Western Cape Government

Making better choices: green procurement in state-subsidised human settlements

Unpacking green procurement for successful implementation

Western Cape Department of Human Settlements

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Table of Contents

List of Figures

Message from Head of Department

To be completed

Executive Summary

Our world is changing. The uncertainty caused by climate change, fiscal constraints, and growing social inequalities places increasing pressure on government and undermines the ability to provide services. Overcoming these risks, while taking hold of the opportunities, requires bold new ways of engaging with our environment and systems of municipal services provision. As government (municipal, provincial and national) is one of the largest consumers in the economy, those who direct this spending through service delivery have the power to shape local and national economies and the impact these have on the environment and society.

Adopting green procurement can simply be understood as better procurement rather than a new, alternate system; that is a step forward in the journey for improved procurement practices to meet South Africa's development priorities and goals. This can allow government to lead by example and use its market power to positively impact the environment and society for all citizens and future generations in the Western Cape and South Africa.

Making better choices: green procurement in state-subsidised human settlements has been developed as a resource to assist you in the implementation of green procurement in state-subsidised human settlements. This can enable you to achieve an improved environmental impact and quality of life for residents in the Western Cape. This document unpacks green procurement in state-subsidised human settlements through a range of tools: a design manual for making better choices, interventions for policy, and how to operationalise green procurement in supply chain management practices.

> Green Procurement is defined as 'the means that public authorities seek to procure goods, services and works with **an increasingly positive environmental impact, with associated social and economic benefits for beneficiaries, society as a whole and the national fiscus throughout their life-cycle,** compared to goods, services and works with the same primary function that would otherwise be procured.

Green procurement is an essential path to be taken in the journey towards a more sustainable future. In line with the National Development Plan goal of 'Building environmental sustainability and resilience' and the Provincial Strategic Goal 4: 'To enable a resilient, sustainable, quality and inclusive living environment', the aim of green procurement in state-subsidised human settlements is therefore:

- Improved sustainable use of resources
- Increased ecological resilience
- To enable sustainable livelihoods

The principles of green procurement over the full project life cycle therefore include:

- Reducing energy consumption
- Reducing water consumption
- Minimising waste generation
- Reducing greenhouse gas emissions
- Improving quality of life and dignity for beneficiaries (safety, health and access to services and economic opportunity)
- Providing high quality living environments, services and houses
- Making the most of ecological service systems
- Increasing the reuse and/or the recycling of resources
- Minimising exposure to environmental risks and hazards
- Maximising quality job creation
- Maximising economic inclusion, especially for SMMEs and local sub-contractors
- Increasing multi-stakeholder collaboration
- Being appropriate to the local environmental, social and governance context

The priorities of green procurement and the approach to implementing green procurement will differ in each municipal based on its local environmental, social, political, and economic context. This guideline does however suggest that a number of steps are necessary for implementation. While these are represented as linear, it is anticipated that some of this steps will occur simultaneously or overlap. This can be expanded upon by each municipality in the Western Cape, as lessons are learnt and fed back into the processes and strategies for state-subsidised human settlements.

1

Understand the local context

- Bio-physical context: climate, energy sources, water quantity and quality, anticipated effects of climate change
- Social and economic: culture, social assets and needs, demographics, infrastructure, economic assets, community needs
- Local service providers – green and conventional: professional, technical, materials and goods

Output: Status Quo document – can be, in part, drawn from IDP and SDF

2

Policy and political support

While not a prerequisite for the implementation of green procurement, this can assist developers and allow for a greater degree of intervention for improved environmental and social benefits.

- Share knowledge of green procurement and its value with councillors and officials
- Embed green procurement in policy and strategies
- Prioritise green procurement principles in relation to local context

Output: IDP, SDF and/or council backing

3

Project identification and approval

- Identify projects where green procurement can be implemented and piloted
- Identify the appropriate green procurement design interventions, through community engagement, for land, site layout and housing units
- Identify funding opportunities (cross-subsidisation, grants, community contributions)
- Submit project for approval in Western Cape Human Settlements Pipeline

Output: Project Initiation Document

4

Procurement Procedure

- Identify best suited procurement procedure: Procurement Procedures; Packaging strategy; Contracting strategy; Pricing strategy; and Targeting Strategy.
- Develop specifications and Terms of Reference/Scope of Works, inclusive of desired project outcomes based on policy objectives and prioritised principles
- Develop functionality criteria for eligibility and relevant weight based on project objectives

Introducing green procurement in state-subsidised human settlements

"Given its significant purchasing power, the public sector has a key role to play in driving the market for environmentally sustainable products and, consequently, promoting more sustainable consumption and production for a better future,"

> Johan van der Merwe, the City's Mayoral Committee Member for Energy, Environmental and Spatial Planning (City of Cape Town, 2015).

Making better choices: green procurement in state-subsidised human settlements has been developed as a resource to assist you in the implementation of green procurement in state-subsidised human settlements for an improved environmental impact and quality of life for residents in the Western Cape. It unpacks green procurement in state-subsidised human settlements through a range of tools, namely:

- **Enabling better choices: green procurement in provincial and municipal policy:** This provides direction for and input into the range of existing strategies and policies (both provincial and municipal) that need to guide and enable the implementation of green procurement.
- **Making better choices: A design manual:** This provides a description of practical design interventions and construction processes for how greener choices are made in state-subsidised human settlements projects. This section also includes a guide for 'green' home owners.
- **Procuring better choices: Tender templates for green procurement:** This provides guidance as to how environmental and social performance criteria can influence the procurement process and the drafting and awarding of tenders for state-subsidised human settlements provision.

This guideline offers an initial pathway to implementing green procurement in municipalities in the Western Cape. Wherever possible, examples are given to illustrate how this may be applied. The successful implementation of green procurement in state-subsidised human settlements will be realised through a strong partnership between provincial government, municipalities and suppliers of goods, services and construction works. As your knowledge increases, the standards improve, and the market for greener products and services matures, it will be necessary to review and update these guidelines to respond appropriately to these changes.

Why do we need green procurement in state-subsidised human settlements?

Our world is changing. The uncertainty caused by climate change, fiscal constraints, and growing social inequalities places increasing pressure on government and undermines the ability to provide services. Overcoming these risks, while taking hold of the opportunities, requires bold new ways of engaging with our environment and systems of municipal services provision. As government (municipal, provincial and national) is one of the largest consumers in the economy, those who

direct this spending through service delivery have the power to shape local and national economies and the impact these have on the environment and society.

In particular, a significant portion of the national budget is allocated to the provision of human settlements and infrastructure. Over the past 22 years, this system has provided many South Africans with homes and critical basic services. However, this has often manifested in highly resource-intensive processes and has locked cities and towns into unsustainable and ecologically-damaging patterns of consumption and ways of living.

Worldwide, buildings account for:

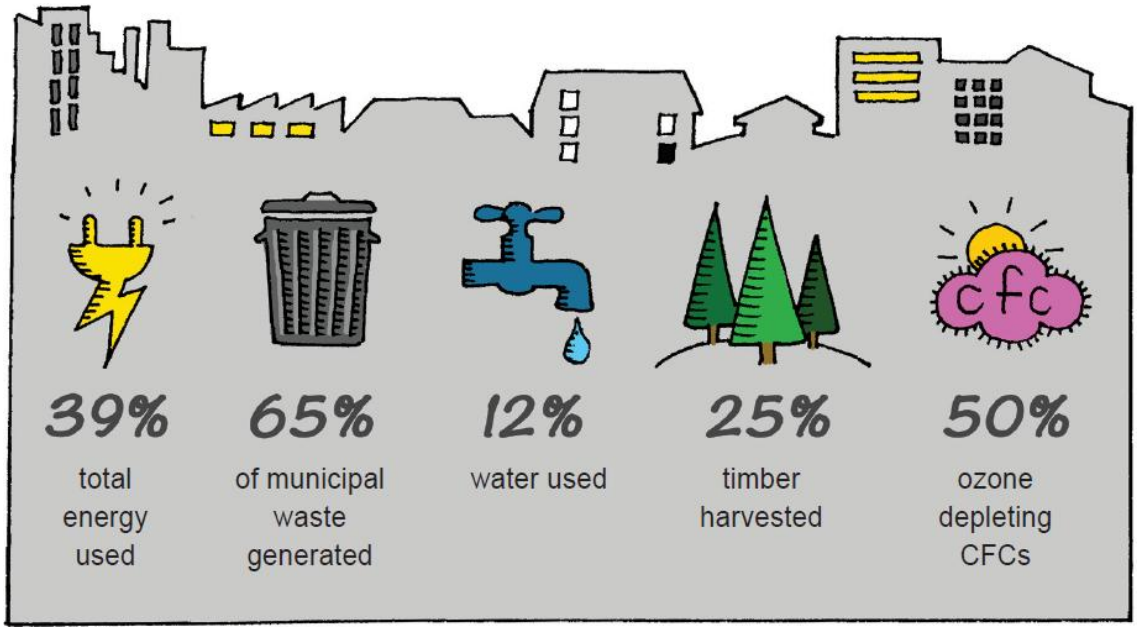


Figure 1: Proportion of resources used in buildings (construction and operation) worldwide. Source: ICLEI Africa Urban-LEDS Green Building Guidelines, 2015

This impact is further increased when the effect of buildings and construction is considered in relation to broader ecological and municipal service systems. Furthermore, these have had negative impacts on the health, well-being and socio-economic realities of beneficiaries.

There are multiple concerns arising from the current resource consumption facilitated by the built environment and buildings. These include:

- The production of the energy and materials used in buildings is one of the primary sources of greenhouse gases that have caused global climate change. In the Western Cape, climate change is expected to result in higher temperatures, reduced rainfall, and more severe storm events[1];
- The increasing cost burden of utilities for beneficiaries and municipalities;
- Reduced resource availability as ecological limits are reached;

[1] https://www.westerncape.gov.za/text/2015/march/western_cape_climate_change_response_strategy_2014.pdf

- Ecological degradation and loss of biodiversity, which undermines the provision of ecosystem services that support human well-being.

Through shifting to more sustainable and resilient modes of delivering human settlements, there are significant opportunities for increased job creation, social and economic inclusion and equity, and improved access to services and resources. It is these opportunities that must be capitalised upon for better human settlements.

What is green procurement in state-subsidised human settlements?

Adopting green procurement can simply be understood as better procurement rather than a new, alternate system. Green procurement is a step forward in the journey for improved service delivery practices to meet South Africa's development priorities and goals. This can allow government to lead by example and use its market power to positively impact the environment and society for all citizens and future generations in the Western Cape and South Africa.

> Green procurement builds on existing procurement processes and is defined as:
>
> 'the means that public authorities seek to procure goods, services and works with **an increasingly positive environmental impact, with associated social and economic benefits for beneficiaries, society as a whole and the national fiscus throughout their life-cycle,** compared to goods, services and works with the same primary function that would otherwise be procured.

Green procurement in the provision of state-subsidised human settlements projects requires that decisions are made throughout the whole life cycle of a human settlements project to reduce the total natural resource (water, land, materials) and energy consumption of the settlement, houses and by beneficiaries. This is to be accompanied by increased opportunities for job creation and improved quality of life for beneficiaries. This means that decision-makers need to take into account environmental, social and economic considerations for the design, construction and occupation/operation of the houses, community and municipal service systems.

What are the principles of green procurement in state-subsidised human settlements?

The principles of green procurement in South Africa go beyond those of general public procurement; that is value for money, open and effective competition, ethics and fair dealing, accountability and reporting, and equity. This is due to the objective of green procurement in this sector to improve the environmental, social and economic impact of state-subsidised human settlements. Due to the different climates, cultures and socio-economic realities in municipalities across the Western Cape, there can be no single aesthetic or approach applied uniformly to all human settlements projects. However, all green human settlements will share and build on the aims and principles captured below.

In line with the National Development Plan goal of 'Building environmental sustainability and resilience' and the Provincial Strategic Goal 4: 'To enable a resilient, sustainable, quality and inclusive living environment', the aim of green procurement in state-subsidised human settlements is therefore:

- Improved sustainable use of resources
- Increased ecological resilience
- To enable sustainable livelihoods

Following this, the principles of green procurement over the project's whole life cycle include:

- Reducing energy consumption
- Reducing water consumption
- Minimising waste generation
- Reducing greenhouse gas emissions
- Improving quality of life and dignity for beneficiaries (safety, health and access to services and economic opportunity)
- Providing high quality living environments, services and houses
- Making the most of ecological service systems
- Increasing the reuse and/or the recycling of resources
- Minimising exposure to environmental risks and hazards
- Maximising quality job creation
- Maximising economic inclusion, especially for SMMEs and local sub-contractors
- Increasing multi-stakeholder collaboration
- Being appropriate to the local environmental, social and governance context

The adoption and application of these principles by municipalities requires a prioritisation process, as guided by policy, and is linked to different design and procurement strategies.

Frequently asked questions about green procurement

Can green procurement improve the environmental impact of state-subsidised human settlements?

Yes, making decisions that take into account environmental considerations in the human settlements planning processes and the design and construction phases of a state-subsidised human settlements project can have a significant effect on the environmental impact of the project, its buildings and the lives of beneficiaries.

In the Kleinmond Eco-housing project, the aims included reducing water and energy consumption by beneficiaries and reducing the construction waste sent to landfill. These were successful through the inclusion of rainwater harvesting tanks, solar water heaters, energy-efficient light bulbs, and a modular design that minimised the cutting and wasting of bricks. These interventions reduced the amount of resources used by beneficiaries and reduced the embodied energy of the building; thereby having a global environmental impact by reducing the overall greenhouse gas emissions of the houses, thereby helping to mitigate climate change.

Can green procurement improve the social and economic impact of state-subsidised human settlements?

Yes, it is possible and often occurs with little further effort or intervention. This is because green procurement often goes hand-in-hand with social and economic upliftment. This is especially important when engaging with low income communities and state-subsidised human settlements. Without this, green procurement can often fail to be accepted by the community and municipality who are facing a range of immediate socio-economic priorities.

In the Witsand iEEECO project, the improvement of thermal performance in houses reduced energy consumption needed for space heating. For beneficiaries, this resulted in improved health and reduced utility costs due to no longer needing to heat the house with harmful substances, such as paraffin. This, in turn, benefits the municipality and other spheres of government, as well as the broader economy, as there is increased school attendance and productivity due to improved health and beneficiaries having more money to spend within the

Can green procurement offer value-for-money?

Yes, green procurement offers an opportunity to not only receive value for money over the procurement cycle, but over the full life cycle of the project too. This is particularly important in state-subsidised human settlements as the outcome of a project can have a significant impact on the livelihoods of residents for years to come and can be a burden or a blessing to the municipality in which it is located. The result of poor implementation of green procurement is borne by municipalities and beneficiaries who have to continually cover the cost for rising utility prices and absorb the cost of increased services provision.

The Standard for Infrastructure Procurement and Delivery Management (2015: iii) states that "Value for money may be regarded as the optimal use of resources to achieve the intended outcomes. Underlying value for money is an explicit commitment to ensure that the best results possible are obtained from the money spent, or maximum benefit is derived from the resources available."

These operational costs are not always considered by developers and implementing agents due to their primary focus on capital expenditure and the quantity of human settlements units provided. Furthermore, this can be attributed to government decision-making occurring in silos, where those responsible for provision of basic services and indigent policy are not part of the decision-making process for capital projects. This can result in a lower capital cost, rather than value for money, through a lower life cycle cost being selected. For certain interventions, the green procurement option can even result in a capital cost saving. This could be due to the design or construction making use of less material or if the project is supported by grants or external funding due to it being more environmentally sustainable.

Therefore, to ensure long term financial sustainability for both beneficiaries and municipalities, which is the ultimate achievement in the 'value for money' pillar of procurement, it is necessary to look at the anticipated costs over the full life cycle of the project in decision-making processes for feasibility and design. When taking into account the financial implications of increasing utility costs and the cost of service provision, along with reduced resource availability and increasing climate change vulnerabilities, green procurement to incorporate environmental considerations can achieve true value for money.

Burger and Swilling (2010: 166) completed research in 2008 to demonstrate that a life-cycle approach generates results demonstrating that sustainable living is more affordable for both the household and the tax base of the city, over a 30-year period. Environmental considerations being included in the state-subsidised human settlements procurement process, as seen in the tables below, can result in a 1.4% lower life-cycle cost over the 30-year lifespan. With regard to investment by the City, due to the sustainable living interventions reducing the need new water infrastructure and non-renewable energy by means of recycling and use of renewable sources, there is a 52% improvement in life-cycle cost-effectiveness when compared to the conventional approach. According to this research, beneficiaries pay less right from the start, ending the 30-year design working life period with a 37% better cost-effectiveness than the conventional approach.

Table 1: Current approach costing

Capex Item	Amount
Land	10 050
Civil services infrastructure	25 855
Electrical infrastructure	9 600
Top structure 40m²	43 506
Opex Item	**Amount**
Household water and sanitation	362
Household electricity	1 020
Household other energy	850
Household maintenance	1 305
City water and sanitation	492
City electricity	293

Table 2: Sustainable living costing

Capex Item	Amount
Land medium density	4 430
Civil services infrastructure, including neighbourhood water and sanitation system	17 227
Electrical infrastructure, reduced capacity and network distances	7 680
Top structure 46m², medium density, User Performance Level 2, ecological design	158 654
Solar water heating, components shared between units	5 000
Solar water heating replacement in Year 20	5 000
Landscaping as ecological design feature	640
Opex Item	**Amount**
Household water and sanitation	181
Household electricity	510
Household other energy	425
Household maintenance	1 305
City water and sanitation	123
City electricity	147

Conclusions were reached by measuring and comparing 30-year life-cycle cost effectiveness of the two alternatives. The results are expressed as net present values, using a discount rate of 9%. Unfortunately, this research is currently the only available, that is publicly available, for the South African context that compares the life cycle costs of a standard state-subsidised house against that of a house designed for sustainable living. For more information, please see:

Who benefits from green procurement in state-subsidised human settlements?

Green procurement offers benefits to the beneficiaries, as individuals and a community, and the three spheres of government, namely municipal, provincial and national. The benefit and value of green procurement must be considered within the broader system of government support and intervention, not only within the human settlements sector. Below is a list of benefits that may be experienced due to the implementation of green procurement practices:

Benefits for Beneficiaries

- lower monthly spending on utilities, such as energy and water, due to resource efficient features and/or alternative sources of resources
- improved access to resources from alternative sources
- improved health due to higher thermal efficiency;
- reduced spending on transportation due to being better located

Benefits for Local Government

With less money being spent by beneficiaries on utilities and transport, more money can be spent within the local economy on goods and services therefore boosting economic growth

- local sourcing and making use of SMME suppliers can boost the local economy
- resource efficient municipal services provision to human settlements can reduce operational costs therefore saving the municipality money
- if more residents can afford their utilities and services, then fewer are indigent who rely on the municipality for support
- risk-averse locations being used can reduce the costs of disaster risk management
- the enhancement and protection of ecological systems can support municipal services provision at a reduced cost
- reduced and reused construction waste leads to more landfill capacity and delays the capital needed for a new landfill
- higher residential densities results in cheaper services provision.

Benefits for Provincial Government

- Healthier homes lead to healthier people who are more productive at school and work and require less support from provincial health services
- higher residential densities makes transport more financially sustainable
- aids the achievement of publicly committed to Provincial Strategic Goals 4 and 5, the development of the green economy, and the goal to reduce greenhouse gas emissions and energy consumption in the province.

Benefits for National Government

reduced energy consumption both within the homes and through the choice of materials reduces the need for more expensive power generation plants and aids in the achievement of international commitments to reduce greenhouse gas emissions

- reduced water demand reduces the need for new water infrastructure and extends the anticipated capacity of surface water sources
- Local sourcing and increased productivity increases economic production, possibly reducing reliance on support grants

Who is responsible for green procurement in state-subsidised human settlements?

A range of stakeholders are involved in green procurement processes from across the public, private, community and non-governmental sectors. A table listing those stakeholders is provided below and broadly identifies where their primary responsibilities are.

Stakeholder	Strategy	Project	Tender	Tender	Monitoring	Project	Project	Occupation

	and Planning	Approval	Design	Evaluation	and evaluation	Design	Construction	and operation
Western Cape Department of Human Settlements	X	X	X	X	X	X		
Provincial treasury	X	X			X			
Municipal human settlements and/or infrastructure manager and department	X	X	X	X	X	X		X
Municipal councillors	X	X						
Municipal manager	X	X						
Municipal supply chain manager	X		X	X				
Bid adjudication committees				X	X			
Project Approval and Project Planning Committees	X	X						
Developer		X	X	X	X	X		
Beneficiaries	X					X	X	X
Regulatory and standards authorities	X					X		
Professional service providers and the main contractor		X				X	X	
Social Housing Institutions	X	X	X	X	X	X	X	X
Intermediary organisations						X	X	

What is whole life value thinking and how is it used for green procurement?

Whole life value thinking is a way of evaluating the capital costs of a project to consider whether a product or service will offer value for money over the life cycle of a project and not only for the short term purchasing considerations. The full life cycle of a project is defined as beginning at the planning stage, to design and detail design, to construction, to habitation, and eventually to demolition; with procurement decisions at each stage, as is illustrated below.

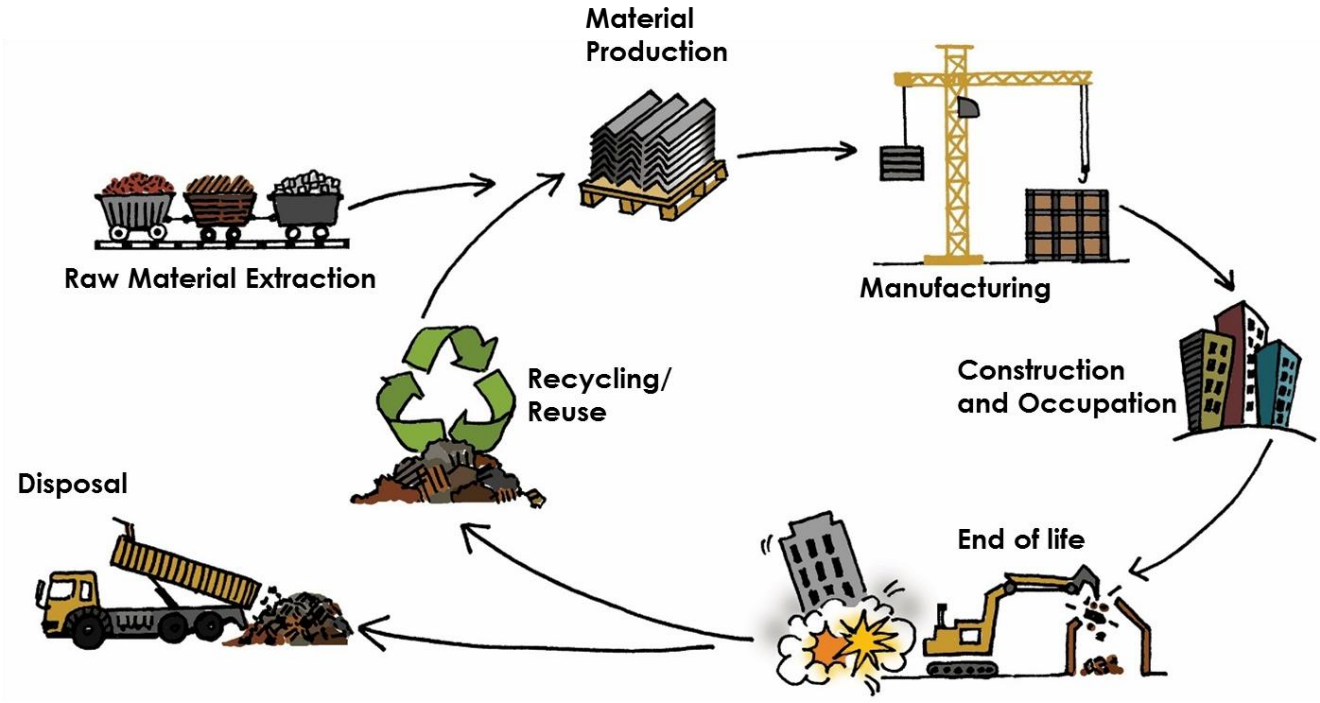
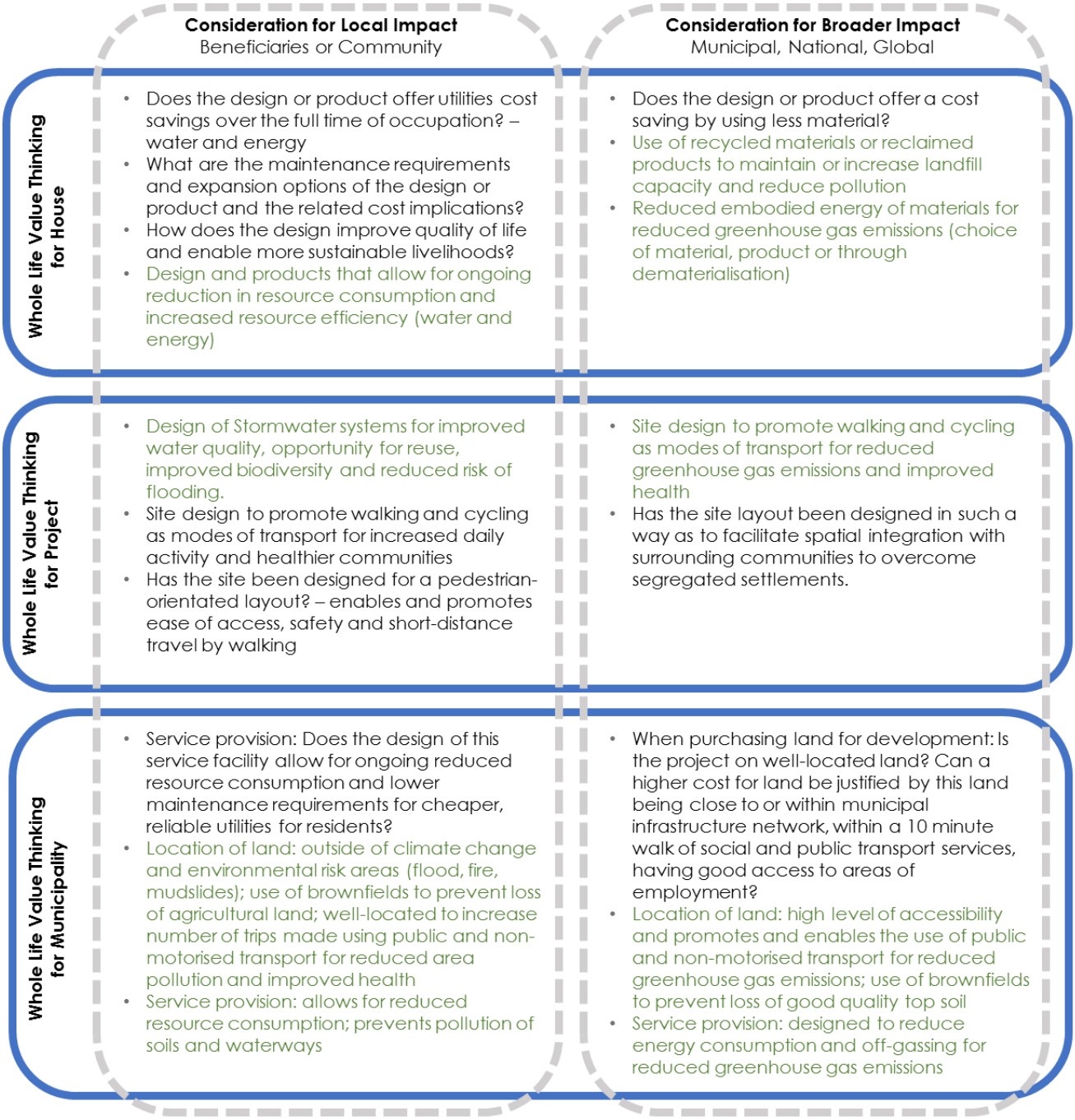


Figure 2: A diagram depicting the whole life cycle of a building and its products. Source: ICLEI Africa Urban-LEDS Green Building Guidelines, 2015

In South Africa, state-subsidised housing must have a design working life of a minimum of 30 years for the structural system and 15 years for repairable or replaceable components. Whole life value thinking in human settlements requires that a range of cost considerations are taken into account at different scales and times of intervention. This can include considerations of the direct financial implications of a decision as well as the indirect financial implications (for example, a cost saving to another municipal department) and the broader environmental, social, economic benefits for the municipality or country. A description of some of these considerations is provided in the diagram below. These considerations are shown in relation to the scale of planning and design (house, community and municipality) and the scale of the impact (whether local, for beneficiaries or communities, or broader, for the municipality, country, or world).



***green text indicates an Environmental Consideration**

How are appropriate environmental trade-offs determined and justified?

