the poor families living in these houses. Low-cost houses may be cheap to build, but their running costs are astronomical. Because of the use of energy-inefficient materials, it is sometimes warmer outside the house than inside. The costs of keeping these houses heated come out of the earning of the people who can least afford to pay them – heating can cost poor people up to 60% of their income. Furthermore, poor families use dirty, dangerous fuels such as coal and paraffin to heat their homes. These fuels cause indoor and outdoor air pollution, respiratory diseases as well as being dangerous in terms of causing fires and burns.

Can it work for me?

Definitely, if you are considering building a new house or if you want to increase the comfort levels of your home – making it warmer in winter and cooler in summer. More importantly, if you want to save money and reduce the cost of heating or cooling your house, you should seriously consider incorporating some interventions in your home. Although it is much cheaper to incorporate these principles and implement the measures before the house is constructed, it is possible to retrofit existing structures. EEHD building principles are valid for electrified and non-electrified buildings. Some interventions are low to no cost (house orientation, positioning and size of windows, use of plants and colour and good ventilation); some are medium cost (roof overhang, energy efficient appliances) and some are high cost (wall, roof and ceiling insulation; additional glazing and draft proofing around windows and doors).

Benefits of EEHD

There are tangible benefits through the use of EEHD principles such as:

- Increased comfort (not too hot or too cold) and improve quality of life;
- An improvement in the health of people living in the house;

- Reduction of energy demand because less energy is required to heat or cool the house;
- Savings on energy costs (electricity and heating bills), therefore releasing funds for other basic essentials such as food, clothing and education;
- Financial benefits through energy and subsequent monetary savings; and
- Environmental benefits through reduced air pollution; which is a result of less 'dirty' fuels being used;
- Improved air quality reduces the cases of respiratory and associated illness;
- Benefit to Eskom and the municipality through reduced peak electricity demand;
- Bear in mind that although the upfront cost of insulating your roof for example, may seem high, think about the savings you will achieve over the life-span of your house. The avoided cost of heating your home or reducing your heating expense will pay off the investment in a short period.

For more information contact:

ERA Architects: Ken Stucke 082 451 8069 or Kenneth@zanet.co.za

Enviro-Fringe Services: Sue Bellinger 082 577 7000 or sueb@mweb.co.za

2.2 Energy efficient technologies

a. Photovoltaic solar panels provide electricity using the radiant energy of the sun. For more information on this visit www.sessa.org.za and click on Energy Resources.

List of links to photovoltaic information and suppliers

[AI Power](#)

[Atlantic Solar Heaters \(Pty\) Ltd](#)

[C-Dynamics](#)

[CSIR](#)

D Lite Electrical

[Endangered Wildlife Trust](#)

[Eskom NGE](#)

KG Electric

[Maxlite](#)

[Ministry of Mines and Energy - Namibia](#)

[Minus 40 \(Pty\) Ltd](#)

[Renergy Technologies](#)

[Shell Renewables](#)

[Solar Age Namibia](#)

[Sun Electricity cc](#)

Tenesa

[University of Durban-Westville](#)

[Willard Batteries](#)

Willi's Energy Savers

A team at the University of Johannesburg has developed a solar panel, up to five times more efficient and at a third of the price of existing photovoltaic units. They have started production in Germany and units should reach South African shores by the end of 2008.

b. Energy saving bulbs (CFL): Osram lighting manufacturers produce energy-saving bulbs to be used in conjunction with photovoltaic panels. The use of these bulbs will reduce the energy needed for a building's lighting.

c. Motion sensors: these turn off the lights automatically if no motion is detected in the room after a certain period of time. (www.electrosense.co.za)

d. There are many other energy saving products on the market such as solar water heaters, geyser blankets for conventional geysers, natural skylighting etc. Geyser blankets are available from large stores such as Game.

List of links to water heating information and suppliers:

[Atlantic Solar](#)

Bitol Tech

Double D Solar Panels

Gauteng Solar Solutions

[Maxlite](#)

[New Energy Technologies](#)

[Restor \(Africa\)](#)

[Solar 2000](#)

[Solarbeam](#)

[Solarhart S.A](#)

[Solar Heat Exchangers](#)

[Solar Primeg](#)

[Solardome S.A.](#)

[Sunpower Solar Water Heating](#)

[Suntank](#)

[Tasol Solar](#)

The Solar Shop

Willi's Energy Savers

[Xstream Hot Water Cylinders](#)

Also keep an eye on the Central Energy Fund Projects, one of which is the introduction of high-quality solar water heating for domestic use in middle- to upper-income homes as part of a six-month pilot project, taking advantage of the high number of days with sunshine in South Africa. 500 Geysers were installed as part of the pilot programme. The next roll-out of this programme promises about 200 000 solar water heaters. Consumers will be able to apply for a subsidy to have one fitted to their homes.

