

# **Sustainable Housing Development: A City of Cape Town project evaluation**

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## **Declaration**

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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## **Abstract**

The thesis reports on an evaluative study of the sustainability of housing development by the City of Cape Town with the Witsand, Atlantis, housing project as case study to empirically measure such sustainability. The study was attempted to determine how the City of Cape Town has planned for and implemented sustainability measures and what the results were in the Witsand project. The research therefore determined to what extent the expressed policy intent of sustainability housing delivery was implemented successfully in Witsand in terms of output and outcomes.

The objectives of this study included outlining a theoretical and analytical framework for sustainable development as prescribed in the National, Provincial and Local Government policies and relevant legislation. An evaluative case study is provided, describing how the City of Cape Town implemented its policy in practice. This housing project was chosen because it is claimed to be the first large-scale integrated sustainable housing project in South Africa.

The research methodology entailed an analysis of relevant literature, policies, legislation and project design documentation. In addition, the field work utilised a semi-structured mixed questionnaire for conducting interviews with the Project Manager, community development worker and a sample of residents.

The research found that the City of Cape has followed the sustainability blueprint as far as their means allowed. The satisfaction level of the community is high. It was found, however, that the people, even though they received houses that were designed and constructed to take full advantage of the environment without harming it; lack the knowledge to maintain sustainable, energy conserving living. This indicates that sustainability in low income housing is not only a matter of design and technology, but also of instilling a particular behaviour amongst beneficiaries.

## Opsomming

Hierdie tesis voer 'n evaluering studie van die volhoubaarheid van behuising deur die Stad Kaapstad by die Witsand, Atlantis projek, wat as 'n gevallestudie om sodanige volhoubaarheid empiries te meet, gedien het. Die studie is onderneem om te bepaal hoe die Stad Kaapstad volhoubaarheidsmaatreëls beplan en geïmplementeer het, en wat die resultate van die Witsand projek was. Die navorsing het dus bepaal tot watter mate die uitdruklike beleidsvoornemens vir die lewering van volhoubare huisverskaffing in terme van uitset en uitkomst suksesvol in Witsand geïmplementeer is.

Die doelstellings van hierdie studie het die skets van 'n teoretiese en analitiese raamwerk vir volhoubare ontwikkeling, soos in Nasionale, Provinsiale en Plaaslike beleid en toepaslike wetgewing voorgeskryf, ingesluit. 'n Evaluerende gevallestudie wat beskrywe hoe die Stad Kaapstad se beleid prakties uitgevoer is, word voorsien. Hierdie projek is gekies vanweë die aanspraak dat dit die eerste grootskaalse geïntegreerde volhoubare projek vir huisverskaffing in Suid-Afrika was.

Die navorsingsmetodologie het 'n ontleding van toepaslike literatuur, beleid, wetgewing en gedokumenteerde projekontwerp behels. Daarbenewens het die veldwerk gebruik gemaak van 'n gemengde semi-gestruktureerde vraelys vir onderhoude met die Projekbestuurder, gemeenskapsontwikkeling werker en 'n steekproef van die inwoners.

Die navorsing het bevind dat die Stad Kaapstad die bloudruk vir volhoubaarheid sover as die stad se middele kon toelaat, gevolg het. Die bevredigingsvlak van die gemeenskap is hoog. Daar is egter gevind dat die mense, ten spyte daarvan dat hulle van huise voorsien is wat ontwerp en gebou is om sonder enige skade aan die omgewing ten volle daaruit voordeel te trek, kennis ontbreek om op volhoubare wyse en met besparing van energie te lewe. Dit dui daarop dat volhoubaarheid in lae-inkomste behuising nie maar net 'n kwessie van ontwerp en tegnologie is nie, maar ook vereis dat 'n bepaalde soort gedrag onder die begunstigdes gevestig moet word.

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## List of Acronyms

IIECO: Integrated Energy Environment Empowerment Cost Optimised

MDGs: Millennium Development Goals

CoCT: City of Cape Town

NEMA: National Environmental Management Act

NSDP: National Spatial Development Perspective

RDP: Reconstruction and Development Programme

NHBRC: National Home Builders Registration Council

WCSHSS: Western Cape Sustainable Human Settlement Strategy

BNG: Breaking New Ground

IDP: Integrated Development Plan

WSSD: World Summit on Sustainable Development

DEAT: Department of Environmental Affairs and Tourism

NFSD: The National Framework on Sustainable Development

SDIP: The Sustainable Development Implementation Plan

IMEP: Integrated Metropolitan Environmental Policy

SCCPA: Southern Coastal Compensation Problem Area

EECO: Energy and Environmentally Cost Optimised

NGO: Non-Governmental Organisation

URTI: Upper Respiratory Tract Infections

COD: Chronic Obstructive Pulmonary Disease

DSM: Demand Side Management

WEHBSO: Witsand EECO Housing Beneficiary Support Organisation

CFL: Compact Fluorescent Lights

DPC: Damp-proof Course

UCT: University of Cape Town

UNITAR: United Nations Institute for Training and Research

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## **Chapter 1: Background and Context**

### **1.1 Introduction**

This thesis focuses on and evaluates sustainable housing development in the City of Cape Town, specifically regarding the Witsand, Atlantis, housing project. The Witsand housing project is compared to literature on sustainable housing development and thus reflects to what extent the City of Cape Town has been delivering on its sustainability intentions. This thesis also aimed at recognising the limitations that may be experienced, so that recommendations can be useful to future housing projects.

This chapter of the study is organised into the following sections: Section 2 deals with the background and rationale of the study. Section 3 deals with the problem statement. Section 4 presents the objectives, purpose and the significance of the study. Section 5 deals with the research methods that were used and design thereof. Section 6 presents the research report outline and structure. Presented below is the discussion of the background/rationale for this study on the Witsand Atlantis Housing Project.

### **1.2 Background/rationale for the study**

South Africa needs to consider sustainable development in the construction of low-income houses to contribute to poverty reduction through minimising dwelling-related operating costs and also to reduce the life-cycle impact of these houses on the environment. With a backlog of 400 000 houses in Cape Town (based on 2010/11 figures) (Oscroft, 2008), the impact thereof on the environment must be considered. The designing and building of houses must be managed in such a way that a minimal effect on the environment is ensured, if the negative effect cannot be avoided entirely.

Constraints such as the limited ability of beneficiaries to make a living and afford the costs of housing tenure; land availability; limited energy supply; shortage of health services; and increasing urbanisation (worsened by the illegal immigrant problem) which exacerbate problems of overcrowding and the rate of increase in the housing backlog challenge low-

income housing delivery. Housing provision is nevertheless a constitutional obligation and a more sustainable product is therefore imperative.

In addressing the constraints, the City of Cape Town adopted, as one of its goals, to become a sustainable, world-class African city (City of Cape Town Energy and Climate Change Strategy, 2006:5). The first step in reaching this goal is to put the applicable strategies and policies in place to be aligned with the world trend in sustainability. The City of Cape Town has started implementing strategies that are sustainable and environment friendly into housing development; one area where this was aimed for and thus was targeted as case study for the research for this thesis is the Witsand Integrated Energy Environment Empowerment-Cost Optimised (IEECO) housing development in Atlantis.

The Witsand IEECO housing development will be evaluated, and then measured against what the policies aim to achieve, to identify the level of success in practice and practices that can be improved on. This was done by assessing what was lacking in the Witsand IEECO project or what the constraints were that hindered the development of sustainable human settlements, and by providing suggestions for improvement. The problem statement follows next.

### **1.3 Problem Statement**

South Africa is a signatory to the Kyoto Protocol and the Millennium Development Goals (MDGs), which means that the RSA will have to adhere to the targets and goals set by the Kyoto Protocol (Rogers, Jalal & Boyd, 2008:340). The challenge is to realise the objectives of the Kyoto Protocol, such as cutting back on greenhouse gas emissions, and meeting the targets of the MDGs, including ensuring environmental sustainability. Goal 7 of the MDGs includes three targets, namely:

Target 9: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; target 10: Halve, by 2015, the proportion of people without sustainable access to safe drinking water; target 11: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers. (Millennium Declaration, 2000).

The challenge is to interpret these global objectives into operations and projects. This includes catching up the housing backlog in South Africa whereby improved sanitation and secure tenure are achieved, while meeting the sustainable outcomes as stated by the MDGs (Millennium Declaration, 2000).

The implication of these global objectives and targets is that each and every project for the development of human settlements should serve these targets (Oscroft, 2008). The initial cost of building a sustainable human settlement is more than that of conventionally designed houses, but the one of the long-term benefits is that it saves money. People, however, do not always have the financial means to build sustainable houses and the implication is that government should invest more in building sustainable low-income medium-cost housing.

## **1.4 Objectives of the study and its significance**

The lack of housing for South African people is a very big problem in the country. Creating houses more sustainability will provide a platform for more effective and efficient housing projects. The objective of the study is therefore based on the sustainability aspect of the building and construction of government housing.

### **1.4.1 Objectives and purpose**

The overall aim of this study was to evaluate the extent to which sustainability in the design and construction of houses in the City of Cape Town's Witsand IEEECO (Integrated Economic Energy and Environmentally Cost Optimised) housing project was realised as intended by the City's strategy and as benchmarked against policies and literature on sustainable housing.

The sub-objectives were as follows:

- To describe the theoretical and legislative framework underlying the study of sustainable development;
- To evaluate the City of Cape Town's strategy with regard to the design and construction of sustainable houses;

- To evaluate the designs and construction of the Witsand IEECO housing development;
- To evaluate the sustainability in outcomes in terms of the experience of the beneficiaries.

#### **1.4.2 Significance of the study**

It is theoretically possible for all human settlements to be eco-sustainable, given the guidelines and objectives as set out in the literature and legislation. Given the renewed drive for sustainability in the world, it is fitting that such a study should be conducted to establish how the City of Cape Town has performed. This study sets out to determine whether it is possible to achieve that in a developing country such as South Africa with its limited resources and the prevailing building culture.

### **1.5 Research Design and Methodology**

The design of this study provided for evaluation research and took the form of an implementation (process) evaluation. Process evaluation looks at how programme activities are delivered.

#### **1.5.1 Research Design**

The empirical study made use of textual data. It included presenting empirical data in tables and graphs to enable analysing and interpreting the data gathered in order to draw conclusions. The realisation of the City of Cape Town's strategy for sustainable housing development was therefore evaluated in the Witsand case. During the case study, the necessary field work included semi-structured interviews with a sample of residents, the community development worker and the project manager. The results of the field work were compared with the theory on sustainable development construction and design to see to what extent practice achieved what the theory and policy intended.

### **1.5.2 Research Methods**

Existing data were collected from various sources. The collected data included information from the South Africa Constitution and other relevant Environmental Acts, books, relevant journals and newspaper articles, and relevant strategies and report documents for the delivery of eco-sustainable housing of the City of Cape Town.

Primary data were collected by conducting field work, researching and writing up the case study. Less structured modes of observation took the form of individual semi-structured interviews with informants during the field study, e.g. project managers and homeowners of the Witsand housing development. A questionnaire and personal observation were used to gather data; the questionnaires were used to measure the satisfaction and level of awareness of sustainability amongst new homeowners in the Witsand project and personal observations determined the new homeowners' attitudes and adherence to their responsibilities towards sustainability. The houses built by the City of Cape Town in the Witsand area were also evaluated by means of observation in accordance with the strategy document guiding the City of Cape Town's sustainable housing development. Probability sampling is normally used with an implementation evaluation research design. For the purpose of this study, however, a non-probability sampling approach was used. The sampling methods used to conduct the interviews with homeowners were purposive and accidental. The interviewees who were known beforehand were the project manager of the Witsand housing development and the key role players working for the City of Cape Town with regard to sustainable development.

### **1.6 Thesis outline and structure**

The rest of the thesis is structured as follows: The second chapter outlines the theoretical, legislative and policy frameworks surrounding sustainable housing development which informed this specific project. The third chapter focuses on the Witsand project as a case study. Chapter 4 outlines and records the empirical data that were collected during field work. The analysis of the research findings is presented and interpreted in Chapter 5. Chapter 6 logically links the theory and the results of the research findings and also includes the summary of the study and the recommendations.



## **Chapter 2: Legislative and theoretical focus around sustainable housing development**

### **2.1 Introduction**

Chapter 2 serves to contextualise the objectives of the study by placing it in a legislative and theoretical framework. Sustainability as expressed in the National Policy Framework, Environmental Act, Constitution and sustainability theory is explored. This chapter is divided into two sections of information which were used to inform the project, namely the legislative background and then the sustainability policy framework.

This chapter also presents the then current attitude (2009 – 2010) toward housing of the City of Cape Town and how it has changed with regard to policy and strategies regarding the sustainability of houses. It is especially focused on whether the sustainability of the design and construction of government housing developments are taken into consideration when referring to sustainable human settlements. The focus of the analysis starts with a broad South African National Government perspective and is then narrowed down to a Western Cape Provincial Government perspective and, finally, to the City of Cape Town perspective. The specific policies and strategies that were focused on was those which helped inform the project.

### **2.2 Legislative background on sustainable housing development**

This section describes the importance of sustainable development in the world in general and in South Africa and the City of Cape Town in particular. It unpacks how sustainable development has been gaining increasing attention in the South African context by giving it space in National, Provincial and Local government policies.

#### **2.2.1 Definition and importance of sustainable development**

Sustainable development as referred to in Chapter 1 is “development that can meet the needs of the present generation without compromising the ability of future generations to meet their own needs” (Brundtland Report of the World Commission on Environment and

Development: Our Common Future, 1987:31). Sustainable housing development is therefore no different to sustainable development and should be looked at from a holistic perspective. Sustainable eco-housing has also been gaining an increasing amount of attention internationally. It is worth noting that it is a worldwide concern and every country should do its part to develop as sustainably as they can so as not to compromise future generations.

The focus of this study is the sustainability specifically of the design and construction of housing and the awareness that should develop around it. Sustainability should be considered during all the stages of developing houses. Sustainable construction, according to Miranda and Marulanda (2002:1) “comprises stages from the selection of the raw materials to manufacture of construction materials, components thereof and completed building materials, and the design of drainage systems”. Miranda and Marulanda (2002:1) argue that the key point for sustainable construction is to take full but wise advantage of the natural environment without changing it and still allow other living organisms to exist and be preserved, and simultaneously to minimise energy wastage. Sustainable design of houses should take into consideration energy saving technologies, the necessary space required for humans and the environment to be in harmony and balance, and recycling should also be incorporated (Miranda & Marulanda, 2002:1).

Housing in South Africa is a huge challenge that continues to face the government as many citizens still do not have access to houses on account of the injustices of the pre-1994 apartheid era. The majority of people in South Africa do not have the means to buy and privately own their own houses. They largely rely on the government to provide them with homes. The constitutional right of access to housing has made the provision of houses to the people of the country a priority for the South African government since 1994. However, due to the huge housing backlog in practice, it initially simply meant the provision of very rudimentary shelter. We know that there is much more to housing than providing shelter and long-term social, socio-economic and environmental sustainability – it also includes the empowerment of the beneficiaries in the interest of human development. The various legislative and policy frameworks relevant to sustainable housing are discussed in the following section.

## **2.2.2 The Policy Frameworks**

Policies concerning housing are set out below. This follows the order of national government policy, provincial government policy and local government policy and gives the necessary background to the government's position on the current housing situation, including sustainable housing in South Africa.

### **2.2.2.1 The National Policy Framework**

This sub-section focuses on all the housing policies formulated at national level. These policies are discussed in the following order: starting with the Constitution, the discussion continues with the Housing Act; the National Environmental Management Act; and The White Paper of 1998: New Housing Policy and Strategy for South Africa; The Design and Construction of houses strategy; A Social Housing Policy for South Africa; and The Comprehensive Plan for the Development of Sustainable Human Settlements.

In the Bill of Rights of the Constitution of the Republic of South Africa (1996), Government Gazette No. 17678 (section 26), it is stated that “everyone has the right to have access to adequate housing and the state must take reasonable legislative and other measures within its available resources, to achieve the progressive realisation of this right”.

The Housing Act (RSA, 1997:2) also acknowledges the importance of sustainability in the development of houses. The Act serves to provide and aid the sustainable housing development process and has a set of general principles applicable to housing development within all spheres of government. It also defines the role of local, provincial and national government in housing development (The Housing Act, 1997).

Section 2(c) of the General Principles of the Housing Act (RSA, 1997) states that “National, provincial and local spheres of government must-

- (a) ensure that housing development-
  - (i) provides as wide a choice of housing and tenure options as is reasonably possible:
  - (ii) is economically, fiscally, socially and financially affordable and sustainable”

The National Housing Act states the importance of choice when it comes to building people's homes within the means that government can provide (RSA, 107). Sustainable housing applications should be offered as a choice to people since choices play a role in empowering people. In the long run it also makes financial sense to implement sustainable housing. It can be proved that sustainable housing costs less in the long run and has minimum effect on the environment. This will be discussed later in this chapter.

The National Environmental Management Act (RSA.1998), NEMA, is relevant because it states the importance of considering the environment and the safekeeping thereof as development take places. According to NEMA principles (RSA, 1998), "sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations".

The third principle of the National Environmental Management Principles (RSA, 1998) states that, "development must be socially, environmentally and economically sustainable". This means that a balance needs to be found between the environment, the economic and the social aspects in order for development to be sustainable. Each concern needs to be given sufficient attention as they are equally important within the context of development.

The National Department of Housing (now Human Settlements) which is responsible for delivering houses to South Africans who are underprivileged has a policy framework in place which consists of two authoritative documents: The "White Paper on Housing", which phrases the formal housing policy, and "The Comprehensive Housing Plan for the Development of Integrated Sustainable Human Settlements", which is also known as "Breaking New Ground", and provides a more recent interpretation of the policy.

The 1998 White Paper, "A New Housing Policy and Strategy for South Africa", essentially served as a vehicle for a capital subsidy that moved housing in the direction of the poor (Burger & Swilling, 2009:4). The capital subsidy included land cost and therefore the urban poor were given houses on the outskirts of urban land (Burger & Swilling, 2009:4). The people therefore were far from affordable public transport and areas of work. This type of delivery of houses is not beneficial to the home-owners due to high transport costs for

travelling to places of employment. They experience the day-to-day challenge of high transport costs to and from work, while at the same time trying to maintain the costs of the home over and above basic services such as water and electricity. This argument has also been expressed by Adebayo and Adebayo (2000:3), who state that most poor people are unable to afford the on-going costs of maintaining a home, such as water and electricity costs. Affordability is always the goal of households in order to improve their housing situation (Adebayo & Adebayo, 2000:1).