During the procurement process, a situation may arise where a decision must be made between the environmental performance and outcomes of two or more goods, services and/or construction works. The ideal situation would be one where a single solution offers all of the desired environmental outcomes. However, in reality, a decision may need to be made between saving energy, saving water, or generating less waste. For example, is it better to have a house design that prioritises the reuse and recycling of materials in its construction in comparison to a house that uses virgin construction materials, but provides improved thermal and energy efficiency during occupation?

It can be difficult to determine an appropriate trade-off without understanding these trade-offs within the local and broader context and who benefits from these environmental outcomes. When faced with a situation where a trade-off will need to be made, it is important to ask the following questions:

- Which option best aligns with the strategies and priorities identified in the IDP, SDF and HSP?
- Which option provides the greatest benefit to beneficiaries, over its lifecycle?
- Which option provides the most certain environmental outcome?
- Which option provides the greatest value for money over its life time to the municipality and/or beneficiary?
- Which option provides the most improved environmental impact over its life time?

Clay bricks vs Concrete Blocks - Environmental trade-offs in masonry material choice

The following short case study offers an example of how to think through the choice between two products using an understanding of the products' environmental trade-offs.

Clay bricks and concrete bricks are widely used in construction. Both materials have distinct advantages over each other. Clay brick production is a simple and continuous process from raw clay to finished brick. Clay brick provides the benefit of having its environmental impact being linked primarily to the energy inputs required for production. Therefore, as technology advances and clean sources of fuel are developed, clay bricks can only become more sustainable. Concrete bricks are simple to produce when all the ingredients are at hand. Concrete bricks can be manufactured on the site of construction thereby saving energy and costs related to transportation. Portland cement is the most environmentally contentious ingredient in concrete bricks and blocks. However, cement technology has moved towards replacing cement clinker with waste materials, such as fly ash and ground granulated slag. This replacement has the double advantage of replacing a material with high carbon dioxide emissions with a material, which would under ordinary circumstances end up as waste.

From: Clay and Concrete brick by M.N. Dlamini, CSIR BE (Candidate Researcher), 2014

What is greenwashing and how can it be avoided?

Greenwashing is the act of misleading consumers regarding the full environmental impacts of a good or service. Greenwashing promotes a 'greener' picture of a good or service that would not be supported by an analysis of its full life cycle and value. To avoid green washing it is important to ask the following questions when considering the options available (if yes, then it can be considered greenwashing):

1. Are there any hidden environmental trade-offs made over the life cycle of the good or service? For example, does an alternative building technology provide increased thermal

performance, for reduced energy consumption, yet it is manufactured very far from the project, even internationally, and therefore requires a lot of energy to transport the material to site?

2. Is the service provider unable to provide proof of the environmental claims made for the specific product or service being considered?
3. Is the environmental benefit of the good or service provided only in vague terms and often used phrases, such as 'environmentally-friendly'?

This concludes the introductory section of the guidelines. It is hoped that you now have a better understanding of green procurement and how to start applying it. This is the foundation that the guidelines will now build upon in the sections that follow.

Enabling better choices: Green procurement in provincial and municipal policy

To aid the implementation of green procurement, it is important that the intent, objectives, and processes for green procurement in state-subsidised human settlements are captured in the documents that guide strategic and daily decision-making in the municipality and provincial government. This is done within the context of international and national policy.

The policies and strategies discussed in this section have been identified as key points of intervention where green procurement considerations can be incorporated within existing processes. The range of policies and strategies discussed illustrates the fact that a green supply chain management policy and processes alone cannot achieve an improved environmental impact for state-subsidised human settlements. This requires significant support from strategic and forward planning documents that set the vision and desired pathways for government decision-makers.

This guide offers insight as to how and where changes and additional inputs into these strategies and policies can be made to incorporate green procurement considerations and offers examples of what these changes could be with contextual considerations highlighted. It is important to note that, at times, these interventions speak to more general green procurement policy statements beyond the human settlements sector.

Green procurement is becoming an increasingly important feature of international and local policies for sustainable economic development. This is evident in Sustainable Development Goals and the National Development Plan, along with other environmental and economic legislation in South Africa.

Green Procurement in the Sustainable Development Goals

Improving procurement practices for more sustainable and equitable resource consumption has been recognised internationally through the 2015 United Nations Sustainable Development Goals (SDGs). This is because if, as predicted, the world's population totals 9.6 million by 2050, with a growing middle-class, three planets' worth of resources will be required to sustain current lifestyles. South Africa has been a global leader with regard to sustainable development by adopting the SDGs in 2015 and ratifying the Paris Climate Agreement[2] in 2016. While all 17 SDGs are interlinked,

[2] The Agreement is a comprehensive framework which will guide international efforts to limit greenhouse gas emissions and to meet all the associated challenges posed by climate change. This outcome recognises that climate change represents an urgent threat to human societies and the planet, requiring the widest possible cooperation by all countries and other stakeholders. The main objective of the Agreement is to limit the global temperature increase to well below 2 degrees Celsius, while pursuing efforts to limit the increase to 1.5 degrees.

Goal 12: Responsible consumption and production specifically engages with green procurement practices. The following are relevant targets of this goal for green procurement:

- By 2030, achieve the sustainable management and efficient use of natural resources
- By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
- Promote public procurement practices that are sustainable, in accordance with national policies and priorities
- By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

Green Procurement in South African legislation

Over the past 22 years South Africa has continuously, and increasingly, been a leader in Africa with regard to taking into account environmental considerations in government decision-making across all spheres. South Africa has ratified international commitments to reduce greenhouse gas emissions and transition to a more sustainable and low emission development trajectory. These are supported by the National Development Plan, the National Climate Change Response White Paper, the Green Economy Accord, and the Constitution. In particular, green procurement is a tool for government to use to meet the Constitutional objectives (Section 152(1)) of sustainable service delivery, social and economic development and the promotion of a safe and healthy environment, while also meeting the targets of the international agreements (Urban SEED, 2012).

Supply Chain Management Policy

Supply Chain Management policy governs all procurement decisions and processes within each organisation, whether a municipality or the provincial government. Therefore, it is suggested to insert the following, more general, statements with regard to green procurement with the implications for state-subsidised human settlements being captured in the sector-specific policy(ies):

- A definition of green procurement
  - Green Procurement is defined as 'the means that public authorities seek to procure goods, services and works with **an increasingly positive environmental impact, with associated social and economic benefits for beneficiaries, society as a whole and the national fiscus throughout their life-cycle,** compared to goods, services and works with the same primary function that would otherwise be procured.
  - Objectives and Principles

The desired objectives of this Supply Chain Management Policy include:

- The promotion of resource-efficiency and an increasingly positive environmental impact throughout the life cycle of goods, services or construction works procured by the Municipality.
- Sustainable livelihoods enabled through enhancing ecological resilience, both within the local and global environmental context, and supporting the green economy.
- Value for money over the life cycle of a good, service or construction work.

The principles of green procurement stated below are to be prioritised, and possibly reduced, to reflect the needs and status quo of the local context in each municipality. The principles of green procurement over the full project life cycle therefore include:

- Reducing energy consumption
- Reducing water consumption
- Minimising waste generation
- Reducing greenhouse gas emissions
- Improving quality of life and dignity for beneficiaries (safety, health and access to services and economic opportunity)
- Providing high quality living environments, services and houses
- Making the most of ecological service systems
- Increasing the reuse and/or the recycling of resources
- Minimising exposure to environmental risks and hazards
- Maximising quality job creation
- Maximising economic inclusion, especially for SMMEs and local sub-contractors
- Increasing multi-stakeholder collaboration
- Being appropriate to the local environmental, social and governance context

- Policy Statements

Determine an appropriate procurement strategy that is in line with the Infrastructure Delivery Management System (IDMS) based on the local context (biophysical, social and economic, and service providers), financial resources, and capacity. The Standard for Infrastructure Procurement and Demand Management (SIPDM) sets out the processes for the establishment of a procurement strategy; this includes:

- Procurement Procedures: SANS 10845-1 defines procurement procedures as "the selected procedure for a specific procurement". The procurement procedures is the methodology or approached adopted on how offers are solicited.
- Packaging strategy: SANS 10845-1 defines the packaging strategy as "*the organisation of work packages into contracts*". The packaging strategy needs to consider the aggregation of demand, where possible, in order to promote the efficient use of resources.

- Contracting strategy: The contracting strategy as defined in SANS 10845-1 is the "*strategy that governs the nature of the relationship which the employer wishes to foster with the contractor, which in turn determines the risks and responsibilities between the parties to the contract and the methodology by which the contractor is to be paid*".
- Pricing strategy: SANS 10845-1 defines a pricing strategy as the "*strategy which is adopted to secure financial offers and to remunerate contractors in terms of the contract*".
- Targeting Strategy: According to SANS 10845-1, a targeting procedure is "*the process used to create demand for the services or goods (or both) of, or to secure the participation of targeted enterprises and targeted labour in contracts in response to the objectives of a secondary procurement policy*".

- Develop tender documents where environmental and social criteria are included in the functionality and/or eligibility criteria
- Bid Specifications and the Bid Specifications Committee

  Green procurement must be incorporated for all specification of goods, services and constructions works, as far as is reasonably possible and in accordance with the Integrated Development Plan and relevant sector policy.

  Green procurement criteria are to be considered as functionality criteria, in eligibility criteria and/or the conditions of tender.

  When developing the specifications for tender bids, the committee must apply their minds and take into account the long term potential environmental, social and economic impacts of the good, service and/or construction works as a means to reduce the harmful impacts associated with its procurement and operation.

  In the development of bid specifications, it is necessary to consider the opportunities for innovative tender responses, through methods such as specifying performance targets and outcomes-based criteria.

  Procurement strategies and the functionality criteria used should assist in developing the green human settlements sector by starting small but signalling the intent to expand. This provides new entrants with innovative solutions to develop the track record required, while also providing larger, dominant role players to adapt to changing requirements.

  The goals and aims of green procurement, as is captured in the Western Cape's *Making Better Choices: green procurement in state-subsidised human settlements* must be stated in the tender and developed into specific, relevant and contextually-appropriate objectives and specifications for the tender.
- Bid Evaluation Procedures

In terms of the procurement of construction works and professional services that lead to construction, the Standard for Infrastructure Procurement and Delivery Management's (SIPDM) prescripts are to be applied using Method 3 or 4, where functionality is a consideration along with price and B-BBEE scoring. This enables the most favourable offer and/or the greatest value for money offer to be awarded the contract and not simply the cheapest.

In accordance with the Preferential Procurement Policy Framework Act of 2000 (Section 2(1)(e) and (f)) and Draft Regulations of 2016 (Section 7), the contract may be awarded to tenderers who have not scored the highest points but who meet the objective criteria stipulated in the tender document. The procedures, that are to be followed for this, are contained in the above mentioned act and regulations.

When evaluating tender bids, the committee must apply their minds and take into account the long term potential environmental, social and economic impacts of the tender proposals offered as a means to reduce the harmful impacts associated with the good, service and/or construction works.

Value for money over the project life cycle (including operation and disposal) must be evaluated and used as a determining factor in awarding the contract.

Opportunities for a positive environmental impact offered and proven by service providers should be considered a value-add proposition.

Municipal Policy

Integrated Development Plan

The Integrated Development Plan (IDP) of the municipality is a strategic document that co-ordinates the work of all municipal departments and sets the vision and priorities for the local government over a five-year period. This is an important medium-term planning instrument that sets a framework for all important issues identified through a public participation process; such as how land should be used, what infrastructure and services are needed, and how the environment should be protected and enhanced. Many municipalities express a desire to be more sustainable and improve livelihoods in their IDP visions. Green procurement is a valuable tool that can be used to support the realisation of this vision, especially for an improved environmental impact and the spatial integration of towns and human settlements.

For green procurement principles and practices to be embedded in this document it is suggested that the following is included:

- An acknowledgement of the constraints and opportunities

  The [XX] Municipality acknowledges that human settlements have significant impact on local and global environmental systems, in the form of greenhouse gas emissions, resource

consumption, and exposure to climate change induced risk. The [XX] Municipality therefore recognises the need to conserve and steward the use of valuable natural resources, such as water, energy, soil and productive agricultural land, for more sustainable livelihoods of current and future residents; especially with regard to the services and infrastructure provided by the state. Further to this, it is acknowledged that the location of state-subsidised human settlements projects determines a significant portion of the overall environmental and social impact. Projects located closer to areas of employment and economic and social assets and outside of ecologically sensitive areas are considered well-located. Well-located land for human settlements projects is therefore an essential condition for greater environmental and social benefits to beneficiaries, municipalities, the national fiscus and the global environment. Essential to this, is the buy-in from all stakeholders, with engagement being considered a priority throughout the development of human settlements projects. By addressing these concerns, there are opportunities for green growth, local economic development with the associated job creation, and an improved quality of life for beneficiaries of state-subsidised human settlements and infrastructure.

- A Statement of Intent

  [XX] Municipality will therefore promote the principles and support the implementation of green procurement to enable and facilitate an increasingly positive environmental impact due to the operations of the municipality.

- Develop policy statements in accordance with this acknowledgement

  Policy Statement 1: Prioritise environmental criteria/outcomes in such a way as to address the greatest local concerns; these would apply for the next five years. For example, if the municipality is experiencing perennial low rainfall, then water saving strategies might be considered more important than waste reduction strategies for a time.

  Policy Statement 2: All future state-subsidised human settlements projects undertaken by the municipality will adhere to the principles of and take into account opportunities for green procurement in accordance with the Western Cape's guidelines, Making Better Choices: Green procurement in state-subsidised human settlements.

  Policy Statement 3: The Spatial Development Framework of the [XX] Municipality will identify well-located land available for state-subsidised human settlements (including opportunities for restructuring zones), in accordance with the criteria outlined in the Making Better Choices: Green procurement design manual.

  Policy Statement 4: The principles of whole of life value thinking and life cycle assessment will be incorporated into the supply chain management policy and the human settlements plan.

Policy Statement 5: Green procurement training will be provided for all relevant officials, starting in the human settlements department and supply chain management.

Policy Statement 6: Identify a champion for green procurement and its implementation in the municipality for a [XX number of years] year period.

Spatial Development Framework

The Spatial Development Framework (SDF) informs the IDP and translates it spatially. To improve the environmental benefit of state-subsidised human settlements, the SDF identifies the opportunities and constraints of land available for human settlements, especially where these are compounded. For green procurement principles and practices to be embedded in this document, it is suggested that the following is included:

- An acknowledgement of the constraints and opportunities

  State-subsidised human settlements are too often relegated to the periphery of towns and urban areas in [XX] Municipality. This can result in ongoing spatial segregation, increased services provision costs to the municipality, and increased greenhouse gas emissions related to greater distances to travel to work, school and other daily activities. Identifying well-located land for state-subsidised human settlements is therefore a significant opportunity to improve the environmental and social impacts associated with these projects.

  Furthermore, too often state-subsidised human settlements projects are developed as isolated units of the urban fabric in the municipality. This prevents the use of non-motorised transport for daily travel and can increase safety concerns. To overcome this, it is necessary to promote and design settlements with pedestrian-priority as a key focus. This can help to decrease the greenhouse gas emissions of the daily activities of many residents, which they otherwise would be unable to do of their own accord. Furthermore, the site layout is key to enabling the orientation of buildings for improved thermal and energy efficiency. This is known as passive design.

- Define green procurement and its significance in state-subsidised human settlements

  In spatial terms, green procurement in state-subsidised human settlements therefore requires that land identified for human settlements projects in the municipality is well-located and that project sites are designed for pedestrian-priority to improve the environmental and social impact of the project throughout its life cycle.

- A Statement of Intent

  The [XX] Municipality will identify and only make use of well-located land for all future state-subsidised human settlements projects. The project site layouts will be design for improved pedestrian-priority and orientated for thermal and energy efficiency.

- Develop policy statements in accordance with this acknowledgement

  Policy Statement 1: The SDF will analyse and identify all land parcels in the municipality in terms of the criteria for well-located land stipulated in the Western Cape's Making Better Choices: green procurement design manual.

  Policy Statement 2: Abide by the principles and criteria for pedestrian-orientated site layouts set out in the Western Cape's Making Better Choices: green procurement design manual.

  Policy statement 3: Ensure that the urban edge is delineated in such a way as to encourage settlement densification and compaction rather than settlement sprawl, even where there is settlement growth anticipated.

Human Settlements Plan

The Human Settlements Plan (HSP) is a municipality's human settlements strategy that seeks to understand the human settlements context and need and make relevant recommendations for a five-year period accordingly. The HSP also identifies all possible projects to be undertaken in the municipality in the next five years and provides valuable input into the Provincial Human Settlements Pipeline. For green procurement principles and practices to be embedded in this document it is suggested that the following is included:

- An acknowledgement of the constraints and opportunities

  The development of state-subsidised can have long term environmental, social and economic impacts on the beneficiary, the community and the municipality in which the project is located. This impact is dependent upon the choices made throughout the project process (in the procurement, design, construction, and inhabitation) that will determine whether this is harmful or beneficial.

  As human settlements projects shape the settlements in the municipality, they can lock the residents and the municipality into modes of resource consumption, exposure to ecological risk, and methods of service provision. It is therefore important to incorporate green procurement principles and activities from the earliest stages of the project's planning for an increasingly positive environmental and social impact over its life time.

- Define green procurement and its significance in state-subsidised human settlements

  Green procurement in state-subsidised human settlements offers a strategic opportunity to improve the environmental impact of the sector over its life time. This requires that choices are made all along the lifecycle of the project to reduce the total natural resource use (water, land, soil, materials) and energy consumption of the projects and by beneficiaries, increase resilience to climate change induced risks, and improve the livelihoods of beneficiaries. This means that decision-makers need to take into account environmental considerations for the design,

construction and occupation/operation of the building/home, community and municipal service systems.

- A Statement of Intent

  The [XX] Municipality therefore requires/supports the implementation of green procurement in state-subsidised human settlements to improve resource efficiency, ecological residence and enable sustainable livelihoods over the full life cycle of the project.

- Principles for green procurement in state-subsidised human settlements

- Reducing energy consumption
- Reducing water consumption
- Minimising waste generation
- Reducing greenhouse gas emissions
- Improving quality of life and dignity for beneficiaries (safety, health and access to services and economic opportunity)
- Providing high quality living environments, services and houses
- Making the most of ecological service systems
- Increasing the reuse and/or the recycling of resources
- Minimising exposure to environmental risks and hazards
- Maximising quality job creation
- Maximising economic inclusion, especially for SMMEs and local sub-contractors
- Increasing multi-stakeholder collaboration
- Being appropriate to the local environmental, social and governance context

- Develop policy statements in accordance with this acknowledgement

  Policy Statement 1: Design all future human settlements projects, identified within the municipality, in accordance with the Western Cape's Making Better Choices: green procurement design manual, for both the housing units and the project site.

  Policy Statement 2: Align all proposed human settlements projects with land identified as well-located in the municipality's Spatial Development Framework.

  Policy Statement 3: Develop a set of appropriate housing typologies, acceptable to communities and council.

  Policy Statement 4: Develop Beneficiary and Community Handover Workshops for training and education to continue resource savings and enable more sustainable livelihoods as the project is occupied.

  Policy Statement 5: Develop a process for a monitoring and evaluation framework to measure the outcomes achieved against those desired in the Human Settlements Plan.

Policy Statement 6: Develop a greening action plan, where funding and resources are made available to beneficiaries who want to plant and maintain vegetation on their erf and in the community.

Policy Statement 7: Develop a register of those in the municipality who supply human settlements services, goods and construction works with an improved environmental impact.

Policy Statement 8: Collaborate with other departments in the municipality to understand the broader social, environmental and economic opportunities possible from specific human settlements projects.

Policy Statement 9: Project prioritisation will take into account those projects that have been designed to reduce resource consumption, improve resource efficiency, improve ecological resilience, and enable sustainable livelihoods over the life cycle of the project and for the broader municipal area.

Policy Statement 10: Make use of previously used sites within existing settlements or retrofit underutilised buildings – give to these preference over greenfield sites as sites for human settlements projects.

Policy Statement 11: Develop the processes to identify the community/beneficiary group early in the project planning stage, so they can be included in the design process.

Policy Statement 12: Develop an assessment to identify the environmental and procurement risks faced by each project proposal.

Policy Statement 13: Make reference to 'Procuring Better Choices' when allocating scoring/weighting to each factor based on the strategies and priorities for the municipality identified in the IDP.

Policy Statement 14: Give preference to row housing and semi-detached housing typologies over detached housing units.

- Develop locally-specific targets that may include:

- Overall procurement targets – e.g. 80% of procurement (by value and by number of tenders) in state-subsidised human settlements should include GPP criteria by 2018.
- Product/service specific targets – e.g. by 2021, 50% of all building materials should be locally sourced.
- Operational targets – e.g. all procurement, human settlements, town planning and engineering services department officials will receive green procurement training by 2017.

Metropolitan Built Environment Performance Plan

The Built Environment Performance Plan (BEPP) is a budget alignment tool required by National Treasury in all metropolitan municipalities. The City of Cape Town is the only metropolitan municipality in the Western Cape. The BEPP and associated processes articulate a Metropolitan Municipality's investment rationale and institutional arrangements to address spatial and sectoral integration. The BEPP brings together a range of sector plans that allows decision-makers to identify conflicts and opportunities for improved delivery in the municipality. For green procurement principles and practices to be embedded in this document it is suggested that the following is included:

- Define green procurement and its significance in state-subsidised human settlements

Green procurement in state-subsidised human settlements offers a strategic opportunity to improve the environmental impact of the sector over the life time of its projects. This requires that choices are made all along the lifecycle of the project to reduce the total natural resource use (water, land, soil, materials) and energy consumption of the projects and by beneficiaries, increase resilience to climate change induced risks, and improve the livelihoods of beneficiaries. This means that decision-makers need to take into account environmental considerations for the design, construction and occupation/operation of the building/home, community and municipal service systems.

- Develop policy statements in accordance with this acknowledgement

Policy Statement 1: Project prioritisation will take into account those projects that have been designed to reduce resource consumption, improve resource efficiency, improve ecological resilience, and enable sustainable livelihoods over the life cycle of the project and for the broader municipal area.

Policy Statement 2: Evaluate all human settlements projects in relation to their proximity to current and/or future transport and infrastructure networks. Prioritise projects in close proximity to these networks, with projects near future networks following these, and projects outside of these networks to be considered last.

Policy Statement 3: Prioritise actions and projects to incrementally improve the environmental performance and resilience of infrastructure and services provision, by considering the following questions:

- Are there opportunities to reduce resource consumption in the municipality through demand management strategies?
- Are there opportunities to increase resource efficiency in the municipality through retrofitting infrastructure reticulation and bulk services?

- Where new service capacity is required, have alternative, decentralised and/or modular service provision options been investigated/considered?

Provincial Policy

Western Cape Human Settlements Framework

The Western Cape Human Settlements Framework is currently being drafted by the Department of Human Settlements. The key focus areas include the shift from housing to sustainable human settlements; from low value production to an urban dividend; and from the state as provider to the state as co-provider of infrastructure and enabler of human settlements. This is a long term framework that will guide the provincial government's intervention in human settlements for the next two decades. For green procurement principles and practices to be embedded in this document it is suggested that the following be included:

- The vision should include reference to desired environmental impacts, along with the social and economic impacts of human settlements:

  By 2040, communities, the private sector, NGOs and the state, will work collectively and effectively to ensure that human settlements meet the needs of people and support their social and economic empowerment ***while reducing the associated negative environmental impacts and taking hold of the social and economic opportunities this presents.***

- Strategic aims: Sustainable Human Settlements

  Sustainable human settlements are resource-efficient and improve the ecological resilience of towns and urban areas. Human settlements can either hamper or enable more sustainable livelihoods through the location of new developments in relation to existing infrastructure and socio-economic networks, the street layout, the design of houses, the construction process, and the practices of occupants. It is therefore important to take into account the long term environmental impacts of human settlements decisions. Sustainable human settlements are therefore concerned with the outcome and quality of interventions not just the quantity achieved.

  Sustainable human settlements are well-coordinated areas of investment that offer long term value for money. Human settlements are made up of a range of stakeholders' interventions over time. One intervention can therefore offer multiple benefits for a range of co-dependent systems and stakeholders. Long term value for money can be experienced in the reduced operational and maintenance costs of an intervention, less government support being required, and broader economic and social benefits. Therefore, it is necessary to consider the whole life value of interventions, not only the upfront capital costs.

- Delivery Guidance: New Developments

The priority identified is to "create an improved assessment matrix which can be used to assess new project applications on the basis that they are demand responsive, infill, meet minimum criteria for density and green building, and are costed with regard to social, financial and ecological balance." To support this, it has been identified that the Human settlements Project Approval Process offers an opportunity for intervention where questions regarding environmental criteria will be included. This would require all developers to engage with the environmental, social and economic implications of the projects proposed.

Policy Statement 1: For improved data availability and usability, develop a set of standard cost reporting requirements and investigate the feasibility of a template Bill of Quantities/Project Costing to be made available as part of every project close out report.

Department of Human Settlements Strategic Plan and Annual Performance Plan

The Annual Performance Plan of the Western Cape Department of Human Settlements monitors the progress made every year with regard to the Programmes and Strategic Objectives determined in the Strategic Plan of the Department.

- Updated Situational Analysis – Environmental Impact of human settlements

  (From the Western Cape State of the Environment Outlook Report by the Department of Environmental Affairs and Development Planning) "Human settlements are a key driver of environmental change and therefore need to be developed and managed in a sustainable manner. Increased population, consumption patterns and growth of human settlements have an impact on the natural resource base through an increased demand for resources leading to their depletion and scarcity. Furthermore, human settlements can result in the destruction of ecologically sensitive habitats, the loss of productive land, and the pollution of natural systems through the unsustainable use of natural resources or resultant waste products. This in turn results in the loss of biodiversity, decrease in ecosystem health, and changes to the provision of ecological goods and services which are fundamental for our quality of life and survival. The challenge is to reduce and mitigate negative environmental resource use and unsustainable consumption patterns associated with growing human settlements, while at the same time addressing the social and economic imperatives for human settlements, infrastructure and services. In response, a number of national and provincial policies, plans and strategies have been developed to address the human settlements demand, provide quality places and promote well-functioning human settlements. The successful implementation of these, as well as good monitoring and evaluation, will result in improved quality of life of people and sustainable human settlements.

  Despite increasing population size and migration patterns, and associated pressures of growth and urban development, the outlook is still seen as positive for a number of reasons. Improvements in technology allow for improved efficiency of use of resources, improved design,

restrictions on pollution, and so on. Improved understanding of physical processes and modelling of environmental and climatic change, also allows for behavioural and management shifts. This suggests that there is an improvement, and an improving outlook for the future of settlements."

- Programme 3: Human settlements Development - Promote innovation and the better living concept

  Current Objective: "To increase sustainable resource use, which includes exploring innovative technologies through construction, energy, water and sanitation."

  Suggested new objective: 'To increase resource efficiency and enhance ecological resilience throughout the life cycle of a settlement, which includes exploring and implementing innovative technologies, better design practices and green procurement through the provision of houses, services, and projects."

- Develop locally-specific targets that may include:

- Overall procurement targets – e.g. by 2018, 80% of successful tenderers (by value and by number of tenders) undertake green procurement to some extent in state-subsidised human settlements.

- Product/service specific targets – e.g. 50% of all building materials should be locally sourced by 31 March 2020.

- Operational targets – e.g. all procurement, human settlements, town planning and engineering services department officials will receive green procurement training by 2017.

The Western Cape Human settlements Norms and Standards

The Norms and Standards offer guidelines for the accepted minimum construction and materials standards for all human settlements units in the Western Cape. These are based on SANS 10400-XA and are adhered to in all human settlements projects. The proposed interventions for the inclusion of green procurement principles for state-subsidised human settlements are indicated below. Those suggested for inclusion are considered as 'no to low cost' options, as described in the Green Procurement Design Manual.