2.3 Water saving technologies

The use of water saving devices has a direct and positive impact on dwindling water resources as well as a reduction in cost of water.

a) Dual flush toilets reduce the amount of water consumed by giving the user the option of a smaller "flush" for non-solid human waste.

b) Aerated shower heads and taps reduce water consumption. They give you the same water pressure by including pressurized air bubbles in the water stream,

but less water is actually used. For more information **call RST Water saving systems on 016 982 3320 or www.rst.co.za**

c) Rainwater harvesting. Water can be channeled into tanks fitted to gutters, or underground water storage facilities can be used. This water can then be used for irrigation for gardens etc.

e) Grey water harvesting: Water from basins can be channeled straight into gardens, especially those with plants that have high water requirements. This reduces the need for separately irrigating these gardens. Note that only natural cleaning products should be used. Enchantrix and Mary Jane's have these products available. Also available from Fruit and Roots Hobart centre, Corner of Hobart and Grosvenor roads, Bryanston.

f) Dry Compost Toilets : www.separett.com

2.4. Gardening and grounds

a) Plant only indigenous plants suitable to the area. These plants require less care and less water to sustain themselves. The use of such plants also increases the biodiversity of fauna in the area.

b) Avoid the use of chemicals in the ground as this leads to pollution of groundwater sources which may be a future option as a water source for human consumption.

c) Avoid water run off: Large areas of paved driveways etc. cause water to run, limiting infiltration into the ground and increasing the potential for erosion and damage to buildings.

d) Landscaping using appropriate indigenous and water-wise plants, as well as, reducing hard surfacing, will encourage a more ecologically sound environment. Promoting natural green areas, even in cities (e.g. green roofs) assist environmental conservation by reducing the Heat Island Effect.

For more information:

Environmental friendly water and gardening products: www.nutrigardens.co.za

Drip irrigation products at www.relaxirrigation.co.za or contact Darryl du Preez at info@relaxirrigation.co.za

2.5. Waste management

The proper management of waste will decrease carbon emissions as well as the energy required to transport and store waste.

a) Implement a waste minimization strategy: the less waste purchased through packaging, the less damage is done to the environment.

- b) Recycling of waste: Contact a company in your area that deals with collection of and/ or recycling of waste – try the Institute for Waste Management in Southern Africa:

www.iwmsa.co.za

3. Conclusion

As with a conventional building, the design of a Green building requires the knowledge and assistance of various parties. Networking with these parties will ensure that the best designs and technologies are incorporated. Ultimately, one should consider not just the environmental impact of the building once it is erected, but the whole life-cycle of the building including the materials and processes used to build it. A well-designed and constructed building will in the long term have profound environmental, economic and health benefits.

Please note: Companies mentioned in this document are not necessarily endorsed by WESSA. They are merely cited as examples of sources of various products. Consumers are encouraged to compare prices and quality wherever possible.

Further Reading:

www.alive2green.co.za
www.greenworks.co.za
One Planet Living
Green Buildings Council
Australia's Green Star

Summary of Green Building Suppliers

Product	Province	Supplier	Town/City	Email	Tel
Green Products	Gauteng	Geyser Duvet			0861 438 838
(Geyser Blankets, Insulation)		Khanyisa Electric		www.khanyisa.co.za	011 466 4137
	Limpopo	Builders Warehouse	Pdokwane		
		Game	Pdokwane		
		Pick n Pay	Pdokwane		
Insulation	Eastern Cape	Eco Insulation		www.eco-insulation.co.za	083 381 4378
		Dalen Industries		daLenind@mweb.co.za	041 484 4590
		Therm Guard		thermguard.ec@polka.co.za	083 234 9037
		Energy Conservation and Applications		eca@intekom.co.za	082 566 2118
Solar Panels	Eastern Cape	Telecom Techniques	Port Elizabeth		041 365 5073
	Gauteng	Cosmic Solar Systems		-	011 440 7610
		Divwatt		www.divwatt.co.za	011 794 3825
		Greencon		info@greencon.co.za	
		Flexopower		www.flexopower.com	011 465 0022
		Solarite		info@solarite.co.za	012 335 3576
	Limpopo	Pietersburg Gas & Hardware	Pdokwane	derikk@mweb.co.za	015 293 0101
	Limpopo	SolarVision			015 293 2248
	North West	CompuSoft	Hartbeespoort	CompuSoft@myconnection.co.za	082 893 5316
	Western Cape	Sieckmann Engineering		peter@sieckmann.biz	021 7159070
Solar Water Heaters	Eastern Cape	Telecom Techniques	Port Elizabeth		041 365 5073
		Suntank		info@suntank.com	041 360 2479
		Solar Energy Solutions		dmittens@mweb.co.za	041 484 3095
		Africa Power Solutions	Port Elizabeth	africapowersolutions@telkomsa.net	041 581 0650
	Gauteng	Solahart		info@solahart.co.za	011 465 7377
		Gauteng Solar Solutions		jchn.ledger@wol.co.za	

		Suncol		admin@suncol.co.za	011 421 6331
		Aerolite		roxanne.duraan@sover.co.za	
		Solartech		jhbnorth@setsa.co.za	072 226 3940
	Limpopo	Solar Impact	Tzaneen	jchannvanwyk@webmail.co.za	072 328 9544
		Pietersburg Gas & Hardware	Pdokwane	derikk@mweb.co.za	015 293 0101
Solar Lighting	Eastern Cape	SeaviewPumps			083 959 5945
Wind/Water Turbines	Eastern Cape	Telecom Techniques	Port Elizabeth		041 365 5073
	Gauteng	Iron Fireman		admin@ifsa.co.za	011 618 1315