For housing to be beneficial to people, special attention should be given to life-cycle utilisation and maintenance costs. These considerations should be incorporated into housing strategies and policies. The type of design and construction of houses that can influence costs and lead to the new home-owners saving in the long term is to be carefully considered to ensure socio-economic sustainability.

Sustainable development is not ignored in South African policy and strategy development (Burger & Swilling, 2009:5). In 2003, the National Department of Housing set out a strategy for the design and construction of houses and also drafted a social housing policy for South Africa. The Design and Construction of Houses Strategy provides guidelines on how houses should be constructed and designed according to the National Building Regulations and Standards Act (RSA, 1977) and the Technical Requirements of the National Home Builders Registration Council in accordance with the Housing Consumer's Protection Measures Act (RSA, 1998).

According to the Design and Construction of Houses Strategy, a choice is to be given to people who require subsidised housing via user performance levels (RSA. National Department of Housing, 2003:38). This means that the choice aids an incremental approach to housing as it provides for more flexibility, but does not really move away from the old rigid approach or construction of subsidy housing. The choice is in the form of user performance level 1 or level 2. User performance level 1 provides for those who cannot afford the full service at the time but is still acceptable to live in, e.g. limited penetration of water to the interior of the house; minor levels of cracking; and discernible deflections. User performance level 2 provides for those who can afford the full service of the traditional user requirements in housing by involving mortgage lending finance (RSA. National Department of Housing, 2003:38).

Although the Design and Construction of Houses Strategy speaks about providing the people with a choice, the only choice, though, concerns what they can afford at the time. The choice that is spoken of is really a non-choice, as people who cannot afford the level 2 option have no choice but to be satisfied with the level 1 option. A real choice of an alternative design and construction of houses should be given to potential home-owners. If people cannot afford contractors, they could build their own houses (Swilling, 2006:12). This option is also referred to as the People's Housing Process whereby equity leads to less profit, thus bigger houses.

A Social Housing Policy for South Africa (RSA. National Department of Housing, 2003:3) was developed from the realisation that the housing crisis can be alleviated through the creation of sustainable medium-density rental housing. The policy has two objectives:

- Acknowledging the priority of the restructuring of South African society. More specifically, it aims to contribute to the Government's vision of a mixed integrated society living in sustainable human settlements.
- Improving the overall housing sector, in particular the rental sub-component.

To make this a reality, it is acknowledged that the private sector and the institutions for sustainable social housing need to be involved. The sustainability issue was largely considered in terms of location, viability and integration with regard to social housing. This type of housing, however, is not targeted at the very poor or the unemployed, but rather at those who earn a secure income (low or medium income) (RSA. National Department of Housing, 2003:5).

The Social Housing Policy for South Africa makes it clear that the government recognises the importance of sustainability. For the purpose of the policy, sustainability the housing environment; upgrading and conversion of existing buildings or where greenfields developments are more cost effective, is of greater concern in the development of human settlements (RSA. National Department of Housing, 2003:10). Greenfields development refers a housing scheme built from scratch, on vacant land (Sowman & Urquhart, 1998:3). Social housing is demand driven, as opposed to the subsidy regime, and the single unit dwelling model therefore need not be carried over to the social housing developments, as

social housing can take the form of group housing, multiple-level and multiple-unit dwellings (RSA. National Department of Housing, 2003:10).

The Comprehensive Plan for the Development of Sustainable Human Settlements (2004) represents a further refinement of the policy by the Department of Housing. This Plan acknowledges that there is a need to create integrated human settlements; therefore new interventions are aimed at this.

This policy expression states that the government has committed itself to developing more equitable, liveable and sustainable cities. To achieve this, the Cabinet has adopted a National Spatial Development Perspective (NSDP) and The Department of Provincial and Local Government has adopted a National Urban Reconstructive Strategy (2004) to address issues of development and sustainability. The NSDP is concerned with decisions on development spending and infrastructure investment. The Draft National Urban Strategy (2004) puts forward a vision of cities and towns that are well-designed and developed in an environmentally friendly way (Department of Housing, 2004:11).

In late 2008, Dr Lindiwe Sisulu, the then Minister of Housing placed emphasis on including sustainability in the development of human settlements. For all practical purposes, sustainable human settlements in this policy refers to “well-managed entities in which economic growth and social development are in balance with the carrying capacity of the natural systems on which they depend for their existence and result in sustainable development, wealth creation poverty alleviation and equity.”

The Comprehensive Plan for the Development of Sustainable Human Settlements (RAS, 2004) also recognises the need to develop more suitable housing products and human settlement designs. The main reason for this is to provide quality housing. The Comprehensive Plan for the Development Human Settlement document (2004:16) proposed a few important aspects of design that are described below. In its intent to promote quality housing, the Department of Housing explored the introduction of enhancing measures and incentives and using professional designers at the planning and designing phase of the project.

Design, as stated above, received special attention in the 2004 Comprehensive Plan. The Plan acknowledges that traditional technologies and indigenous knowledge should be considered when constructing houses in rural areas. In the urban areas there is also a need to change the design and construction of the typical “RDP” houses. Alternative ways of design and technology should be considered. One of the roles of the Department of Housing is to look at various ways of enhancing the designs of houses and also to promote and incorporate alternative technologies, such as indigenous knowledge systems, in the designs of houses.

However, President Jacob Zuma’s proclamation during his 2009 state-of-the-nation address went further when he described housing delivery as “... not just about building houses. It is also about transforming our residential areas and building communities with closer access to work and social amenities, including sports and recreation facilities”. This supports the name change of the Department of Housing to the Department of Human Settlements. The focus of the department is changing and the new name is a reflection thereof (Ndaba, 2009:1). Government is trying to move away from building houses to building communities where social and economic amenities are included (Ndaba, 2009:2).

Quality of housing is a concern that also needs to be addressed. In 2004, government made a shift from the Reconstruction and Development Programme (RDP) because it focused too much on quantity rather than quality. The adoption of a Comprehensive Plan for the Development of Human Settlements in an integrated, sustainable and qualitative manner is aimed at changing the old view. According to Doyoyo from Georgia Institute of Technology School of Civic and Environmental Engineering cited in Ndaba (2009: 3), the change from ‘Housing’ to ‘Human Settlements’ “is appropriate because it goes beyond housing and addresses a lot of other issues, such as job creation and the livelihood of the environment within which the houses are built”. However, government has still fallen short of this aim due to insufficient resources and a lack of coordination of national and provincial priorities (Ndaba, 2009:1). Doyoyo believes that the key to overcoming the challenges the Department faces, besides taking advantage of renewable energy sources and all types of innovative technologies, is to guarantee the involvement of centres of excellence around the human settlements problem and to put together a team of experts in order to create more sustainable housing.



The Department needs to develop a programme to address the poor quality of houses built before the national norms and standards of the National Home Builders Registration Council (NHBRC) were introduced and then undertake an audit on that. Local government must see to it that the standards and national norms are abided by in accordance with the NHBRC when houses are constructed. A previously built subsidised house could not be viewed as an economic asset to the poor as it could not be invested in, improved or sold in order for inhabitants to move into better accommodation when able to do so (Ndaba, 2009:4). According to Palmer Development Group (PDG) consultant Alison Hickey-Tshangana, leveraging or selling a home is often also made impossible because a formal transaction requires the occupant to have an official title deed.

The National policy states that the new instruments that were developed for the purpose of creating more sustainable human settlements will be used in conjunction with the older instruments developed in the first 10 years of democracy. The development of sustainable human settlements is currently the focus, as opposed to commoditised housing units. The reason for this is that more flexible solutions can be found for the housing problem. According to the new policy, greater emphasis is now placed on the housing delivery process, the quality of the houses and the long-term sustainability of the environment of the houses (RSA. National Department of Housing, 2004:16).

In 2007, the 40m<sup>2</sup> quality subsidised house was introduced. The technical specifications of the houses needed to abide by the NHBRC rules. The design of the houses take the form of two bedrooms, one separate bathroom with a shower, hand basin and a toilet, one combined kitchen and living area and a ready board electricity installation (Department of Local Government and Housing, 2007:1). The total cost projected in the City of Cape Town circular 3 of 2009 for 2009/2010 effective as from 1 April 2009 was R55, 706 per 40m<sup>2</sup> subsidised house (City of Cape Town, 2009: 1).

### **2.2.2.2 Provincial Policy Framework**

This sub-section focuses on the policies in the Western Cape Province. The sustainable human settlement and housing policies of the Western Cape are discussed in the paragraphs to follow.

The Department of Local Government and Housing has developed the Western Cape Sustainable Human Settlement Strategy (WCSHSS). This strategy is in line with the Comprehensive plan for the development of sustainable human settlements formulated by the National Department of Housing (RSA. Department of Local Government and Housing, 2006:6). According to the WCSHSS (2003:6), 14 360 RDP style-like houses [40m<sup>2</sup> Breaking New Ground (BNG) house] would be delivered in the Western Cape, mainly on the urban peripheries, if the reigning intervention and subsidies remain unchanged. Each housing unit would cost up to R70 000 and there was about R1 billion available per annum. The WCSHSS also made known that the existing approach intensified the problem of poverty by being financially unsustainable, using unsustainable resources and locating the poor on the urban peripheries (Provincial Government Western Cape, 2006: 8).

The Western Cape Sustainable Human Settlement Strategy acknowledged a need for change with regard to housing development and the rethinking of the housing policy in order for it to be sustainable (Swilling, 2006: 4). The WCSHSS also acknowledged that, if the existing “project for the poor” delivery framework remained in place, the way in which the housing backlog would be eliminated, would be very unsustainable (Swilling, 2006:7). This was mainly due to the risk that the delivery framework would repeat the mistakes of the old policy (Provincial Government Western Cape, 2006:13).

The overarching goal of the Western Cape Sustainable Human Settlement Strategy was the development of sustainable human settlements. The document fails, however, to address certain aspects of sustainability. According to Swilling (2006:8) the document made use of the word sustainable, but what was really meant in the document is something more “equitable and more durable forms of spatial, social and economic development.” In Chapter 5, the document mentions the importance of energy efficiency and environmental sustainability and the inclusion thereof in housing projects. The document failed to mention the importance of using sustainable resources (Swilling, 2006:9).

The Western Cape Sustainable Human Settlement Strategy has recognised that a new approach to housing development needed to be implemented to combat the energy crisis. This was a step in the right direction, but the document could improve greatly on what is meant by sustainability. The design and construction of the sustainable human settlement is not focused on it, but it can be noted that the National Home Building Registration Council (NHBRC)

provided the guidelines and standards of the house. In this regard, however, Swilling (2006:9) claims that it can be interpreted that the NHBRC somehow favoured unsustainable building of houses in South Africa by refusing to approve alternative and innovative building of housing which could very possibly provide the solution for unsustainable housing (Swilling, 2006: 9).

The challenge of the housing backlog in South Africa has moved the City of Cape Town to focus on “accelerated housing provision and ensuring that land utilisation is well planned, managed and monitored” (City of Cape Town, 2008/9: 62). The Integrated Development Plan (IDP) of the City of Cape Town states that living environments should be planned, created and implemented on sustainable development principles which focus on the need for energy, water and waste efficiencies. It also makes known the importance of adequate access to economic opportunities, cultural and recreational activities, educational, welfare, police and health services (City of Cape Town, 2008/9: 62).

### **2.2.2.3 Local Government Housing Policy**

The City of Cape Town’s Housing Strategy is evolving (moving towards human settlements) and a new strategy is currently in progress. However the City’s Integrated Development Plan (2008/9) has a section on housing and does consider the importance of sustainability. It adopted the National Breaking New Ground Plan. This is briefly discussed below.

The City of Cape Town’s Integrated Development Plan (City of Cape Town, 2008/9: 62) also focused on integrated human settlements. It acknowledged the importance of sustainable development principles being incorporated into human settlement development (City of Cape Town, 2008/9:62). In Cape Town alone, 400 000 families did not have access to adequate formal housing at the time. In order to effectively deal with the housing backlog, the City of Cape Town needed to deliver approximately 20 000 houses per annum for the next 10 years. However, the City’s financial resources only allowed the delivery of approximately 7 500 housing opportunities (service criteria without top structure) per annum. The current rate of housing delivery in Cape Town was at 4 500 opportunities per annum as a result of insufficient technical, financial, planning and social facilitation capacities (City of Cape Town, 2008/9:62).

The City of Cape Town adopted the National Breaking New Ground Plan on Integrated Human Settlements and also the Western Cape Sustainable Human Settlement Strategy (City of Cape Town, 2008/9:63). This means that the City was more committed to developing integrated human settlements than merely just a shelter. An aim of the City was thus to create a balance between quantity and quality. In essence, this meant creating a balance between reducing the backlog and the standard of housing and improving the living environment for the communities involved (City of Cape Town, 2008/9: 63).

The housing plans of the City of Cape Town were aligned with the Habitat Agenda, the Millennium Development Goals, the 2001 World Summit on Sustainable Development (WSSD), and the national housing policy. Some of the strategic shifts included the promotion of the triple bottom line (ecological, economic and social sustainability), a move away from housing construction to sustainable human settlement and a shift towards sustainable resource use (City of Cape Town, 2008/9: 63-64). The sustainability question in the South African context is discussed next.

### **2.3 Sustainability Policy Framework**

The Kyoto Protocol is discussed first because it places South Africa in the international context with regard to the importance of sustainability. The Kyoto Protocol is an agreement subscribed to by various countries in Kyoto, Japan, in December 1997. The agreement is based on limiting world greenhouse gas emissions to slow the progress of global warming (The Kyoto Protocol, 2005: 1).

The expectations of the Kyoto Protocol principles, as derived from The Kyoto Protocol (2005:1), from the committed countries is:

1. To develop programmes to slow climate change
2. To share technology and cooperate to reduce greenhouse gas emissions
3. To develop a greenhouse gas inventory listing national sources and sinks

The World Summit on Sustainable Development was held in Johannesburg, South Africa in 1992. This was the biggest Sustainable Development United Nations conference ever and this is where various countries re-committed themselves to the common goal of sustainable development (Johannesburg Declaration on Sustainable Development, 2002:1). South Africa has achieved much regarding sustainable development. One goal includes embarking on a major social programme in order to progressively achieve universal access by all to adequate housing, energy, education, health, water and sanitation; increased investment in infrastructure; the provision of more equitable access to natural resources; and establishing the structures for the participation of local communities in the drafting of Integrated Development Plans (IDPs) (Johannesburg Declaration on Sustainable Development, 2002:8).

South Africa is clearly moving in the direction of sustainable development, but is faced with huge challenges. These challenges usually take the form of poverty and environmental degradation. The citizens of South Africa need to reflect on their consumption and pollution of natural resources. One example of legislation that was put in place to protect the environment as early as the 1960s is the Atmospheric Pollution Prevention Act. This Act's main objective was the prevention of pollution at the expense of the atmosphere and further to establish a National Air Pollution Advisory Committee, for similar matters (RSA, 1965).

The South African government, together with civil society, needs to reach a balance between the wellbeing of the environment and dealing with the housing backlog.

Sustainability should always be at the forefront of any development project. South Africa has a National Environmental Management Act (RSA, 1998) in place. This act provides for “cooperative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state, and to provide for matters connected therewith” (RSA, 1998). The importance of and the support of sustainable development is described.

The Act states that “sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations” (RSA, 1998). The Act also states the importance of the right to have the “environment protected, for the benefit of present and

future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation” (RSA, 1998). The promotion of conservation is also noted in the Act, as well as the securing of ecologically sustainable development, and the use of natural resources whilst promoting justifiable economic and social development (RSA, 1998). The Act 107 also argues the importance of the cooperation and support of the three spheres of government and all organs of state in South Africa, in order to reach the above-mentioned goals.

The South African National Environmental Management Act (RSA, 2003) was amended for quite a few reasons. It was done to provide appropriate definitions for certain expressions; to provide for the administration and enforcement of certain national environmental management laws; and to provide for related matters. The National Environmental Management Second Amendments Act is concerned with inserting specific definitions and substituting others regarding environmental authorisation to make further provision, to alter some text and to provide for the registration of associations of environmental assessment practitioners (RSA, 1998 as amended by section 1 of Act 56 of 2002).

The single most important piece of legislation that serves to protect the rights of all citizens of South Africa is the South African Constitution of 1996. The environment is particular deal of consideration. It reads as follows:

Everyone has the right-

- (b) to an environment that is not harmful to their health or wellbeing and
- (c) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that-
  - (i) prevent pollution and ecological degradation;
  - (ii) promotes conservation; and
  - (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development

In section 26 of the Bill of Rights (Constitution, 1996:26), the focus is on housing. It reads as follows:

Everyone has the right to have access to adequate housing.

- (2) The state must take reasonable legislative and other measures within its available resources, to achieve the progressive realisation of this right.

Since both housing and a sustainable environment are rights of a South African citizen, a balance between the two rights needs to be reached in order to abide by the Constitution. A solution that was investigated in this study, is the development of sustainable human settlements.

In the next section, legislature and the South African housing policies are described. The focus is on whether or not sustainability is considered in the development of housing.

The National Environmental Management Act (NEMA) which was implemented in 1998 (RSA, 1998) serves to protect the environment and provides cooperative environmental governance. The Act defines sustainable development as “the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations”. The Act provides cooperative governance and protects the environment through the establishment of principles for decisions to be made that may affect the environment, and for the institutions that promote the procedures and governance for the coordination of environmental functions exercised by “organs of state”.

The National Framework on Sustainable Development is another paper focusing on sustainable development. The framework explains sustainable development as an

...on-going process that requires a particular set of values and attitudes in which economic, social and environmental assets that society has at its disposal, are managed in a manner that sustains human well-being without compromising the ability of future generations to meet their own needs.

(National Framework on Sustainable Development, 2007:12)

The Department of Environmental Affairs and Tourism (DEAT) recognises the main aim of the National Framework Development Strategy NFDS as providing a framework for sustainable development that can serve as a basis for developing a national strategy and action plan for South Africa (DEAT, 2007:12). The vision of the National Framework on Sustainable Development is expressed as

South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through national, regional and global collaboration. (DEAT, 2007:13).

The Framework proposes strategic interventions to re-orientate South Africa's development in a more sustainable way. It shows how the government and its social partners will be developed, strengthened and realigned to achieve the development goals of sustainability. It wants to shift the thinking of South Africans to efficiency and innovation in using resources and also the integration of governance systems – economic, ecological and social.

The pathways to sustainable development suggested by the above reveal the size of the part human settlements play in South Africa becoming more sustainable. In order to achieve sustainable human settlements, natural resources need to be used more efficiently in all phases, but especially in the construction phase, and government should invest in sustainable infrastructure. It might initially cost more but will save much more money in the long run.