1. Required additional norms and standards
    a. Site and service
    b. Site layout design
2. General
    a. All human settlements projects must consider the document 'Making Better Choices: green procurement in state-subsidised housing' for both design and procurement processes. For design, this includes the 'Efficient Site Layout', the 'High Performance House Design', 'Sustainable building materials and products'.
3. House Design

a. The internal house layout should allow livable areas (lounge/dining area) to be on the northern side of the building, with service areas (kitchen and bathroom) to be located on the southern side of the building.
b. Where housing units are designed in the semi-detached or row house typology, it is required that the internal layouts be mirrored to reduce noise transfer between the quieter areas (bedrooms) and louder areas (lounge/dining/kitchen) of the neighbouring units.
c. House to be orientated and windows are to be designed to allow for appropriate daylighting levels and to make use of passive design principles for maximum thermal efficiency (larger windows on the northern side of the house)

4. Strip footings
    a. The aggregate for concrete in foundations may be from recycled materials and cement substitutes may be used to make concrete, subject to certification by a registered structural engineer.
    b. All foundations systems to investigate opportunities for and be designed in such a way as to promote dematerialisation, where possible.
5. Raft foundations
6. Foundation walls
7. Floor slabs
8. External Walls
    a. Only external walls that have the following performance criteria will be considered:
        i. Masonry R-value: 0.35
        ii. Non-masonry R-value for Climate Zones 2 and 4: 1.9
        iii. Non-masonry R-value for Climate Zone 1: 2.2
9. Multi-level housing
10. Internal walls
11. Plumbing and drainage
    a. All water devices installed will conform with or be an improvement on (SANS 10400-XB , when released or) the following maximum flow rates, as certified by the supplier:
        i. Kitchen Tap - 5.5 litres per minute
        ii. Showerhead - 7.5 litres per minute
        iii. Dual-flush combined flow rate or Low-volume flush - 3.2 litres per flush
        iv. Wash hand basin tap - 4.5 litres per minute
    b. All drainage and piping systems to investigate opportunities for and be designed in such a way as to promote dematerialisation, where possible.
12. Windows
    a. All north-facing windows to have shading provided that allows the ingress of sun during winter, with no ingress of sun during summer.

13. External Doors
14. Internal doors
15. Ceilings
    a. The Department will give preference to insulation materials that are part of the ceiling system to reduce overall material use and with the following performance criteria: fire-retardant and recycled materials used.
    b. All houses must have a ceiling insulation installed with a material R-value of 3.7 for Climate Zone 1 and 4 or 3.2 for Climate Zone 2.
16. Roof structure
17. Roof sheets
18. External paint finish
19. Electrical
    a. All light fittings provided are to improve on the 40W incandescent light bulb's energy use by a minimum 60% and last for a minimum of 8000 hours.

Human Settlements Approval Process

The recently revised Western Cape Approval Process for human settlements projects, provides opportunities to intervene for green procurement that are directly linked to the funding approval and prioritisation of projects. There are three funding gates with associated forms to be filled out by the project developer to determine whether the project meets relevant criteria. Suggestions to include green procurement considerations have therefore been included in these documents: The project initiation report, the project feasibility report, and the project implementation readiness report. These have been discussed with the DHS and are awaiting final approval. The suggestions made are in accordance with the 'Making better choices: green procurement in state-subsidised housing' to ensure projects that adhere to these guidelines are most likely to be prioritised and funded.

The Western Cape Department of Human Settlements Construction Procurement Strategy

The Construction Procurement Strategy outlines appropriate procurement procedures that will enable the Department of Human Settlements to achieve the objectives and goals set out in the five-year Strategic Plan and the Annual Performance Plan. This is a combination of the delivery management strategy and contracting and procurement arrangements. In this strategy, green procurement is framed as a secondary objective of state-subsidised human settlements as 'Greening of procurement by implementing resource efficient and climate change resilient technologies in order to maximise value over the total lifespan of investments in housing and bulk infrastructure'. However, it is suggested that this objective be expanded to include strategic, design and passive interventions, not only technologies.

This concludes the second section of the guidelines: Enabling Better Choices: Policy and strategies for green procurement.

Making better choices: The planning and design of green human settlements

Throughout the planning and design of human settlements projects, decisions are made about how the project will be serviced, the location of the project, the street layout, the housing unit, the materials chosen, and how these projects are constructed. These decisions are made by a range of stakeholders including the municipal councillors and officials, communities, beneficiaries, professional service providers and construction contractors. The checklists and design manual, provided in this guideline, are included to help all these stakeholders make better choices for an improved environmental, social and economic impact from the provision of state-subsidised human settlements. This sector is unique and faces its own specific challenges when aiming to take environmental and social considerations into account. The design manual and checklists are underpinned by whole life value thinking and outcomes-based procurement.

The design manual provides a range of environmental and social considerations to take into account throughout the planning and design process. The design manual starts with resilient services provision and well-located land as these are two foundational concepts, without which it will be difficult for human settlements projects to be truly sustainable. This is followed by the considerations for an efficient street layout, high performance house design, sustainable building materials and products and improved construction processes. It concludes with how to continue the positive environmental impact post-occupation.

The checklist provided offers a summary of the environmental and social considerations discussed in the design manual. Each design consideration is characterised in terms of the following attributes:

- The project phase that it is applicable to:
  - Strategic Project Planning: in broader policy and strategy
  - Design Phase: when the aesthetics, functionality and performance of services, site layout and house are determined
  - Construction Phase: when the project is on site being built
- The anticipated cost implication:
  - No Additional Cost: Any additional cost of an intervention can be paid for within the current subsidy or the intervention does have an additional cost in order to design or construct
  - Capital Savings: The intervention results in less money being spent upfront for the design and construction of the project
  - Spend a little, save a lot: The intervention requires a low additional capital cost and has the potential to result in resource and cost savings with improved environmental and social benefits.

- Invest to save: The intervention requires a significant additional capital cost, but has the potential to result in large resource and cost savings with greatly improved environmental and social benefits.

- The financial benefit and social/economic benefit to (as determined by Constitutional mandates and roles)
  - National Government: encompassing broader National GDP, national fiscus, state-owned enterprises, energy production.
  - Provincial Government: encompassing health services, education, public transport, watershed management.
  - Municipality: encompassing local economic development, waste management, water and wastewater services, and social stability.
  - Beneficiaries: encompassing household expenditure, well-being and health.
- The environmental outcomes
  - Minimise resource consumption: use less resources (water, energy, materials) across the project lifecycle.
  - Maximise resource efficiency: where resources (water, energy, materials) are still required, ensure that these are used sparingly and to the greatest effect.
  - Minimise greenhouse gas emissions: throughout the project life cycle, reduce the release of gases that trap heat within the Earth's atmosphere and spur on climate change, including but not limited to carbon dioxide (CO2), methane (CH4) and hydrofluorocarbons (HFCs), and/or increase the absorption of these gases through sequestration.
  - Protect/Enhance ecological service systems: environmental systems that support life, well-being, and livelihoods through providing provisioning, regulating, supporting, and cultural services to humans and settlements.
  - Minimise exposure to environmental risk: reduce the vulnerability of beneficiaries by reducing their experience and increasing their resilience to natural disasters and climate change.
  - Improved well-being of beneficiaries: well-being is a state of being with others and the natural environment that arises when human needs are met, where individuals and groups can act meaningfully to pursue their goals, and where they are satisfied with their way of life.
  - Maximise opportunities for inclusive economic growth: Opportunities are identified and make use of small, medium and micro enterprises as main, or sub-contracted, service providers. This can assist with local economic development.

The design considerations addressed in the checklists and design manual illustrate how the principles of green procurement may be applied. This is by no means an exhaustive list of all considerations, but rather guidance on the issues to be considered and should allow for an improving environmental impact over time.

Western Cape Government

Green procurement checklists

	Project Phase for decision			Indicative Cost				Financial benefit to				Social/Economic benefit to				Green Procurment/Environmental Outcome						
	Strategic Project Planning	Design Phase	Construction Phase	No Cost	Capital Savings	Spend a little, save a lot	Invest to save	National Government	Provincial Government	Municipality	Beneficiaries	National Government	Provincial Government	Municipality	Beneficiaries	Minimise resource consumption	Maximise resource efficiency	Minimise greenhouse gas emissions	Protection/Enhancement of ecological service systems	Minimise exposure to environmental risk	Improve quality of life beneficiaries	Maximise quality job creation
Resilient services provision																						
Are there opportunities to reduce resource consumption in the municipality through demand management strategies?	✓					✓		✓		✓	✓			✓	✓	✓		✓		✓		✓
Are there opportunities to increase resource efficiency in the municipality through retrofitting infrastructure reticulation and bulk services?	✓	✓				✓	✓			✓				✓	✓		✓					✓
Where new service capacity is required have alternatives been investigated?	✓	✓					✓	✓		✓				✓	✓	✓	✓	✓	✓	✓		✓
How has climate change risk been analysed for all infrastructre capital and operational decisions?	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓				✓	✓		
Well-located land																						
Aligned with policy																						
The site is within the current Urban Edge?	✓									✓	✓		✓	✓	✓	✓	✓	✓			✓	
The site is identified for housing in the IDP, SDF and HSP?	✓													✓								
The site is adjacent to or within the existing service infrastructure systems (water, energy, sanitation, waste) with available capacity for the project?	✓			✓	✓			✓		✓		✓		✓			✓	✓		✓		
Accessible and integrated, every household is																						
Currently or planned to be within a 1km walk to a scheduled public transport	✓	✓		✓		✓				✓	✓			✓	✓	✓	✓	✓		✓	✓	✓
Currently or planned to be within a 1km traveling distance of a dedicated non-motorised transport network	✓	✓		✓		✓				✓	✓			✓	✓	✓		✓			✓	
Currently or planned to be within a 1km walk to a daily activities, such as a grocery store, ATM, ECD centre	✓	✓		✓						✓	✓			✓	✓	✓		✓			✓	✓
Currently or planned to be within a 500m walk to high quality public space	✓	✓				✓			✓	✓	✓		✓	✓	✓	✓					✓	
Currently or planned to be within a 5km traveling distance to community and social services	✓	✓		✓						✓	✓			✓	✓	✓		✓			✓	
Within a 10km traveling distance to an economic centre with employment opportunities	✓			✓						✓	✓	✓	✓	✓	✓	✓		✓			✓	✓
Safe from environmental risks and outside ecologically sensitive areas																						
Outside of Critical Biodiversity Areas (CBAs) and ecological corridors	✓					✓				✓	✓			✓	✓					✓	✓	
Outside of a 100 year flood plain and sea level rise predictions	✓					✓				✓	✓			✓	✓					✓	✓	
More than 100m from a watercourse or wetland	✓					✓				✓	✓			✓	✓					✓	✓	
Outside of a fire risk area (if adjacent, there is a sufficient and monitored firebreak in place)	✓					✓				✓	✓			✓	✓					✓	✓	
Not exposed to possible landslides or rockfalls	✓					✓				✓	✓			✓	✓					✓	✓	
Not on high value agricultural land or soil	✓					✓				✓	✓			✓	✓					✓	✓	

	Project Phase for decision			Indicative Cost				Financial benefit to				Social/Economic benefit to				Green Procurment/Environmental Outcome						
	Strategic Project Planning	Design Phase	Construction Phase	No Cost	Capital Savings	Spend a little, save a lot	Invest to save	National Government	Provincial Government	Municipality	Beneficiaries	National Government	Provincial Government	Municipality	Beneficiaries	Minimise resource consumption	Maximise resource efficiency	Minimise greenhouse gas emissions	Protection/Enhancement of ecological service systems	Minimise exposure to environmental risk	Improve quality of life beneficiaries	Maximise quality job creation
Efficient Site layout																						
Design for spatial integration																						
Identify opportunities to connect the project site directly with the surrounding street layout and urban fabric	✓	✓		✓						✓	✓			✓	✓	✓		✓			✓	
Consider the project as a city/town piece and not a separate entity, look to have multiple entrances/exits to the project site to connect to the surrounding area.	✓	✓		✓		✓				✓	✓			✓	✓	✓		✓			✓	
Design for resource efficiency																						
Street layout enables houses that can make the most of passive solar design and efficient stormwater management		✓		✓						✓	✓			✓	✓	✓	✓	✓			✓	
Erfs laid out for medium to high denisty and semi-detatched or row housing	✓	✓			✓					✓				✓		✓	✓	✓		✓		
Dedicated NMT lanes on the primary mobility network in the project and/or well-defined and easy to navigate NMT network	✓	✓				✓			✓	✓	✓			✓	✓	✓		✓			✓	
High to medium gross density for reduced material and servicing requirements, along with increased thermal performance	✓	✓		✓						✓				✓		✓	✓	✓	✓	✓		
Services are clustered and/or co-located	✓	✓			✓				✓	✓			✓	✓	✓	✓	✓	✓			✓	
Street lighting does not permit light to shine upwards in to the night sky.		✓		✓						✓				✓		✓		✓	✓			
Include spaces for organic waste management and the collection, storage and sorting of recycling.	✓	✓		✓						✓				✓	✓	✓			✓			✓
Design for accessibility																						
Easily navigable street layout	✓	✓		✓						✓	✓			✓	✓	✓		✓			✓	
Defined street edge		✓		✓										✓	✓						✓	
Street design gives pedestrians priority		✓		✓		✓					✓	✓	✓	✓	✓	✓		✓			✓	
Opportunities for a mixed land use are identified, whether formal or informal.	✓	✓				✓					✓			✓	✓	✓		✓			✓	✓
Streets are designed for universal access		✓				✓					✓			✓	✓	✓		✓			✓	
Streets are designed for increased safety		✓				✓								✓	✓	✓		✓			✓	
Space is identified and support is provided for community or private food	✓	✓				✓					✓			✓	✓	✓		✓	✓		✓	✓
Parking spaces are provided in places where they are not a nuisance or hazard		✓		✓							✓				✓						✓	
Design to make use of ecological service provision																						
Improve the ecological value of project site with endemic vegetation	✓	✓				✓				✓			✓	✓	✓				✓		✓	
Improve air quality through the provision of vegetation and trees		✓				✓			✓	✓				✓	✓					✓	✓	
Identify and integrate sensitive ecolgical areas in to the design through the provision of a 100m active buffer zone	✓	✓		✓						✓			✓	✓					✓	✓	✓	✓
Incorporate water sensitive design principles for stormwater management.	✓	✓				✓	✓			✓				✓	✓	✓		✓	✓	✓	✓	✓

	Project Phase for decision			Indicative Cost				Financial benefit to				Social/Economic benefit to				Green Procurment/Environmental Outcome						
	Strategic Project Planning	Design Phase	Construction Phase	No Cost	Capital Savings	Spend a little, save a lot	Invest to save	National Government	Provincial Government	Municipality	Beneficiaries	National Government	Provincial Government	Municipality	Beneficiaries	Minimise resource consumption	Maximise resource efficiency	Minimise greenhouse gas emissions	Protection/Enhancement of ecological service systems	Minimise exposure to environmental risk	Improve quality of life beneficiaries	Maximise quality job creation
High performance house design																						
Resource efficient human settlements typology																						
Row housing and/or semi-detached houses are given preference over detached houses	✓	✓		✓						✓	✓			✓	✓	✓	✓			✓		
Passive design principles and applications in state-subsidised housing																						
Where possible, houses are orientated to geographic north (between 20° east and 8° west)		✓		✓							✓		✓	✓	✓	✓	✓	✓			✓	
Internal space layout designed for improved thermal efficiency and ease of house expansion		✓		✓							✓		✓	✓	✓	✓	✓	✓			✓	
Windows are designed to slow the transfer of heat between inside and outside (perference for larger windows on north side and smaller windows on south side, no windows on east or west)		✓				✓					✓			✓	✓	✓	✓	✓			✓	
All windows on the northern side of the building are to be shaded in such a way as to allow winter sun in and keep summer sun out		✓				✓					✓			✓	✓	✓	✓	✓			✓	
Preference should be given to insulation materials that meet the minimum R-value requirements along with further performance criteria such as being made from recycled materials, locally produced and fire retardant.		✓		✓										✓				✓				✓
Where buildings can not be orientated north, the walls must have a greater R-		✓				✓	✓				✓		✓	✓	✓	✓	✓	✓			✓	
In areas of high diurnal temperature range, thermal mass is increased.		✓				✓					✓		✓	✓	✓		✓				✓	
Roof is designed for solar water heater		✓		✓						✓							✓					
Increase the reflectivity of external painted surfaces (roofs and walls) to reduce internal temperature gain and reduce the urban heat island		✓		✓							✓			✓	✓	✓		✓			✓	
Energy efficiency and alternative sources																						
All light fittings provided are to improve on the 40W incandescent light bulb's energy use by a minimum of 60% and last for a minimum of 8000 hours.		✓				✓					✓			✓		✓	✓	✓				
Alternative energy sources considered	✓	✓					✓				✓			✓	✓	✓		✓			✓	✓
Water efficiency and alternative solutions																						
Water-efficient fixtures and fittings meet maximum flow rates specified for: - A kitchen tap - A handwash basin tap - A shower and/or bath tap - A toilet - A bath		✓		✓		✓				✓	✓					✓	✓		✓	✓		
Consider alternatives to municipal water supply: rainwater, greywater, blackwater	✓	✓				✓	✓			✓	✓			✓		✓	✓		✓	✓		
Consider alternatives to waterborne sewerage systems	✓	✓					✓			✓	✓			✓		✓	✓	✓	✓	✓		✓

	Project Phase for decision			Indicative Cost				Financial benefit to				Social/Economic benefit to				Green Procurment/Environmental Outcome						
	Strategic Project Planning	Design Phase	Construction Phase	No Cost	Capital Savings	Spend a little, save a lot	Invest to save	National Government	Provincial Government	Municipality	Beneficiaries	National Government	Provincial Government	Municipality	Beneficiaries	Minimise resource consumption	Maximise resource efficiency	Minimise greenhouse gas emissions	Protection/Enhancement of ecological service systems	Minimise exposure to environmental risk	Improve quality of life beneficiaries	Maximise quality job creation
Sustainable building materials and products																						
Design for dematerialisation		✓			✓				✓	✓						✓	✓	✓				
Reduced embodied energy and embodied water		✓		✓												✓	✓	✓	✓			
Reduced carbon footprint		✓		✓												✓	✓	✓		✓		
Specify the use of post-consumer recycled content	✓	✓		✓												✓		✓				
Specify the local sourcing of materials and products	✓	✓		✓			✓						✓	✓		✓		✓				✓
Consider the use of alternative building technology and materials	✓	✓		✓	✓	✓								✓	✓	✓	✓	✓			✓	✓
Improved construction processes																						
Mitigate the environmental impact of the construction process																						
Environmental Management Plan (EMP)	✓		✓			✓				✓				✓					✓	✓		
Waste Management Plan (WMP)	✓		✓			✓				✓				✓					✓	✓		
Demolition Plan (where applicable)	✓		✓			✓				✓				✓					✓	✓		
Protect top soil on site			✓			✓			✓	✓			✓	✓					✓			
Rehabilitate land damaged by construction activities			✓			✓				✓				✓					✓	✓		
Reduced resource consumption																						
Sustainably sourced, reused or recycled shutterboard			✓	✓												✓		✓				
Plan and co-ordinate material delivery for reduced transport emissions			✓		✓													✓				
Use energy efficient light fittings and equipment on site and in site offices			✓		✓												✓					
Ensure that all distribution boards are clearly labelled and metered to monitor and manage energy use.			✓			✓										✓	✓	✓				
Use targeted task lighting when working in dark areas or at night			✓		✓											✓		✓				
Implement site water efficiency and demand management initiatives			✓	✓						✓						✓	✓		✓			
Prevent the spread or leakage of waste from the site which could pollute local water bodies			✓	✓						✓									✓	✓		
Continuing the positive environmental impact																						
Establish an awareness and education programme for beneficiaries	✓	✓				✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Green Design Manual

Resilient services provision

Resilient services provision can enable reduced resource consumption and increased resource efficiency across a range of scales for the benefit of many stakeholders. Other than the minority of residents who can afford their own service provision systems, residents in human settlements depend upon the bulk service systems built and maintained by municipalities and state-owned enterprises. The potential for improved sustainability and resilience of human settlements is therefore constrained or enabled by the decisions made by municipalities. It is therefore, in large part, the responsibility of the municipality to ensure that these bulk service systems are built and managed to allow for reduced resource consumption, increased resource efficiency and greater resilience over their life cycle. It is suggested that the following framework be applied to bulk services provision for increased resilience:

- Are there opportunities to reduce resource consumption in the municipality through demand management strategies?
- Are there opportunities to increase resource efficiency in the municipality through retrofitting infrastructure reticulation and bulk services?
- Where new service capacity is required, have alternative, decentralised and/or modular service provision options been investigated/considered? Have these been located outside of climate change risk areas?

Inspiring practice: The Preekstoel Biofiltration Plant

The Preekstoel Biofiltration Plant is a water treatment plant located in the Overstrand Municipality. It was developed to meet future growth in water demand, along with a range of interventions including proactive water demand management and seeking alternative sources of raw water. Groundwater was identified as a viable alternative water source but needed to be treated to remove the iron and manganese content of the water. The chemical process to remove these minerals is very expensive from both a capital and operating perspective. Therefore, a less well-known treatment process of biofiltration was installed, first as a small-scale pilot plant to test the system and familiarise operational staff, and then as a full-scale plant. This process is premised on creating an environment within the plant that is conducive to the colonisation of the filter media by bacteria that specialise in oxidising water rich in iron and manganese. This process is estimated to save the municipality approximately R30-million rand over the plants' life cycle in comparison to a chemical treatment process.

Case study on resilient service provision: Feasibility study for alternative and sustainable infrastructure for settlements – focus on Mossel Bay

The aim of the report is to comparatively assess the economic impacts for a project site in Mossel Bay with regard to a Business As Usual (BAU) approach compared to a human settlement project that incorporates renewable technologies and sustainable interventions into settlement design (Integrated Sustainable Settlement).

Findings:

Increased employment opportunities in alternative and sustainable infrastructure provision in both the construction and operational phases

Skill Level	Highly skilled	Skilled	Unskilled	Total
Business as Usual				
Construction Phase	55	164	328	546
Operational Phase	1	4	5	10
Alternative and sustainable infrastructure				
Construction Phase	78	222	428	727
Operational Phase	14	18	20	52

While there is an increase in the capex and maintenance costs for alternative infrastructure, such as photovoltaics etc., the operational cost is significantly less than conventional services provision. This is important as the maintenance and operational costs have a direct impact on the financial sustainability of municipalities.

Total Costs	CAPEX	OPEX	Maintenance	TOTAL
Business as usual	R 78 M	R 1,6 B	R41 M	R1, 8 B
Alternative Infrastructure	R 531 M	R 96 M	R203 M	R 830 M

When reviewing the accumulated costs over a 40 year period, it is evident that the business as usual approach is a far higher cost with a larger proportion of that cost attributable to residents. This could have negative consequences especially for poorer households.

OPTION	CAPEX		OPEX		Maintenance		TOTAL
BAU: Option 1							
% Payable by Municipality	100%	R108 M	18%	R285 M	100%	R41 M	R434 M
% Payable by Future Residents	0%	R0	82%	R1, 3 B	0%	R0	R1, 3 B
Integrated sustainable development: Option 2							
% Payable by Municipality	100%	R533 M	5%	R5 M	78%	R157 M	R695 M
% Payable by Future Residents	0%	R0	95%	R90 M	22%	R45 M	R135 M

Alternative and sustainable infrastructure systems allow for significant reductions in resource use: Energy (where energy is generated on site) – 59% in winter and 126% in summer; Water – 64%; Landfill space saved – 35%

Well-located Land

Situating state-subsidised human settlements projects in well-located areas helps to contribute to more compact and dense settlements. The location of a human settlements project can have long term environmental and financial implications for both the municipality and beneficiaries. Well-located land is therefore a critical component of, and the first step to, more sustainable state-subsidised human settlements. Well-located land for human settlements projects directly affects the social and economic opportunities available to beneficiaries, as well as the municipality's financial sustainability.

Case study for well-located land: The impact of spatial growth patterns on municipal sustainability in the Western Cape

In 2013, the Western Cape Department of Environmental Affairs and Development Planning commissioned a study of the impact of current spatial growth patterns in towns around the province. Seven towns were selected as case studies for a typical town of each settlement category. This study offered a longer term perspective on settlement growth, concluding that if settlements are allowed to continue to sprawl as they grow, there will be significant detrimental environmental and financial impacts on municipal sustainability, this is with regard to both capital and operating costs over the next ten years. The table below illustrates the magnitude of these impacts across the various settlement typologies.

Settlement Typology	Case study town(s)	Quantitative outcome due to compact spatial form			
		Capital investment saving	Operating position improvement	Cost saving on transport for low income households	Reduction in carbon emissions
A	City of Cape Town	18%	17%	18%	25%
B1	Stellenbosch; George	15%	23%	3.5%	42%
B2	Saldanha Bay; Overstrand	14%	24%	2%	47%
B3	Theewaterskloof; Beaufort West	15%	24%	0.7%	53.5%
Western Cape Aggregate		17%	20%	6%	33%

Findings from research:

- Current spatial patterns are not sustainable for municipalities (exacerbates financial vulnerability) and are detrimental to the environment and the urban poor.
- Smaller municipalities' budgets (B2 and B3) are highly sensitive to expenditure increases and therefore have the most to gain in their operating budgets from compact spatial form.
- The modelling suggests that rates and tariff increases of up to 4% above inflation would be required annually in order for the BAU situation to regain financial sustainability. This is not a politically feasible or an equitable option. Therefore, without significant intervention to the spatial form of growth and ongoing settlement management, municipal financial viability will deteriorate at an ever increasing rate over time.
- While the municipal cost implications of sprawl may be most obvious in larger towns and the City of Cape Town, the greater impacts in smaller municipalities may be the loss of biodiversity, cultural, scenic and heritage landscapes.
- If current settlement patterns persist, households will pay even greater proportions of their income on transport than they do at present, and will thus continue to contribute to

A well-located site is aligned with local policy

- It is within the urban edge
- It is identified for human settlements and spatial targeting in the IDP, SDF and HSP
- It is adjacent to or within the existing service infrastructure systems (water, energy, sanitation, waste) and there is capacity available
- It has been identified with input from the public (beneficiary community and residents)
- Where new service capacity is required, alternative service delivery solutions have been investigated.

A well-located site is accessible and integrated

This is to be applied in relation to settlement type, such as a metropolitan area (Cape Town) versus regional centre (Worcester) versus a town (Robertson).

Every household is:

- Currently or planned to be within a 2km walk to a public transport network
- Currently or planned to be within a 2km traveling distance of a dedicated non-motorised transport network
- Currently or planned to be within a 1km walk to a daily activities, such as a grocery store, ATM, ECD centre
- Currently or planned to be within a 500m walk to high quality public space
- Currently or planned to be within a 5km traveling distance to community and social services

- Within a 10km traveling distance to an economic centre with employment opportunities

A well-located site is safe from environmental risks and outside ecologically sensitive areas

- Outside of Critical Biodiversity Areas (CBAs) and key ecological corridors identified in the municipality
- Outside of a 100 year flood plain and sea level rise predictions
- More than 100 metres from a watercourse or wetland
- Outside of a veldfire risk area (if adjacent, there is a sufficient and monitored firebreak in place)
- Not exposed to possible landslides or rock falls
- Not on productive agricultural land or soil

Efficient street layout

The layout of a human settlements project site can enable significant reductions in resource consumption and improved resource efficiency in the long term. This is because the site layout sets the local preconditions for the choices that the professional service providers can make regarding orientation and services provision, and those that the beneficiaries make regarding mobility. The site layout is difficult to change later in the project and almost impossible to alter once the project is occupied. It is therefore important that the following aspects of the site layout are considered early in the project process to enable an improved environmental and social impact from state-subsidised human settlements provision.

Design for spatial integration

- Identify opportunities to connect the project site directly with the surrounding street layout and urban fabric, as illustrated in Figures 2 and compared with Figure 3.
- Consider the project as a city/town piece and not a separate entity, look to have multiple entrances/exits to the project site to connect to the surrounding area.

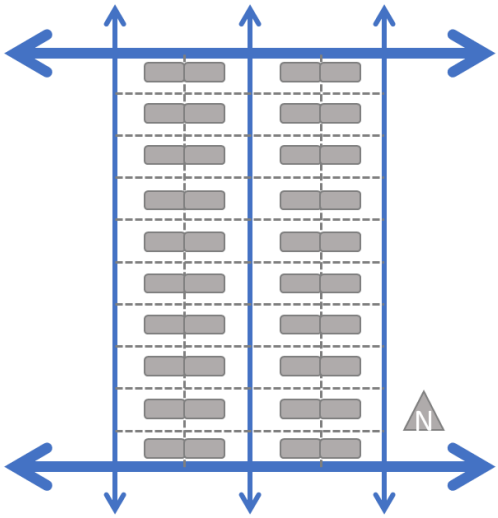
Figure 3: (far left) Street layout of Project One, where the site has been laid out for spatial integration with many entry points.

Figure 4: (left) Street layout of Project Two, where the layout results in poor spatial integration with only two entry points.

Design for resource efficiency

- Street orientation: Apart from providing access, the street layout should be optimised for resource efficiency for the services provision and the house design and its occupation. Street design should take into consideration both the need to maximise passive solar design and effective stormwater management.

  Passive solar design: As stipulated in SANS 10400:XA, buildings are to be orientated to the north, as far as possible, to maximise the use of passive heating and cooling. To facilitate this, the street layout can be designed running from North to South or West to East (as seen in Figures 4 and 5).



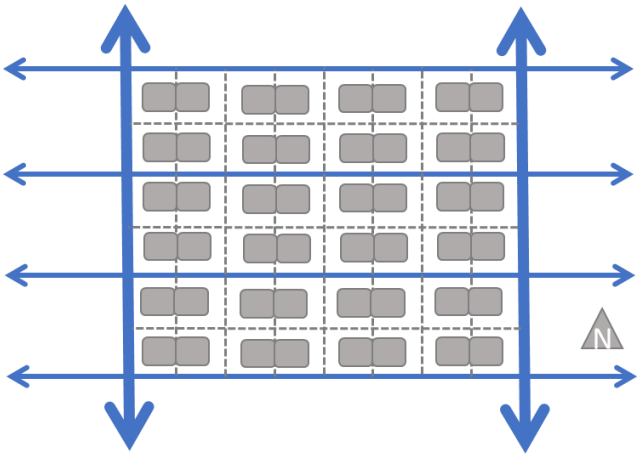


Figure 5: (left) Illustrative street layout for North-South orientation Figure 6: (right) Illustrative street layout for West-East orientation

  Stormwater management: streets play a fundamental role in stormwater management and the provision of services. If the street network is designed on the principle of facilitating natural drainage, there are a number of efficiencies and sustainability aspects that come to the fore:

  - Streets designed appropriately can deal with stormwater above ground without costly underground pipes and services. It also means that you do not have to leave out plots for overland stormwater escape routes.
  - Streets laid out at the correct gradient minimise the need for sewerage pump stations.

- Erf size: Land is valuable and the human settlements database is growing, large erfs can therefore no longer be provided without being at significant cost to the environment, municipal budget or other beneficiaries on the human settlements database. The erfs must therefore be designed so as to allow for medium to high density housing and typologies such as semi-detached or row housing, thereby maximising the benefit of the land.
- Non-motorised transport (NMT) network: design dedicated NMT lanes on the primary mobility network in the project for bicycles, skateboards, prams etc. to make use of. As shown in the images below, these can either be separated physically or indicatively on the road surface, depending on the level and type of traffic on that road. Safer routes such as these can

encourage people to use non-motorised transport rather than private motor vehicles to move around the project site or into surrounding areas.

Figure 7: (left) Cycle lane that is separated physically. (Right) Cycle lane separately indicatively with a painted road surface. http://myciti.org.za/en/passenger-information/universal-accessibility/bicycles/ http://www.bicyclecapetown.org/wp-content/uploads/2012/06/bikelane.jpg

Savings associated with the higher density Joe Slovo Phase 3 Development, City of Cape Town

The Joe Slovo Phase 3 development was delivered within the budget allocated to typical RDP projects. The top structure was R94 000 as opposed to a RDP household top structure cost of R72 000, but the cost of infrastructure was R6000 as opposed to R28 000. This saving resulted from:

- The densification of the development meant that only 4 metres of services was required per household as opposed to the typical 10 metres. The foundations were made deeper so as to not interfere with the services.
- The large number of pedestrianised roads in Joe Slovo Phase 3 which require less and cheaper material when compared to roads designed for vehicles. The reduction in base course thickness and road width, combined with cheaper pavers when compared to road bitumen resulted in approximately a further 65% saving on infrastructure costs.
- The ground plain was shaped to eliminate the need for underground stormwater services.

From: Joe Slovo Phase 3 Lessons Learnt Document. 2013, Sustainable Energy Africa

https://www.westerncape.gov.za/assets/departments/human-settlements/images/human-settlements-joe-slovo-danida-solar-water-heaters.jpg

- High to medium gross density: Higher density human settlements projects contribute to more compact urban areas. High density allows for resource efficiency in service provision, as less material is needed to provide infrastructure to each housing unit, and greater value for money as each metre of infrastructure is servicing a greater number of households thereby bringing down the per capita cost. Longer term resource efficiency is also possible through the increased thermal efficiency of higher density units, as fewer surfaces are exposed to outdoor temperature variations, and less land is needed per house.
- Clustering and co-location: resource and financial efficiency can be achieved through grouping a range of related activities together where mutual financial, operational, and social benefits are possible. It is also possible to derive multiple benefits from a single well-designed

intervention, such as a public space area or sports field that is also a stormwater attenuation pond or rainwater collection point during storm events. A school, library and childcare centre can be placed adjacent to this to improve the security of these spaces and to make use of them throughout the day and evening.

- Street lighting: Light pollution is classified as light from electrical lighting that spills upwards into the night sky or on to neighbouring properties. Light emitted upwards is considered as wasted light and energy and can pose a hazard to air traffic and impact on nocturnal ecosystems and their movement patterns. This is of particular importance in tourism areas where light pollution may prevent star gazing opportunities. Do not permit light to shine upwards into the night sky, as illustrated in the diagram below.

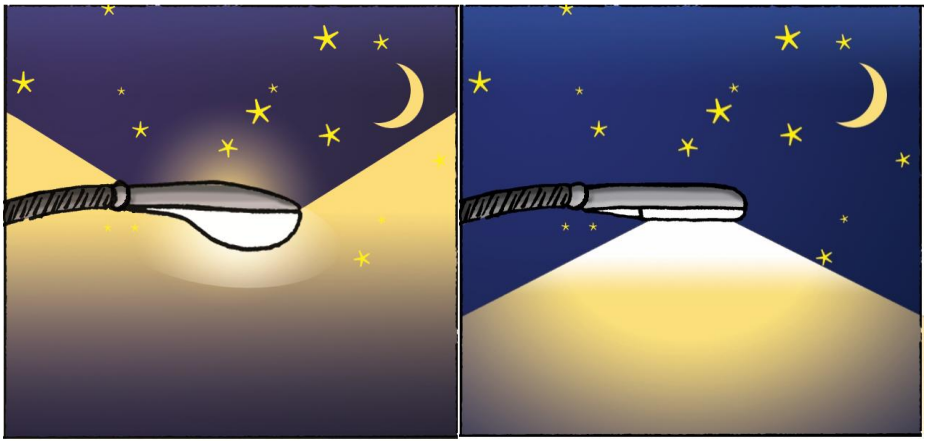


Figure 8: (Left) Street light designed to emit light pollution. (Right)Street light designed for no light to be emitted into the night sky (from ICLEI Africa Green Building Guidelines)

- Localised waste management: Include spaces for organic waste management and the collection, storage and sorting of recycling. This could provide an opportunity for local economic development and a more cyclical use of materials, while reducing the amount of waste going to the municipal landfill.

Design for accessibility

- Easily navigable street layout: Design using a grid layout rather than a discontinuous street layout, as illustrated below. This can help shorten distances between places, thereby promoting the use of non-motorised transport and walking. Allow the grid to have an appropriate range of variation to allow for different uses and prioritised mobility options.

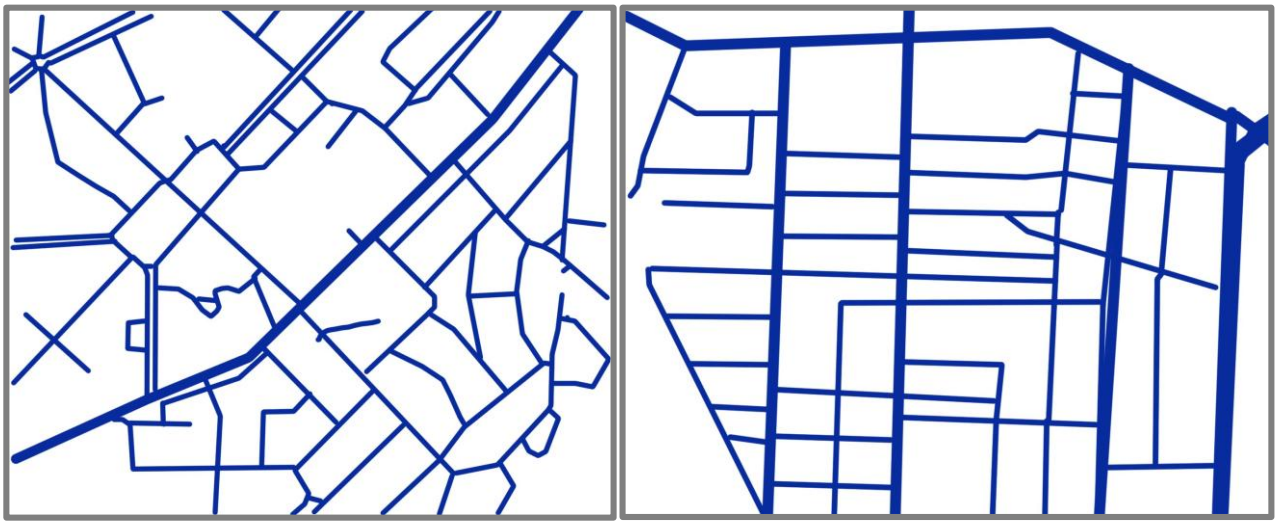


Figure 9: (left) A street layout that is not easily navigable nor ordered, also known as an illegible street layout.

Figure 10: (right) A street layout that is easily navigable and ordered, also known as a legible street layout.

- Defined street edge: Place the buildings closer to the street edge to define the public realm.
- Pedestrian-priority: Look for opportunities to maximise space for pedestrians on streets, especially on street corners, and design for safety, with appropriate visibility and passive surveillance as a key factors. This, along with giving people places to walk to, can encourage beneficiaries to walk to daily activities rather than drive thereby improving road safety.
- Mix of land uses: Identify opportunities for the creation of a 'main street' where shops and businesses can develop over time, whether formal or informal. One design feature could be to have very wide pavements on a primary access street and permit local informal traders to establish shops, restaurants and businesses in these areas.
- Universal access: Design streets and intersections for the most vulnerable pedestrians in the community, such as young children, the disabled, adults with prams, and the elderly. Designing for these pedestrians in particular will improve the street environment for all pedestrians.
- Design for safety: The street interface and design, along with the house design can influence the experience of pedestrians and passers-by through the provision of passive surveillance for safer streets. The design aspects for safer communities include: increased surveillance and visibility; safe access and movement; a positive image; positive relationships and layered spaces; and good urban management and monitoring. Further guidance is provided by the City of Cape Town: http://resource.capetown.gov.za/documentcentre/Documents/Procedures,%20guidelines%20and%20regulations/Design%20and%20Management%20Guidelines%20for%20a%20Safer%20City.pdf
- Convenient Parking: While it is expected that lower income areas rely on public rather than private transport, especially for daily commuting, it should be expected that some beneficiaries

will have cars. These might only be used on the weekend, therefore it is important to consider where these cars will be safely parked and not be a hazard or inconvenience to other residents.

Design to make use of ecological service provision

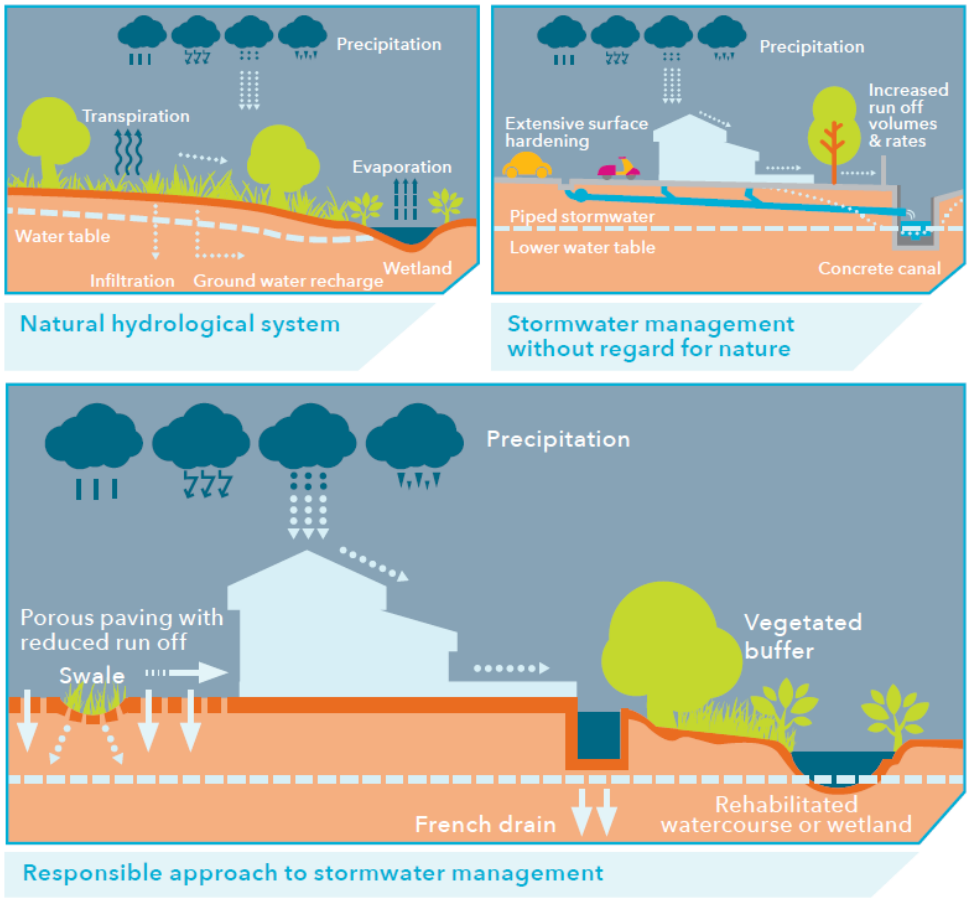
- Improve the ecological value of the project site: Provide seedlings of endemic, drought resistant vegetation and edible plants, where appropriate, along with training on how to maintain a garden for beneficiaries who are interested. This can help to improve the ecological value of the site, for biodiversity, flora and fauna.

Vegetation and planting for multiple benefits – Witsand iEEECO Phase 1

On the completion of the Phase 1 houses, the services of Green Communities, an NGO based in Cape Town, assisted the new home owners to plant vegetation and trees and train residents in related skills in greywater harvesting for irrigation, composting and the propagation of plants. The aim of the project was primarily to secure the loose sand on which Witsand is located, especially during the periods of high winds that are experienced in the area. The loose sand was particularly problematic as it undermined the foundations of the houses (White, 2015). A secondary aim was then to improve the passive design features through providing external shading. Where possible, Green Communities provided indigenous vegetation and edible plant seedlings to beneficiaries that helped to reduce water consumption through xeriscaping and to improve food security.

- Improve air quality: the planting of trees and vegetation can help to reduce the levels of dust and other pollutants as they filter the air and keep sandy soils in place during periods of high wind.

- Design with sensitive ecological areas: if the project site contains or is adjacent to a critical biodiversity area or watercourse, provide a buffer area (minimum of 100m or as confirmed by ecological specialist) around/along this sensitive area. Make use of the buffer area as an opportunity for public space in the project and surrounding areas. Further to this, incorporate environmental offset areas into the overall layout through the creation of green corridors.
- Reduce the urban heat island: The urban heat island effect refers to a change of the microclimate in built up areas where temperatures are higher than in rural areas. This is due to the increased cover of dry, impermeable surfaces and thermal mass in urban areas from buildings, roads and other infrastructure which hold on to heat for longer periods of time and release it at night, rather than absorbing it as occurs in rural areas. Planting and maintaining trees can provide summer shade to keep homes and outdoor areas cooler. Large and small areas of permeable surfaces, such as local parks and vegetation strips, can absorb excess heat and reduce the temperature of surrounding areas.
- Stormwater management through water sensitive design:



A diagram illustrating the changes from the natural hydrological state to that affect by an insensitive site development to the required approach, where sustainable stormwater management is undertaken. (From Framework for Resource Efficiency Criteria for Development in Cape Town, CoCT, 2013)

Reduce the occurrence of flooding by maintaining the natural flow of water on site: that is the infiltration, filtration and velocity of stormwater. This can be done through increasing the

percentage of permeable surfacing and directing rainwater/stormwater to water sinks (flower beds, filter strips, bioswales, and lawns) or water tanks instead of into drains, as illustrated above. For more information: http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/TT%20558-13.pdf and http://wsud.co.za/

High Performance House Design

Within the context of a well-located site with an efficient street layout, a high performance house design can enable a significantly improved environmental impact in the provision of state-subsidised human settlements. This is through reduced resource consumption and improved resource efficiency, specifically water and energy. The most appropriate design interventions, performance and aesthetics will be context specific, depending on whether the surrounding area is suburban, peri-urban or urban. The diagram below is an image drawn of a more suburban housing typology and identifies some of the designs interventions and technologies that could be made use of for an improved environmental and social impact.

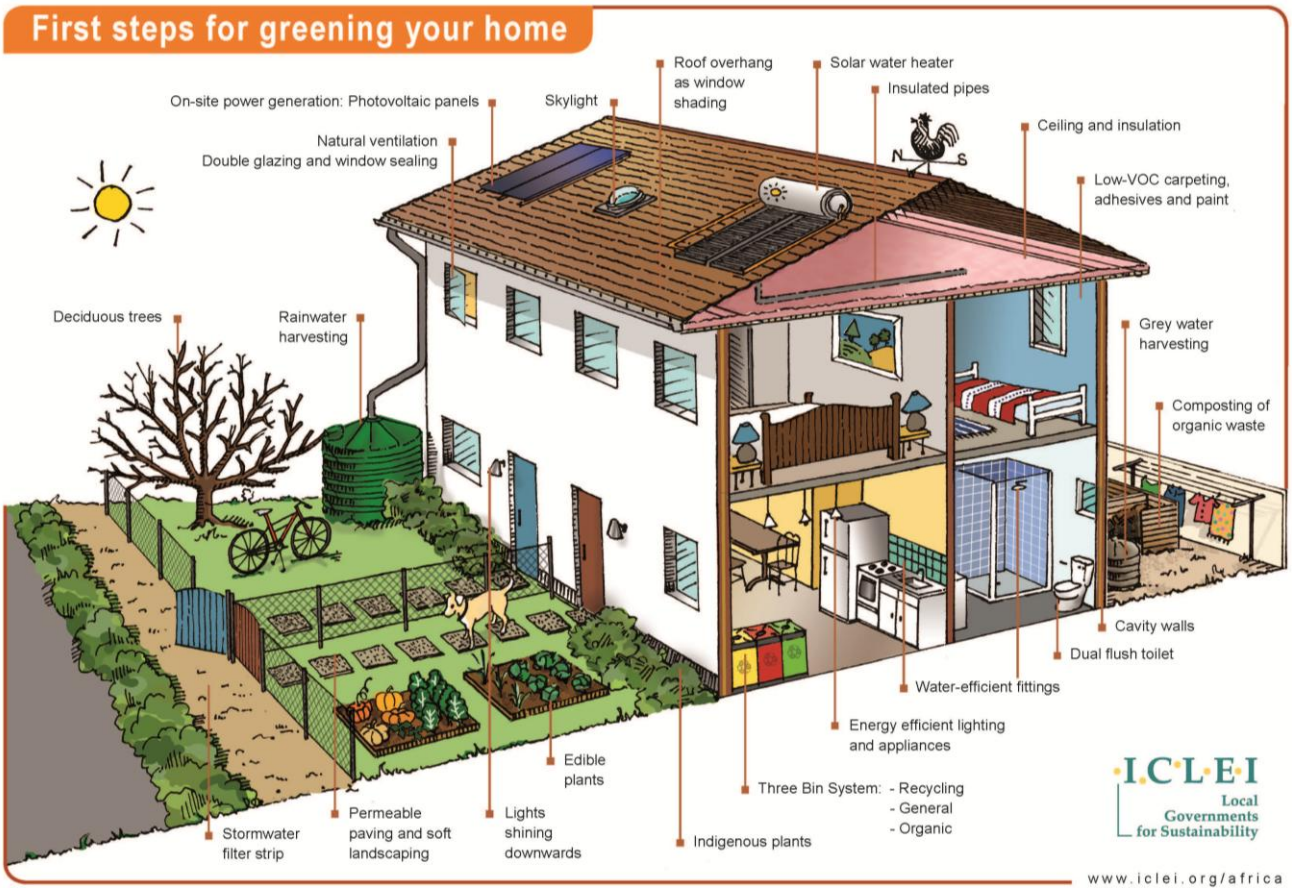


Figure 11: Design interventions and technologies that could be made use of for an improved environmental and social impact. (from ICLEI Africa's Green Building Guidelines)

Resource efficient human settlements typology

Row housing and semi-detached housing units offer greater resource efficiency than detached homes. This is with regard to the improved thermal performance as less of the building envelope is exposed to external temperature fluctuations and therefore retains a more constant internal temperature; cooler in summer and warmer in winter. Secondly, semi-detached and row housing is more dense and therefore makes use of less land and service network infrastructure, which in turn protects valuable agricultural land and biodiversity along with reducing operational costs of infrastructure. It also allows for more people to live on well-located land. It is therefore suggested that all state-subsidised homes built are row or semi-detached housing units to take advantage of the above mentioned benefits.

As seen in the diagram below, with data from the United States of America, these graphs show a comparison between the overall energy consumption of detached, semi-detached and multiple family buildings in suburban areas and transit-orientated development areas. This research shows that the human settlements typology can account for an up to 25% improvement in occupational home energy use, with location accounting for a 38 – 48% decrease in energy consumption and related greenhouse gas emissions.

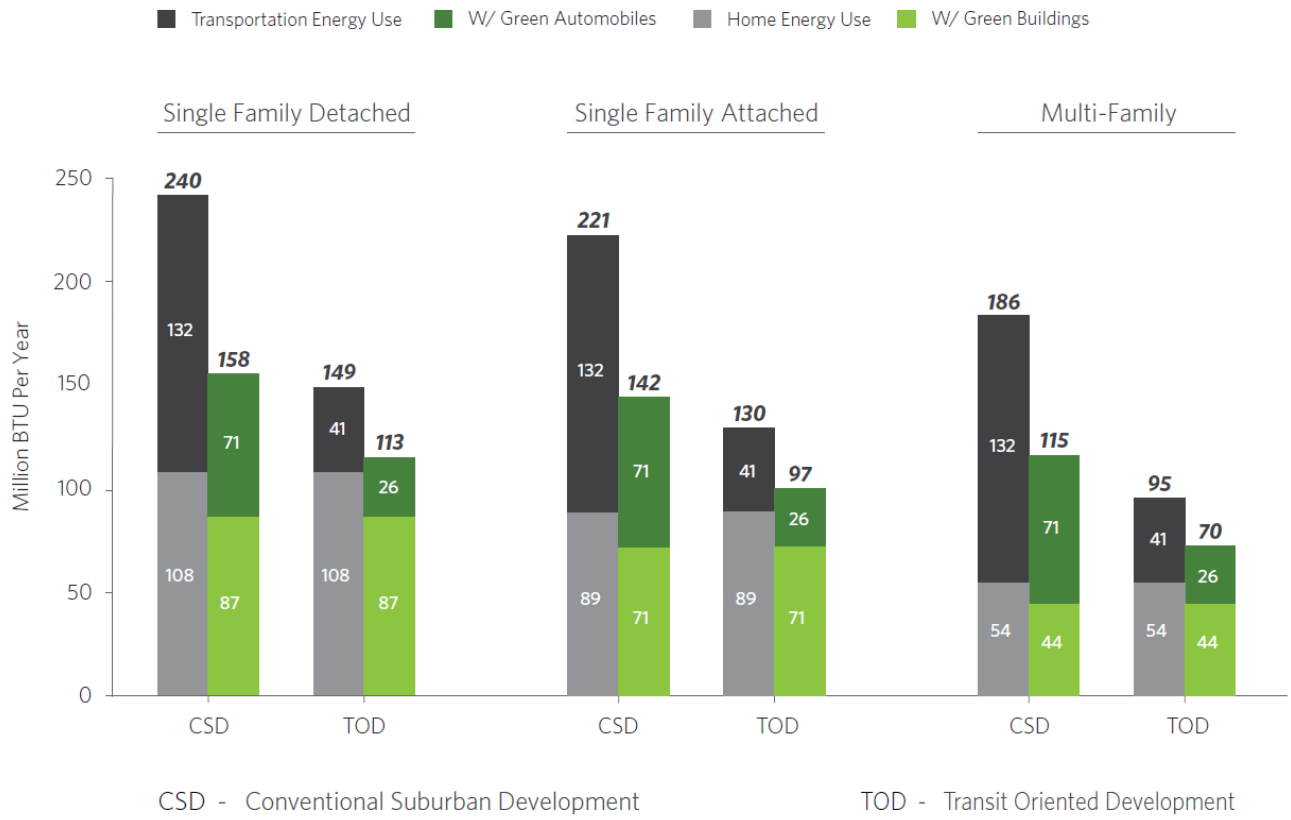


Figure 12: A comparison in the total energy consumption of three different housing typologies in located in both a suburb and on a transit route.

https://www.epa.gov/sites/production/files/2014-03/documents/location_efficiency_btu.pdf

Joe Slovo Phase 3, City of Cape Town

– Quantitative analysis of thermal performance due to housing typology and orientation

The thermal performance of the Joe Slovo Phase 3 households, as a double storey row house, was compared to that of a more typical RDP household development in Delft, Cape Town, as a single storey detached house. Both have ceilings and the same thickness of Isotherm insulation (40mm), so these comparisons are based on housing unit design alone.

Thermal analysis of household orientation in Joe Slovo indicates that north facing houses provide the best comfort levels over the year on average. South facing houses are most comfortable in summer, but are the coldest in winter. East and west facing houses are warmest in winter, but are the hottest in summer.

The Joe Slovo design results in lower temperature variations (the difference between temperature extremes) when compared to a typical RDP style house.

- In summer Joe Slovo is 3-6 degrees cooler than the maximum temperature in Delft
- In winter Joe Slovo is 0.5 to 3 degrees warmer than the minimum temperature in Delft

The room area on the bottom storey of a Joe Slovo household is typically .5 to 1.5 degrees colder than the top storey. This means that it will be more comfortable to be in the bottom storey in summer, but more comfortable in the top storey in winter.

From: Lessons Learnt Document. 2013, Sustainable Energy Africa

Passive design principles and applications in state-subsidised human settlements

Passive design takes advantage of the climate to maintain a comfortable temperature range within the home. This can occur through allowing or preventing sunlight into the home and increasing the thermal resistance of the walls and roof assembly. This reduces the amount of energy needed to heat or cool homes resulting in reduced greenhouse gas emissions and lower costs for occupants, and improves the indoor air quality and the health of residents as harmful fuels, such as coal and paraffin, are no longer needed for space heating.

A building with good passive design does not necessarily cost more to design or construct, but is likely to save money throughout the life of the building, and is therefore considered a quick win in designing a better state-subsidised house. Unlike other energy efficiency measures, these cannot be retrofitted later, and must be included from the beginning of the planning and design process.

It is important to note that SANS 204 and 10400-XA stipulates the minimum requirements for all buildings in South Africa to adhere to. The core passive design principles are included in these regulations. The intention of this document is to build on these regulations and illustrate design

options for increased thermal performance and energy efficiency above those provided by SANS 204 and 10400-XA.

The following principles are essential to passive design:

- North-orientated building footprint: Orientation for passive cooling and heating is about making use of the sun appropriately, with the necessary controls. The sun can be most easily controlled if the house is orientated to geographic north (between 20° east and 8° west), with the longest façade facing north and shorter façades on the east and west. Where the north façade is also the street-facing façade, the majority of the glazing should be on the north façade; that is larger windows provided on the north façade with smaller windows or no windows provided on the West and East façades. This will assist in reducing unwanted heat gain throughout the day.

  The performance outcome: This orientation can maintain a moderate internal temperature throughout the day, as it allows minimal heat gain in summer and minimal heat loss in winter. This means that houses are cooler in summer and warmer in winter due to the way that the house is orientated. This should lead to a cost-saving and improved indoor environment for beneficiaries, as less money is spent on space heating and cooling, especially when heating with harmful substances, such as paraffin.

- Internal space layout for passive design and unit expansion: Living spaces should be arranged so that the rooms where people spend most of their hours are located on the northern side of the unit. Uninhabited rooms, such as bathrooms, can be used to screen unwanted western sun or to reduce heat loss on the south facing façades. Living rooms should ideally be placed on the northern side. Furthermore, the layout of the spaces internally should allow for an easy expansion of the unit, if the overall design and typology allow for this. An example of how this could be done is shown in Figure 12.

  The performance outcome: The most inhabited areas are the most comfortable with regard to indoor temperature.

Figure 13: An example of an internal site layout that accounts for both passive design, with the living area to the north and service areas to the south, and easy expansion, with the inclusion of a passageway. This example is from Kleinmond Eco-housing.

- Window sizing: The size and design of windows must take into account the local climatic conditions. This is because glass has a low R-value and allows for the quick transfer of heat from inside to outside and vice versa. For example, if the human settlements project is being built in an area with high temperature fluctuations between day and night, such as the Karoo, it is best to

have smaller windows to reduce the heat transfer from the hot outdoors during the day and the cold outdoors at night. This design intervention has been used historically in the Western Cape, especially in areas of large diurnal temperature differences.

The performance outcome: Reduce or slow down the transfer of heat between the indoors and outdoors of a building to maintain a more constant and comfortable indoor temperature.