## **2.4 Sustainable Housing-related Theory**

In this section of the chapter, housing and sustainability theory are discussed and sustainability, lastly, is analysed in terms of construction and design in the context of housing.

### **2.4.1 Housing Theory**

The 1972 work of John Turner titled “Freedom to Build: Dweller Control of the Housing Process”, is recognised as a classic reference on housing, according to Spence, Wells and Dudley. Turner defined the idea of house as both a noun and a verb. When house is not considered a noun, it refers to the way in which people came about being housed and the way they sustain their living in and from a house (Burger & Swilling, 2009:4). According to



Bourne (1981:15), housing is of such a nature that it has inputs, outputs and a matching process and can be known as a “flow of services”. He also states that shelter is only one of the outputs and is incremented by things such as the environment, services, access, equity, social relations, satisfaction and status.

Alternative and innovative sustainable building of houses include orienting and operating the houses in a way that uses less energy, e.g. by means of effective insulation; effective use of natural lighting; a northern orientation; placing only small windows to the east and west; roof overhangs that link with the appropriate height of windows; substantial thermal mass components; ventilation systems that allow for cool air entering from the south and windward sides and warm air flowing out from the warmer upper parts of the building. Low energy materials, especially by reduction in cement content, can also be used for the building of houses. One way of being sustainable is to make use of recycled bricks, cob (wattle and daub), sand bags, or infill, straw bale, adobe bricks or hemp and maximising the use of other recycled building materials rather than using traditional materials (Swilling, 2006:11).

#### **2.4.2 Sustainable Housing Theory**

Contemporary housing literature tends to take into account the importance of sustainability in the development of housing. It is important that sustainability be considered in everything that is being implemented as it affects the environment, which is especially true in the case of housing.

There are three approaches to sustainable development, namely the economic, the ecological and the socio-cultural approach. The core of the economic approach is to maximise income while maintaining constant or increasing stock of capital. Ropetto, as cited in Rogers *et al.* (2008:43), argues that our economic systems should be managed so that we can live off the dividends of our resources. The ecological approach is concerned with maintaining the resilience and robustness of biological and physical systems. According to this approach, sustainable development is about maintaining the essential ecological processes and life support systems; the sustainable use of species and ecosystems; and also the conservation of genetic diversity (Rogers *et al.*, 2008:44). The socio-cultural approach is concerned with maintaining “the stability of social and cultural systems” (Rogers *et al.*, 2008:44). According to Barbier (1987), sustainable economic development is directly concerned with increasing

the standards of the poor, which can be measured by education, real income, increased food, health care, sanitation and water supply, and is only concerned indirectly with economic growth (Rogers *et al.*, 2008:44).

A balance needs to be reached between all three approaches and these approaches should be considered equally in order to achieve sustainability. This means that sustainable human settlements should not cost excessive amounts of money; it should take the environment into account at all times; and also meet the need to provide the people with running water, sanitation and other household services. It can be proven that developing sustainable houses will save money in the long run. This is discussed in the next paragraph.

Burger and Swilling (2009:12) took the life-cycle cost-effectiveness of subsidised housing as provided in the first twelve to fifteen years since the end of apartheid and compared this to a package of sustainable living alternatives (Table 2.1). They as far as possible made use of the costing of recent, on-going and planned housing projects in the Cape Town region.

Table 2.1 provides a summary of results based on the research done by Burger and Swilling (2009:13). Their research entailed looking beyond the start-up costs and then comparing the life-cycle cost effectiveness of a housing package as currently provided with that of a sustainable living housing package.

From the Table 2.1 it can be noted that the initial capital expenditure invested by the Department of Human Settlements (the then Department of Housing) would be higher in the case of the sustainable living package. However, the end product is shown to be of a much higher quality and it, in the longer run, saves money and promotes social, economic and ecological sustainability through the living and community space design and reduced consumption of resources and life-cycle operating costs. According to the results, the life-cycle cost of the sustainable housing package is 1,4 percent (R4 666) lower over its 30-year technical design working life. At the end of the 30-year life cycle the household has 37 percent better cost effectiveness than with the current approach (Burger & Swilling, 2009:12). In addition to cost saving, the sustainable housing package structure will last far longer than 30 years (Burger & Swilling, 2009:12).

Table 2.1: Comparison between current approach and sustainable living approach with regard to housing

Source:	A. Current Approach				B. Sustainable Living				C. Difference
	1. CoCT	2. DoH	3. Household	A. Total	1. CoCT	2. DoH	3. Household	B. Total	A. - B.
CAPEX (Y0)	R 45 505.00	R 43 506.00	R -	R 89 011.00	R 29 977.00	R 163 654.00	R -	R 193 631.00	R -104 620.00
NPV (Y0 to Y5)	R 50 175.00	R 43 506.00	R 19 078.00	R 112 759.00	R 31 591.00	R 163 654.00	R 12 801.00	R 208 046.00	R -95 287.00
NPV (Y0 to Y10)	R 56 382.00	R 43 506.00	R 41 063.00	R 140 951.00	R 33 752.00	R 163 654.00	R 27 056.00	R 224 462.00	R -83 511.00
NPV (Y0 to Y15)	R 64 637.00	R 43 506.00	R 66 980.00	R 175 123.00	R 36 647.00	R 163 654.00	R 43 277.00	R 243 578.00	R -68 455.00
NPV (Y0 to Y20)	R 75 618.00	R 43 506.00	R 98 214.00	R 217 338.00	R 40 527.00	R 163 654.00	R 67 157.00	R 271 338.00	R -54 000.00
NPV (Y0 to Y25)	R 90 234.00	R 43 506.00	R 136 643.00	R 270 383.00	R 45 730.00	R 163 654.00	R 89 634.00	R 299 018.00	R -28 635.00
NPV (Y0 to Y30)	R 109 697.00	R 43 506.00	R 184 806.00	R 338 009.00	R 52 711.00	R 163 654.00	R 116 978.00	R 333 343.00	R 4 666.00
NPV (Y0 to Y35)	R 135 626.00	R 43 506.00	R 246 149.00	R 425 281.00	R 62 080.00	R 163 654.00	R 150 912.00	R 376 646.00	R 48 635.00
NPV (Y0 to Y40)	R 170 185.00	R 43 506.00	R 325 337.00	R 539 028.00	R 74 661.00	R 163 654.00	R 193 768.00	R 432 083.00	R 106 945.00

Source: Burger & Swilling, 2009

### 2.4.3 Combination of housing development and sustainability factors

Sustainability needs to be considered through all the stages of the construction of the building in the provision of human settlements. Internationally, many human settlements have already been developed sustainably.

Sev (2008) provides guidelines on how the construction and design of houses can be done in a sustainable way. According to Sev (2008:1), the relationship between construction and the environment has become very clear as construction has strong social and environment impacts. He emphasises that sustainability is an overarching concept that can be affected by and affects every aspect of infrastructure development (Sev, 2008:2). According to Burgan and Samson (2006, as cited in Sev, 2008:2), construction consists of housing, utilities, workplace and transport infrastructure and is therefore of high economic significance and has huge social and environmental consequences. The emission of greenhouse gases is but one of the consequences of construction, due to the energy used in demolition, transporting, extracting of the raw material, maintaining, operating and constructing (Rwelamila *et al.*, in Sev, 2008:2).

It is important to incorporate sustainable principles right from the beginning of a housing project to realise high-performance and low-environmental impact structures (Sev, 2008:3). A construction project that is truly sustainable should consider the social, economic and

environment issues through all the phases, namely the planning, construction and demolition stages (Kibert & Wyatt, cited in Sev, 2008:2).

The “traditional” way of developing houses or buildings is very different to what contemporary strategies are trying to instil. The traditional way of construction, specifically regarding housing developments, was more focused on cost, quality and performance issues. The new sustainable construction and design focuses on the issues of minimisation of resource consumption; issues of environmental ruin; and the creation of a well-built environment, as well as guaranteeing human wellbeing and comfort (Sev, 2008:3).

The construction industry can make a contribution to sustainable development by using energy, water, materials and land efficiently (Sev, 2008:5-7). This is briefly discussed below.

The efficient use of energy depends on the type of energy being used. This will impact the location, magnitude and the type of environmental effects caused by energy consumption. In energy conservation, the main goal or objective is to reduce the use of fossil fuels and increase the use of renewable energy sources (Sev, 2008:5). According to Sev (2008:5), low-energy urban development improves quality of life with regard to cultural, institutional, ecological, political, economic and social aspects in the city.

Designers should investigate environmental impact on a larger scale, and the implications thereof, when constructing buildings, like houses, and also take into consideration the building in relation to the site. One way of maximising the use of renewable resources (e.g. wind power and solar energy) from the site is to use passive heating and cooling through orientation (Sev, 2008:5). The designers must find alternatives ways of adjusting the building according to passive day lighting and solar gain (Yeang & Gordon, in Sev, 2008:5).

Ways of doing the above are mentioned briefly. The ways in which windows are situated play a role. In the Northern Hemisphere, south-facing windows will assist with afternoon heating and east-facing windows will allow for early heating in winter. West-facing windows, on the other hand, need to be designed with caution so that their placement will not contribute to overheating. In the same way, windows should be north facing in the Southern Hemisphere.

The next aspect concerns the use of vegetation. Vegetation can play a huge role as an alternative measure to be used for sustainability, rather than things like mechanical air-conditioning. Evergreen provide a good example of this; if planted to the north of a building or house it will prevent summer heating and if planted correctly it will give protection from winter winds (Sev, 2008:5). A study of termite mounds has led to a natural air-conditioning solution with the assistance of wind and solar power. During the daytime the mounds warm up from the sun and during the night the warm mounds create suction which draws cool air in at the base. When this principle is applied to a building, the air cools the concrete slabs below the innermost area and serves as a cooling system. The sun is also made use of to light offices and the most central area (Gissen, Hawkes & Forster, cited in Sev, 2008:5).

Other sources of energy must be substituted for fossil fuels for construction to become sustainable. More use of solar, wind, geothermal energy and water should be made as a substitute to fossil fuels. Wind and sun are environmentally friendly as they do not emit pollutants and thus are sustainable sources (Sev, 2008: 5).

The embodied energy in materials attempts to measure the energy that goes into the lifecycle of the materials, it will thus be best to choose materials that are low in embodied energy (Sev, 2008:5). Aluminium is an example of a material with very high embodied energy because of the great amount of electricity used to mine the raw material (Sev, 2008:5).

Heat loss and gain should be avoided through insulation and additional devices. The reason for this is because it reduces cooling and heating loads therefore results in the use of energy in the process of building (Sev, 2008:5). Devices such as wind wings can be added to protect the house or building against prevailing winds and heat loss in winter, solar shading will also decrease the heat gains in summer (Sev, 2008:6).

The equipment used in the construction must also be energy efficient. This will reduce the operational energy used in the house or building, which represents the larger part of the energy costs during the life cycle. According to Williams and Dair (2007) high-efficiency heating, cooling and ventilation systems, together with a high-performance shell, should be carefully selected as it becomes crucial in the sustainability debate (Sev, 2008:6). Conventional boilers cost less, but are also less efficient than the high-efficiency condensing boilers (Storey & Baird, 2001; Sev, 2008:6).

Sev (2008:6) explains how water should also be used efficiently for construction to contribute to sustainable development. The various ways in which water can be used efficiently include potable water reduction; non-potable water substitute systems, recycling water, designing low-demand landscaping and collecting rainwater (Sev, 2008:6). Potable water reduction can be done by making use of efficient plumbing equipment. Examples of this are water saving; bio-composting and vacuum-assisted toilets; automatic shut-off sinks; low-flow shower heads; waterless urinals; steam trap programmes; and re-circulating dishwasher water for commercial applications (Sev, 2008:6). The non-potable water substitution systems can be achieved by the accumulation and using by-product water to replace the potable water. This water can be used for toilet flushing; process cooling; irrigation systems; and cooling system heat sinks (Armstrong, in Sev, 2008:6).

Water can be recycled by reusing grey water (which is water that was used for washing hands) or sewage. Such water can be used to flush toilets or to irrigate ornamental plants (Sev, 2008:6). The designing of low-demand landscaping is also a way of using water efficiently. Using plants native to the local ecosystem serves to reduce water on the location, as it eliminates extra watering of the plants as they would be adapted to the local rainfall of the area (Mendler & Odell, cited in Sev, 2008:6). Underground drip irrigation is another way of improving the efficiency of water. This reduces water loss caused by evaporation of surface water (Sev, 2008:6). The last way to use water efficiently is to collect rain water for many purposes like irrigation, household applications and to drink etc.

Sev (2008:6) also provides ways of making efficient use of materials. He recommends that the re-using of abandoned buildings and materials is a great way of recycling. He further states that re-using buildings reduces energy consumption as there will be a reduced need for transportation of goods and materials. Another advantage of recycling through incorporating recycled or reclaimed materials in construction projects is that it uses less energy, compared to producing new materials. The next guideline that Sev (2008: 6) provides is to properly size the building or house so that less material will be required. This can be a great saving mechanism. This method is especially applicable to the designing and programming phases of the architectural process. A further guideline that Sev (2008:6) provides is to select durable materials. This would be an efficient way of lengthening the life of the building or house and simultaneously reduce the amount of material used.

Land is another aspect Sev (2008:7) touches upon. He points out that soil erosion, acid rain, groundwater contamination and other pollutants caused by the industry hurts the wellbeing of plant communities. These points to the importance of sustainable design for an understanding to be developed of the interrelationships of water, plant communities and associations, and habitats and soils and also the impacts that human life has on them.

The conventional or traditional model of building has not taken into consideration sustainability issues and mainly focused on the design, construction, operation and maintenance (Kim & Rigdon, in Sev, 2008:7). With the realisation of the importance of sustainable development and the impacts thereof, sustainability should be considered throughout the house's life cycle. This involves pre-building, building and the post-building cycles (Sev, 2008:7). Sustainable building will have to include the understanding of the social, economic and environment impacts throughout all the phases of the housing development. Sev (2008:7) developed a life-cycle approach which seeks to balance the traditional issues with rising environmental concerns that affect decisions and choices in the designing phase.

A study by Glicksman and Lin (2006) is based on sustainable urban housing in a first world country, namely China. With China's accelerated growth rate and improving rank in the world economy, it makes for an interesting case. It is argued that it is clear that energy efficiency is more cost effective in many instances than an increase in energy supplies. They also note that well-designed buildings or houses will also contribute to a healthier environment besides saving energy.

China can benefit greatly by the efficient use of resources and capital in the expansion phase. It is often more cost effective to invest in energy-efficient building features than investing in additional energy supplies for a new building of conventional design (Glicksman & Lin, 2006:xx).

In the case of China, sustainable housing is interpreted in multiple modes, namely social, climatic, technological and urban. According to Glicksman and Lin (2006:26), housing in China could be far more energy efficient. This can be achieved mainly through the reduction of use of air-conditioning and improvements in the design of the building material; to lessen carbon dioxide emissions through the dependence upon climate-destructive energy sources



such as coal-fired power plants; and to make the most of natural ventilation and solar energy for winter heating and day lighting. On the urban scale, plans that are more ecologically responsive in respect of water conservation and retention, take wind pattern into account and also create landscapes that build a sense of community need to be developed.

Glicksman and Lin agree with Sev that designers need to think holistically and integrate all aspects of sustainability in order for sustainable housing to be successful (Glicksman & Lin, 2006:26). The integration of such techniques during the early stages of design and then developing it throughout the design and construction process will deliver an end product that is the result of a more sustainable approach in the design and construction of housing.

Literature on another developed country such as the United States of America focuses on the development of village homes. These village homes consist of narrow streets, long cul-de-sacs, inward-facing houses and natural drainage systems in order to create a more sustainable environment and enhance social life (Corbett & Corbett, 2000:25, 27).

It focuses on the reduction of energy consumption. They point out the following during development: Firstly, insulation of walls and roofs were treated with caution, windows were double-paned and window sills were set to mastic to reduce leakage and all cracks were sealed. Where there were cracks, caulking was done and the edges of slab floors were insulated so that coolness could be retained in summer and heat retained in winter. Light paint colours were used for the exterior walls and roofs to reflect the sun in order to keep the houses cooler. Tiles in light colours were also made use of right through the houses.

High-mass materials were used to store the sun's heat. Adobe walls (using sun-dried clay bricks) were used as it stores and absorbs heat and coolness to bring extremes in temperature to a comfortable level. Other means to store coolness and heat used later took the form of a solar greenhouse which incorporates the use of computers. A thick slab floor is poured on top of rocks. Pipes in the floor allow air to be drawn in for regulating the temperature in the house. This is regulated by means of the computer which senses the temperature in the greenhouse and draws cool night air through the pipes in the floor during the summer months and draws warm during winter months (Corbett & Corbett, 2000:34).



Corbett and Corbett (2000: 34) also describe the importance of proper orientation of the house, which allows for the maximisation of heat gain in winter and the minimisation of heat in summer. One of the ways in which this is done is to design a house that is shorter from north to south and longer from east to west. Another way is to have most of the windows and a modest overhang on the south side of the house to gain the benefit of having shade in summer and the advantage of full sunshine in winter. These solar houses are then ventilated and have sunscreens during summer (Corbett & Corbett, 2000:34).

The homes are built from north to south, the trees are grown from east to west and the building is fitted with a solar water heater. These added interventions to the houses have reduced electricity bills by almost 50% (Corbett & Corbett, 2000:35). This proves that, in the long run, the houses are easier and cheaper to maintain and the money invested will be justified through future benefits.

Winston (2009:1) also researched housing development. She studied the case of Dublin since the early 1980s. Winston's research provides an outline of key characteristics of sustainable housing which includes the economic, social and environmental dimensions thereof. She uses the economic, social and environmental characteristics to measure the effectiveness of sustainable housing development in Dublin. What can be noted from her research is the number of barriers that have to be overcome, are faced with sustainable housing development. She argues that the barriers concern a lack of shared vision; non-compliance with existing regulations; inadequate building regulations; negative perceptions of higher density housing; limited knowledge of and expertise in green building methods; poor quality of designs; an emphasis on demolition; negative attitudes to social mix; limited resources; and a failure to recognise the need for social regeneration (Winston, 2009:1).

In South Africa is one of those countries where a great backlog of housing still exists and many people still do not have their basic needs met. About 7,5 million people in South Africa still need housing (Streek, 2001:1). This means that many people are living in squatter camps and informal settlements, which has a negative effect to the environment. The ideal would be that the current generation should strive to meet basic needs and housing while simultaneously conserving long-term ecologically sustainable development with social equity (Holden & Linnerud, 2006:2). This is a wonderful goal, but many people in South Africa in

reality live in an impoverished condition and their concern is not with sustainability but with shelter. If sustainable houses are more expensive than the traditional houses, they will be ignored by the poor. If the beneficiary has to contribute financially, it may result in reluctance to implement the principles of sustainable development, but. it might be easier to enforce the implementation of the Kyoto Principles if government subsidises the houses.