- Shading windows: All windows on the northern side of the building are to be shaded in such a way as to allow winter sun in and keep summer sun out, based on the angles shown in the diagrams below. The north orientation allows for the use of fixed shading while east and west orientations require more expensive adjustable shading devices. A cost-effective and durable shading device for one storey is an extension of the roof structure of the building; i.e. a roof overhang. It is estimated that the roof is to be extended by 400mm to 600mm to allow for effective shading of the window. The length of the overhang is to be confirmed by the architect or engineer.

  Shading windows can also provide better levels of daylighting as more indirect sunlight is allowed in the building. To further increase good daylighting levels while keeping out harsh and hot sunlight in summer, a shading device can be attached one third of the way down the height of the window. This is known as a light shelf, as seen in the diagrams below.

  The performance outcome: Shading windows to allow sun into the house in winter and prevent it from coming in during summer. This is to provide passive heating during winter and passive cooling during summer. Better levels of daylight to eradicate the need for electrical lighting during the day.

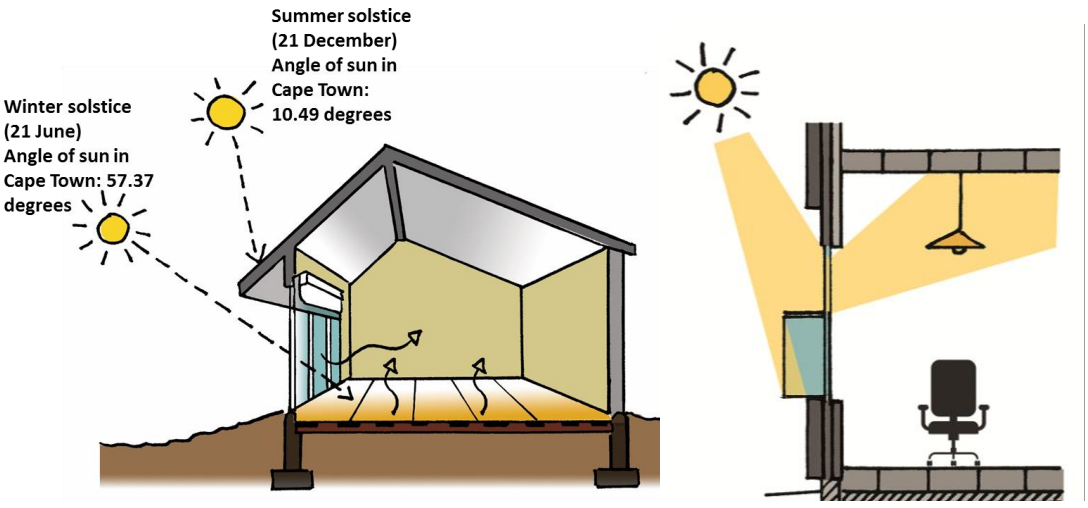


Figure 14: (Left) Shading designed to let sunlight in during winter, and keep it out in summer (ICLEI Africa green Building Guidelines)

Figure 15: (Right) How a light shelf works by reflecting diffuse light into a room (from ICLEI Africa Green Building Guidelines)

- Insulation: Preference should be given to insulation materials that meet or exceed the minimum R-value requirements along with further performance criteria such as being made from recycled materials, locally produced and fire retardant. In certain circumstances, where a north-facing orientation is not possible, the low R-value of masonry walls has not been sufficient for good level of thermal performance. Therefore, it is suggested that if the building is not orientated north, the wall construction should have an increased R-value and include the use of thermal insulation, if necessary.

  The performance outcome: Improved thermal efficiency of the house. Insulation increases the thermal mass of the building envelope thereby reducing internal temperature fluctuations and costs associated with heating and cooling.

What is an R-value?

At the technical level, **R-value** is a measure of resistance to heat flow through a given thickness of material. In theory, the higher the **R-value**, the greater that resistance.

http://www.cellulose.org/HomeOwners/WhatR-valueMean.php

- Thermal mass: Thermal mass is the ability of a material to absorb and store heat energy. Materials that have a high thermal mass, are usually thicker and denser than conventionally used material, and can absorb and retain heat, releasing it slowly hours later. The reverse is true too. Where the thermal mass material is cooler than internal temperatures, it will absorb heat, resulting in a cooler interior space. Thermal mass is most effective in areas where there are high diurnal temperature fluctuations (a large difference in the temperature between daytime and nighttime). Thermal mass should therefore be included in the design and maintained throughout occupation, such as an exposed concrete or stone-tiled floor, to store heat during the day and release it at night for an alternative, no cost method of space heating in winter and cooling in summer, as seen in the diagram below.

  The performance outcome: A more constant internal temperature that is cooler in summer and during the day, and warmer in winter and at night. Furthermore, a cost-saving on energy used for space heating.

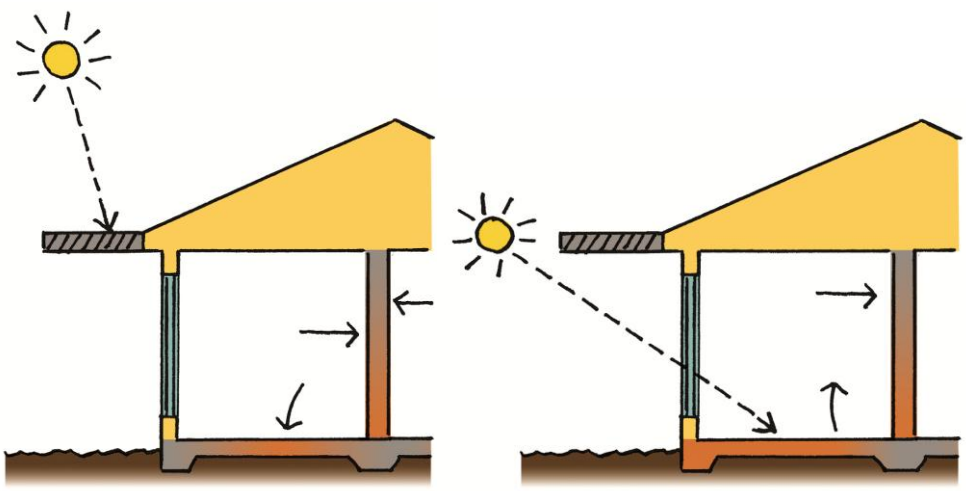


Figure 16: An illustration of how thermal mass works in Summer (left) and Winter (right) (from ICLEI Africa Green Building Guidelines)

- Roof design for solar water heating: Not all human settlements projects will have extra budget or grant funding available during the project time frame to include solar water heaters in the delivery of the houses. Therefore, it is important to ensure that the roof is designed optimally for a solar water heater to be installed at a later stage. This requires that the roof is orientated north and the roof pitch is equivalent to or as close as possible to that of the project's latitude. The angle of the pitch can be optimized by a steel frame however, it is not possible to alter the roof orientation after construction. The design and orientation of an existing roof pitch will be a determinant of which solar water heating system can be used, as some types of heaters are still usable for roofs that do not orientate north.

  The performance outcome: To reduce energy usage for water heating by enabling the installation of an efficient solar water heater.

- Increased reflectivity of external surfaces: Increase the reflectivity of external painted surfaces (roofs and walls) to reduce internal temperature gain (keeping it cooler inside the house) and reduce the urban heat island. This is done easily through painting surfaces white. However, it is important to take into account the visual impact on surrounding areas of increased reflectivity of external surfaces.

- Natural Ventilation: to make the most of natural ventilation in state-subsidised human settlements, it is necessary to ensure that the depth of the housing unit and/or room, as well as the site layout, corresponds appropriately to the number and placement of openings as is shown in the diagram below.

  The performance outcome: Improved natural ventilation through the housing unit for reduced particulate matter and moisture content of internal air, and for cooling of internal spaces.

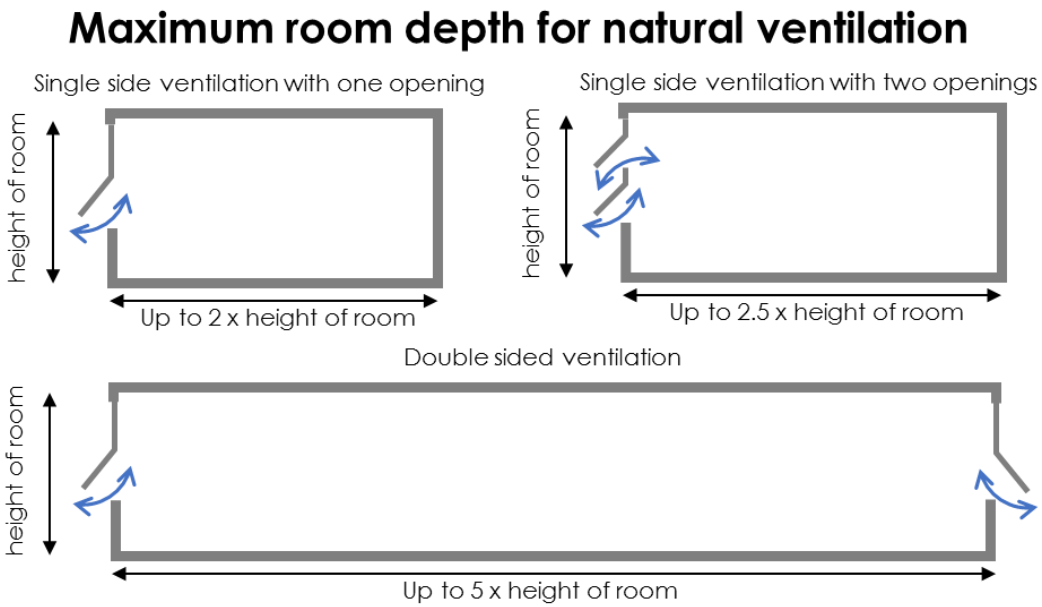


Figure 17: Rule of thumb for natural ventilation - maximum room width per ventilation type.

Design to standard lengths

Design housing units in accordance with the dimensions of standard building materials and products. This can significantly reduce the amount of construction of waste from materials that need to be cut, reduce the total embodied energy and greenhouse gas emissions per housing unit, and reduce the capital cost as less material is required. Examples of this are modular masonry design in single storey units and designing to the dimensions of the pre-cast floor slabs in double storey housing units.

Learning from inspiring practice: Kleinmond Eco-housing

The modular masonry design of the house resulted in an economical use of conventional cement blocks (390mm by 190mm by 40mm) with special T-blocks and Corner blocks manufactured by a supplier. The dimensions of the house strictly adhered to the 390mm dimension of the blocks with a 10mm joint spacing. This prevented the need to cut blocks on site resulting in increased structural stability and reduced construction waste, making more money available for other innovative

Energy efficiency and alternative solutions

- Energy-efficient lighting: The only electrical fixture or fitting provided as part of the state-subsidised human settlements subsidy is the light bulbs. Compact Fluorescent lightbulbs are soon becoming the norm as incandescent bulbs are being phased out. It is therefore important that, in this innovative and fast changing sector of energy efficiency, a performance standard and not a specific product is specified to ensure that there is an ongoing improvement in energy efficiency for lighting in state-subsidised houses in the Western Cape.

Therefore, it is suggested that all light fittings provided are to improve on the 40W incandescent light bulb's energy use by a minimum 60% and last for a minimum of 8000 hours.

The performance outcome: Improved energy efficiency for reduced greenhouse gas emissions and utilities costs for beneficiaries.

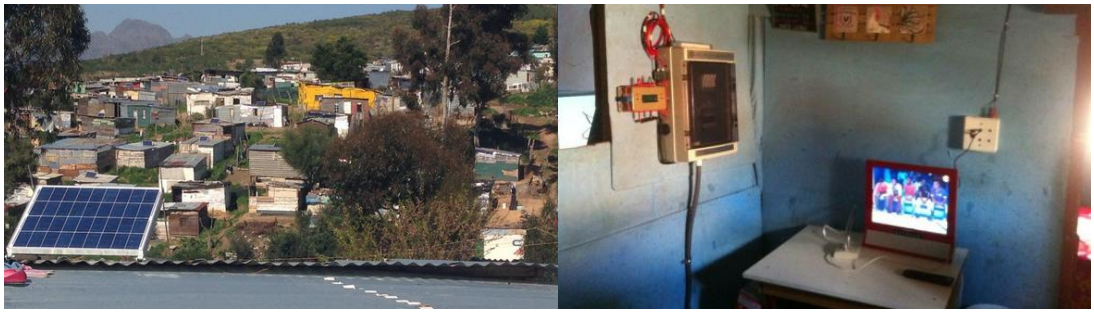
Further energy efficiency measures are discussed in the section 'Continuing the positive environmental impact' as it is based on the choices and actions of beneficiaries.

Alternative energy sources and solutions in state-subsidised homes

The two most common alternative energy uses in state-subsidised homes are solar water heating systems and photovoltaic panels. This section will discuss the questions to be considered when including these in the project and provide insight from projects where they have been used and evaluated. Essential to both of these systems is the warranty and expected lifespan of the systems. This is an introductory guide for more in depth and detailed discussions with the relevant engineers, who will determine the final specifications of the alternative energy solutions.

Learning from Inspiring Practice: The iShack Project in Enkanini, Stellenbosch, South Africa

The iShack Project being piloted in Enkanini, Stellenbosch is using solar electricity to demonstrate how 'green' technologies can be used appropriately to incrementally upgrade informal settlements and slums and at the same time build local enterprising capacity and resilience within a community. The off-grid, solar utility provides household electricity to power lights, television and other small media appliances.



http://www.sustainabilityinstitute.net/si-news/4859-ishacks-start-to-emerge-in-enkanini

Fundamental to the technology design is the modular scalability of the household installation so that the electricity supply can grow incrementally as the technology evolves and as costs come down. The iShack solar roll-out started in October 2013 and by April 2015 the electricity service had been delivered to over 800 households.

Initially funding was received for infrastructure and start-up capital from the Green Fund and the Bill & Melinda Gates Foundation, and has also received generous donations from private individuals and groups. However the business model is designed to ensure that the energy service is financially sustainable without having to draw on ongoing grants and donations. Thus the long term running costs are paid for largely by the end-users and subsidised by the local municipality, Stellenbosch, via a Free Basic Alternative Energy subsidy. The iShack project is in negotiations with the Stellenbosch municipality to "allocate the subsidy to renewable projects in a way that is compliant with procurement procedures".

Solar water heaters and photovoltaic panels can benefit the beneficiaries, through an improved quality of life and possible cost savings. Currently, these are the two most common alternate energy sources. However, this may change and it will be necessary to keep up to date on scalable solutions as technology and new solutions are developed.

As has been experienced in projects where these alternatives have been provided, residents who have available Free Basic Electricity (FBE) will make use of it in other appliances such as an electric stove, fridge, irons, entertainment or washing machines. The environmental impact is therefore most likely not a reduction in energy consumption, but rather cleaner energy provision where a large energy consumer, such a water heating, is making use of energy that produces no greenhouse gas

emissions by its use. This helps to mitigate global negative environmental impacts and climate change. Learning from this experience, municipalities are therefore encouraged to consider providing alternative sources of energy as the Free Basic Energy provided to beneficiaries.

Solar Water Heating

The building location and roof orientation will help determine how water should be heated. If the roof faces north and gets full sun or gets limited sun (due to shading of the roof or due to the microclimate), a solar water heater will be viable. However, if the roof gets very little or no sun, gas water heaters may be a better alternatives to electrical resistance water heating.

- Flat panels or evacuated tubes

The panels that absorb sunlight to heat water come in two basic forms: flat panels and evacuated tubes, as seen in Figure 18. The attributes of each system are provided in the tables below to assist decision-making as to the most appropriate system depending on the project design and local context.

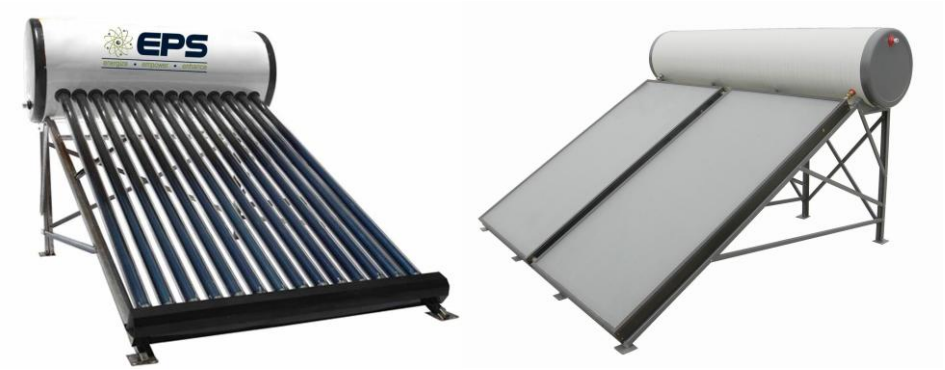


Figure 18: (Left) Evacuated tube solar water heater (Right) Flat panel solar water heater.

	Evacuated Tube solar water heater	**Flat panel solar water heater**
Product Description	Made of rows of long glass tubes. In each glass cylinder, the heat is absorbed by a pipe, which is insulated from the colder outside air by an insulating vacuum.	A single large pane of glass over a collector lined with metal pipes to collect the sun's heat.
Performance	Requires solar radiation - Better in colder and/or cloudier conditions. Greater consistency in performance	Requires direct heat - Better in sunny conditions. Varied performance throughout the year
Water temperature	Up to 90 °C	55 °C - 60°C

Maintenance	Sensitive to hailstone damage, can overheat in very hot summer conditions and burst, collector can be repaired if damaged	Available with longer warrantees. Can freeze in very cold winter conditions and burst, requires anti-freeze liquid to be replaced every two years in areas where temperatures drop below 4°C; collector must be replaced if damaged.
Orientation and roof angle	Less sensitive to placement angle	Directly north and angle equal to latitude
Pressure	High and low pressure systems available	High pressure systems available
Locally made brands available	Tubes made internationally, assembled locally – can be up to 80% locally made	Can be up to 100% locally made.
Aesthetics	More bulky, greater visual disturbance	Sleek, minimal visual disturbance

- Direct or indirect heating

	Direct heating	**Indirect heating**
Description	Heats water directly	Heats a glycol solution that heats the water (no contact between water and glycol solution)
Cost implication	Lower	Higher
Efficiency	High	Moderate
Maintenance Requirements	Lower	Higher
Suitable climate	Frost-free areas	Frost-prone areas, water with high mineral content

- Water storage requirements: The general rule is a minimum of 50 litres of tank storage per person, plus another 50 for the house. The greatest complaint from residents with regard to solar water heaters installed is that there is not enough hot water provided. Therefore to achieve beneficiary satisfaction and meet the desired resource efficiency, where residents do not need to heat water electrically, it is important to appropriately size the solar water heating systems.
- Close-coupled or split

	Close-coupled system	**Split system**
Description	Geyser is placed directly above the panels, lying horizontally. Makes use of thermosiphon effect (hot rises, cold sinks)	The geyser tank is not on the roof
Cost implication	Lower	Higher
Electricity requirement	No	Yes, pump needed
Efficiency	Slight loss due to exposure to outdoor conditions (esp. at night)	Slight improvement due to no exposure to outdoor conditions
Maintenance Requirements	Lower, few mechanical parts	Higher

- A manual by-pass switch or timer

  Solar water heating should meet most water heating requirements; however an electrical back-up element in the geyser is standard in case hotter or more hot water is required, especially in winter. Often, a timer is installed in the Electrical Distribution Board that is set to switch the electric geyser element on for a few hours every day. This automatic system can negate the energy savings provided by the solar water heating system as water is heated electrically even if not needed. An alternative to this, that has shown greater cost and energy savings, is a manual by-pass switch. This requires beneficiaries to switch on the electric geyser element when hot water is needed. This conscious decision also connects the resident and their actions directly to their energy consumption; resulting in increased awareness and control of energy use.
- Roof bracket: if the roof pitch is at a lower angle than that equivalent to the latitude of the project location, it might be necessary to make use of a roof bracket for the solar water heating system. The correct angle can increase heat gain by 10 – 20%, depending on the system.

Inspiring Practice – Joe Slovo Phase 3, City of Cape Town – Procurement of Solar Water Heaters

Lessons learnt – SWH Procurement

The SWHs were procured in a separate tender to the main construction contract, as separate funding from DANIDA was sourced after construction began. This created several problems with the main contractor, who was concerned that installation by a separate contractor would affect the guarantee that they could provide on the roof structure. This was resolved by awarding the contract to a subcontractor of the main contractor. While not an ideal approach, the procurement process did result in a comprehensive tender document which can be used for future government SWH procurement, and provided some lessons to take forward should SWHs need to be procured in future RDP developments. These are:

- Include SWH procurement, installation and maintenance as a component of the overall construction tender, to ensure roof guarantees and effective site management
- Tender documentation must include reference to standards and legislation to ensure product, installation and maintenance quality, and to ensure that local content requirements are met
- Tenders can be used to encourage additional benefits to be offered by the tenderer – Joe Slovo received additional solar powered courtyard lighting through the SWH tender.

Lessons learnt - SWH installation and maintenance

In order for the SWHs to be safely installed on the development roof, four reinforced roof trusses were required to accommodate the additional load from the unit, at an additional cost of R220 per household. Truss spacing did not need to change but knowing where the reinforced trusses were required an additional level of co-ordination from the contractor. Joe Slovo Phase 3 also provided additional challenges to the SWH installation team due to it being a double storey development.

Additional plant and safety equipment was needed to safely lift installers onto the roof, and this slowed the rate of installation down. Once installed, a maintenance programme was put in place. Key learnings from SWH installation and maintenance are provided below:

- Local unskilled labour can form up to 33% of the SWH installation team. In Joe Slovo's case, six of the 18 installation staff were local unskilled labour.
- Double storey buildings slow down the rate of installation by 40%, pushing up installation costs by a similar amount.
- An additional R310 per SWH should also be budgeted for in a double storey installation to pay for the personnel lifting equipment and additional piping runs. Also an additional R2500 per installer extra is required to cover safety equipment due to working at double storey height
- Members of the local community can be trained and capacitated to perform the function of basic maintenance, and to be the first 'go to' people whenever a problem arises. A strong link with the installer and manufacturer is essential should problems be more complicated than simple maintenance, and clear understandings as to manufacturing warrantees and installation guarantees need to be established up front.

Lessons learnt - SWH performance

Four households in Joe Slovo were monitored to determine the amount of energy saved from having a SWH. Two of the houses were north facing, one was west facing and one was south facing. The SWHs on the north and west facing houses were mounted at 50 degrees facing north and west respectively. The SWH on the South facing house was mounted facing North at 13 degrees due to the slope of the roof.

Energy savings in the houses measured varied from 8 to 100kWhs per month. This is a direct result of the amount of hot water used by the household. Under current City of Cape Town electricity tariffs, this translates to a monthly saving of R7.27 to R90.86.

Comparing orientation, north facing SWHs at 50 degrees to the horizontal perform the best over the period June-October, while west facing SWHs performed better in November. The SWH north at 13 degrees to the horizontal on south facing roofs performed the worst over the 6 month measurement period.

Maximum water temperatures in June range between 35 to 42 degrees C, while in October they range between 42 and 58 degrees C (noting that the water is tempered not to come out hotter than 60 degrees for safety purposes)

From: Joe Slovo Phase 3 Lessons Learnt Document. 2013, Sustainable Energy Africa

Photovoltaic panels and batteries

Photovoltaic panels generate electricity from visible light or UV radiation into electricity. There are 3 types of Solar Panels available, namely:

- Monocrystalline Solar Panels: These solar panels are made of a large crystal of silicon. Monocrystalline solar panels are the most efficient with regard to absorbing sunlight and converting it into electricity; and thus do better in lower light conditions than other solar panels.
- Polycrystalline Solar Panels: These are the most common solar panels on the market today. They look a lot like shattered glass and consist of multiple small silicon crystals. Polycrystalline solar panels are slightly less efficient than Monocrystalline solar panels but are less expensive to produce.
- Amorphous Solar Panels: These panels consist of a thin film made from molten silicon that is spread directly across large plates of stainless steel or similar material. Amorphous solar panels are less efficient than the other two types of solar panels but are also the cheapest to produce. One advantage of amorphous solar panels over the other two is that they are shadow protected, meaning that the solar panel continues to charge while part of its cells are in a shadow.

Figure 19: A photovoltaic panel used in the Kleinmond Eco-housing Project.

Further consideration of the specification of a photovoltaic panel should include properties such as the efficiency (cost per watt), the sizing of the panel matched to the desired use, the battery and whether it is connected to the electricity grid, and the provision of a visual battery meter. The latter is considered to be a valuable addition to the system in order to maintain the battery's life and efficiency; that is, beneficiaries can monitor the battery level and therefore do not run down the battery which damages the ability to store electricity. The specification should be undertaken by a qualified engineer and/or supplier.

Water efficiency and alternative solutions

Water efficiency

Within a state-subsidised home, the following water fittings are provided as standard, and therefore should be targeted for water efficiency measures to enable ongoing water consumption savings throughout the occupation of the human settlements unit:

- A kitchen tap
- A hand wash basin tap

- A shower and/or bath tap
- A toilet
- A bath

All water devices installed will conform with or be an improvement on SANS 10400 XB, when released, or the following maximum flow rates, as certified by the supplier:

- Kitchen Tap - 5.5 litres per minute
- Showerhead - 7.5 litres per minute
- Dual-flush combined flow rate or Low-volume flush - 3.2 litres per flush
- Wash hand basin tap - 4.5 litres per minute

In most state-subsidised human settlements projects, baths are preferred over showers as they offer greater functionality. Therefore consider procuring sit-baths or shorter baths, of 1.5m instead of 1.7m, to reduce the amount of water used per bath.

Alternative water sources and solutions

The greatest water uses in low income homes are laundry, toilet flushing and bathing. Alternative water sources available for use in state-subsidised homes include rainwater, greywater and groundwater. The most commonly included in state-subsidised human settlements projects is currently rainwater tanks. This is due to greywater and groundwater systems being very expensive to install. However, it must be noted that informal greywater reuse systems are used widely.

Figure 20: A Rainwater tank used in the Kleinmond Eco-housing Project.

Rainwater tanks can provide a valuable source of non-potable water and even potable water, if the system is well-maintained and protected from contaminants. The following considerations need to be taken into account:

- Local climate: whether the project site receives enough rainfall to make a rainwater storage tank a valuable contribution to overall water consumption. To add to this, it is important to consider when the majority of the rainfall occurs, i.e. in summer or winter, in relation to water demand.
- Tank Material: Plastic or polyethylene tanks are preferable as they do not leach contaminates, chemically react with the water and do not break down over time.
- Costing: The inclusion of rainwater tanks requires the addition of gutters to the house design, which must be factored into the cost of providing this

system. However, this cost can be reduced by only providing guttering and/or a monopitch on the side of the roof that receives the most rainfall. Costing should be considering in relation to the expected life span of the system, with a cheaper system over its life cycle, generally being the tank with the greater durability and the longer warranty.

- Warranty and life span of tank: A longer lifespan and warranty is preferable. A minimum eight year warranty should be requested.
- Sizing: The size of the tank depends on the size of the roof area being drained. It can be expected that most tanks appropriate for state-subsidised human settlements will be between 260 - 2000 litres, unless communal systems are considered. The calculation used to determine sizing is: roof area from which water is to be collected multiplied by the highest average monthly rainfall received. This is the maximum size required. [roof area x average monthly rainfall = maximum capacity of rainwater tank]

  Following this, it is important to consider the space available on site for the rainwater tank as it will help determine the appropriate shape and dimensions.
- Design: It has been demonstrated that accessibility is key to beneficiaries making use of rainwater in storage tanks. In the Kleinmond Eco-housing project, the rainwater tank was placed on a concrete plinth, with the tap slightly raised to allow a bucket to fit under the tap.

Alternative sanitation service provision

The flushing of toilets uses a significant proportion of total water use in state-subsidised homes (up to 70%). It is therefore important to consider alternative methods of sanitation services provision, especially as the availability of potable water decreases. These alternatives can include the reuse of wastewater, within a town or a municipality, and the use of non-waterborne sewerage systems. These systems allow for human waste to be seen as an economic good rather than a hazard, where the nutrients are harvested and the harmful contaminants are removed. However, due to current perceptions along with possible space and access constraints, it is necessary to work with the beneficiary community when considering alternative sanitation service options to ensure that there is understanding and acceptance of these systems for long term effectiveness.

Inspiring practice: Sanitation system in Doornkop, Mpumalanga

A ventilated pit latrine used in Doornkop, Mpumalanga. This settlement is on community-owned land. The composted waste is collected from the pits regularly by a community-based business and converted into fertiliser that is sold to farmers in surrounding areas. The community decided to install these systems as they offered the opportunity for job creation, income generation, and a reduced environmental impact in comparison to conventional flush toilets.

Sustainable building materials and products

When considering more sustainable building materials, it is necessary to consider both permanent fixtures, such as roof tiles and masonry blocks, and items used in the construction of the building, such as timber shutterboard. This is because the selection of building materials has upstream and downstream environmental and social impacts. The lifecycle of a material or product, as seen in in the diagram below, begins at extraction and harvesting of the material components and ends with disposal. This is commonly known as cradle-to-grave. However, with a desire to reduce resource consumption and greenhouse gas emissions, the recycling and reuse of materials is gaining momentum in the construction industry. This is known as cradle-to-cradle.

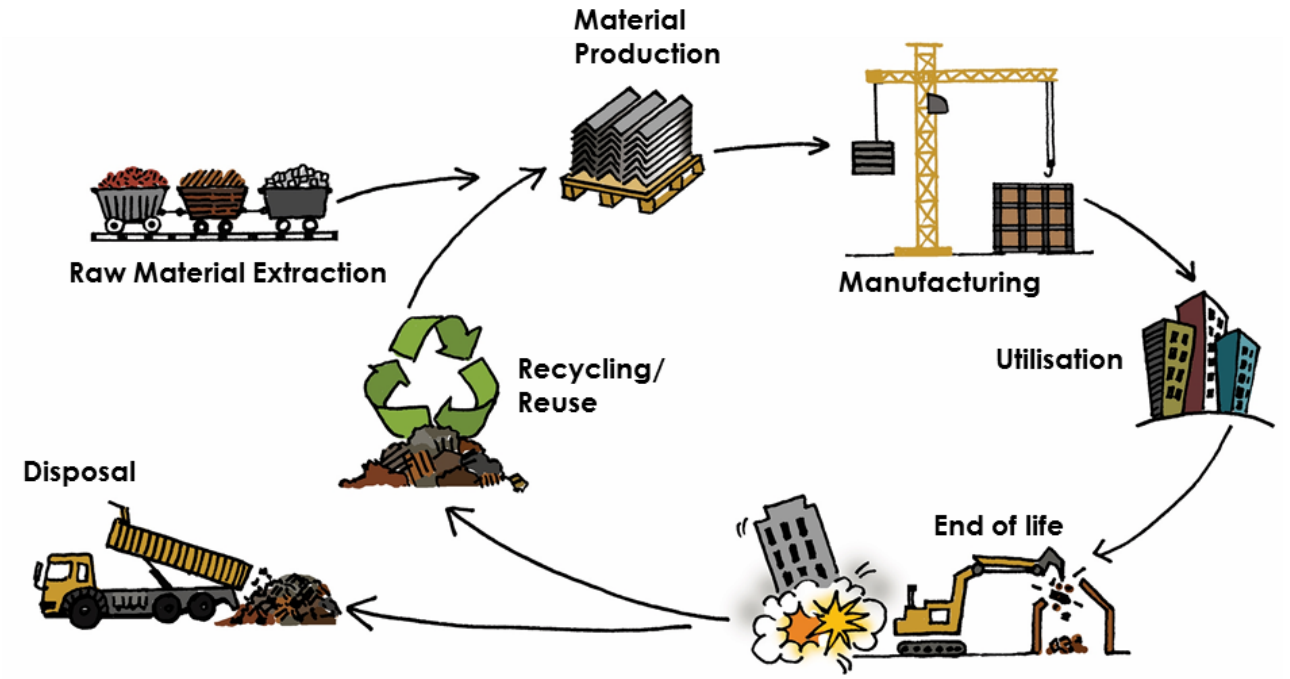


Figure 21: The building material life cycle. (from ICLEI Africa Green Building Guidelines)

To achieve a more sustainable use of building materials, it is necessary to understand and adopt the following principles from the onset of the planning and design process in order to be cognisant of the whole life cycle value and implications of the material selection:

Dematerialisation

Dematerialisation refers to designing a building in such a way as to reduce the net amount of material used without compromising its strength and functionality. This can occur through the reduction of material used in the structure of the building, where a modular design is used to reduce the need to cut bricks, thereby reducing construction waste too, and through the use of less material for piping, ductwork and internal finishes. This can also be achieved where a material is multifunctional, such as a ceiling board that is also roof insulation.

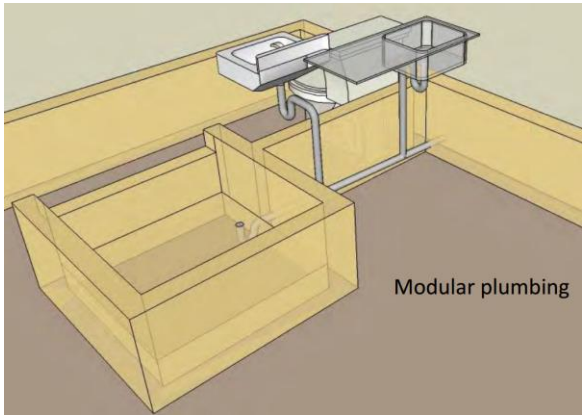
Inspiring practice: Designing a house to make use of less material in the Kleinmond Eco-housing Project

This innovative state-subsidised human settlements project aimed to improve the quality of construction and reduce utility costs and bulk infrastructure costs, through the application of science and technology to improve livelihoods of the poor in South Africa

The interventions listed below were designed and included to reduce construction waste and save on materials, thereby saving on construction cost and reducing the embodied energy and related greenhouse gas emissions for each unit.

UTRCP Continuous foundation slab: Dematerialisation refers to designing the building in such a way as to decrease the amount of material used for the same function. This was done for the strip foundations, the walls, the ceilings and the plumbing. The houses do not have conventional strip foundations, but rather a continuous foundation slab based on the CSIR's ultra-thin concrete paving technology (UTRCP). This is a usually a 75mm reinforced concrete slab with a 400mm deep and 350mm wide concrete ring foundation, as seen in Figure 18. However, for this project it was increased to 100mm due to concerns raised by the local building inspector. In total, each house was constructed using one ton less concrete, than conventional building methods, with an associated reduction in carbon dioxide emissions of almost one ton per house.

Pre-fabricated plumbing unit: The space layout of each unit placed the bathroom and kitchen against a shared wall, as can be seen in the image below. This allowed for all the plumbing to be limited to one wall in the house, except for the toilet outlet. A single plumbing unit was designed and pre-fabricated to be inserted into the wall on site. This reduced the amount of waste generated as any offcuts could be re-channeled into the production process within the factory.



http://researchspace.csir.co.za/dspace/bitstream/10204/6173/1/VanWyk1_2012.pdf

Low embodied energy and virtual water

All materials require energy, water and other natural resources to be grown or extracted, processed, and transported to the project site. This results in materials having an energy and water bill before being used. This is called embodied energy and virtual water. The embodied energy can be directly related to the amount of carbon dioxide emitted per kilogram of the material. The higher the embodied energy and virtual water of a material, the less sustainable it is considered to be. It is important to consider the embodied energy and virtual water against the occupational water and energy use. For some products, the embodied energy can be equal to 10 – 15 years in operational energy consumption for homes.

Material	MJ/kg	$kgCO_2/kg$
CONCRETE	**0.95**	**0.13**
Bricks	3.0	0.22
Wood	8.5	0.46
Wood: Multilayer	15	0.81
Steel: virgin	35.3	2.8
Steel: recycled	9.5	0.43
Aluminium: virgin	218	11.46
Aluminium: recycled	28.8	1.69
Glass-fibre composites	100	8.1
Glass	15.0	0.85

Source: ICE version 1.6a Hammond G.P. and Jones C.I 2008 Proc Instn Civil Engineers

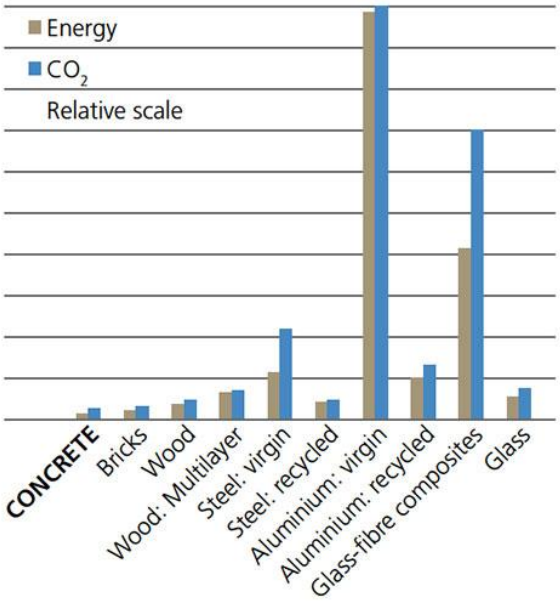


Figure 22: The embodied energy and related carbon dioxide emissions per common building material. These figures are from the USA market and therefore will be slightly different in South Africa. This, however, does provide an indicative embodied energy, especially when comparing materials.

Low carbon footprint

A 'carbon footprint' is a measure of the greenhouse gas emissions associated with an activity, a group of activities or a product. A good indicator of a high carbon footprint is a high embodied energy because, unless the material production process uses renewable or clean energy. South Africa derives the majority of its energy from greenhouse gas emitting sources such as petrol, diesel and low grade coal. Understanding the carbon footprint of a product or material can help developers make procurement decisions that reduce greenhouse gas emissions related to state-subsidised human settlements, thereby aiding in the mitigation of climate change.

Post-consumer recycled content

Recycled material is a valuable resource as it offers renewable access to non-renewable resources. This reduces the overall environmental impact of construction materials, as lower quantities of new materials need to be extracted. This, in turn, lowers the energy and water used and carbon emissions of building materials, and reduces the amount of waste going to landfill unnecessarily. Post-consumer recycled content refers to materials that were used previously, rather than off-cut material that is recycled within the manufacturing process. Common building materials which are recycled and reused include concrete, steel and timber, as described below. It is necessary to have an engineer sign-off on the use of post-consumer recycled construction materials and to make sure that, when specifying a minimum recycled content, the local market is able to supply it.

- Concrete: New concrete mixes can use recycled and crushed concrete as aggregate in place of stone. It is important to consider the use of recycled aggregate when an existing building on

site is going to be demolished. A suggested outcomes-based specification for concrete is that a minimum of 50% of aggregate is from previously used sources.

- Steel: Structural steel components and steel rebar used in reinforced concrete can contain high proportions of post-consumer recycled steel without undermining the strength of the material for construction purposes. Therefore, look to increase the percentage of recycled steel used in steel products, such as rebar, structural beams, window and door frames, etc. through specifying steel with a minimum post-consumer recycled content of 60%.
- Timber: When choosing timber products, either use recycled wood, reused wood, or wood that is from sustainably managed sources and certified by the Forest Stewardship Council (FSC) or the Programme for the Endorsement of Forest Certification (PEFC). This helps to protect natural forests and promote sustainable wood harvesting practices for this renewable resource.

Inspiring practice: Using material found on site in Ocean View BNG human settlements

The Ocean View project is located in the City of Cape Town and makes use of locally sourced material from the construction site where 543 homes have been completed. The site identified for human settlements had to be blasted to remove significant amounts of Table Mountain sandstone before it was suitable for construction. The rock blasted away was then stockpiled for use in the dwellings as an alternative to cement blocks for some of the external walls. This reduced the embodied energy of the houses and provided an opportunity to upskill community members in masonry construction techniques using natural stone. The need to blast the site was therefore seen as an opportunity with related positive environmental and social impacts.

http://static.wixstatic.com/media/e80af7_b35e0680328f40f396915a738929d69b.jpg/v1/fill/w_784,h_523,al_c,q_90,usm_0.66_1.00_0.01/e80af7_b35e0680328f40f396915a738929d69b.jpg

Local sourcing

Sourcing materials locally is beneficial to the environment as it reduces greenhouse gas emissions associated with transport and is beneficial to the economy as it creates local jobs as demand drives growth in the materials sector. A further benefit can be the creation of a unique aesthetic identity that is specific to the local culture and context.

The Department of Trade and Industry requires that a percentage of certain products are sourced locally, however this list does not yet include building materials. Furthermore, National treasury defines local sourcing in three tiers: within the municipality, within the province, and within South Africa. For the purposes of this green procurement design manual, building materials are considered to be sourced locally if they are extracted, harvested, recovered and manufactured within 400km of the construction site. To ensure even greater environmental benefits, the materials should be sourced within 50km of the site.

Key to the practice of local sourcing is understanding the local market and suppliers, and what resources are available to you, whether only for a single project or consistently.

Alternative/Innovative building technology and material

Alternative Building Technologies (ABTs) or Innovative Building Technologies (IBT) are defined by the NHBRC as,

> "Non-standardised (ABT/IBT) construction refers to any form of home construction which utilised building systems, methods, materials, elements or components which are not fully covered by existing standards and specifications or codes of practice and/or which are not described or referred to in the deemed-to-satisfy rules of the National Building Regulations."

The Western Cape Department of Human Settlements requires that all ABTs[3] must have an Agrement Certificate and will no longer accept a rational design as proof.

An alternative definition for ABTs to be considered is Sustainable Building Materials:

"Sustainable building materials can be defined as materials with overall superior performance in terms of specified criteria. The following criteria are commonly used:

- Locally produced and sourced materials
- Transport costs and environmental impact
- Thermal efficiency
- Occupant needs and health considerations
- Financial viability
- Recyclability of building materials and the demolished building

[3] The term ABT is inclusive of the term IBT, in this document.

- Waste and pollution generated in the manufacturing process
- Energy required in the manufacturing process
- Use of renewable resources
- Toxic emissions generated by the product
- Maintenance costs[4]"

As noted by the CSIR (van Wyk, 2015), IBT can generally de described by its materials, i.e., either light (steel frames) or heavy (concrete panels), and methods, i.e. either on site (mixing and erection of raw materials on the construction site) or offsite (factory-based fabrication).

The NHBRC, in collaboration with the CSIR, has developed a tool to assist developers when making a decision for an appropriate and applicable IBT system, from a NHBRC register of IBT available in South Africa. IBTs are categorised as follows:

Category	Definition
Classification A: Light Building System (LBS), steel structural frame	The superstructure of the IBTs in this classification category is similar to the light steel frame (LSF) construction that has emerged in South Africa in recent years as a viable alternative to standard brick and mortar constructions. The IBTs in this classification category are characterised by a load bearing steel structural frame complying with SANS 517: 2011 Light Steel Frame Building.
Classification B: Light Building System (LBS), steel structural frame, insulated foundations	Other than having insulated foundations, the building systems in this classification category are similar in all other respects to those falling into classification A above.
Classification C: Light Building System (LBS), panels, light weight concrete	The external wall of the IBTs in this classification category is characterised by lightweight, prefabricated concrete panels which are either interlocking or bolted to each other. Wall thicknesses may vary depending on climatic conditions and fire resistance requirements.
Classification D: Hybrid Building Systems	The superstructure of IBTs in this classification category is a complex mix of concrete, insulating materials, structural frames and cladding boards. The superstructure may comprise a structural frame which is assembled on site, clad internally and externally with building boards/insulating boards and the wall cavity is filled with in-situ cast concrete which may or may not be reinforced.

[4] http://www.sustainabledevelopmentnetwork.com/manual1/Chapter%203.pdf

Classification E: Heavy Weight Building System (HWS), building blocks	The superstructure of ABTs in this classification category is assembled from prefabricated dense concrete panels and posts or in-situ cast panels having a similar weight to dense concrete.
Classification F: Heavy Weight Building System (HWS), building blocks	The superstructure of IBTs in this classification category is assembled from prefabricated hollow or solid building blocks in a manner very similar to the erection of standard brick and mortar walls.
Classification G: Masonry construction	This category is the conventional masonry construction that is used as a benchmark.

Lessons learnt from procuring and making use of ABTs in Delft 3 and 5

The Delft 3 & 5 human settlements project, located in the City of Cape Town, included the construction of 1485 houses using alternative building technology. The business case made for the use of ABT in this project was to test the durability, cost effectiveness, environmental impact, appeal and acceptance of such technologies.

The business case for this project was not realised, as the complexities of this as a pilot project limited the benefits possible from the use of Alternative Building Technology. The key lessons learnt from this project include:

- A life cycle approach must be taken towards understanding the environmental impacts of any ABT pilot to look at embodied energy and maintenance costs too. For example, the prefabricated panels had to be transported from the factory in Gauteng, significantly negating any improvement in operational energy efficiency.
- Pilot projects that test new technologies should be smaller to start with (to build 150 houses rather than 2000) to test and showcase the product in the market and then scale up with the knowledge gained from that experience.
- The hidden costs and extended time lines of pilot projects need to be accommodated for sufficient learning to take place; this is both during the process and once the houses have been handed over (monitoring and evaluation).
- More care must be taken to ensure that the tender specifications for future ABT projects are sufficiently descriptive to match the desire of the Western Cape DHS to test innovative and new materials, technologies and construction systems.

ABTs are increasingly being considered in building construction due to offering the following properties, depending on the system:

- Dematerialisation

- Improved thermal performance
- Quicker construction

It is important to note that ABTs do not necessarily offer an improved environmental outcome and building performance in comparison to conventional building materials, especially when life cycle considerations are taken into account. The Agrément Certificate provided for ABTs certifies that the product has been tested against specific criteria; not that it is a green product. It is necessary to evaluate the Agrément Certificate provided to understand the performance of the ABT against a standard masonry house in terms of thermal performance. Further to this, it is important to consider the above mentioned concepts for sustainable material use for ABTs too.

Low to no Volatile Organic Compounds (VOCs) and Formaldehyde

Volatile organic compounds (VOCs) and formaldehyde are harmful substances used in paints, adhesives and sealants, carpets and flooring, and engineered wood products. These substances are linked to detrimental health effects, such as eye, nose and throat irritation, headaches, loss of co-ordination and nausea, as well as damage to liver, kidney and central nervous system. It is therefore suggested that only no- or low-VOC and no- or low-formaldehyde products should be used in the internal spaces of a house.

Eco-labels - Standards for green products and services available in South Africa

Ensuring that the products and materials procured for state-subsidised human settlements meet the desired environmental performance can be time consuming and difficult to undertake. It is therefore suggested to make use of eco-labels that offer an indication of the performance of the material or product. Eco-labels identify the positive environmental attributes of a product; that is the anticipated environmental impact of a product or material, predominantly focusing on the source of the material or the resource-efficiency it allows over its life cycle. However, these labels will not give explicit information on product components or standards, but rather indicate if products meet the criteria set for standards. Not all eco-labels are of equal standing; therefore, it is important to understand the strengths and weaknesses of each label.

There are three categories of eco-labels in South Africa, as set out by the International Organisation for Standardization (ISO), with the range of standards available increasing as their use gains traction in the construction industry: ISO 14024 -Third Party - (Type I environmental labelling with a focus on whole life cycle analysis); ISO 14021- Self-declared environmental claims (Type II environmental labelling); and ISO 14025- Environmental Product declarations - (Type III environmental declarations). Third-party certification is preferable as it reduces the likelihood of presenting false claims.

It is important to note that, at this time, not many suppliers have undertaken to certify their products and/or materials. It is therefore necessary to phase in the specification of eco-labels with it being an advantage in functionality at first and, once sufficiently wide-spread in the market, to make this is a

compulsory requirement for specific product and materials identified. Furthermore, as per the Department of Public Works' Green Building Policy, there is a process currently underway to develop government-recognised eco-labels for building and construction materials and products.

The information below has been drawn from: www.ecospecifier.co.za. This is a valuable source of information regarding green materials and products available in the building and construction industry in South Africa. EcoSpecifier offers a tool to help specify appropriate and greener materials or products. Further to this, is the GreenCape Green Building Material Catalogue undertaken in 2015 for materials that aid in compliance with the SANS 204 and SANS 10400:XA regulations. This can be found at: http://greencape.co.za/assets/Green-Building-Material-Catalogue-Final.pdf

Examples of third-party certified eco-labels in South Africa applicable to state-subsidised human settlements

EcoStandard EcoProduct: EcoStandard South Africa has developed an eco-label referred to as EcoProduct for building materials. The assessment and rating is based on a lifecycle assessment approach in terms of the ISO14024 Environmental labels and declarations — Type I environmental labelling — Principles and procedures in order to provide a holistic assessment of a building product. For more information: http://www.ecostandard.co.za/

Global GreenTag Certified: Green Tag™ is a third party, green building product rating and certification system, underpinned by rigorous scientific and Life Cycle Assessment (LCA) processes. The Green Building Council of South Africa makes use of this eco-label. GreenTag's LCARate programme assesses the overall sustainability of products across a range of categories compared to a worst case 'Business as Usual' product. This includes consideration of greenhouse gas emissions; health and eco-toxicity; life cycle analysis; social responsibility and labour conditions; synergy: making products more efficient; and biodiversity. It awards products on four levels, Bronze, Silver, Gold and Platinum. For more information: http://www.globalgreentag.com/

ISO 14001 Certification: An EMS (environmental management system) meeting the requirements of ISO 14001 is a management tool enabling an organisation of any size or type to:

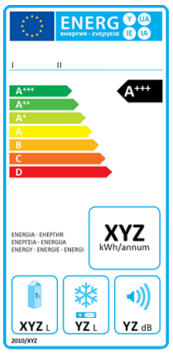
- identify and control the environmental impact of its activities, products or services;
- improve its environmental performance continually; and

- implement a systematic approach to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved.

ISO 14001 does not specify levels of environmental performance. The intention of ISO 14001 is to provide a framework for a holistic, strategic approach to the organisation's environmental policy, plans and actions. ISO 14001 gives the generic requirements for an environmental management system. Construction companies can be ISO14001 certified. For more information: http://www.iso.org/iso/catalogue_detail?csnumber=60857

Energy Star USA: ENERGY STAR is a voluntary USA government-backed programme dedicated to helping individuals protect the environment through energy efficiency. The ENERGY STAR mark is the USA's national symbol for energy efficiency, making it easy for consumers and businesses to identify high-quality, energy-efficient products, homes, and commercial and industrial buildings. ENERGY STAR distinguishes what is efficient or better for the environment without sacrificing features or performance. Products that earn the ENERGY STAR mark reduce greenhouse gas emissions by meeting strict energy-efficiency guidelines set by the U.S. Environmental Protection Agency. For more information: https://www.energystar.gov/

EU Energy Label: The EU energy label is designed to provide consumers with accurate, recognisable and comparable information on domestic household products regarding energy consumption, performance and other essential characteristics. It allows consumers to identify how energy efficient a product actually is and to assess a product's potential to reduce energy costs. All the information the label contains is based on test standards prescribed in European Legislation. The label initially classified products from G up to A+++, with A+++ being the most efficient energy class and G the least efficient. For more information: http://www.newenergylabel.com/uk/purpose



FSC Certification: The Forest Stewardship Council (FSC) is an international, not-for-profit, membership-based organisation with a mission to promote environmentally appropriate, socially beneficial and economically viable management of the world's forests. There are three types of FSC Certification: FSC 100% - Products only contain material from FSC Certified forests that meet the environmental and social standards of FSC; FSC Mixed sources - Products with material from FSC certified forests, recycled material or other controlled sources; and Recycled Products only contain post-consumer material and may include some pre-consumer material content. For more information: https://africa.fsc.org/en-cd

PEFC Certification: The Programme for the Endorsement of Forest Certification Schemes (PEFC) is a not-for-profit, membership-based, non-governmental

organisation with a mission to promote sustainable forest management globally. PEFC promotes Sustainable Forest Management through 30 PEFC endorsed national certification systems which provide localised management and priorities. Under PEFC certification, the chain of custody of forests is tracked back through the supply chain to verify the management of forests. For more information: http://www.pefc.org/

Opportunities to make better choices in current material specifications

Drawing from the Western Cape's 2014 Norms and Standards for Housing, the table below lists the most common materials used in a state-subsidised house and indicates which of the sustainable building material principles is most appropriate to apply. Furthermore, the order in which these are listed is arranged with the most strategic materials for an improved environmental impact at the top of the list.

Material/Product	**Dematerialisation**	**Low embodied energy and virtual water**	**Low carbon footprint**	**Post-consumer recycled content**	**Local sourcing**	**Alternative building material and technology**	**Low to no VOCs or formaldehyde**
Concrete blocks (140mm and 90mm)	X	X	X	X	X	X	
Concrete	X	X	X	X	X		
Plaster		X	X		X		
Gypsum plasterboard as ceiling board	X	X	X	X	X	X	
Mortar – cement		X	X				
Sand					X		
Insulation: glasswool/polystyrene	X	X	X	X	X	X	
Wall ties		X	X	X			
Rebar		X	X	X			
Damp proof membrane and damp proof course		X	X	X			
Piping - polycop	X	X	X	X	X		
Hardwood doors		X	X	X			X
Hollow core Masonite and clad doors		X	X	X			X
Fascia and barge board		X	X	X			X
Mortar - lime					X		
Carbolinium (creosote)						X	

Prepaid meters and cabling					X		
Hoop iron				X			
Silicone for sealing							X
Wall paint and varnish							X
Brick force		X	X	X			
Stainless steel sinks		X	X	X			
Pressed steel doorframes		X	X	X			
Timber purlins and beams		X	X	X	X		
Galvanized steel roof sheeting				X		X	
Sanitaryware					X		
Taps and showerheads					X		

Improved Construction Processes

This section of the design manual details the green procurement actions that can be undertaken within the construction phase of a building. Once a human settlements project reaches site and construction begins, many direct environmental impacts are experienced. Green procurement decisions taken in preparation of and during this stage can help mitigate the impact of constructing the building on both the local and global environment and have positive socio-economic benefits.

Mitigate the environmental impact of the construction process

Good environmental management planning and practices on site:

- An Environmental Management Plan (EMP) to stipulate controls and measures for environmental protection and reduced degradation of the site, especially with regard to water, soil, existing vegetation, and pollution.
- A Waste Management Plan (WMP) to monitor waste streams on site and, where possible, to ensure that reuse and recycling of construction waste takes place. This is to reduce the amount of waste going to landfill.
- A Demolition Plan (where applicable) to plan for and allow for the reuse of building elements, such as windows and doors, and recycling of building materials, such as concrete and steel rebar. This is to reduce the amount of waste going to landfill and reduce the embodied energy of materials used in the new project.

Protect top soil: Top soil is a valuable resource as it is the most nutrient rich and healthy soil that can support agriculture and biodiversity. During construction, care should be taken to conserve as much of the existing top soil as possible. This can be stockpiled and reused on site later (preferred) or it can be carefully harvested and used on a different site (rather than sending it to landfill).

Rehabilitate land damaged by construction activities: Construction is a high impact activity and even the most careful contractor is going to have some negative impact on the site through construction activities. Time and budget should be allocated to enable rehabilitation of the damaged land once construction is complete.

Reduced resource consumption

Sustainably sourced, reused or recycled shutterboard: Specify the use of construction timber products, such as shutterboard as formwork for concrete, to be made of recycled wood, reused wood or wood which is from sustainably managed sources and certified by the Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC).

Implement site energy efficiency and demand management initiatives: The following construction practices can contribute towards a reduction of energy demand during construction and result in operational cost savings to the contractor:

- Use energy efficient light fittings and equipment on site and in site offices. Installing motion detectors in site offices can be a useful tool to prevent wasteful use of lighting.
- When working at night or in darkened areas of the site or building, ensure that only sections that need to be illuminated for work or safety reasons are lit with targeted lighting.
- Ensure that all distribution boards are clearly labelled and metered to monitor and manage energy use. Investigate and respond to any spikes in use or the use of electricity at times when the site should be unoccupied as this might demonstrate machinery running unnecessarily.

Implement site water efficiency and demand management initiatives: It is necessary to reduce water demand through the use of water-wise practices and water-efficient features on site. These strategies can include installing water-efficient and low flow rate taps and showers, and ensuring the water is used only when needed – hoses and taps are not left to run unnecessarily.

Implement on-site water management strategies: The construction of buildings can cause damage to local water systems through dumping waste in or next to rivers and wetlands, bulldozing or using hydrologically sensitive areas for construction purposes, and from runoff from the site containing excess pollutants. It is therefore necessary to adopt an environmental management plan which stipulates the following practices for water:

- No leaking taps or hoses on site.
- Sufficient, well-marked and enclosed waste holding areas (bins/skips) and toilet facilities to prevent the spread or leakage of waste from the site which could pollute local water bodies.
- Washing of cement mix and paint brushes to take place in designated settling tanks where the particulate can be separated and disposed of suitably. No cement water to be allowed to seep into the ground.

- Ensure all hazardous wastes and materials (such as motor oil) are in sealed containers to prevent the spread or leakage of waste from the site which could pollute local water bodies.

Continuing the positive environmental impact

The daily practices and choices that beneficiaries make are important for achieving the improved environmental impact desired in the planning and design of the project. In order to continue the resource efficiency, resource savings and improved environmental impact, beneficiaries will need to be educated on what they can do and how they can make better choices while living in these homes.