The White Paper on Sustainable Energy for the Western Cape Province (2008) lists various targets for the province. The White Paper incorporates relevant aspects from the Provincial Growth and Development Strategy, the Sustainable Development Implementation Plan and the internal document on the Sustainable Energy Strategy for the Western Cape Province. In order to reach the Republic of South Africa's goals of sustainability, technological, institutional, economic and social change have to be infused. The targets listed in the White Paper on Sustainable Energy for the Western Cape Province (2008:8-9) are described briefly in the following paragraph.

The first target is concerned with electricity. It states that "15% of the electricity consumed in the Western Cape will come from the renewable energy sources in 2014, measured against the 2006 provincial electricity consumption". The second target is energy efficiency. The goal is to have a final energy demand reduction of 15% by 2014. The third and fourth targets deal with social sustainability. It is clear that these targets can only be met once the social, ecological and economic aspects of development are equally considered as part of development, as stated by all the authors mentioned above.

The Sustainable Development Implementation Plan (SDIP) of the Western Cape aims to provide an action plan based on the concerns of sustainable development that the Provincial Government can take care of (White Paper on Sustainable Energy for the Western Cape Province, 2008:13). The main targets of the SDIP is to sustain human settlements through energy provision and climate change mitigation; sustainable water use and management; sustainable waste management; biodiversity management; and sustainable provision of transport (White Paper on Sustainable Energy, 2008:13).

The City of Cape Town has a Cape Town Energy and Climate Change Strategy and an Integrated Metropolitan Environmental Policy in place to move toward a sustainable city. The City of Cape Town strives to be a sustainable world-class African city that is committed

to and cares for the creation of a better life for its people (Cape Town Energy and Climate Change Strategy, 2006). One of the aims of the strategy is to improve energy efficiency and energy supply options to contribute to sustainable growth and development through cost-effective energy provision. Two of the energy targets set by the City of Cape Town are applicable to this study: (1) 10% of households are to have solar water heaters by 2010, and (2) 10% of the city-owned houses are to have solar water heaters by 2010.

The Integrated Metropolitan Environmental Policy (IMEP) aims to give direction to local government's activities and programmes and thereby promote sustainable development (The City of Cape Town, 2003:4). The IMEP will form part programmes and strategies to guarantee the adherence with the principles of sustainability. The City of Cape Town is faced with the challenge of promoting development while at the same time managing the redistribution of resources to redress current inequalities according to the policy (The City of Cape Town, 2003:4).

South Africa has an annual population growth rate of 2,6 each year and 57% of the people live in towns and cities. In Cape Town alone there are approximately 296 000 registered applicants on the city's official housing database (Oscroft, 2008). The money allocated for subsidised housing in Cape Town is only sufficient to deliver 9000 houses. This means that the housing backlog will continue to increase by approximately 1000 units per year (Oscroft, 2008). The Town Planning and Environmental Approval processes required by the Provincial Land Use Planning Ordinance and the National Environmental Management Act cause many frustrations for housing practitioners. Sustainable human settlements can provide a solution as it will be environmentally friendly and help to combat the housing backlog.

The above-mentioned argument was supported by Richard Dyantyi, past MEC for Local Government and Housing of the Western Cape. He recognised that, if the methods of building houses and funding remain unchanged, the government would only be able to provide 14 300 RDP houses annually (Powell, 2007:3). The strategy of the Western Province Department of Housing suggests alternative solutions to the normal solutions for housing problems. One of the alternative solutions includes the building of sustainable human settlements close to public transport, services and other facilities.

## 2.5 Summary

Sustainability should be considered through all stages of developing houses, but the scope of this study is limited to the design and construction stages. It can be gathered from Chapter 2 that this argument for sustainability is supported by many authors. Swilling argues that sustainable buildings should be built in a way and with materials that use less energy. He suggests that it should be done by using alternative materials to the traditional materials and by recycling building materials (2006:11). Sev (2008:2) states that there is a very clear relationship between construction and the impact it has on the social situation and the environment. He provides guidelines on how design and construction can be done in a sustainable manner. This argument is supported by Glicksman and Lin, who mention that well-designed buildings will save energy and contribute to a healthier environment. Burger and Swilling argue that incorporating these innovations for building sustainable houses will prove more cost effective in the long run. This argument is supported by Corbett and Corbett (2000:35), who claim that added interventions mentioned in this chapter had reduced the electricity bills by almost 50% .

It is imperative to consider sustainable housing development in all relevant policies and thus in all forms of housing development. The South African government has introduced it in legislation and policies and influential government officials, such as Dr Lindiwe Susulu, past Minister for Housing, have emphasised the necessity of incorporating sustainability in the development of human settlements.

Municipalities have started implementing the guidelines in housing strategies and have started implementing it with certain housing projects. The next chapter is focused on one specific housing project of the City of Cape Town (Witsand Housing Project) in order to evaluate it against the relevant literature in place.

## **Chapter 3: The Case of the Witsand IEECO Housing Development Project**

### **3.1 Introduction**

As previously stated, affordable housing is a serious need in post-apartheid South Africa and the reduction of greenhouse gas emissions also still remains a priority for South Africa. A balance should thus be found between sustainable, affordable, energy-efficient and environmentally friendly houses and the reduction of greenhouse gas emissions through the use of renewable energy whilst still improving sustainable economic development (PEER Africa<sup>1</sup> (Pty) Ltd., 2010: 1).

The first large-scale integrated housing management project in South Africa seeking this balance was in Witsand, Atlantis (SA ROOFING, 2008:10). The Witsand housing project is the focus of the study as it is the only EECO housing project in the Western Cape (PEER Africa, 2004:5). It is also the only EECO housing project in South Africa with World Bank recognition via the International Finance Corporation based on PEER Africa/KCIHT designs and self-help implementation methodology (PEER Africa, 2004:5). The Witsand EECO housing project started in the Witsand informal settlement (2200 shacks) as a People's Housing Process (PHP)-oriented project (Guy, 2004:10). The project is focused on energy use and the consideration of the environment, which impact on health and safety.

Important elements such as the socio-economic background of the project; how potential home owners were selected; project-specific details; details of the design; construction; and the cost of the houses will be dealt with in this chapter.

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<sup>1</sup> PEER Africa is a South African Company that specialises in sustainable economic development and who is also concerned with energy-efficient and environmentally friendly development, became an Energy Services (ESCO) partner with the Eskom DSM group in 2004. They have attempted to reach the balance mentioned above. The principles are said to have been put in place, so they are used in the planning and implementing of such sustainable economic development projects in areas such as Gugulethu in Cape Town, Kutlwanong in Kimberley, Soweto in Johannesburg and Witsand in Atlantis, Cape Town region (PEER Africa (Pty) Ltd., 1).

### **3.2 Stakeholders in the Witsand Project**

The Witsand informal settlement was selected as the location for this EECO pilot project by the Blaauwberg Administration, City of Cape Town. The settlement had been a farm, but the owners had left. Witsand then became a piece of vacant land, until some illegal migrants that had been kicked out and backyarders from Atlantis occupied the land. They were followed by people without houses. The people occupying the area then put up their shacks on the vacant land and formed the informal settlement (Cupido, 2009). At the time that the housing project was decided on, the informal settlement was about 10 years old (PEER Africa/KCIHT EECO Show Case Human Settlement Project Witsand Cape Town, South Africa, 2002:2).

The community of the Witsand informal settlement mainly comprise farm workers, but some are factory workers from in and around Atlantis (Horn, 2007:7). The people who lived in the informal settlement had been waiting for houses for twenty years and are qualifying beneficiaries (Horn, 2007:7). They received houses in the area where they had already been living. This meant that they were able to keep their sense of community because they were not relocated.

Beneficiaries of the Witsand EECO houses needed to qualify for the then provincial housing subsidy of R24 274, 00 (City of Cape Town Review, 2002:1). They were then registered and placed on a waiting list until it was their turn to receive houses. They needed to abide by specific regulations as set out by the City of Cape Town and meet the qualifying criteria for the housing subsidy, as set out below (Western Cape Department of Housing, 2009:15-16).

The first criterion for selection identified people who were married or continuously lived together with one another, or persons proven to have financial dependents. Financial dependents could be children or other family members. The second criterion was that all those applying for a housing subsidy in South Africa had to be citizens of the Republic of South Africa, or had to be in possession of a permanent resident permit. The third criterion was that applicants had to be competent to contract: The applicant therefore had to be over the legal age of 21 years, of sound mind, and married or divorced. The applicant's monthly household income was not to exceed R3, 500. This had to be proven by the submission of adequate proof of income. Applicants also had to be first-time beneficiaries of government

funding: an applicant or anyone else in the household may not have received previous housing benefits from the government. Deviation from this requirement was only possible if the applicant qualified for the consolidation subsidy or was disabled. This can only be the case if the applicant qualifies for the Consolidation Subsidy or they are disabled. The applicant had to be a first-time property owner. This meant that they could not own another house or could not have owned a house previously. The exception to this rule was if the person was disabled or owned a vacant stand that was obtained through the Land Restitution Programme, or owned a housing property for the first time without any assistance from government and any dwelling/house on the property did not comply with Norms and Standards in respect of the Permanent Residential Permit registered in the name of the applicant. An exception was also possible if the person qualified for the consolidation subsidy.

To briefly clarify the above: the procedure of obtaining a house in the Witsand housing project was as follows: Government officials discussed the policy with prospective homeowners and explained what was available according to affordability and how much the subsidy could be stretched to get as much out of it as possible. A Community Development Worker presented the options to the community. Prospective homeowners had an option to expand their range of choices and supplement the standard or base house by making their own financial contribution. Initially, 10 different types of base house were show-cased, each providing different configuration options, e.g. semi-detached and slightly bigger, versus smaller, single houses (Cupido, 2010).

The consideration and approval of the construction of 2000 energy efficient houses in Witsand was submitted to the then Provincial Housing Development Board in March 2001 (Horn, 2007:7). Phase 1 of the Witsand EECO Housing project comprised building 400 houses and the Phase 2 target was 1600 houses (Dippenaar, 2009:15).

Efforts made by Mr Edward Samuels, Executive Director of Housing and Community Services for the Blaauwberg Region was driving the Witsand housing project before the new structure of the Cape Town Municipality of 2000 was implemented (Guy, 2004:11). The EECO development team was thus chosen by the City of Cape Town as well as the Witsand community with little involvement from the Provincial Government (Guy, 2004:11).

PEER Africa private investment provided the EECO methodology for the energy management strategy, and research and development work done over many years by various stakeholders also added value to the project (Guy, 2004:10).

Eskom's interest in the Witsand housing project is mainly based on the need to increase energy efficiency awareness and the measures to be taken. Eskom also wanted to introduce compact fluorescent light bulbs into formal housing in order to decrease the 'peak' energy used for space lighting (Guy, 2004:10). They also wanted to promote the use of energy-efficient appliances that would eliminate the danger resulting from energy sources with high hot air generating potential, such as open fires. The Eskom Residential Demand Side Management (DSM) Group therefore responded favourably to a proposal that was drafted by PEER Africa/KCIHT and the Witsand EECO Housing Beneficiary Support Organisation (WEHBSO) in order to integrate the EECO principles as part of the Residential Demand Side Management Programme (Guy, 2004:10).

### **3.3 Socio-economic background of the project**

At the outset of planning the project, the unemployment status in greater Atlantis totalled 4311 persons (Dippenaar, 2007:108). In the Witsand Informal settlement it totalled 342 out of the 1201 primary and secondary households (International Institute for Energy Conservation, 1990). The unemployment rate of the Witsand informal settlement was high, and the living conditions appalling; there was one toilet for every 250 persons, the quality of air in winter was very bad, and fly infestations in the summer time were out of control (PEER Africa (Pty) Ltd. 2010: 1).

The language compositions of the community as derived from the interviews conducted by the researcher via the fieldworkers are 92% Xhosa speaking, 7% Afrikaans speaking and 1% Sesotho speaking. None of the people were English or Zulu speaking.

Witsand informal settlement had an increasing population (from 5 km up to 80 km around the Koeberg), according to the 2005 estimation. They were made of 2405 persons who comprised 1273 (53%) male and 1132 (47%) female inhabitants (Dippenaar, 2007: 28). In 2001 the ages of the population of Witsand were recorded as: between the ages of 0 and 4:



290 (12%), 5 to 9: 204 (8%), 10 to 14: 128 (5%), 15 to 19: 140 (6%), 20 to 24: 477 (20%), 25 to 29: 506 (21%), 35 to 39: 134 (6%), 40 to 44: 108 (5%), 45 to 49: 71 (3%), 50 to 54: 52 (2%), 55 to 59: 31 (1%), 60 to 64: 14 (0.6%), 65 to 69: 12 (0.5%), 70 to 74: 0, 75 to 79: 0, 80 to 84: 0 and 85+: 09 (0.4%) (Dippenaar, 2007:29).

Before the inception of the project (2001 statistics) the types of dwelling in the Witsand area comprised 49 houses or brick structures on separate stands or yards, four traditional dwellings/huts/structures made of traditional materials, 41 informal dwellings/shacks in back yards, 773 informal dwellings/shacks not in back yards, four caravans or tents. There were no rooms/flatlets not in back yards but on shared properties, no flats in block of flats, no town/cluster/semi-detached houses (simplex; duplex; triplex), no private ships/boats (Dippenaar, 2007:30). It is clear from Dippenaar’s statistics that most of Witsand was made up of shacks before the housing project.

The following sub-sections focus on primary and secondary household and lodger statistics of the newly developed Witsand area in order to provide a consolidated picture of the community composition.

### 3.3.1 Primary Household Statistics

Table 3.1 presents the statistics on gender, unemployment, number of people with dependants, marital status and the nationality of the primary or secondary households and lodgers residing in the area (see Annexure 1). The data are derived from statistics in the City of Cape Town project records provided by Cupido (2009).

Table 3.1: Primary Household Statistics

Gender statistics

Male	Female	Total
350	147	497

Statistics of unemployment

No. of Unemployed Residents	No. of Unemployed Females	No. of unemployed Males
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134	39	95
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Marital statistics

Married	Single	Divorced	Cohabiting	Widowed
179	251	8	52	4

Dependants

People with dependants	People without dependants	Unknown
85	58	4

Nationality

South African	Other
497	none

Source: M. Cupido, Project Manager, Housing Division, City of Cape Town. Cape Town: *Personal interview*, 28 September 2009.

This sub-section focuses on primary households; these are the households of the legitimate owners of Witsand residential properties. The whole primary household population of Witsand has South African citizenship and are not foreigners. These primary households of the Witsand population are made up of 497 people (21%). The male numbers are dominant as they comprise more than double the female population. The exact numbers are 350 males and 147 females.

Most people living in Witsand are now employed but there remains a huge need for employment as 134 people (6%) are still without jobs. Ninety-five (71%) of the 134 unemployed people are male, which is a very large number. There are 85 people who have other people who depend on them financially.

The marital statistics show that 251 primary residents are single, 179 are married, eight are divorced, 52 cohabit and four are widowed.

### 3.3.2 Secondary Household Statistics

Secondary households are households that live with the main household. The relevant numbers for such households are presented in Table 3.2.

Table 3.2: Statistics of secondary households

#### Gender Statistics

Male	Female	Total
496	208	704

#### Statistics of unemployment

No. of Unemployed Residents	No. of Unemployed Females	No. of Unemployed Males
208	69	139

#### Marital statistics

Married	Single	Divorced	Cohabit	Widow
246	353	8	93	4

#### Dependants

People with dependants	People without dependants	Unknown
600	104	0

#### Nationality

South Africa	Other
704	none

Source: M. Cupido, Project Manager, Housing Division, City of Cape Town. Cape Town: *Personal interview*, 28 September 2009.

There are 704 people who live as second households – many more than the members of primary households. 208 of those 704 people are unemployed (139 males and 69 females).

The marital status is similar to that of the primary households. Most of the people are single (353 single), 246 are married, eight are divorced, 94 cohabit and four are widowed. Within these secondary households, 600 of the 704 are responsible for people who are dependent on them.

### 3.3.3 Lodgers

Besides the primary and secondary households, some households also accommodate lodgers. From among those lodgers, 153 (11%) of the total number of people (1354) living in other people's houses actually pay for accommodation. Statistics for lodgers are presented in Table 3.3.

Table 3.3: Statistics for Lodgers

Gender Statistics

Males	Females	Total
90	63	153

### 3.4 Case study: Geographical location

Witsand, Atlantis is situated in what government calls the Southern Coastal Compensation Problem Area (SCCPA) (Guy, Annegarn & Eland, 2007:2). The fact that the area is rated as SCCPA qualifies this project for an additional subsidy for implementing external finishing, ceilings and ceiling insulation (Guy, Annegarn & Eland, 2007:2). The SCCPA has specific aims and standards and thus has specific guidelines that need to be followed. The aim of the SCCPA with the first priority is to increase the temperature of the indoor wall above dew point in order to reduce the development of dew and thus of mould (Guy, Annegarn & Eland, 2007:3).

The next section presents two maps of the Witsand area. The first map (Figure 3.1), by Du Toit (2008) highlights the settlements of the area. The second map (Figure 3.2), by Gumede (2002), is a locality plan of the Witsand area.

The three most important aspects when it comes to designing and implementing more sustainable urban systems are transport, food supplies and construction of buildings/urban infrastructure (Burger & Swilling, 2009:1). Even though only the construction of buildings is dealt with in this study, it is important to view sustainable development holistically, thus the reason for both maps.

Figure 3.1 shows the Southern Coastal Condensation Problem (SCCP) area as Atlantis falls nearly in the centre of the Cape West Coast Biosphere Reserve. This is the reason for the Witsand area qualifying for an additional government subsidy. It can also be noted that a main road runs through Atlantis, so access to transport is possible.