This section of the design manual offers operational tips for continuing the positive environmental impact for which the planning and design laid the foundations for. This can be used as part of a Home Owners Education Programme and be developed further into an easy-to-read brochure.

Title: Making better choices to save money and the environment

Introduction

Congratulations, the house you now own has been designed with you and the environment in mind throughout the planning and design of this project. This has been done to save you money, to have a less harmful impact on the environment, and help prevent climate change. The [Western Cape Department of Human Settlements/the municipality] is proud to present this brochure that will help you make better choices to ensure that you achieve the water, energy and waste savings and related cost benefits made possible by this project. By allowing this brochure to guide the actions you take and the choices you make, you are contributing to more sustainable human settlements in the Western Cape.

Around the world, residents use resources, such as energy and water, and generate waste in their homes and through their daily activities. This is directly related to the emission of greenhouse gases that cause global warming and the modification of important ecological systems that support life on Earth. There are small actions that all residents can take to reduce the amount of resources they use to ensure that future generations have resources to use and a safe, healthy planet to live on.

This brochure provides a few of the first steps to making better choices in your home and daily activities to save you money and help reduce your environmental impact.

Using less energy

Using less electricity can save you money and help the environment as less greenhouse gases are emitted from coal power stations. Using less energy also means considering how to use less petrol, paraffin, coal and wood in your home and in daily activities.

Fact: Most of South Africa's energy comes from coal. South African coal is low grade and large amounts of carbon dioxide (CO2) are released into the atmosphere when it is burned. South Africa produces about 8 tons of CO2 per person each year. This is twice as much as the global average of 4 tons/person. The rest of Africa only produces, on average 1,1 tons of CO2 per person each year.

- Heating your home

  To make the most of the winter sunshine, open the curtains and allow the sunlight and heat into your living area. The sunlight will then heat the floor and room. Make sure that there is no carpet or floor covering to allow more heat to be absorbed by the floor. This heat is then released at night when it is cooler. To make sure this heat is kept within your home, close the curtains at night. Doing this should reduce the number of nights you need to use a heater in your home.

  If it is still cold, put on more clothes, use a blanket or make a hot water bottle, as this is a more efficient way to get warmer rather than turning on a heater. However, if you do still need a heater and it uses gas or paraffin, remember to always have a window open in the room to allow fresh air in, so extra moisture and harmful gases out to keep you and your family healthy.
- Lighting

  Switch off all lights in a room that is not in use.

  Make use of sunlight to light rooms up during the day, open your curtains or use mesh or gauze curtains.

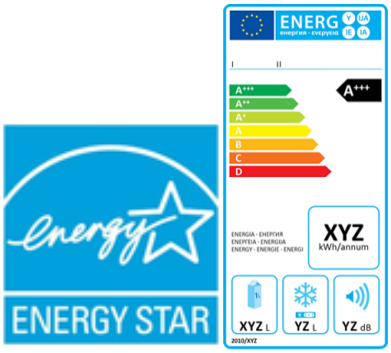
  When replacing light bulbs make sure that you save up to buy energy efficient bulbs, such as Compact Fluorescent Lights (CFLs) or Light Emitting Diodes (LEDs). While these are more expensive than incandescent bulbs, they use up to 80% less electricity and last longer. This will save you money as the light uses less electricity and does not need to be replaced as often.
- Cooking

  Using a wonderbag or fabric stored heat cooker can save you energy while preparing food. This is done by placing a pot with partially cooked food into the wonderbag where it will continue to cook using no extra energy. A wonderbag can be purchased or you can create your own with polystyrene foam balls or hay by following the steps found at: http://sustainablog.org/2014/06/slow-cooking-without-electricity-diy-plans-hay-boxes-wonderbags/
- Washing clothes

  If using a washing machine, wash your clothes on 30 degrees or using cold water. Only a very dirty load needs to be washed at higher temperatures.
- Appliances

Switch off all appliances at the wall, as these draw electricity even when not in use.

Look to buy appliances that are certified to use less electricity, such as EnergyStar or EU Energy Labels, which will save you money as you use them compared to non-energy efficient appliances.



- Heating water

  Heating water can use a lot of electricity or energy. To save money on electricity, only boil as much water as is required when boiling a kettle or pot of water. Also, take shorter and/or cooler showers and baths to use less hot water.

- Walk or cycle rather than drive

  Walking and cycling to your destination can save you money on transport costs and reduce the amount of carbon emissions from petrol vehicles to help reduce the impact of climate change. It can also make you healthier.

  If it is unsafe or not possible to walk or cycle to daily destinations, consider arranging a carpool with your neighbours and speaking to your local ward councilor and mayor to allocate funding for safer pedestrian and cycling routes.

Using less water

Using less water can save you money by making the most of the free basic allowance of 6 kilolitres of water per household per month.

- Personal Hygiene

  Take a shower instead of a bath and aim to keep showers short, less than five minutes.

  Switch the tap off while brushing your teeth or washing your hands with soap.

- Watering your garden

  If you have a garden or vegetable patch, do not water it between 10:00 in the morning and 4:00 in the afternoon. This is the hottest time of the day and when the rate of evaporation is highest.

  If you have a water-wise garden or plants that grow naturally in the area in your garden, you will not require additional watering.

  Cover any open soil with mulch (pieces of broken bark and twigs) to help the soil hold water for longer.

- Flushing the toilet

If your toilet is dual flush, make sure to use only the appropriate flush size.

If your toilet is not dual flush, consider placing a one-litre bottle filled with water or a brick inside the toilet cistern. Do this carefully so as to not damage any part of the cistern. This will significantly reduce the amount of water used per flush.

No foreign or solid objects, such as ear buds, golf balls and medicine containers, should ever be thrown down the toilet. These items block and seriously damage sewer pipes, which are costly to repair and will waste water if they burst.

- Rainwater tanks

  If you have a rainwater tank installed, ensure that the lid is securely fastened to prevent debris, sunlight or pests from entering the tank. This water can always be used for non-potable purposes such as washing clothes and cars and cleaning the house. Test the water before using it to prepare food, drink or wash yourself or others.

  Ensure that your gutters are kept clean to prevent animal droppings, pests or debris from flowing into the tank.

- Water leaks

  Regularly check that there is no water leaking from pipes in and around your house. If not visible, this can be tested by looking at your water bill from the municipality. If it is far higher than normal, there could be a leak in a water pipe in your house.

  If you see a large water leak in the street from a burst pipe, contact your local municipality as soon as possible to fix it to prevent water being wasted.

Creating less waste

The municipality encourages you to have a three-bin system at home to separate waste and make the most of waste as a resource rather than sending it to landfill. Collecting, separating and recycling waste can provide an extra source of income if it is sold to a local recycling company. These bins would be for:

- Recycling: This includes items such as plastic, glass bottles, paper and tin cans that are clean and can be recycled to be used once again in a similar or different form or product.
- Organic waste: Items such as fruit and vegetables, tea bags, egg shells and other organic products should go into a compost heap or worm farm in the garden. Compost is a nutrient-rich soil that can help your vegetables and plants grow better.
- Landfill Waste: This is household waste that cannot be recycled or composted, or is contaminated and will be sent to the municipal landfill where it will stay for many decades to come.

If you do not yet have kerbside recycling collection available to you in your neighbourhood or do not have a local recycling collection point, consider speaking to your neighbours and lobbying your local ward councillor and mayor to implement an appropriate recycling system in your neighbourhood or municipality.

Procuring better choices: implementing and operationalising green procurement

Essential to the successful implementation of green procurement is the inclusion of related policy objectives and desired performance criteria in the procurement process and tender documentation. There are numerous opportunities within current procurement processes to improve the environmental impact, and related social and economic benefits, of state-subsidised human settlements. The approach to procuring better choices is therefore to embed environmental and social considerations into existing procurement systems and documentation instead of developing a parallel green procurement process and documentation. This section builds on and concludes 'Making Better Choices'. It demonstrates the ways in which environmental and social considerations and objectives can be prioritised and implemented in the procurement strategy, tender documentation and the evaluation of tenders.

Prior to implementing green procurement all relevant departments, such as supply chain management, human settlements, infrastructure services, and town planning, should be familiarised with these guidelines, the business case for and the benefits of green procurement in state-subsidised human settlements, and the resources available to support implementation.

Green procurement can be achieved through implementing both supply side measures and demand side measures. Both of these are discussed in these guidelines, however the greatest focus is placed on demand side measures as developers, such as the public sector, have greater direct influence on demand, rather than supply. Supply side measures are those actions that assist change in what the market is able to provide. This includes, but is not limited to, research, training and encouraging service providers and officials to adopt greener practices, and identifying manufacturers of "green" products. Demand side are those actions that assist change in what a developer of state-subsidised human settlements requires. This includes, but is not limited to, changes in specifications, procurement requirements, legislation, tender and contract requirements etc.

This green procurement manual provides the following information and assistance for procurement undertaken in terms of 16b of the Western Cape Infrastructure Delivery Management System:

Section 1: Implementing green procurement in state-subsidised human settlements

- Commit to the process, and secure political support, by adopting policies that include green procurement objectives with clear definitions and targets appropriate to your municipality.
- Set priorities for human settlements by taking into account local climate and context and by consulting 'Making Better Choices' and local residents and stakeholders.
- Put in place information, training and monitoring activities to ensure the objectives stated in policy are achieved.

Section 2: The Procurement Process

- Understand how green procurement fits into the existing legislative framework and procurement processes available.
- Get an overview of the products and services available in the market, especially within your municipality, by engaging suppliers and undertaking a market analysis.

Section 3: Defining the specifications and the terms of reference

- When tendering, define the objectives and technical specifications for contracts in a way which takes into account environmental impacts throughout the life-cycle of the goods, services or works you are buying, and consider using labels and existing standards to define your requirements.
- Apply objective functionality criteria based on environmental technical capacity or environmental and supply chain management measures.
- Set award criteria which encourage tenderers to deliver even higher levels of environmental performance than those you have specified, and apply these in a transparent way.
- Set contract performance clauses which underline the environmental commitments made by contractors, and provide appropriate remedies where they fall short. Ensure there is a system for monitoring these commitments and that they are also applied to subcontractors

Section 4: Evaluating and awarding tenders

- Make use of functionality scoring (quality) in final evaluation score of tenders
- Understand how to apply Method 3 and Method 4 appropriately

Section 1: Implementing green procurement in state-subsidised human settlements

In order for green procurement to be systematically implemented and enabled to achieve improved environmental and social outcomes from state-subsidised human settlements, it is necessary to lobby for its inclusion in the supply chain management policy and other relevant policies. This is discussed in greater detail in 'Enabling better choices: Green procurement in provincial and municipal policy'. While it is possible to implement green objectives without doing so, by adopting these changes in policy, it means that green procurement has political support from the municipal council and gives greater certainty to the market to invest in green services and goods. Both of these will eventually make green procurement the norm, rather than an exception that is restricted to pilot projects.

Setting green procurement priorities

Essential to this process is determining the municipal green priorities. These will be determined by the characteristics of the local context, such as the climate, culture, and other sector priorities including,

but not limited to, infrastructure services and local economic development. It is suggested that the process for the prioritisation of the green principles be incorporated into the broader IDP and SDF public participation processes, rather than on a project-by-project basis. This will help to further the reach of green procurement, over time, beyond state-subsidised human settlements to high income settlements and other municipal functions.

Training and monitoring and evaluation

To ensure that officials are prepared and able to implement green procurement, it is necessary to make this information on green procurement available to all municipal officials, along with identifying opportunities and budgeting for training. It is also necessary to establish a system of monitoring and evaluation to determine whether these goals have been achieved. It is important to identify who will undertake this monitoring and evaluation and consider how it can be incorporated within existing processes in the municipality. The table below provides a few of the key aspects for monitoring and evaluation to allow the municipality to build on the knowledge of green procurement and its implementation in each project.

Monitoring and Evaluation Consideration	**Response**
Name of project	
Location	
Project Land Area	
Number of units	
Size of units	
Housing typology of units	
Gross density achieved	
Housing subsidy used	
State any external or unusual sources of funding	
Project partners (organisations/institutions involved)	
Motivation for the project/Business Case (principles of green procurement incorporated)	
Was the business case achieved? Provide reasons for this	
List specifications specific to green procurement	
Were these specifications effective for achieving the project business case	
Describe the procurement process	
Describe level of community acceptance and process by which this was achieved	

Describe the lessons learnt from this project that can be used to improve future projects	
Documentation to provide	
Provide photos: inside of unit, external view of unit, site	
Full set of site and unit As Built drawings	
A full Bill of Quantities measured in accordance with the Standard System for Measuring Building Work and overall project costing	

If this template is used for all human settlements projects undertaken, it will provide a valuable evidence base for future decision-making with regard to green procurement. It will also allow municipalities and provincial government to compare projects against one other and understand the factors that lead to success or failure and to appropriately adapt approaches and policies.

Section 2: The Procurement Process

Green procurement within the current legislative framework

There are a range of acts, policies and regulations that have been developed to guide and govern the procurement process; this includes the Public Finance Management Act, Municipal Financial Management Act, Preferential Procurement Policy Framework Act and Regulations, Construction Industry Development Board Act, Regulatory Framework for Supply Chain Management, and the National Treasury Regulations.

In particular, the Preferential Procurement Policy Framework Act and Regulations (PPPFA and PPPFR) can be leveraged as an instrument of socio-economic change to go beyond B-BBEE and use preferential procurement as a tool to achieve broader environmental, social and economic outcomes, with a focus on local small, medium and micro-sized enterprises. The two-phased approach for evaluating tenders, as permitted in the 2011 amendment of the PPPFA, allows bid adjudication committees to reject tenders that do not meet the set functionality and/or eligibility criteria. This can be leveraged for green procurement as only those bids that meet the environmental considerations set out in the functionality and/or eligibility criteria can be awarded a tender.

> In policy and legislation, it is evident that there are opportunities for the implementation of green procurement, rather than a prevention of it, as is often thought.

Procurement strategy to incorporate green objectives

A procurement strategy describes the ways in which goods, services and construction works will be procured from suppliers. This is to be guided by the Standard for Infrastructure Procurement and Delivery Management (SIPDM) when procuring for human settlements projects, as of 1 July 2016 for provincial government and 1 July 2017 for municipalities. When implementing green procurement,

the procurement strategy chosen will determine when and how environmental and social considerations can be incorporated into tenders.

The SIPDM sets out the processes for the establishment of a procurement strategy; this includes:

- Procurement Procedures: SANS 10845-1 defines procurement procedures as "the selected procedure for a specific procurement". The procurement procedures is the methodology or approached adopted on how offers are solicited.
- Packaging strategy: SANS 10845-1 defines the packaging strategy as "*the organisation of work packages into contracts*". The packaging strategy needs to consider the aggregation of demand, where possible, in order to promote the efficient use of resources.
- Contracting strategy: The contracting strategy as defined in SANS 10845-1 is the "*strategy that governs the nature of the relationship which the employer wishes to foster with the contractor, which in turn determines the risks and responsibilities between the parties to the contract and the methodology by which the contractor is to be paid*".
- Pricing strategy: SANS 10845-1 defines a pricing strategy as the "*strategy which is adopted to secure financial offers and to remunerate contractors in terms of the contract*".
- Targeting Strategy: According to SANS 10845-1, a targeting procedure is "*the process used to create demand for the services or goods (or both) of, or to secure the participation of targeted enterprises and targeted labour in contracts in response to the objectives of a secondary procurement policy*".

To achieve the objectives of green procurement, each of the strategies will need to be considered based on the priority objectives, the desired outcomes of a project, and the current market conditions. The section below describes how each of these strategies can be used to achieve the environmental, social and economic benefits of green procurement.

Procurement Procedure

The choice of a procurement procedure determines how the market is approached by a developer. Depending on the desired outcomes of the project, the procurement procedure can vary in the degree of openness to the market. This can assist a developer, especially when there is a need to target a specific group of suppliers for innovative approaches or products. All procedures for state-subsidised human settlements must be competitive, with the following options available to developers, with the related considerations for green procurement stated:

Procedure	**Description**	**Key Principles and Considerations for Green Procurement**
Competitive Selection Procedure	Any procurement procedure in which the contract is normally awarded to the contractor who submits the lowest financial offer or obtains the highest number of tender evaluation points	

A	Nominated procedure	Tenderers that satisfy prescribed criteria are entered into an electronic database. Tenderers are invited to submit tender offers based on search criteria and, if relevant, their position on the database. Tenderers are repositioned on the database upon appointment or upon submission of a tender offer	This procedure is suitable in circumstances where specific criteria or resources are required e.g. accredited Green Star professionals
B	Open procedure	Tenderers may submit tender offers in response to an advertisement by the developer to do so	The use of functionality criteria under this procedure allows the introduction of green objectives in the procurement process
C	Qualified procedure	A call for expressions of interest is advertised, and thereafter only those tenderers who have expressed interest, who satisfy objective criteria and who are selected to submit tender offers, are invited to do so	This procedure is suitable for calling for suppliers of green products and technologies to register on the relevant database of the organ of state
D	Quotation procedure	Tender offers are solicited from no less than three tenderers in any manner the developer chooses, subject to the procedures being fair, equitable, transparent, competitive and cost-effective	This type procedure is suitable under a framework agreement, especially for repetitive routine work such as maintenance and repair, in order to obtain more competitive prices
E	Proposal procedure using the two-envelope system	Tenderers submit technical and financial proposals in two envelopes. The financial proposal is only opened should the technical proposal be found to attain the minimum threshold score	This procedure is suitable where new green technologies and innovations are being investigated
F	Proposal procedure using the two-stage system	Non-financial proposal are called for. Tender offers are then invited from those tenderers who submit acceptable proposal based on revised procurement documents. Alternatively, a contract is negotiated with the tenderer scoring the highest number of evaluation points	This procedure is suitable where new green technologies and innovations are being investigated
G	Shopping procedure	Written or verbal offers are solicited in respect of readily available goods obtain from three sources. The goods are purchased from the source	This procedure is more suitable for 'off the shelf' type goods and not necessarily appropriate for construction contracts

		providing the lowest financial offer once it is confirmed in writing	
H	Confined market procedure	Tenderers are invited from a very limited number of contractors who are able to provide goods, services or works which are not freely available in the market or which are provided solely for the developer in accordance with unique requirements	This procedure may provide better value for money than a negotiated procedure as there is more competition
Competitive Negotiation Procedure	A procurement procedure which reduces the number of tenderers competing for the contract through a series of negotiations until the remaining tenderers are invited to submit final offers		
A	Restricted competitive negotiations	A call for expressions of interest is advertised and thereafter only those tenderers who have expressed interest, who submit tender offers, are invited to do so. The developer evaluates the offers and determines who may enter into competitive negotiations	This procedure is suitable where new green technologies and innovations are being investigated.
B	Open competitive negotiations	Tenderers may submit tender offers in response to an advertisement by the developer to do so. The developer evaluates the offers and determines who may enter into competitive negotiations	The use of functionality criteria under this procedure allows the introduction of green objectives in the procurement process

Learning from Delft 3 & 5 Precinct – Procuring Alternative Building Technology

The tender was advertised as a 'develop and construct' contracting strategy that made use of a 'qualified or two-step' procedure. This meant that a call for expressions of interest was advertised, and thereafter only those tenderers who have expressed interest, satisfy objective criteria and are selected to submit tender offers, were invited to do so.

This allowed the developer to engage and evaluate with a smaller set of bidders, who were known to be competent for the work as they had achieved objective criteria stated in the Expression of Interest.

The Terms of Reference allocated a number of points to personnel, experience, and the enhancements to the project that the service provider was willing to provide within the project budget. The tender provided a list of possible enhancements to be considered with an associated points weighting. The purpose of including and scoring these enhancements was to incentivise contractors to improve the product provided by increasing their functionality score, if

Framework Agreements as a Packaging Strategy

Framework agreements can be beneficial when considering a packaging strategy that will promote green procurement aims and objectives, while increasing the efficiency of the tendering process. According to the Standard for Infrastructure Procurement and Delivery Management, a framework agreement is defined as "an agreement between an organ of state and one or more contractors, the purpose of which is to establish the terms governing orders to be awarded during a given period, in particular with regard to price, and where appropriate, the quantity envisaged." Framework agreements allow the employer to execute work on an as-instructed basis over the term of the agreement.

Framework agreements are therefore appropriate for green procurement in state-subsidised human settlements as it provides flexibility in the awarding of contracts, has the ability to pool demand from various departments or authorities, and promotes resource efficiency (reduces the need for advertising, paper consumption, administration costs, etc.). Furthermore, framework agreements have the ability to incentivise suppliers to offer greener solutions. This is due to the potential to be awarded multiple contracts over the framework agreement period, thereby recouping any additional expense due to implementing these solutions.

Although framework agreements are mainly used for construction repair and maintenance contracts for rental stock, they can also be used for professional service contracts and for construction capital works projects. With regard to larger capital works projects, it must be borne in mind that there are a limited number of large construction companies with the required CIDB

grading and therefore smaller construction companies may be excluded. However, this may be overcome through targeting strategies such as mandatory subcontracting, contracting obligations, etc. that can be built into the conditions of contract for the framework agreement.

Contracting Strategy

There are various contracting strategies available for implementation, with the choice of a strategy often being specific to the circumstances of each project. The most regularly used strategies are Design by Employer, Develop and Construct, and Design and Construct.

Contracting Strategy	Description	Key Principles and Considerations for Green Procurement	
		Pros	**Cons**
Design by Employer	Contract under which a contractor undertakes only construction on the basis of full designs issued by the employer. (Design is a separate function to construction and is managed by the client or his agent.)	The developer has a greater degree of control and can directly influence the design to ensure that green procurement aims are met	Less collaboration with contractor as design is separated from construction and therefore fewer opportunities for innovation
Develop and Construct	Contract based on a scheme design prepared by the client under which a contractor finalises the production information and constructs it. (The final design details are integrated with construction and are managed by the contractor.)	Allows for greater collaboration with the contractor which may create more opportunities for innovation	The developer has a lesser degree of control in comparison to design by employer (design and performance criteria must therefore be clearly stipulated in the bid documents).
Design and Construct	Contract in which a contractor designs the works based on a brief provided by the client and constructs it. (Design is integrated with construction and is managed by the contractor.)	The overall project delivery time is reduced which may contribute to a reduction in resource usage	The developer has a lesser degree of control in comparison to design by employer (design and performance criteria must therefore be clearly stipulated in the bid documents).

The selection of a contracting strategy needs to be framed within the primary objective of human settlements delivery, the secondary objective of green procurement, and the municipality's capacity for execution. In the context of green procurement the contracting strategy should ideally aim to:

- Easily manage and monitor the achievement of green objectives and priorities, such as resource efficiency and thermal performance;

- Shorten project delivery times, without comprising opportunities to achieve secondary objectives, such as job creation;
- Simplify contractual relationships;
- Maximise collaboration between project stakeholders;
- Create opportunities for innovation; and
- Allow for the evaluation of bids offered based on whole life value.

Pricing Strategy

For green procurement, the pricing strategy needs to be considered as a tool to ensure the achievement of the green objectives. The pricing strategy is directly linked to the contracting strategy and the level of involvement of the developer. Pricing strategies are either cost-based or price-based. For green procurement, it is suggested that price-based strategies are used to allow for a more competitive bidding process, improved cost containment, to ensure that project activities or objectives are monitored, and where payment is only received once objectives are achieved. The pricing strategy is an important determinant of the relationship between the developer and the contractor and whether innovation is allowed in the project process, especially when engaging with unforeseen problems to be solved. These strategies include:

Pricing Strategy	**Description**	**Key Principles and Considerations for Green Procurement**
Lump sum	Contract in which a contractor is paid a lump sum to perform the works. (Interim payments which reflect the progress made towards the completion of the works may be made.) Typically used in Design and Construct contracts.	Lump-sum contracts are generally easier to manage than other conventional contract types and may therefore lead to a reduction in resource usage. Can foster a greater degree of collaboration among the developer, professional team and the contractor and therefore opportunities for innovation can be maximised. The developer needs to have a higher level of involvement in the process in order to ensure that green specifications and objectives are adhered to as the contractor is working to a fixed price may compromise on quality.
Bills of Quantities	Contract in which a bill of quantities lists the items of work and the estimated / measured quantities and rates associated with each item to allow contractors to be paid, at regular intervals, an amount equal to the agreed rate for the work multiplied by the quantity of work actually completed. (A bill of quantities is prepared in accordance	The design needs to be sufficiently detailed before the bill of quantities can be produced thereby leading to longer project timelines and therefore this may lead to a reduction in resource usage. The degree of collaboration among the developer, professional team and the contractor is limited as the design is finalised or at an advanced stage before the contractor is appointed and therefore there may be fewer opportunities for innovation.

	with a standard system of measurement.)	
Price List / Price Schedule (Schedule of Rates)	Contract in which a contractor is paid the price for each lump sum item in the Price List / Schedule that has been completed and, where a quantity is stated in the Price List / Schedule, an amount calculated by multiplying the quantity which the contractor has completed by the rate.	Provides flexibility in terms of scope of work and if used in the context of a framework agreement, demand can be pooled and this could lead to a more efficient use of resources. A detailed design is not required at tender stage and therefore project timelines can be shortened and this lead to a reduction in resource usage.
Activity Schedule	Contract in which the contractor breaks the scope of work down into activities which are linked to a programme, method statements and resources. Each activity is priced as a lump sum, which is paid on completion of the activity. The total of the activity prices is the lump sum price for the contract work.	Contract administration may be easier and may therefore lead to a reduction in resource usage. A clear statement of the scope of work and specifications is required in order to ensure that green specifications and objectives are adhered to by the contractor.

Targeting Strategy

Targeting strategies can be used to the advantage of green procurement through incentivising or obligating suppliers to adhere to the green project objectives through functionality criteria, incentive payments, conditions of contract, and mandatory requirements. It is the choice of the developer to make use of one of these strategies or a combination. As the market matures and green procurement becomes the norm, the targeting strategy can transition from incentivising the adoption of green procurement principles to requiring it as compulsory for consideration of a bid.

Targeting Strategy	Description	Key Principles and Considerations for Green Procurement
Evaluation Points	Give a weighting to environmental, social and economic policy objectives along with the usual project criteria, such as quality, which are scored at the short-listing stage or the admission to a database.	Amend to include environmental objectives and related weightings

Incentives for KPIs	Incentive payments are made to contractors should they achieve a specified target (key performance indicator) associated with a social or economic goal in the performance of a contract.	Environmental performance goals and the measurement thereof to be stipulated in the contract data
Mandatory Subcontracting	Require contractors to invite competitive tenders from targeted enterprises for specified portions of the works in terms of a specified procedure and specific forms of subcontract. Upon the award of the contract, the sub-contractor becomes a domestic subcontractor.	The use of targeted enterprises/local subcontractors and suppliers is a widely used condition of contract and should be applied as far as possible. This can be beneficial in green procurement if 'green' suppliers have been identified and then are targeted and made use of in the contract. This targeting strategy can also be applied to framework contracts for larger capital works projects to ensure participation of smaller firms.
Contractual Obligations	Make policy objectives a contractual condition, e.g. a fixed percentage of the work is required to be subcontracted out to enterprises that have prescribed characteristics, or a joint venture shall be entered into; and parts of the works are to be executed using employment-intensive methods	Amend to make green policy objectives a contractual condition Include contractual conditions for local labour, local content and resource efficient construction methods

Market analysis

One of the core functions performed by Supply Chain Management is demand management, which involves the pro-active planning for the procurement of products, construction works and services. Fundamental to the demand management function in the context of green procurement is the requirement for undertaking a needs analysis of resource requirements and an understanding of the market offering of green products and services.

According to National Treasury's Guidelines for Implementation of Demand Management, Supply Chain Management's demand management objective is to:

> "ensure that the resources required to fulfill the needs in the strategic plan of the institution are delivered at the right time, price and place and that the quantity and quality will satisfy the end user"

Drawing from the National Treasury's Guideline for Implementation of Demand Management, a detailed needs analysis with respect to green procurement will typically include:

- Availability of alternative green products or technologies,
- All local suppliers of these products (specify location of supplier and place of manufacture and extraction of resources for the product)
- Life cycle cost considerations of alternative green products or technologies

- Performance specifications and certification of green alternatives

There are various websites that offer information on green products and technologies such as Ecospecifier, Greener Products, etc. Further information on these websites and applicable eco-labels in South Africa can be found in the Sustainable Materials section of 'Making Better Choices: Design Manual'.

Suppliers and service providers to government need to register on the Central Supplier Database. It is therefore recommended that a market analysis of available green products and technologies be conducted by means of calling for an expression of interest for suppliers of greener material and product alternatives to register on the Central Supplier Database. This can include materials and products that:

- Result in improved energy and water efficiency while in use or habitation of a unit;
- Have a lower embodied energy and virtual water content;
- Use less material for the same structural strength or functionality;
- Reduce the amount of waste generated in the production and/or construction process;
- The inclusion of post-consumer recycled or reused content;
- Make use of locally sourced raw materials
- Low to no Volatile Organic Compounds (only applicable to paints, adhesives, sealants, and carpets)
- No Formaldehyde (only applicable to wood or boarding used for cabinets, doors and prefabricated walls)

This database of suppliers could then be considered for projects that are either designed in-house (within the Department of Human Settlements or within the municipality) or designed by a professional team. There could also be consideration of incentivising contractors to make use of these suppliers in their supply chain and design-and-build proposals. An example of a market analysis is shown below. This is a Green Building Material Catalogue undertaken by GreenCape in 2015 for materials that aid in the compliance of the SANS 204 and SANS 10400:XA regulations. This can be found at: http://greencape.co.za/assets/Green-Building-Material-Catalogue-Final.pdf

INSULATION

Products in market	Dimensions (thickness)	NRC	R-value	Resource efficiency indicator
Bulk insulation materials	Insulation supplied in roll form in varying densities and thicknesses result in a range of thickness specific R-values. Bulk insulation can be fitted over purlin, between purlin, in ceiling voids or cavity walls depending on the specific ratings determined by SANS 10400 XA. Densities of bulk insulation generally range from 10kg/m³ to 14kg/m³).			
Aerolite® – Glasswool	100mm	1	2,50m².K/W	DIY
Climatic zones 2	115mm	1,05	2,88m².K/W	DIY
Climatic zones 1 and 4	135mm	1,1	3,38m².K/W	DIY
Alutherm® – Glass fibre	50mm	0,75	1,25m².K/W	DIY
	75mm	0,8	1,88m².K/W	DIY
	100mm	0,85	2,67m².K/W	DIY
Climatic zones 1 and 4	135mm	0,92	3,38m².K/W	DIY
Alutherm® – Polyester fibre	50mm	0,6	1,25m².K/W	DIY
	75mm	-	1,88m².K/W	DIY

Section 3: Developing Green Tender Documents

This section of the report examines and highlights the opportunities for introducing green procurement into tender documentation. Key tools available to introduce green procurement objectives within the existing tender process includes:

- The introduction of green functionality criteria and enhancements in the evaluation of tenders for construction work as well as professional service contracts,
- The design of specifications using interventions described in the design manual for the site layout, housing units and materials, and
- Setting the green objectives as conditions of contract.

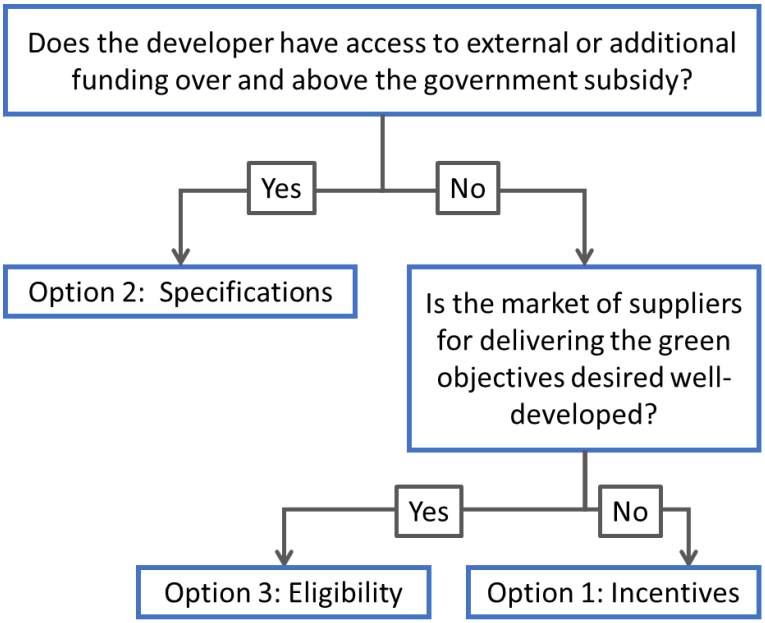
There are three main ways in which green objectives can be included in tenders, as shown below:

- Option 1: Incentivising contractors by giving them extra points for functionality/eligibility if they undertake to include green design or features. This means that contractors might choose not to pursue these extra points, resulting in no additional features and no improved social and environmental impact. It is important to note that enhancements are included in the costs of the tender and, if necessary, additional costs are paid for by the bidder.
- Option 2: The green features desired can be included as specifications. This requires that the developer is certain that the approach and specifications chosen will result in the desired green outcomes. For example, there is a direct relationship between the installation of water-efficient fittings and reduced water demand. Water-efficient fittings also have objective performance features, such as flow rate, that can be specified and easily procured. This can therefore be

included in the specifications. However, there is not always a reduction in water demand from the installation of rainwater tanks; so, while there might be other benefits for beneficiaries, it is not necessarily appropriate to specify rainwater tanks if you want to reduce overall water consumption. Specifications should be used for design attributes and green features that do not require additional funding, beyond the subsidy value.

- Option 3: Include green criteria in the functionality in such a way as to require that at least some of the green criteria must be provided to meet the minimum functionality score for eligibility.

Depending on the project's context and the maturity of the market, any of these options would be appropriate to use, as shown below in a decision-making tool provided.



Functionality for green procurement

Functionality is defined in Preferential Procurement Regulations as "the measurement according to predetermined norms, as set out in the tender documents, of a service or commodity that is designed to be practical and useful, working or operating, taking into account, among other factors, the quality, reliability, viability and durability of a service and the technical capacity and ability of a tenderer". Functionality has however been seen as a mechanism that excludes smaller competing firms. It is therefore imperative that the functionality criteria are examined within the context of the overall procurement strategy, in particular the targeting strategy. Functionality criteria determine the eligibility of bidders and should therefore be objective, fair, reasonable, transparent and measurable.

Functionality criteria is also known as quality criteria. Each criterion is given a weighting or score which is stated and described in the tender documents. The weighting of functionality criteria should be directly related to the priorities of green procurement as determined by the IDP, SDF or Supply Chain Management Policy. For green procurement, functionality is a valuable tool due to it being

possible to exclude bidders who do not have the relevant experience, expertise or supply chain to deliver the green objectives desired.

Western Cape High Court, Cape Town, in reportable case No 21158/2012:

"Functionality as it is defined in the Tender Documents concerns the ability of the tenderer to deliver what is required, to meet the needs of the tender, to deliver a service or commodity which is fit for purpose. It is based on the objectively measureable criteria of experience and standing, capability and re-sources. As such it has a bearing on the question of whether the tender is cost-effective, i.e. whether it yields best possible value for money. To my mind it is self-evident that it is not cost-effective to award a tender to a party who ticks the right boxes as regards price and preference, but is unable to get the job done properly whether through lack of experience, adequate personnel or financial resources.

I consider that the constitutional imperative that the procurement system be cost-effective, means that functionality must necessarily be taken into account in the adjudication of competing tenders and should not be relegated to a mere qualifying criterion … The point is simply that functionality should not be ignored in the final adjudication between competing tenders, and should be taken into account within the parameters of the Procurement Act.

Functionality criteria will differ depending on whether the contract is for professional services, a construction contractor or a design and build contract. The functionality criteria chosen are guided by the green principles and priorities stated in municipal policy and any other project specific criteria. Functionality criteria can make use of the array of eco-labels for green materials, especially the materials that are predominantly used such as concrete blocks, and other standards, such as the Green Building Council of South Africa's EDGE tool, if approved for use by the Western Cape Department of Human Settlements.

Most notably, with regard to green procurement, functionality criteria may include environmental characteristics, running costs, and aesthetic and functional characteristics.

The current draft Preferential Procurement Regulations (2016) state that, where an organ of state evaluates a tender based on functionality, the following considerations need to be taken into account:

1. The evaluation criteria for measuring functionality must be objective
2. When evaluating tender documents on functionality, tender documents must specify:
    a. The evaluation criteria for measuring functionality
    b. Points for each criterion, if any, each sub-criterion
    c. The minimum qualifying score for functionality

3. The minimum qualifying score for a tender to be considered further:
    a. May not be generic
    b. Must be determined separately for each tender
    c. May not be so:
        i. Low that it may jeopardise the quality of the required goods or services; or
        ii. High that it is unreasonably restrictive
4. A tender that fails to obtain the minimum qualifying score for functionality as indicated in the tender documents is not an accepted tender
5. Each tender that obtained the minimum qualifying score for functionality must be evaluated further in terms of price and preference points systems in accordance with regulations 5 or 6 as the case may be".

The project or tender-specific functionality criteria which include environmental considerations must therefore be weighed up against provisions of these regulations.

The following examples demonstrate how Option 3 might be applied for professional services, construction, and 'design and construct' contracts in state-subsidised housing.

Green functionality for the procurement of professional services

Professional services include those involved in the design and layout of the project site, the housing unit and the services, as well as project and contractor management/oversight. Critical to green procurement is the functionality of the town planning professionals, the architects and the engineers. Functionality can refer to objective criteria such as number of years of experience, number of relevant projects undertaken, certifications with accredited bodies (green and not), and approach and methodology. It can be used for framework agreements or individual tenders. An example of weighting the different criteria is shown below. In this example, a bidder would need to score a minimum of 70 points to qualify for eligibility.

Criteria group	**Maximum possible Score**
Qualification and Experience	45
Methodology	30
Programme	10
Resource Plan	10
Motivation (Why us)	5
Total	**100**

An illustrative example of the Criteria 1 and 2, Qualification and Experience and Methodology, is shown below.

Details	Total Max. Points	Item Max. Points
CRITERIA 1: PROFESSIONAL SERVICES QUALIFICATIONS AND EXPERIENCE		
1.1 Town Planner	15	
A town planner shall be a professional planner registered with the South African Council of Planners (SACPLAN). Provide proof of registration with certified copy of certificate. Relevant experience shall be experience in the design and subdivision of human settlements projects (not limited to but including state-subsidised housing) with a minimum of 50 units. Green relevant experience is that which has been designed with environmental and social considerations taken into account, such as spatial integration, resource efficiency, accessibility, or making use of ecological services provision.		
- Has a minimum of 10 years relevant experience		7
- Has a minimum of 7 years relevant experience		5
- Has a minimum of 4 years relevant experience		3
- Has a minimum of 1 year relevant experience		1
- Less than 1 year relevant experience		0
- Number of projects relevant to green experience undertaken (project profiles that clearly illustrate how green interventions, as described above, have been taken into account, a site layout drawing must be submitted for each project claimed, and references)		
More than 5 projects		5
3 – 5 projects		3
1 – 2 projects		1

No projects		0
- Registered as a Green Building Council Accredited Professional (LEED, BREEAM and Green Star are accepted) (provide copy of certificate) (provide copy of certificate) – Communities Yes = 3 ; No = 0		3
1.2 Architect	15	
An architect shall be a Professional Architect (Pr Arch) or Professional Senior Architectural Technologist (Pr SArch T) registered with the South African Council for the Architectural Profession (SACAP). Provide proof of registration with certified copy of certificate. Relevant experience shall be experience in the design of housing for human settlements projects (not limited to but including state-subsidised housing) with a minimum of 50 units. Green relevant experience is that which has been designed with environmental and social considerations taken into account, such as Passive design principles and applications, energy and water efficiency and alternate solutions, and sustainable building materials.		
- Has a minimum of 10 years relevant experience		7
- Has a minimum of 7 years relevant experience		5
- Has a minimum of 4 years relevant experience		3
- Has a minimum of 1 year relevant experience		1
- Less than 1 year relevant experience		0
- Registered as a Green Building Council Accredited Professional (LEED, BREEAM and Green Star are accepted) (provide copy of certificate) (provide copy of certificate) – New Buildings Yes = 3 ; No = 0		3
- Number of projects relevant to additional experience undertaken (project profiles that		

clearly illustrate how green interventions, as described above, have been taken into account, a plan, elevation and 3D drawing must be submitted for each project claimed, and references)		
More than 5 projects		5
3 – 5 projects		3
1 – 2 projects		1
No projects		0
1.3 Engineer	**15**	
An engineer shall be a Professional Engineer (PrEng) registered with the Engineering Council of South Africa (ECSA). Provide proof of registration with certified copy of certificate. Relevant experience shall be experience in the design of project sites and housing for human settlements projects (not limited to but including state-subsidised housing) with a minimum of 50 units. Green relevant experience is that which has been designed with environmental and social considerations taken into account, such as accessibility, or making use of ecological services provision, passive design principles and applications, energy and water efficiency and alternate solutions, and sustainable building materials.		
- Has a minimum of 10 years relevant experience		7
- Has a minimum of 7 years relevant experience		5
- Has a minimum of 4 years relevant experience		3
- Has a minimum of 1 year relevant experience		1
- Less than 1 year relevant experience		0
- Registered as a Green Building Council Accredited Professional (LEED, BREEAM and Green Star are accepted) (provide copy of		3

certificate) – New Buildings and/or communities Yes = 3; No = 0		
- Number of projects relevant to green experience undertaken (project profiles that clearly illustrate how green interventions, as described above, have been taken into account, and a housing unit and/or site layout drawings must be submitted for each project claimed, and references)		
More than 5 projects		5
3 – 5 projects		3
1 – 2 projects		1
No projects		0
CRITERIA 2: METHODOLOGY	**30**	
How will the 'Making Better Choices: Design Manual' guidelines be taken into account in the layout of the site and design of housing units and services, with regards to the green performance criteria:		
Stakeholder Engagement Plan		5
Overall Design Process		5
Resource efficient site layout and accessibility		5
Passive Design for improved thermal performance		5
Improved water demand management and efficiency		5
Sustainable building materials		5

Green functionality for the procurement of a construction contractor

The contractor is appointed to construct the already designed human settlements project (houses and services). Critical to green procurement for this procurement process is the functionality of the

contractor in terms of the experience in human settlements construction, experience in building green projects, supply chain for the materials and labour sourced and construction and site management practices. An example of weighting the different criteria is shown below. In this example, a bidder would need to score a minimum of 70 points to qualify for eligibility.

Criteria group	**Weighting**
Personnel	25
Company Experience	20
Enhancements	40
Time for Completion	5
Resources and resource plan	5
Motivation (Why us)	5
Total	**100**

An illustrative example of the Criteria 1 to 3, Personnel, Company Experience, and Enhancements, is shown below.

Details	Total Max. Points	Item Max. Points
CRITERIA 1: PERSONNEL	**25**	
1.1 Contract Director	13	
A contract director shall be a person employed in a senior management position within the firm reporting to the board of directors. Relevant experience shall be experience in a construction firm in the capacity of contract director for projects with a minimum value of R20 million.		
- Has a minimum of 10 years relevant experience		8
- Has a minimum of 7 years relevant experience		6
- Has a minimum of 4 years relevant experience		4
- Has a minimum of 1 year relevant experience		1
- Less than 1 year relevant experience		0
- Registered as a Green Star Accredited Professional (provide copy of certificate) – New Buildings and/or Communities Yes = 5; No = 0		5
1.2 Site Agent	12	

A site agent shall be a person employed in the position of Contractor's Site Agent. Relevant experience shall be experience in a construction firm in the capacity of site agent for projects with a minimum value of R20 million.		
- Has a minimum of 8 years relevant experience		8
- Has a minimum of 6 years relevant experience		6
- Has a minimum of 4 years relevant experience		4
- Has a minimum of 2 year relevant experience		1
- Less than 2 years relevant experience		0
- Registered as a Green Star Accredited Professional (provide copy of certificate) – New Buildings and/or Communities Yes = 4; No = 0		4
CRITERIA 2: COMPANY EXPERIENCE	**20**	
- Number of projects relevant to experience completed or currently underway (provide project profiles that clearly illustrate how green interventions, as described above, have been taken into account, and references)		
More than 5 projects		10
2 – 4 projects		6
1 – 2 projects		2
No projects		0
- Number of projects relevant to experience in the incorporation of environmental and social considerations (as described in Making Better Choices) completed or currently underway (provide project profiles)		

More than 5 projects		10
2 – 4 projects		7
1 – 2 projects		5
No projects		0
CRITERIA 3: GREEN CRITERIA	**40**	
ISO140001 certification (provide certificate)		10
Waste Management Plan to divert waste on site from landfill, with associated monitoring process and recycling companies or uses identified (make use of template table provided, provide all waybills for waste collection)		
70% of waste (by volume) to be diverted		7
50% of waste (by volume) to be diverted		5
30% of waste (by volume) to be diverted		3
Supply Chain Practices: Locally sourced materials and suppliers – restricted to materials used for walls, roof, floor slab and foundations (make use of template table provided, provide letters of confirmation from suppliers stating the source and quantity of materials)		
• A minimum of 50% of materials (by cost) is sourced within 50km radius of site		8
• A minimum of 50% of materials (by cost) is sourced within 400km radius of site		6
• A minimum of 25% of materials (by cost) is sourced within 400km radius of site		2
Top Soil Protection Plan (all valuable topsoil is protected during construction activities and		5

either returned to site or used to rehabilitate another site)		
Provide plan to rehabilitate land damaged by construction activities		5
Describe how you will reduce resource consumption on site during construction (refer to Making Better Choices: Design Manual)	5	
- Stipulate how you will ensure efficient use of water during construction		1
- Stipulate how you will ensure efficient use of energy during construction		2
- (If applicable) Stipulate how you will make use of sustainably sourced (FSC), reused or recycled shutter board		1
- Stipulate how you will plan and co-ordinate material delivery to site to reduce fuel consumption and greenhouse gas emissions		1

Template: Tracking local sourcing of materials

Total project cost (including VAT, without professional fees)							R1 500 00	
Material	Unit	Cost per unit	No. of units	Total cost (including VAT)	Distance from point of raw material extraction/ collection point for recycled materials to project site	Distance from point of manufacture to project site	Percentage of material cost to total project cost (stated above)	Category
[EXAMPLE] Concrete Masonry Block	Block	15	10000	R150 000	357km	62km	10%	Within 400km

Template: Construction and site waste diversion

Total Volume of waste removed from site					50m3		
Waste type	Unit (skip or bakkie)	Volume of unit	Number of units	Total volume of waste type	% of total waste	Type of waste diversion: Recycled or Reused	Company responsible
[EXAMPLE] Concrete Masonry Block offcuts	Skip	1.5m3	5	7.5m3	15%	Recycled	Skip Hire and Recyclers

Green functionality for the procurement of a 'design and build' contractor

For a 'design and construct' contract, where a contractor is responsible for the design and construction of a human settlements project, it is necessary to make use of both of the examples above to ensure that Experience, Qualifications, Methodology, and enhancements are incorporated. In this contracting strategy, 'special features' are commonly requested in the functionality to incentivise contractors to improve upon the basic specification (the Housing Norms and Standards). Further to the functionality for professional services and construction contractors, the example below illustrates how functionality may be included in functionality criteria for a 'design and construct' tender. In this example, a bidder would need to score a minimum of 70 points to qualify for eligibility. Key to the methodology requirements is to make use of performance criteria rather than specific specifications.

Criteria group	**Weighting**
Personnel, Qualification and Experience	35
Company Experience	10
Methodology	10
Green Enhancements	35
Resource Plan	3
Programme and Time for Completion	7
Total	**100**

The example below illustrates the kind of approach that may be adopted for the objective functionality criteria included in Enhancements.

Details	Total Max. Points	Item Max. Points
CRITERIA 3: GREEN ENHANCMENTS	**35**	
Points will be awarded for quality based on the alternate green technologies offered. The tenderer is to provide details of the alternate green technologies offered in Returnable Schedule The technologies, including materials and/or products offered shall be built into the structure and the costs thereof shall be deemed to be included in the tender price and will not be considered as extras.		
3.1 Site layout	**10**	
In the site plan proposed, illustrate and describe how the following green enhancements have been achieved (see Making Better Choices: Design manual – Efficient Site Layout):		
- Improved spatial integration		2
- Maximise resource efficiency		3
- Maximise accessibility, especially for pedestrians and non-motorised transport		3
- Maximise use of ecological services provision		2
3.2 Housing Unit	**25**	
3.2.1 Improved thermal efficiency leading to improved energy efficiency	10	
• Internal layout orientated North		2
• Largest window are on North-façade with roof overhang to fully shade window in summer and not shade window in winter		2
• Thermal performance improvement demonstrated using a comparison of a base case unit and the actual unit with energy modelling software		2

• Improved R-value of walls compared to a concrete block wall through increasing thermal mass or providing wall insulation		2
• Naturally ventilated roof cavity to extract excess heat in ceiling and moisture build-up in the unit.		2
3.2.2 Improved energy efficiency	10	
• All lights installed are energy-efficient 6 – 8W Light Emitting Diodes (LEDs) equivalent to the light output of a 60W incandescent light bulb		2
• Solar water heaters are provided		4
• Photovoltaic panels with the necessary battery storage and visible and accessible meters (either individual or communal)		4
3.2.3 Reduced water consumption	5	
• Rainwater and/or stormwater harvesting and storage (either individual or communal)		5

Specifying for better choices

Specifications in tender documents are captured in the 'Part C3: Scope of Work'. These are the requirements that must be adhered to in the tender bids offered and will form part of the contract once the tender is awarded. The specifications outlined are therefore mandatory. With this in mind, when considering including green design attributes or features in the specifications, it is necessary to have a good understanding of the market from which suppliers will be procured. This is because, if the green specifications result in no supplier being able to comply with the tender, then the green specifications, as a secondary objective, have undermined the primary objective of providing human settlements.

It is therefore suggested that specifications for green procurement are made use of only where the market is well-prepared to delivery on the specification but is not doing so at present, such as water-efficient fittings, or where there is no or low cost involved in its delivery.

Performance-based specifications

As an alternative to product specifications that are used in state-subsidised human settlements projects, performance-based specifications can be used. Performance-based specifications are

focused on an outcome rather than the products or process. A performance-based specification could make use of parameters such as 'maximum' or 'minimum' to provide a threshold for the performance which must be achieved and can be improved upon. Herein lies the opportunity of including innovative environmental and social considerations into tender specifications, especially when there is uncertainty about the level to which suppliers have the ability or capacity to deliver. Performance-based specifications allow suppliers and contractors to innovate and investigate more feasible alternatives, both functionally and financially, which may result in the achievement of improved value for money.

Examples of applying performance criteria to specifications

1: Instead of specifying a solar water geyser, the desire for hot water provision could be specified as:

- A non-electrical water heating system
- A water heating system that uses a maximum of 50% of the energy needed for an electrical geyser

2: For improved thermal performance of housing units, make use of measurable performance values, such as R-values for wall insulation:

- A minimum R-Value of 2.47 for all external walls (a 50% improvement on SANS 10400:XA requirements)
- R-value can be used as a functionality criterion, so that a minimum criteria may be set with incremental improvements on this being scored.

Criteria - R-value	R-Value	Additional points
Minimum	1.64	0
Equal to or greater	1.8	1
Equal to or greater	2.2	2
Equal to or greater	2.4	3

Developing green conditions of contract

Conditions of contract are additional provisions required from the developer that must be met by the successful bidder. Currently, this is used for social and economic benefits such as local labour and sub-contracting of small, micro and medium enterprises. Further to this, a developer may choose to use the local sourcing of materials as a condition of contract rather than functionality criteria. This would make it compulsory for the successful bidder to adhere to the requirements for local sourcing.

Ensure that the contract performance clauses underline the environmental and socio-economic commitments made by contractors, and provide appropriate remedies where they fall short. Ensure there is a system for monitoring these commitments and that they are also applied to subcontractors.

Section 4: Evaluating and awarding tenders

Once bids are received from tenderers, it is necessary for the developer's bid adjudication committee to review the bids in terms of being complete, responsive, eligible, and tender evaluation points. For green procurement, the same process is followed as a regular evaluation process.

Methods of Evaluation

National Treasury has implemented the Standard for Infrastructure Procurement and Delivery Management (SIPDM), as of 1 July 2016 for provincial government and 1 July 2017 for municipalities. While this standard does not make reference to 'functionality' as a criterion that may be used to evaluate tenders, it does refer to 'quality'. As stated in SIPDM 14.1.3, quality may be evaluated in tender submissions, as other objective criteria, as provided for in the Preferential Procurement Policy Framework Act in accordance with the provisions of SANS 10845-1. Quality is stated as objective criteria in the tender documents and shall be scored in terms of the prompts for judgement, with fixed scores assigned to each prompt, either individually and averaged or collectively, as stipulated in the procurement documents. This allows tenders to be awarded on an improved understanding of value-for-money, where contracts are awarded not only on the basis of lowest price adjusted for a preference, but also on the highest quality, most economically advantageous or cost-effective offer that is submitted.

The methods available to developers to evaluate tenders are those stated in SPIDM 14.5.2; that is Methods 3 and 4. For green procurement in state-subsidised human settlements, Methods 3 and 4 are beneficial evaluation methods. Method 4 is best used in green procurement where the minimum eligibility can be achieved without incorporation of any green enhancements and green enhancements are included as incentives only; that is Option 1. Method 3 is best used where the tender makes use of green specifications to ensure that objectives are achieved; that is Option 2. For Option 3, where some green enhancements must be committed to by the bidder to achieve eligibility, Method 3 or Method 4 can be used. However, Method 4 will offer a greater incentive to bidders to commit to more of the enhancements. These are described below.

Method 3: Financial offer and preference

Tender bids are first evaluated in accordance with the functionality criteria stated in the tender documents. Only tenders that achieve or exceed the minimum functionality score for eligibility are allowed to be evaluated further in terms of price and preference.

It is anticipated that this will be the method of evaluation that is most commonly used, especially when developers make greater use of the functionality criteria and a higher eligibility score in the tender.

Calculate the total number of tender evaluation points (T_{EV}) in accordance with the following formula:

$T_{EV} = N_{FO} + N_P$

where:

N_{FO} is the number of tender evaluation points awarded for the financial offer made in accordance with 5.11.7 of SANS 10845-3;

N_P is the number of tender evaluation points awarded for preferences claimed in accordance with 5.11.8 of SANS 10845-3.

Rank tender offers from the highest number of tender evaluation points to the lowest. Once tenders have been ranked in accordance with their total tender score, the tender with the highest ranking is most often awarded the tender. However, in exceptional circumstances, a contract may be awarded to a tenderer that did not score the highest total number of points, only in accordance with Section 2(1)(f) of the Preferential Procurement Policy Framework Act (PPPFA).

Method 4: Financial offer, quality and preference

Method 4 allows those evaluating tender bids to include the score given for functionality in the final tender score. Calculate the total number of tender evaluation points (T_{EV}) in accordance with the following formula, as per the SIPDM (2015:45):

$T_{EV} = f_1 (N_{FO} + N_P) + f_2 N_Q$

Where,

- f_1 is the weighting for financial offer and preference and equals 1 minus f_2
- f_2 is the percentage weighting for quality [determined by the developer]
- N_{FO} is the number of tender evaluation points awarded for the financial offer made in accordance with 5.11.7 of SANS 10845-3 where the score for the financial offer is calculated using the following formula:

  $A = 1-((P – P_m)/ P_m)$

- N_P is the number of tender evaluation points awarded for preferences claimed in accordance with the Preference Schedule.
- N_Q is the number of tender evaluation points awarded for quality offered in accordance with 5.11.9 of SANS 10845-3.

To make use of quality in the final tender score, it is necessary to give a percentage weighting to quality in relation to the financial offer and preference. This will indicate the degree to which quality will influence the final tender score. Therefore the higher the percentage, the greater the value attributed to quality. This means that tenders where quality is a key factor as to achieving value for money, will have a high f_2 value. This percentage value is the prerogative of the developer who is advertising the tender.

Example: Evaluating 4 tenders using quality in the final tender score

Calculating final tender score				
Eligibility score is 70, this is a 90/10 tender	**Tender 1**	**Tender 2**	**Tender 3**	**Tender 4**
Scoring for Price (N_{FO})	85	80	70	60
Scoring for Preference (N_P)	6	8	5	10
Subtotal : $N_{FO} + N_P$	**91**	**88**	**75**	**70**
f_1 value	0,6			
Scoring for Quality (N_Q)	70	80	74	78
f_2 value	0,4			
Subtotal : $f_1(N_{FO} + N_P)$	**54,6**	**52,8**	**45**	**42**
Subtotal : f_2N_Q	**28**	**32**	**29,6**	**31,2**
Total ($T_{EV} = f_1(N_{FO} + N_P) + f_2N_Q$)	**82,6**	**84,8**	**74,6**	**73,2**

Interesting to note is that, if only price and preference had been used to calculate the final tender score, the Tender 1 would have been awarded the tender, having only reached the minimum functionality score for eligibility. However, because quality was taken in to into account, Tender 2, who which achieved the highest quality score, has been ranked first and will be awarded the tender.

Rank tender offers from the highest number of tender evaluation points to the lowest. The tender is then awarded to the tenderer with the highest ranking, provided that the developer does not have any justifiable reasons not to do so e.g. tenderer poses a commercial risk.

This concludes the fourth and final section of the guidelines: Procuring better choices: implementing and operationalising green procurement.

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