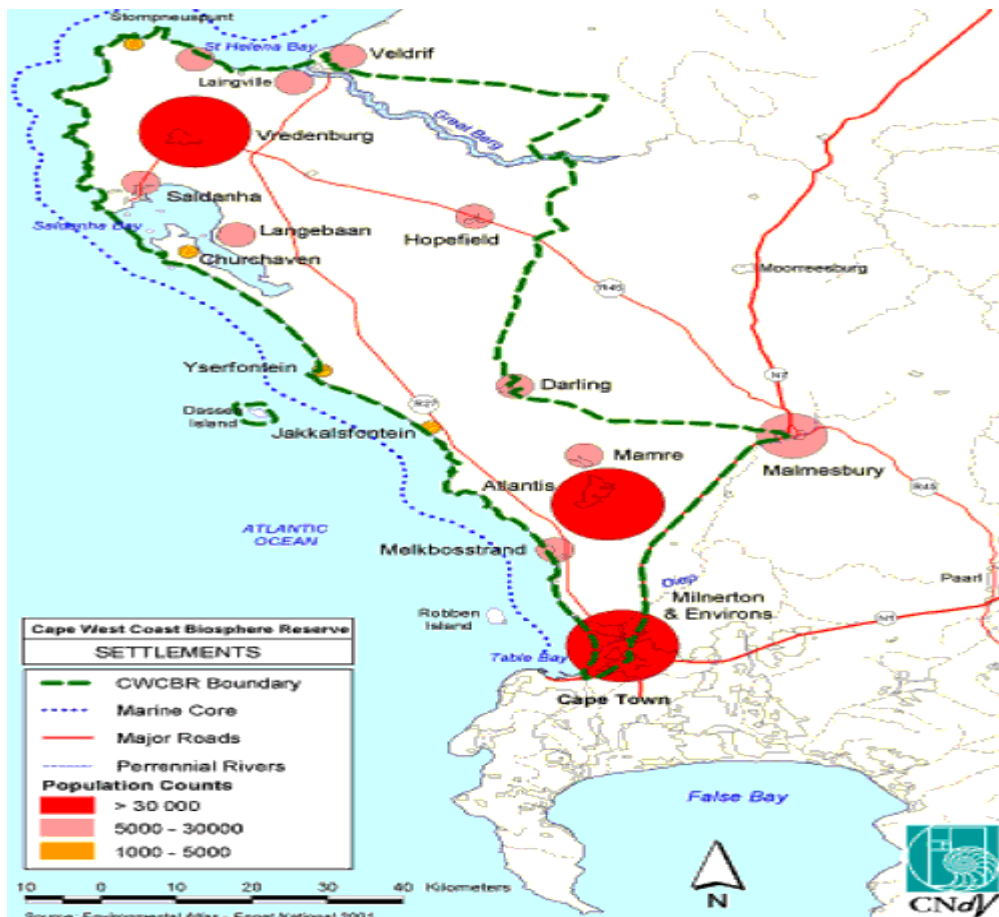


Figure 3.1: The Southern Coastal Condensation Problem (SCCP) area  
 Janette du Toit, Programme Manager: Cape West Coast Biosphere Reserve  
[www.capebiosphere.co.za/html/people.html](http://www.capebiosphere.co.za/html/people.html).

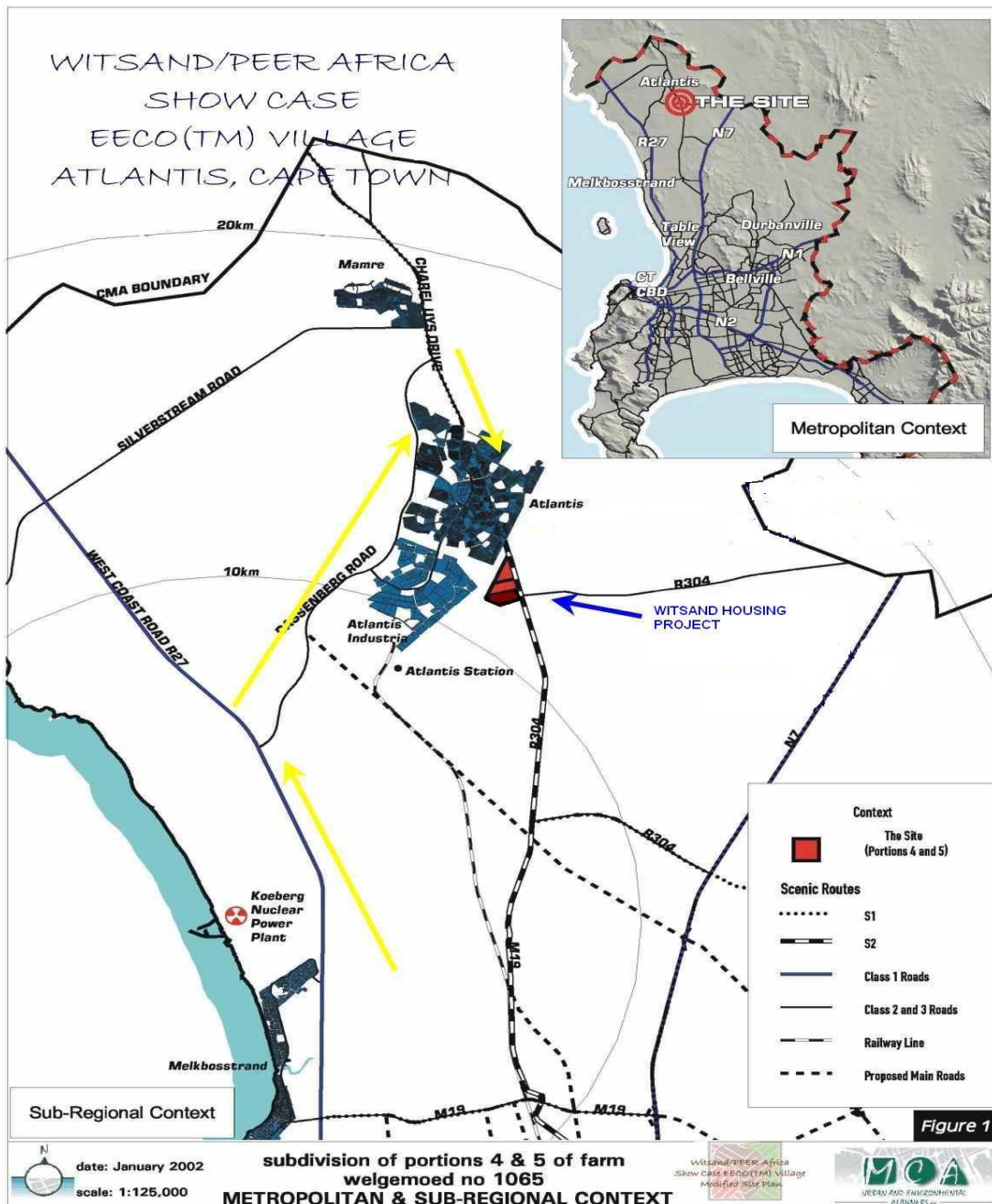


Figure 3.2: Witsand Locality Plan

Source: Duke P. Gumede Head: Project Coordination New Housing - Northern Region, Housing Directorate. City of Cape Town, January 2002.

Figure 3.2 demonstrates how accessible transport, and thus food supplies, is to the Witsand community. It is clear that the railway station is near Witsand and a Class 1 road runs directly to and from Witsand, therefore both public and private transport are easily accessible.

### 3.5 Details of the Houses

The construction specifications were based, in part, on research provided by Agrément South Africa, but the installation practices were ordered by the National Department of housing specifications. These housing specifications were provided by the Provincial Department of Housing to all developers involved (SA ROOFING, 2008:12). Eskom DSM and the city housing SCCPA requirements included the distribution of four compact fluorescent light (CFL) lanterns per household and passive solar specifications directed by PEER Africa (SA ROOFING, 2008:12).

The Witsand IEECO housing project qualified for an additional subsidy as it falls in the Southern Coastal Condensation Problem (SCCP) area. The increase in the government housing subsidy was R3,900 for the project, which is approximately 10% of the total subsidy for the housing unit (Guy, Annegarn & Eland, 2007:3). The additional subsidy was used for the implementation of ceilings, ceiling insulation and external finishing (building type) (SA ROOFING, 2008:10). A public tender was used to find the best priced IEECO construction service provider to provide the ceilings, ceiling insulation and the external finishing that met the minimum IEECO specifications and also the standard government housing construction requirements (Guy, Annegarn & Eland, 2007:5).

The project featured interventions in site layout, architectural support, erven and house design, compact fluorescent lights (CFL) and other thermal-performance measures (SA ROOFING, 2008:10). The Witsand IEECO houses were designed to be built facing north. This makes it possible for the houses to be warm in winter and cool in summer (Horn, 2007:7). The specifications required the houses to be built in a way that would maximise exposure to sunlight as to take advantage of potential solar energy, e.g. by the extension of the roof overhang by 500 mm, orientation of the streets (site plan) and placement of the building on the site. In summer the houses were to avoid excessive heating by the placement of the house row, and placement of windows (with installation of larger windows on the north-facing side) (PEER Africa/KCIHT IEECO Show Case Human Settlement Project Witsand Cape Town, South Africa, 2002:5).

The City of Cape Town's focus on renewable resources is mainly on people so "learning by doing" is a priority of the project strategy (PEER Africa, 2010:4). Using solar energy and passive storm water recovery and re-use are the main renewable resource strategies (PEER Africa, 2010:4).

Energy saving lighting and gas cookers were installed in the EECO houses. The compact fluorescent lights/lamps (CFLs) replaced the ordinary light bulb or other means of lighting used before. Electrical geysers were to be replaced by solar heating devices and thereby save 70% in energy usage. Gas cookers burn more efficiently and cleaner and high levels of safety precautions go with usage of these instruments (International Institute for Energy Conservation, 1990:3).

The City of Cape Town saw the design phase of the Witsand EECO housing project in most cases as the most critical phase of the project as there was not really a site selection option (PEER Africa, 2010:4). According to the City of Cape Town, Blaauwberg Municipality (2005:1) the foundations, superstructure, door frames, roof, plumbing, paint finish, doors and plaster were selected according to specific details. The design elements are discussed in the paragraph to follow.

The elements of construction that was selected according to very specific details in accordance with sustainable building guidelines comprised the foundation, superstructure, external door frame, the window frames, the roof, the plumbing, the type of paint used, doors and the walls of the house.

According to Cupido (2009), the design for the construction of the Witsand IIECO houses were governed by five design requirements relating to the roof overhang, insulation, position/size of windows, orientation, and floor slab. These aspects were dealt with as follows: The Witsand IIECO houses have a wide roof overhang on the sunny side of the house. On this northern side the overhang is a minimum of 400 mm, and can extend to 600 mm. This is to ensure that the unwanted high summer sun does not enter the house, while low winter sun is allowed in.

In energy efficient houses the insulation of the ceiling and walls are especially important. Insulation of the ceiling is necessary as it insulates the house against heat loss during winter



and extreme heat gain during summer. This ensures that the house is cool in summer and warm in the cold winter months. One of the SCCPA requirements for the houses was a 6,4 mm gypsum ceiling with 80 mm of wool insulation or its equivalent (SA ROOFING, 2008:12). The walls of the houses were supposed to be insulated via cavity walls or other insulation such as polystyrene to stabilise temperature changes. Paint used on walls is dark in colour as a means of insulation as it enables the wall to absorb heat from the sun's horizontally angled rays during the day in winter and to then release the heat into the house at night (International Institute for Energy Conservation, 1990:3).

The windows of the energy efficient houses are built according to two specifications: windows are specified to be large and fitted on the northern side of the house. This is to allow as much sunlight into the house as possible during the winter months.

The orientation of the houses also plays a role in it being energy efficient. The longest side of the house is oriented east-west. This means that the house faces north and therefore receives the maximum amount of sunlight throughout the day.

The floor slabs of energy efficient houses are constructed of material that has a high thermal mass (e.g. brick or concrete). This means that the floor is able to store heat during the day and release heat slowly at night. It is thus advised to leave the floor slab uncovered.

The proposed cost of Phase 1 of the Witsand Housing Project was estimated at R9, 000, 000 for 500 units (Guy, 2000:6). The actual cost per Witsand IEECO house included the cost of the foundation, wall-plate and roof for the two types of houses in Witsand, namely single or semi-detached houses. For 500 units of single houses, the cost was R8,241,223.

According to Guy (2000:4), performance and project tracking are crucial in this type of housing project. It requires dedicated staff at the site with all aspects of the project intervention analysis, reporting and verification process.

The Witsand project was extensively monitored and stimulators and devices were used to monitor and assess the 10 units constructed in the field and results were compared to normal RDP houses. What Peer Africa then did was to modify the design of the houses according to these results (Guy, 2009).

Peer Africa submitted a proposal to Eskom and hired the University of Cape Town (UCT) to do an independent study to verify the claims that were made. This study is confidential to Eskom, however. Guy (2009) also proposed about 1 Mw of savings per household per year for the site redesign and the housing design, according to the study. He also states that Peer Africa had a registered patent with Spoor and Fischer for the monitoring equipment and its design. He also mentions that they have a more robust IEECO (TM) measurement and rating scheme which looks at more holistic criteria based on poverty alleviation and not only on the technical logical interventions.

### **3.6 Summary**

The case of Witsand was described and discussed in respect of population, geographical area and the details of the house in this chapter. A comprehensive explanation of how sustainability was designed and built into the case has been presented.

The Witsand housing project had to adhere to specific design and construction criteria. While the installation practices were ordered by the National Department Housing specifications of the time, the housing specifications were provided by the Provincial Department of Housing. The very specific requirements and specifications for sustainability make the Witsand IEECO houses different from the traditional low-cost RDP government houses. This chapter clearly shows how the aspect of sustainability was incorporated into the design and the construction of the Witsand housing project.

In the next chapter the field work that was done will be documented and analysed to determine how closely the City of Cape Town has implemented and adhered to the specifications and installation practices set out by the National and Provincial governments, and how sustainable the houses in the case study are.

It is important, to acknowledge that the design intentions of the City of Cape Town correspond with what was quoted earlier from Miranda and Marulanda (2002:1) concerning taking full advantage of the natural environment for sustainable construction and design

without changing or harming it. The design intentions are also in agreement with the theory about finding ways of energy saving.

According to Hendler and Thomas-Smeddle (2010:12), it is critical that sustainable design criterion should include the following:

- Thermally efficient design
- Sustainable building materials
- Energy efficiency
- Renewable energy options
- Sustainable water and sanitation systems
- Waste minimisation and recycling

The Witsand community's satisfaction with the houses is evaluated in Chapter 4. The awareness of the community with regard to the sustainable nature of their homes and sustainable living is discussed.

## **Chapter 4: Sustainability as community knowledge and a way of living**

### **4.1 Introduction**

In Chapter 2, it was argued that the key point for sustainable construction is to take full but wise advantage of the natural environment without changing it and to still allow other living organisms to exist and be preserved, and simultaneously to minimise energy wastage. However, more specific to socio-economic sustainability, it was also argued that access to services, work opportunities and social amenities and affordability of maintaining and living in a house would be indispensable for sustainability. Sustainable housing would therefore find a balance between macro-economic housing delivery sustainability, i.e. the ability of the economy to sustain low-income housing delivery; ecological sustainability, i.e. the ability of the environment to sustain living while still maintaining the resilience and robustness of biological and physical systems; and socio-cultural sustainability, i.e. maintaining and improving the stability of social and cultural systems. In Chapter 2, South African policy and legislation were analysed to indicate to what extent consideration was given to finding this balance. On the level of policy and legislation, it is evident that such a balance is indeed sought.

In Chapter 3, the attention shifted to the practice, with an investigation into the first large-scale integrated housing management project in South Africa seeking this balance, namely the Witsand Housing Project. A mixed reality emerged from the analysis. Witsand is situated in an area with high levels of poverty and the climate necessitates additional design features to cope with high levels of condensation. However, the area is well served with transport infrastructure and, importantly; beneficiaries of housing were already living in the Witsand informal settlement area. Therefore, although still highly constrained in terms of choice of locality due to poverty, the fact that they have selected Witsand as a place to settle is significant for socio-economic sustainability. Even before initiation of the project, they had already started developing the socio-economic fabric in their community so necessary for sustainability in a low-income community. In Chapter 3 it was also shown to what extent housing design and input by various stakeholders have contributed to the potential of sustainable living.

In Chapter 4, the attention shifts to the beneficiaries, with the purpose of discovering their knowledge and their way of living as expression of a sustainable community. This is the fourth sub-objective of the study as expressed in Chapter 1 and it also shifts the attention from input to process and outcome. The experience of sustainability within the community of Witsand was measured by gathering primary data via questionnaires, interviews and observation. The interviews were conducted to measure the involvement of the homeowners in the project's housing process, to determine whether their awareness of sustainability increased, whether their lives have improved and whether they are giving anything back (social responsibility). All this was done by measuring the experiences from the people's point of view. In the next section (4.2), the framework for conducting the field work is explained by providing an overview of the questions asked; further information obtained from interviews; and information obtained from observations. In Section 4.3, the process of preparing and conducting the field work is further elaborated upon, and in Section 4.4, the findings are explained and illustrated by means of tables and graphs.

## **4.2 Data collection framework**

Table 4.1 provides the framework for data collection. Most of the questions were asked during expert interviews but are nevertheless included here to assist in the interpretation of the data collected from beneficiaries. The field workers were also requested to record certain observations about the appearance of the properties in order to also note whether beneficiaries are able and willing to take care of their properties.

With regard to the questionnaires, the main aim was to measure the different experiences of the people with regard to various issues included in the mind shift towards more sustainable living; the process of the housing development; cost saving; and health. Therefore, the questionnaire aimed to find an answer to the question whether, from the experience and attitude of beneficiaries, sustainable housing policy intentions were realised in the project. In order to get an answer to this, the questions were posed around five aims:

- To determine living conditions prior to the project as expressed by the beneficiaries themselves;
- To determine whether beneficiaries had participated right from the inception of the project, before houses were constructed;

- To determine whether beneficiaries were aware that the houses differed from other typical housing projects;
- To determine whether the housing introduced savings on municipal service costs (as the design did not really include water saving features, the questions only aimed to determine whether beneficiaries felt that their houses introduced savings on electricity);
- To determine whether the housing is more conducive to climate control and improved health status.

Purpose of data collected	Questions conducted by field workers	Interviews with experts	Observations by field workers
To determine if living conditions have improved	1. In what type of dwelling did you live before this?	What were the socio-economic and living conditions prior to the project?	
To determine if beneficiaries participated right from the inception of the project	2. How were you informed about this housing opportunity?	To what extent were beneficiaries involved with the project right from the first concept development stage?	
	3. Were you involved or aware of the initial process for obtaining the house?		
To determine whether beneficiaries were aware that the houses were different from other typical housing projects	4. Are you aware of the special nature of your house?	What was done to make beneficiaries aware of the sustainability intentions and also to urge them to sustain the value of their properties?	Are beneficiaries taking care of their properties? (ability and willingness to maintain the property) Is there a garden around the house? Is there a fence around the house? Is the house neat? Are there cracks in the walls?
	5. Does the special nature of the house make a difference to you?		
	6. What is the difference it makes?		
	7. Did this housing project make you more aware of the environment?		
To determine whether the housing brought beneficiaries savings on	8. Were the following provided in your house: <ul style="list-style-type: none"> <li>• Solar hot water cylinder?</li> <li>• Energy saving lights?</li> <li>• Energy saving stove?</li> </ul>	To what extent did the design provide for reduced consumption? What are residents actually spending on electricity?	

municipal service costs	<ul style="list-style-type: none"> <li>• All the above?</li> <li>• Nothing?</li> </ul>	Is electricity consumption lower than other traditional housing projects? Is water consumption lower than other traditional housing projects?	
	9. Are you saving on electricity now that you are living in this house?		
To determine whether the housing is more conducive to climate control and improved health status	10. How would you describe the day temperature of your house in summer?	To what extent did the design provide for better climate control during both winter and summer?	
	11. How would you describe the day temperature of your house in winter?	To what extent did the design provide for insulation and other means to support healthy living?	
	12. Since you have been living in this house, have you been to the doctor/clinic less or more?		

### 4.3 Process for conducting field work

The field work consisted of two phases, namely a phase of expert interviews and a phase for community surveys by means of questionnaires.

#### 4.3.1 Interviews with experts

The interviews with experts firstly consisted of a series of interactions with the project manager of the Witsand project. He provided access to information on the socio-economic conditions of people living in the area, as discussed in Chapter 3. He also provided access to data and other sources of information related to the design of the project in general and the Witsand houses in particular. He furthermore provided comparable data concerning other traditional projects.

In a typical snowball sampling approach, the project manager also provided access to the next important expert for this research, namely the chairperson of the Witsand Committee. He had also previously been a councillor. The chairperson provided further socio-cultural information and also identified suitable candidates from the community who had the necessary capacity and understanding to conduct the survey by means of questionnaires.

These interviewers obtained previous training by a municipality on how to conduct interviews and surveys. Due to their knowledge of the community and of surveys, they could actually actively contribute to the design of the community survey phase.

#### **4.3.2 Surveys by means of questionnaires**

The survey started with a training session dealing with the purposes and content of the questionnaire and the sampling method. The interviewers also helped with the translation of the questions into the Xhosa language.

The sampling method that was used was systematic sampling using a representative sample method. As  $452/90$  equals every 5,02th house, hence the 5th house, every 5th house was approached; if some households were not available at the specific time an incremental approach was followed and interviewers would go back a second time. If the interviewees were still not available, the residents of the house to the left of the selected house were subsequently interviewed.

A pilot run of interviews was done on the 17th July 2010. The interviewers had to collect the questionnaires (of the pilot study) on a specific date. All were returned without problems, so the next 90 questionnaires were sent off. Ninety questionnaires were collected on the 9th August. Ninety interviews were conducted, but one interviewee was interviewed twice and was thus duplicated (erf 14275). In total 89 questions were useful as one erf was not interviewed.

The results of the 89 valid questionnaires together with supporting information from the expert interviews and observations of interviewers are explained and depicted through graphs or tables in the next section.

#### **4.4 Results of the field work**

Table 4.2 provides a summary of the results obtained from the questionnaires distributed in the community. The sub-sections that follow provide an interpretation of these results.



Table 4.2: Summary of responses by interviewees

Q Nr	Answer 1		Answer 2		Answer 3				
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage			
1.	Shack	8 7	97.8	Other house or homeless	1	1.1	Missing answer	1	1.1
2.	Community Forum	8 9	100	N. A.	0	0	N. A.	0	0
3.	Yes, involved	8 8	98.9	No, not involved	1	1.1	N. A.	0	0
4.	Yes, are aware	8 7	97.8	No, not aware	1	1.1	Missing answer	1	1.1
5.	Yes, makes a difference	8 9	100	N.A.	0	0	N.A.	0	0
6.	See graph 4.1 below								
7.	Yes, increased awareness	8 9	100	N.A.	0	0	N.A.	0	0
8.	Energy saving light	6 7	75.3	Energy saving light & energy saving stove	1 8	20.2	Received nothing energy saving	3	3.4
9.	Yes, saving on electricity	8 8	98.9	No, not saving on electricity	1	1.1	N.A.	0	0
10.	Very hot	1 7	19.1	Hot	1	1.1	Cool	7 1	79.8
11.	Very cold	1 8	20.2	Cold	1	1.1	Mild	6 9	77.5
12.	Less	8 9	100	N.A.,	0	0	N.A.	0	0

#### 4.4.1 Improvement in living conditions

All outputs from Questions 4 to 7 were positive as can be seen from Table 4.2. High percentages indicated that the people are aware of the special nature of their houses; that it makes a difference to them; how it makes a difference; and also that they have an increased understanding or awareness of the environment (see graph in Figure 4.1).

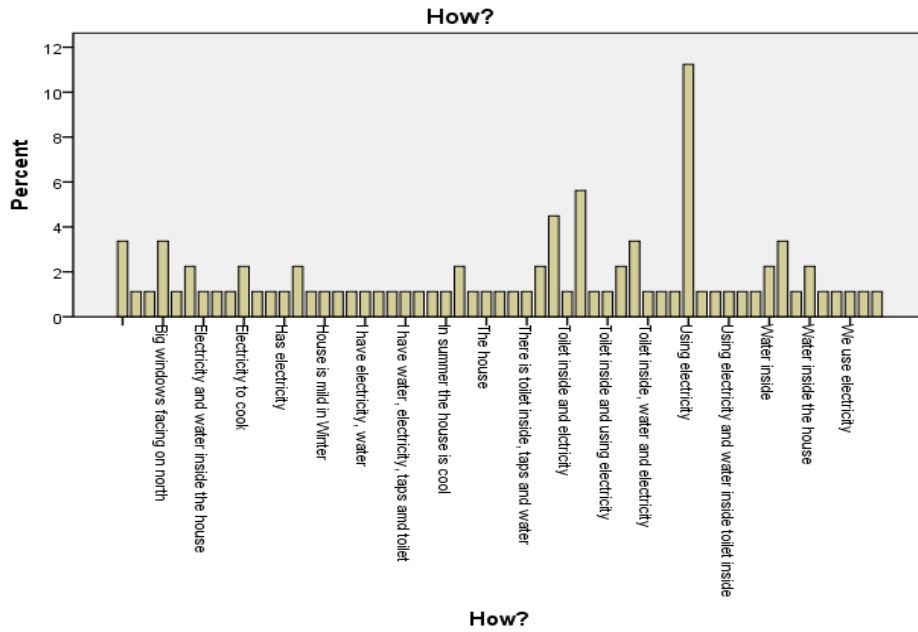


Figure 4.1: Graph showing awareness of the special nature of their houses

Data were also collected by means of certain observations about the houses and the surrounding area in order to determine whether there was an improvement in living conditions. By making these observations we could safely deduce the level of social responsibility linked to sustainable development. The appearances of the houses were looked at to measure social responsibility.

Table 4.3: Results from observations during data collection

**Observations**

**Does the housing plot have a garden around the house a garden?**

	Frequency	Percent.	Valid Percent	Cumulative Percentage
Valid Yes	27	30.3	30.3	30.3
No	62	69.7	69.7	100.0
Total	89	100.0	100.0	

**Is there a fence around the house?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	63	70.8	70.8	70.8
No	25	28.1	28.1	98.9
Not specified	1	1.1	1.1	100.0
Total	89	100.0	100.0	

**Is the house neat?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	88	98.9	98.9	98.9
Not Specified	1	1.1	1.1	100.0
Total	89	100.0	100.0	

**Are there cracks in the walls?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	46	51.7	51.7	51.7
No	39	43.8	43.8	95.5
Not Specified	4	4.5	4.5	100.0
Total	89	100.0	100.0	

Social sustainability is linked with economic development. In order to maintain social sustainability, the living standard of the poor needs to be increased. According to Edward Barbier (Rogers, Jalal & Boyd, 2008:44), sustainable economic development can be measured in terms of increased food, education, real income, water supply, health care, sanitation and only directly concerned with economic growth at the aggregate.

The above is applicable because the houses for this project were built for a poor community and poverty pollutes everything. A more descriptive explanation is that poverty causes both resource depletion and degradation (Burger & Swilling, 2009:21). It was important to see whether this community was overcoming the poverty and, if so, to what extent. One way to measure it would be to look at whether their attitudes had changed to being more socially responsible and whether their standard of living had increased somewhat.

Seventy percent of the homes that had been sampled to respond via the questionnaires did not have a garden around the house, thus only 30% had gardens. This question had a dual purpose. From the one angle the deduction is that a garden around a house indicates taking care of the home and surroundings. As previously noted, Sev (2008:5) believes that vegetation can play a huge role in providing alternative sustainable means to replace things like mechanical air-conditioning. This argument is supported by the City of Cape Town's Smart Living Handbook, in which planting a deciduous tree for shade in summer is suggested (2011:79). From this point of view it can be gathered that most people are not showing signs of their awareness of social sustainability or responsibility having developed. On the other hand, not growing a garden can be a way of saving water and keeping the expenses even lower and, in turn, saving money.

The second observation was that 28% did not have a fence around their house, while 71% had a fence around the house and 1% of the questionnaires did not show a response. A fence around the house may not relate directly to sustainability but, as a means of protection against unwanted elements, it shows a degree of ownership.

The third observation was that 99% of the homes were neat; 1% of the questionnaires did not specify whether the house was neat or not. From 99% of the houses being neat can be deduced that nearly all of the people in the sample take pride in what their houses look like.

The fourth observation was that 52% of the houses have visible cracks in the walls, 44% do not have cracks in the wall and 5% of the questionnaires did not specify. This observation

considered the structural part of the house, which would concern the building material. Cracks in the walls would indicate that the building material was not of a very good quality. It is not the fault of the homeowners that their houses have cracks, but it is the responsibility of the homeowners to fix the cracks. They should take care of their homes and not leave the cracks unfixed. This, however, is impossible to do without the necessary financial means.

From looking at all the observations holistically, it can be gathered that the homeowners have a sense of pride in their new homes and are therefore trying to improve their living conditions.

#### 4.4.2 Did beneficiaries participate from the inception of the project?

The graph in Figure 4.2 reveals whether the beneficiaries were included during the initial stages of the process of obtaining the houses. It measures the participation of the people in the project from their own perspective, and how the information was conveyed

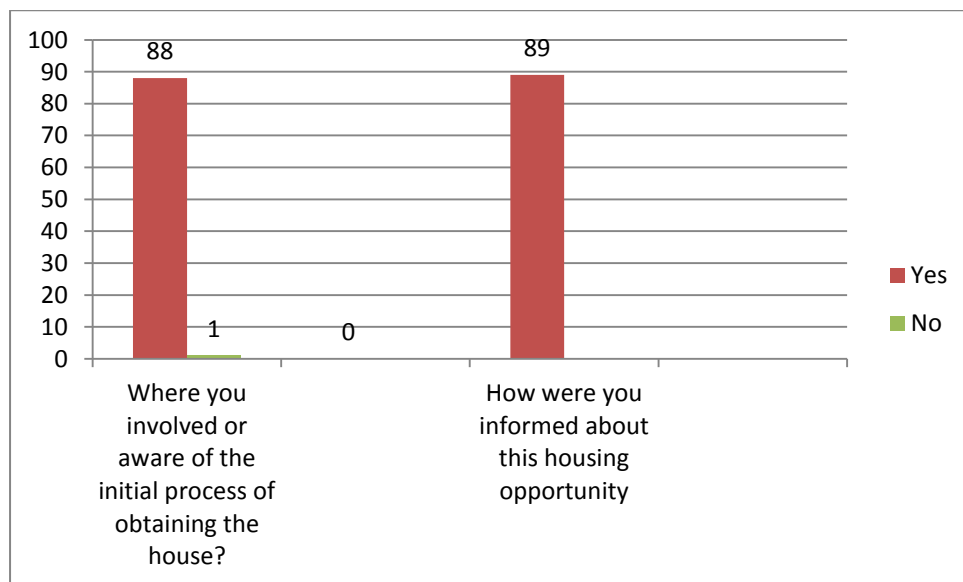


Figure 4.2: Involvement of participants

Figure 4.3 presents the degree to which the new house is an improvement on where beneficiaries used to live. From the graph it can be said that a huge improvement is indicated.

The data shows that 99% of the people previously lived in shacks. It can safely be deduced that the result definitely was positive.

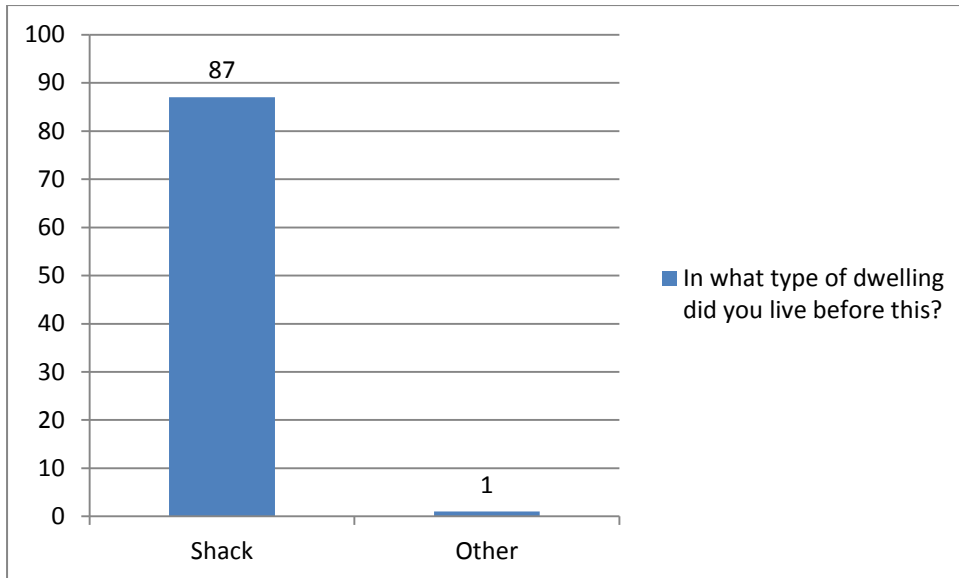


Figure 4.3: Degree of improvement in living conditions

The second question referred to in Table 4.2 was concerned with how the people were informed about the process. It is important to determine the most effective manner for conveying information to the people. The options that were given included the local government official, the newspaper, a pamphlet, the community board or a friend/neighbour. Many of the people are low-income earners who do not necessarily buy newspapers or magazines. The responses to the second question in the questionnaire shows that all the homeowners concerned in this specific housing project were informed about this project via the community forum member.

The third question referred to whether or not the potential home-owners at that stage were involved in the initial process of the housing project and what their experience of the process was. The results show that 99% of the homeowners were involved or aware of the project from the beginning; 1% said they were not. This result shows that there was huge involvement from the community side in the planning. These results are shown in Figure 4.4.

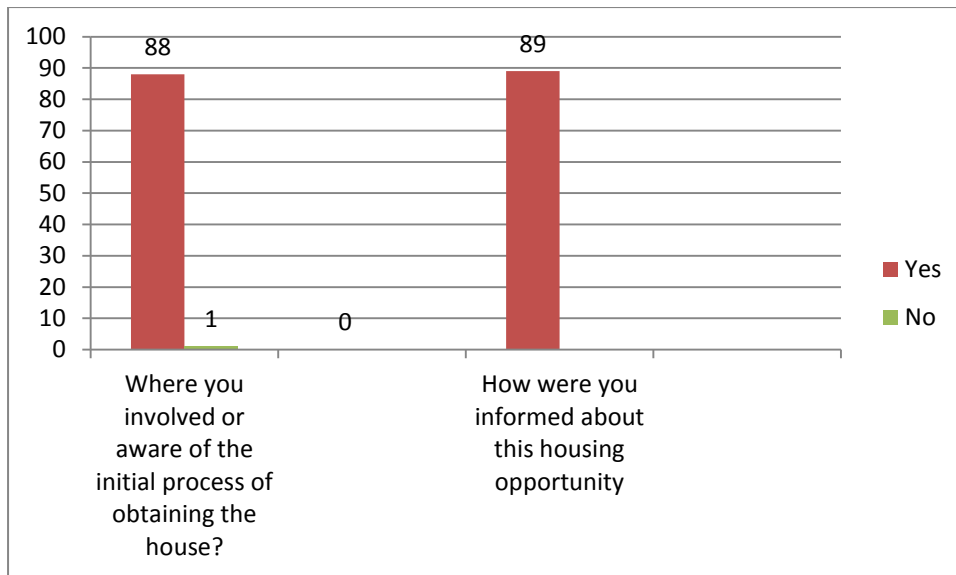


Figure 4.4: Beneficiaries' awareness of/ participation in the project

From responses to Questions 3 and 4, two essential points are clear. The first is that the community forum member is seen to be the most effective means for explaining and distributing information to communities such as the one involved in the research. The next important point is that the collected data record that the community indicated that they participated in the process. Community participation can foster a sense of teamwork and can thus make people feel part of the housing process.

If looking at the results of the previous questions it can be noted that the process was not one of isolation. Most people were informed about the project and had the process explained by a community forum member. They participated to a certain extent as they had choices between 10 different types of house on the basis of whether they could contribute extra money.

#### 4.4.3 Beneficiaries' awareness of the nature of the houses

The next few questions were directed at the awareness of the people, focusing specifically on how much the people knew about ecological sustainability. The questions were meant to measure the level of understanding the beneficiaries may have gained or what they may have noticed about the houses that they are living in. To clarify this, ecological sustainability is briefly defined in the next paragraph.

Ecological sustainability is concerned with maintaining essential ecological processes and life support systems. It is also about the sustainable utilisation of ecosystems and species, and the preservation of genetic diversity (IUCN, WWF, UNEP, 1987, cited in Rogers *et al.*, 2008:44). In the questions that follow we look at whether the interviewees were at all informed about ecological/environmental sustainability and whether they had noticed differences.

Responses to the fourth question presented in Table 4.2 indicate whether the homeowners are aware of the more “sustainable” nature of their houses. All (100%) of the homeowner indicated that their houses were special but they did not necessarily mean that they understood the sustainable design of the house. The next question addressed in which way the people thought of their house as special. This gave an indication of how educated or informed about the topic they were.

A variety of answers were given to this question. Many of the beneficiaries were aware of the roof overhang with the big window and that the house is north facing. Most of them noticed that these things make a difference to the temperature in the house. These are clear observations of the inhabitants of the Witsand housing settlement.

Questions 5 and 6 were meant to find out whether the special nature of the house really affected the new homeowners. All the responses came back as positive and clearly showed that the special nature of the house made a difference to the people. When asked how the special nature of the house made a difference to them, almost all of them mentioned something about running water and electricity. The fact that they mentioned water and electricity as “special” shows that they were not used to having those basic necessities. This, however, has almost nothing to do with the sustainable design of the houses.

The seventh question covered the attitude of the homeowners concerning the environment. All (100%) of the people who were interviewed claimed to be more aware of the environment than they had been before. This however will only be truly reflected if the lifestyle of the Witsand community is researched. The results of the questions can be seen in Graph 4.5.



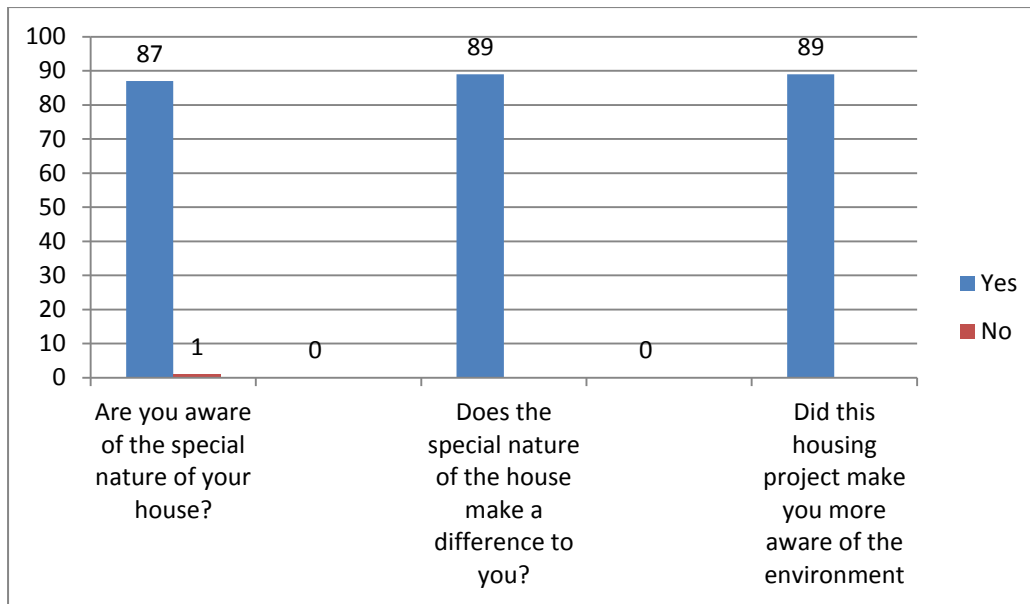


Figure 4.5: Beneficiaries' responses to Questions 5, 6 and 7

#### 4.4.4 Have the municipal service costs decreased?

The next questions were asked to determine how much the people are spending on electricity and also whether they have received any energy saving apparatus in order to determine whether they are saving on costs. These results could play a huge role in determining whether this project was economically sustainable. In Tables 4.2 and 4.3, the amounts are compared to the consumption of people living in a similarly sized government-funded house to see whether there was cost saving in this specific project. Many of the people claimed that they spent less on electricity than before, which represents huge saving and a positive result for this project.

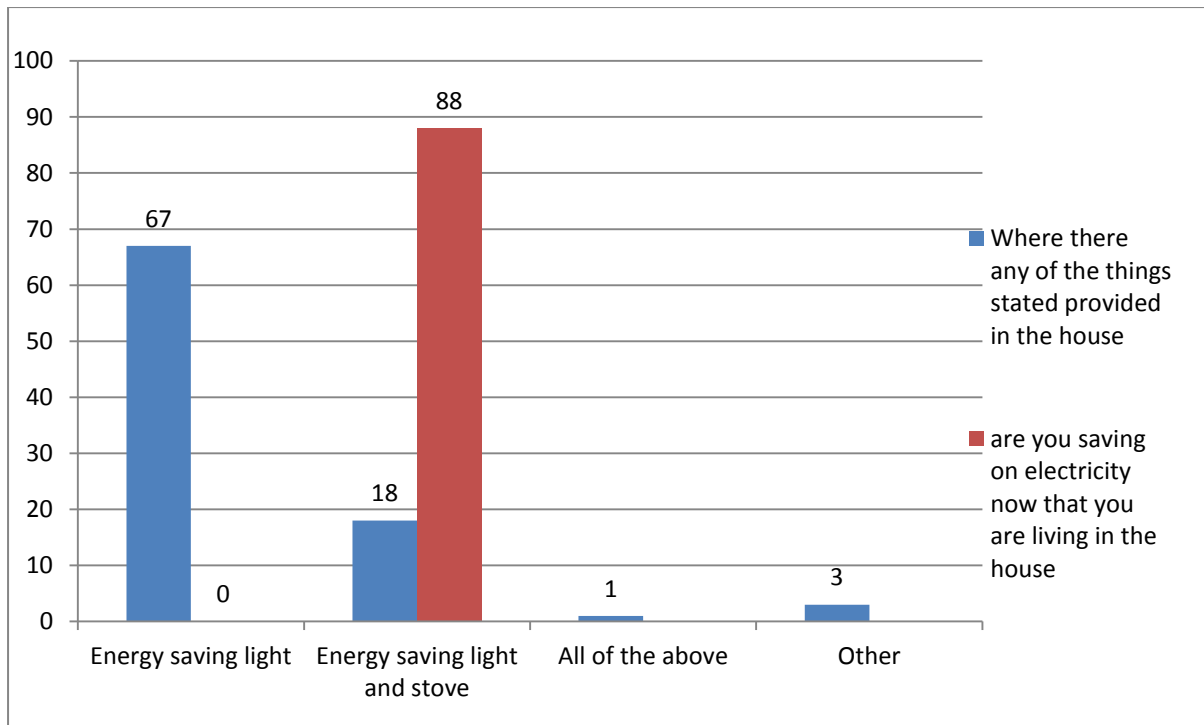


Figure 4.6: Responses to Question 8

Question 8 enquired about what the people had received together with the house to make it more cost effective. The results indicated that 75% of the homeowners received energy saving lights; 20% received energy saving lights and energy saving stoves; 1% received energy saving lights, energy saving stoves and energy saving geysers; and 3% received nothing extra with the house. Energy saving lights or bulbs take the form of the compact fluorescent light bulbs (CFLs).

Table 4.1 reflects answers to Question 8 concerning individuals' awareness and knowledge of what they considered as the "energy saving" instruments. All the homeowners had received the same things from the City of Cape Town. Most of them did not include certain objects, however, because they did not consider it to be energy saving – or "special", as some of them referred to it. Not many of the homeowners were knowledgeable about the "sustainable" nature of the light bulbs, stove and geyser. This lack of information is a real concern because the people will not be able to live out their social responsibility towards sustainable living without the knowledge. Information can guide innovation and, without innovation (Burger & Swilling, 2009:15), sustainable living is not possible. If people are not knowledgeable about the topic, they would not want to conserve energy and would live wastefully.

The ninth question was aimed at determining whether or not the people saved on costs with regard to electricity. The results showed that 99% of the people claim to spend less money than previously on electricity and thus saved money. The remaining 1% did not specify whether or not they spent more or less on electricity since living in this house.

### Information obtained from interviews with experts

Consumption of electricity by the Witsand community was compared with that of the Saxensea government housing project. In Witsand, the average consumption of electricity was calculated as R102,75 per month per household, as shown in Table 4.4.

Table 4.4: Electricity consumption in Witsand

Usage kwh from	Usage kwh to	Consumption	Rand per Kwh, VAT inclusive	Service charge	Rand per kwh, incl VAT
0	50	50	0	0	R 0.00
50	150	100	61.45	0	R 6 145.00
150	450	300	61.46	0	R 18 438.00
450	1336,22	886.22	88.2	0	R 78 164.60
		1336.22			R 102 747.60

Tariffs according to [www.capewatersolutions.co.za/2010/05/03/2010-electricity-tariffs-for-cape-town/](http://www.capewatersolutions.co.za/2010/05/03/2010-electricity-tariffs-for-cape-town/)

Question 9 attempted to get the exact amount that beneficiaries spent on electricity per month. All of the 89 valid questionnaires reported a raw figure. The mean Rand value derived from the 89 questionnaires was R134, 94 spent on electricity per month.

Question 10 dealt with about how much was spent on water per month. The mean value of the 89 totals was R79, 57. This was also compared with consumption in the Saxensea government housing project. The average consumption of water in Witsand was 6.08 kl per month per household. The average tariff for water is calculated at R0.36 per household per month, as shown in Table 4.3. Having stated the above, it should be noted that the first six free kl of basic water distorts the information, as there is zero cost to it.

Table 4.5: Water consumption in Witsand

Usage kl from	Usage kl to	Consumption	Rand per KL vat inclusive	Rand per kl incl VAT
0	6	6	0	R 0.00
6	10.5	0.08	4.55	R 0.36
10.5	20	0	9.7	R 0.00
20	35	0	14.38	R 0.00
30	50	0	17.76	R 0.00
50+	above	0	23.43	R 0.00
		6.08		R 0.36

Tariffs as per [www.water-recycle.co.za/2010/08/25/cost-of-water-cape-town/](http://www.water-recycle.co.za/2010/08/25/cost-of-water-cape-town/)

From the above it could be determined that water and electricity consumption in the Witsand community is higher than in the case of the Saxensea project with which it was compared, despite the energy saving design of the houses and energy saving appliances. This means that the people consumed more electricity because they had more appliances. This actually shows a higher degree of socio-economic sustainability, compared to other projects. The beneficiaries were not given any water saving devices, so there are high levels of consumption of water because it is more easily available.

#### 4.4.5 Are the houses more conducive to climate control and improved health status?

The final three questions were designed to determine whether or not the homeowners were satisfied with the temperature in the houses during the summer and winter seasons, and also whether they were healthier since living in the new houses. All 89 of the homeowners answered the question with regard to summer. Nineteen percent of the people claimed the houses were very hot in summer; 1% said it was just hot; 80% of the people said the houses were cool. The majority of the people are happy that their houses are cool in summer and not scorching hot.

Regarding winter, the houses were claimed to be very cold by 21%; cold by 1%; and 78% said it was mild. One beneficiary did not fill in a response. The majority of the interviewees

reported that their houses were mild and not freezing cold in winter. According to the results presented in Figure 4.7, the improvement in the design and structure of the houses control the temperature in the house quite effectively.

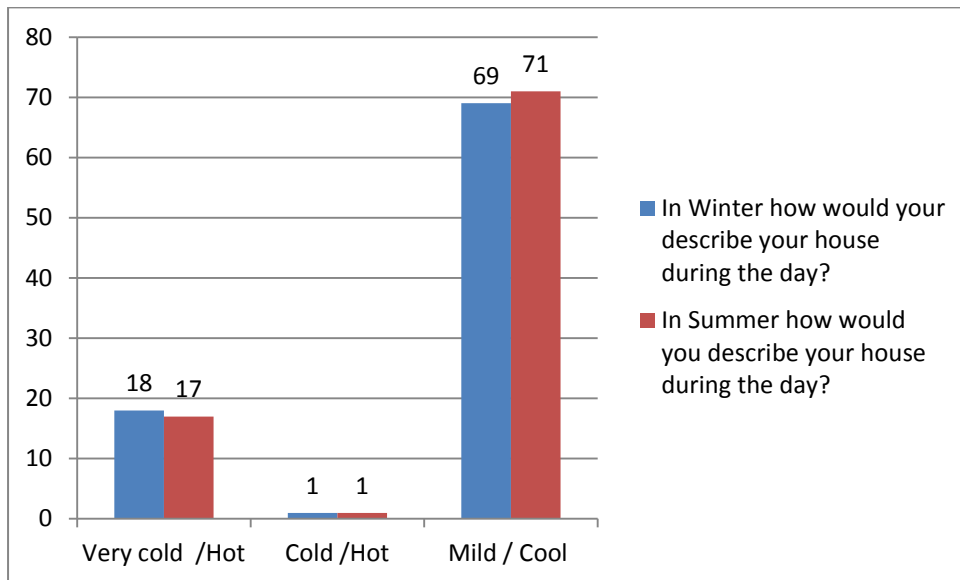


Figure 4.7: Responses regarding summer heat and winter cold

Question 12 was aimed at trying to determine whether the people are healthier than before living in the new house. All (100%) of the people who answered the questionnaires claimed to have visited the doctor or clinic less than they had done so before living in the new house. This could be the result of living in a better insulated house rather than a cold shack. As stated previously, many low-income houses are poorly ventilated and occupants burn a lot of coal to try and create heat and stop cold air from entering their homes. The consequences of this are often bad as the inadequate air supply prevents the complete oxidation of dangerous gases such as carbon monoxide (Guy, 2000:8).

According to a study conducted by Guy (2000:4), there is a direct relationship between the health of a community and the types of energy it uses. Energy sources that have a high air generating potential have serious negative effects on people's health. Chronic and acute exposure to combustion products can result in chronic obstructive lung disease (COD), cancer, particularly lung and nasopharyngeal cancer, heart disease, low birth weights, acute respiratory infections, upper respiratory tract illnesses (URI) and symptoms (Guy, 2000:4).

The above is especially true in the case of informal settlement households (Guy, 2000:8). In coal-burning townships the average exposure to inhalable particulates in South Africa is

estimated to be  $396\mu\text{g}/\text{m}^3$ . According to the air quality guidelines and standards for inhalable particulates (PM10) in South Africa, the maximum concentrations of inhalable particulates for 24 hours is  $180\mu\text{g}/\text{m}^3$  (not to be exceeded more than three times per year) and the annual average concentrate is  $60\mu\text{g}/\text{m}^3$  (which represents the arithmetic mean) (Chow, Watson, 1998; Loveday, 1995; Cochran & Pielke, 1992, cited in Guy, 2000:9). This is well above any health standards or guidelines (Guy, 2000:8). Many low-income houses are poorly ventilated and the effects of coal burning are often worse.

The questions also enquired about exact number of times respondents went to the doctor or clinic in the preceding year. The results revealed the following: 3% said they never went to the doctor; 11% said once; 32% said two times; 32% said three times, 9% said four times, 13% said it was not applicable and one did not fill in an answer. The majority of the respondents said they had gone to the doctor twice or three times a year. This was a follow-up question to the previous one and responses showed that the health status of the people was at acceptable levels.

Figure 4.8 shows how many times the respondents had gone to the doctor or clinic since living in the house.

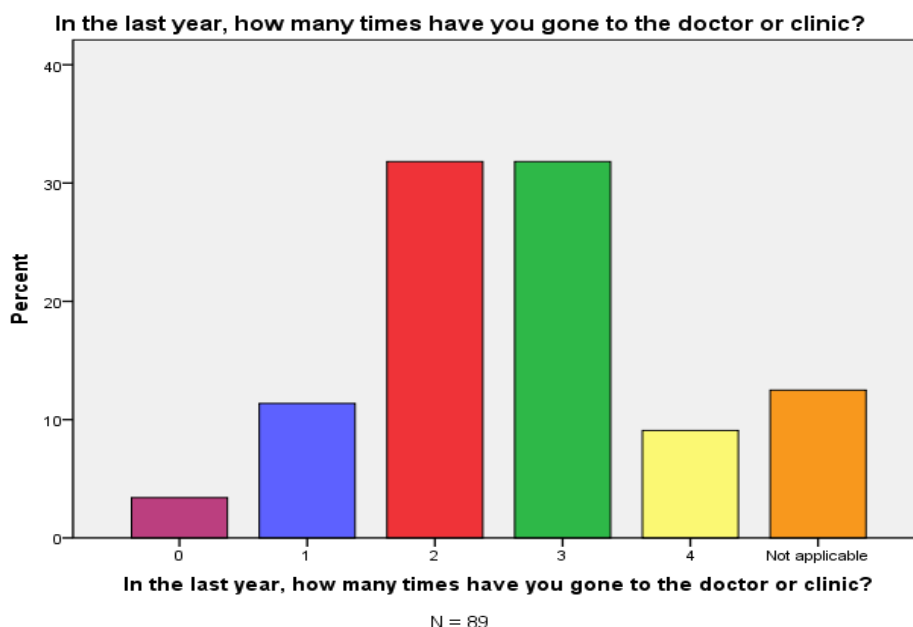


Figure 4.8: Number of reported visits to a doctor or a clinic

## 4.5 Summary

It is clear from the answers to the questionnaire reported in this chapter that the project has both positive and limited outcomes from. One very positive outcome is that people are saving. They are saving on expenses related to things such as electricity and health. Another positive outcome is that all claim to be going to the doctor/clinic less frequently, from which it can be deduced that they are healthier. This can be linked to not having to burn coal and paraffin for heating and cooking any more.

The knowledge of the community about the sustainable nature of their houses is questionable, however. They claim to understand that their houses are “special”, but for them “special” concerns running water and electricity. It can be deduced that they are not completely informed or do not completely understand the link between sustainable development and the nature of their houses.

The community were informed about the project by a community forum member. However the transferring of the information does not seem to have been very successful. The information that was carried over was either very limited or the community forum member did not have adequate knowledge of the project in order to transfer the knowledge. For government to provide opportunities to educate the communities receiving these houses about the topic are thus important.

It should be stated, however, that the community is aware of the visible differences, such as the roof overhang, large windows, and that the house is north facing. They are also aware of the comfortable temperatures in the house during all seasons. This, however, does not mean that they understand the link between the two. In Chapter 5, consolidated conclusions and recommendations will be dealt with.

## Chapter 5: Consolidation of Findings

### 5.1 Introduction

As mentioned in previous chapters, sustainable development of houses in the international context often, according to Miranda and Marulanda (2002:1) signifies minimisation of energy wastage, and construction should take full but wise advantage of the natural environment without changing, while at the same time allowing living organisms to exist and be preserved. Houses developed for sustainability should be designed with the use of energy saving technologies and only the necessary space should be used to facilitate harmonious balance between the environment and humans. Recycling should play an important part in the environmentally friendly design of houses.

The City of Cape Town has introduced the Smart Living Handbook (2011:14-30), which places responsibility on people to do things like manage their waste by recycling, separating their waste and finding ways to reuse it. This, however, is not visible in the Witsand community. This goes back to the question of education for sustainable living. Sustainable development is not just about the design and construction of houses and the people thus cannot just receive the product without being taught about their social responsibility of sustainably living.

In South Africa, however, because of the many people without houses, housing simply means shelter to them. The demand on the South African government for houses is enormous, the resources are few and the lack of education on the topic of sustainability certainly doesn't help. The houses that are given to the poor are often very cold in winter and hot in summer because the building material needs to be compromised in order to increase the amount of the product (houses) due to inadequate available resources. This results in people trying to keep themselves warm or cook with coal and wood in the cold winter months, which often results in deaths and chronic lung disease, heart disease, low birth rates and acute respiratory infections (Atlantis: Witsand: "EECO" Housing Project, 1). This is especially true for women, children and the elderly (PEER Africa, 2010:4). In Witsand, the resident's primary source of energy used to be paraffin and wood before they had electricity (Guy, 2004:5). There is a direct link between poverty and defective energy systems amongst the poor and in lower-income sector (PEER Africa, 2010:4). This alone shows how important it is to change



the way in which houses are built. The new way of constructing houses should be focused on issues of maximisation of resource consumption and creation of a well-built environment, as well as guaranteeing human wellbeing and comfort and addressing the issues of environmental ruin. It should not be focused on the cost, performance and quality issues only (Sev, 2008:3).

The Witsand Housing Project undertaken by the City of Cape Town was the first attempt to create sustainable houses. The Witsand Housing Project represents an environmentally conscious housing design and construction practices as far as the resources would allow it. This specific project qualified for an additional subsidy, as it fell in the Southern Coastal Condensation Problem Area (SA ROOFING, 2008:10). The City of Cape Town has incorporated featured interventions in site layout, architectural support, even and house design, compact fluorescent lights and other thermal-performance aspects (SA ROOFING, 2008:10). In this chapter the findings will be consolidated and compared to what was expected to happen and the process thereof.

## **5.2 City of Cape Town specifications**

In Chapter 3, the City of Cape Town's specifications are set out. The process had to be conducted according to what was set out in the legislation as presented in Chapter 2. Assertions by the City of Cape Town leads one to assume that it was done according to the legislation and all means were maximised as far as resources would allow making full and wise use of environmentally friendly construction and design methods and materials. It is important to note that not only the design and construction methods of the housing are important to sustainability, but also the education of the people with regard to sustainable living. Chapter 4 records how home owners were interviewed and the houses were observed. From the questionnaires that were completed by the home owners of the Witsand community, certain observations or findings are possible. These are discussed in the next section. In the next paragraph however, the specifications according to which the City of Cape Town had to act are briefly touched upon for a descriptive comparison with the findings from the questionnaires.

The blueprints for the Witsand Housing Projects differ noticeably from those for standard traditional government houses. One of the differences is that the houses are required to be

north facing to maximise warmth in winter and keep the house cool in summer. It is specifically specified like this to take full advantage of potential solar energy.

The houses have wide roof overhangs (of approximately 500 mm) on the northern side. The reason for the overhang is so that shade is created and the house does not overheat in summer. The overhang still allows for low winter sun to come in. Both the north-facing placement and the roof overhang are designed to create comfortable temperatures for the home owners without harming the environment.

Various devices were used to assist in the sustainability of the housing project. These included solar heating and lighting and gas cookers. All three mentioned are environmentally friendly alternatives to the standard heaters, lighting and stoves. It is said to be more efficient and cleaner to use (International Institute for Energy Conservation, 1990:3).

The windows of the houses were determined by two specifications. It had to be large and fitted on the northern side of the house. This is deemed important in order to allow as much sunlight into the house as possible.

The walls and ceilings had to be insulated to protect the house against heat gain during summer and extreme loss of heat during the colder months. The walls had to be insulated by means of cavity walls or materials such as polystyrene. The colour of the paint on the walls also play a role in insulation as the correct choice of colour can allow walls to absorb heat during winter days and release it into the house during the night. This can be done by making use of dark-coloured paints.

Another aspect of the house that could make it more environmentally sustainable is the orientation. According to the City of Cape Town, the Witsand houses were built so that the longest side of the house would be oriented east-west. The logic behind this is that, if the house is north facing, it will receive maximum sunlight throughout the day.

The floor slabs are constructed of a material that has a high thermal mass (Cupido, 2009). An example if this would be concrete or bricks. This allows for the absorption of heat during the day and the slow release of the heat during the night. The floor slab should thus be left uncovered to be able to do its job effectively. The foundations, superstructure, doorframes, plumbing, roof, paint finish, plaster and doors were according to specific details (The Blaauwberg Administration site plan, 2005:1). The details are clearly set out in Chapter 3.

The design was mainly focused on five specifications. According to the Project Manager, they concerned the roof overhang, insulation, position/size of windows, orientation and floor slab. The City of Cape Town seems to have focused on the five main specifications which is a positive shift, although this is not the only aspect of sustainability. Sustainable development comprises environmental, social and economic factors. These factors are important, as stated in the Housing Act, "...in the planning, implementation and evaluation of decisions to ensure the development serves present and future generation" (RSA. Act 107 of 1998: 1),

The next section presents the consolidated findings from the questionnaire. This is done to make deductions about the experience of the community during the housing process and also the satisfaction and awareness of the people concerning the nature of the house. This will determine the degree to which the City of Cape Town has in fact succeeded with regard to the Sustainable eco-friendly Witsand Housing Project. The project should not just be evaluated from the aspect of the sustainability of the house, but from a holistic view including social sustainability.

### **5.3 Findings from Questionnaire Consolidated**

In Chapter 4 the various questions that were formulated in a questionnaire for the homeowners to answer were discussed. Certain deductions could be made from responses to the questionnaire and these are shared in the next paragraphs. It sheds light on the people aspect of sustainability and to some extent also then takes into the economic aspect into account. This is because the project involved poor people and poverty plays a huge role in affecting the environment, e.g. through pollution. The extent to which the City of Cape Town was successful will thus be evaluated.

The housing planning process should be open and transparent. The ideal situation should be that the potential homeowners have an input in what their homes will look like, of course within the limits of resources. They should also be educated about the process, so that they can understand the bigger picture and know how to and would want to maintain this environment-friendly way of living.

The findings in Chapter 4 are mainly focused on the experience and satisfaction of the homeowners from their point of view. The questionnaires were aimed at measuring whether the homeowners understood the special nature of their houses and, if so, whether they viewed

things differently. In other words, were they in any way more aware of environmental aspects or sustainable living?

On the whole, the results from the questionnaires are positive. The process seems to have been transparent as beneficiaries were informed about the project by a community forum member. The people claimed to have participated in the initial housing process. They also had 10 options of different types of houses to choose from depending on how much money they were willing to spend. In most cases, it can be assumed that not many people had extra money, because most of the houses were very similar.

The people seemed very happy with their new homes. However, it should be noted that all of them previously lived in shacks and this, therefore, was a positive move for all of them. They all seem grateful to have an actual house with running water and electricity. This makes it hard to assess whether this type of housing is perceived as better than the traditional houses, because none of them had previously lived in a traditional house.

Social responsibility is also emphasised, but this has more to do with the post-housing process. It can be viewed as an indication of how environmentally aware the community is. According to the results from the questionnaires, 70% of the people did not grow a garden around their home; 28% did not erect a fence around their houses; 99% of the houses were neat; and 52% had cracks in their walls. The question about the garden can lead to more than one conclusion. It can mean that the people did not want to grow a garden so that they would not have to consume more water, which might be because they are environmentally conscious. On the other hand, they might not have grown a garden because they do not really care for the environment or for plants. Most of the people had built a fence around the house, attempting to protect it against outside elements. We can deduce, to a certain extent, that the people take pride in their homes because they are neat; however, most of them have cracks in the walls. It is their duty as homeowners to have it fixed. They all have a social responsibility to maintain their homes and consider all aspects of sustainable living.

The questionnaires also show that the people claim to know that their houses are “special” and when asked why they thought this, almost all of them mentioned the temperature inside the house, which was not like in the shack. They spoke about roof overhangs and the house facing north and the big windows. From their answers, it can be deduced that they know the features of their houses differ from the standard government houses. The people all claim to be more aware of the environment, but this need to be proven in the future.

The results from the questionnaire indicated that the community is spending less money on electricity. When asked if they spent less on electricity since living in this house, 99% answered positively.

All of the Witsand community claimed to go the clinic/doctor less since living in the house. This means that they are healthier than before, because they are living under healthier conditions in which their houses are well ventilated and there is no real need for additional forms of unhealthy heating. Poor health is often related to pollution, poverty and poor housing.

In the previous chapter, the claims were that the people were to get energy saving lights, heaters and gas cookers. When the results are investigated, it seems that most people claim to have received energy saving light bulbs, but only 20% claimed having received energy saving lights and cookers. None of them claimed having received the energy saving heater.

On the whole, most people were happy with the temperature of the houses in summer and in winter. The people seem satisfied and happy with the houses but it should be noted that they have very little to compare it with because of having lived in shacks. A deduction can be made that this type of dwelling was an improvement for all of them.

## **5.4 Summary**

In this chapter the aim was to combine the findings reported in the previous chapters. What the theory signifies when it refers to sustainable development is clear. The first finding that was made is that sustainable development should be looked at holistically, so that all the people involved become role - players in the development.

From this chapter, it can be stated that government has always been sceptical about involving the people because of the great pressure under which they are due to limited resources and a great demand. The reason for government's way of thinking was so that the bulk production of houses had to be realised via the cheapest means. South Africans, however, have come to realise that this is not sustainable and will lead to bigger problems later.

The South African government has introduced sustainable aspects into South African policies and papers. Witsand in Atlantis served as a pilot study for the sustainable housing project in Cape Town. The findings concerning whether they have been successful show some positive

results. These positive results are evident in the savings, better health and satisfaction of the community. The results also were limited in that the education of the people with regard to sustainable living, which forms an important part of development was not realised. It is crucial that the community understands the importance of saving energy, managing their waste and protecting the environment.

In the next chapter, the extent to which the City of Cape Town was successful in comparison with the theory is discussed. The City's specific design criterion will be described and measured against practice, as evident in the Witsand Housing Project.

## **Chapter 6: Interpretation of the Literature Compared to Practice, Conclusions and Recommendations**

### **6.1 Introduction**

In this chapter the aim is to determine to which extent the City of Cape has followed through with the literature in practice. This is set out according to the criteria and specifications for sustainable design.

The main focus in this research paper has been on the design, construction, and wellbeing of the people with regard to: the room and window design for lighting, high standards of insulation; insulation materials; natural ventilation; passive solar energy; energy efficient lighting; low-emission fossil fuel appliances; types of materials used for construction; and site management for reduced impact.

### **6.2 Theory compared to practice in the Witsand Housing Project**

According to sustainable housing theory, three approaches are followed, as mentioned in Chapter 2. The approaches are the economic, the ecological and the social-cultural approaches. Just to recap on what the above means, the economic is directly concerned with increasing the living standard of the impoverished. The ecological approach is concerned with keeping a balance and maintaining both biological and physical systems wellbeing. The social-cultural approach is about keeping the social and cultural systems stable.

In looking holistically, this can be seen as a big task at hand, therefore all approaches should be considered in all aspects of life, especially when building of human settlements. One of the main focal points of this study was to look at sustainable eco-friendly housing development in terms of energy efficient techniques, principles and applications in the design, construction and management of the Witsand housing project. There are many indicators of sustainable housing, which point to the specific goal of sustainable development, but, in this paper, the indicators that are focused on concern energy efficiency through making use of fewer resources and being mindful of affordability for the government and the poor, and taking into account the people's experience of the process. The next paragraphs focus on the literature dealing with those indicators.

The United Nations (in Chapter 6 of Agenda 21, 1992), clearly states that health and development are intimately connected. Insufficient development leads to poverty and inappropriate development leads to overconsumption. The paper makes mention that, “it is the very lack of development that adversely affects the health condition of many people, which can be alleviated only through development” (United Nations, 1992). This development is dependent on a healthy environment, and social and economic development.

Chapter 7 of Agenda 21 is concerned with promoting sustainable human settlements and the South African government has focused on three of the programme areas outlined in the Agenda. The focus areas are: The provision of adequate shelter for all; the improvement of human settlement management; and the promotion of sustainable land-use management (City of Cape Town, 2004:2-3).

In the South African context there remain many constraints to improving housing for the lowest income groups with regard to affordability, the development, planning, design and management of the resultant built environment and the impact on health in housing development (Adebayo & Adebayo, 2000:1). The housing problem is so big that the government funding is often not enough to provide houses to all who need it. In the past, a number of initiatives around energy efficiency in low-cost housing have been initiated, but this has not really been main-streamed in the on-going low-cost housing subsidy programme (Klunne, 2002:6).

The government does, however, realise the importance of choice and sustainable housing. The Housing Act (1997:2) serves as facilitation of a sustainable housing development process. It also sets out certain principles that are applicable to sustainable housing development that should be followed within all spheres of government.

The National Housing Act raises the point of affordability. The Act states that, if within its means, government should provide choices concerning the type of houses they are to build for the citizens of South Africa and should by all means make sustainable housing one of the options (RSA, 1997). This is especially important as it falls within the guidelines set out by the National Environmental Management Act (RSA,1998) and the United Nations Agenda 21 (Chapters 6 & 7). Affordability with regard to maintaining the household is also a very important issue. The poor need to be able to maintain the house in order to improve their standard of living and thus improve sustainable economic development. This can be facilitated through the development of sustainable housing.



Energy efficiency of building supplies are more cost effective than increasing the energy supply (Glicksman & Lin, 2006:6). This could mean that sustainable houses should not necessarily cost more than the traditional government-subsidised houses. Sustainable houses also have a much healthier impact on the environment while at the same time saving energy. The energy efficient techniques incorporated in the design and constructions of the house is described in greater detail in Chapter 3 and are just touched on below.

There are various ways of making use of energy efficient materials and techniques in the design, construction and management of housing. Some of these may be costly; therefore limited resources play a huge part. However, much can still be done with very little or no money. In the Witsand Housing Project of the City of Cape Town, different construction materials and design methods were made use of for the houses. This involved specific energy efficient types of detail for the foundation, superstructure, door frames, roof, plumbing, paint finish, doors and plaster.

The housing delivery process is often a complex one. The ideal decision-making process in a democratic country is to have fair and transparent processes that include procedures for public participation to satisfy stakeholders. Constraints surrounding this type of decision making are often present in practical situations, however. A study conducted by the University of Cape Town (UCT) and the United Nations Institute for Training and Research (UNITAR) shows that a few practical issues provide clarity about the expected input from stakeholders, providing appropriate feedback to comments received, and also about organising effective meetings (UCT/UNITAR, 2005:2).

The above is especially true for the housing problem in South Africa because there is such a dire need among the people. Many people are living under unthinkable circumstances with no proper shelter, and no running water and electricity, therefore energy-efficient ways will most likely always take a back seat to catching up on the housing backlog in South Africa. In the case of the Witsand Housing Project, the people were consulted about the process through a community forum leader, but the lack of funds prevented having much choice. In the end, however, according to the responses to the questionnaires that were completed, it seems as though the people were happy with the results and their new homes.

The sustainable ecological housing design comprises the integration of design approaches which take into account appropriate location, economic empowerment, racial integration, public/private partnerships, socio-cultural sensitivity, sensitivity to vulnerable groups,

materials, water and energy efficiency, affordability and green finance with the objective of “One Planet Living.” (Thompson-Smeddle, 2007:3). However, the nature of this study is to see how much has and could be done by local government to a typical previously disadvantaged informal settlement in order to develop a more sustainable design for houses and living. As previously mentioned, Hendler and Thompson-Smeddle (2010:12) have indicated what sustainable design criteria should include. It involved thermally efficient design, sustainable building materials, energy efficiency, renewable energy options, sustainable water and sanitation systems and waste minimisation and recycling.

In the case of the City of Cape Town, focusing on the Witsand Housing Project, many of the objectives were met. This will be briefly outlined below.

The thermally efficient design of Witsand includes the orientation of the houses, placement of windows and the appropriate use of thermal mass. The former can be ticked off, as the Witsand houses are north facing and have a large window. The north facing of the house facilitates the best use of light and sunshine. The northern side of the house receives the most sun, and the roof overhang on this side is bigger to provide shade in summer while allowing the winter sun’s rays to enter, when the sun is at a low angle (City of Cape Town, 2011:79). This is a very cost effective and sustainable way of regulating temperatures within a house or building (Hendler & Thompson-Smeddle, 2010:13).

Appropriate use of thermal mass is also applied in the Witsand houses. Thermal mass is the ability of a material to absorb heat energy (Hendler & Thompson-Smeddle, 2010:14). High-density materials such as concrete, stone, brick and tiles require a lot of heat energy to change the temperature. They are considered to have high thermal mass (Hendler & Thompson-Smeddle, 2010:14). The foundation of the Witsand houses is a minimum of 450 × 150 mm slab as specified with an internal load bearing wall. The floor slab is wood floated with a minimum of one DCP (Damp Proof Course) sheet per unit recorded. There is a 375 Micron DPC under all walls with brick reinforcing after every three layers, then every layer thereafter above window height. The internal walls are built with block brick, reinforced every two layers, and are tied into the external wall.

From the above, it is clear that the City of Cape Town makes use of wood and brick. Brick or concrete floors maintain comfortable temperatures in the house, as the materials are good at absorbing heat during the day and releasing it slowly at night (City of Cape Town, 2011:80).

The next to be discussed is sustainable building material. This is especially important because, according to the Western Cape Human Settlement Strategy, building construction and operation is responsible for 50% of all CO<sub>2</sub> released (Department of Local Government and Housing, 2007, cited in Hendler & Thompson-Smeddle, 2010:15). The City of Cape Town, built adobe walls for the Witsand houses. This refers to walls built with unbaked sun-dried clay bricks. Adobe is a thermal efficient, low carbon emission, structurally sound and inexpensive building material (Hendler & Thompson-Smeddle, 2010:15).

Energy-efficient applications are also important for sustainable design. According to Hendler and Thompson-Smeddle (2010:15), the most common, cost-effective energy-efficient applications are ceilings, insulation, skylights, solar blinds and CFL bulbs. The Witsand houses have ceilings, insulation and CFL bulbs received from the City of Cape Town.

Hendler and Thompson-Smeddle (2010:15) state that the advantages of installing a ceiling include a decrease in spending on indoor heating, improved health as a result of improved air quality and more stable internal air temperature. This is especially advantageous for people who depended on materials for heating that could affect their health, like coal and paraffin. Installation of ceilings and ceiling insulation were possible because Witsand is in an area that qualifies for an additional subsidy that also allows the implementation of external finishing (Guy, Annegarn & Eland, 2007:2). Roof or ceiling insulation serves to conserve heat in winter, it also maintains cooler temperatures in summer (Hendler & Thompson-Smeddle, 2010:16).

The Witsand houses do not have skylights, which are windows placed in the roof or ceiling of a room designed to allow light into the room (Hendler & Thompson-Smeddle, 2010:16). They do, however, have a large north-facing window to allow sunlight into the house. In cases where buildings or houses do not have appropriate overhangs, solar blinds can be fitted (Hendler & Thompson-Smeddle, 2010:16). This is not necessary in the case of the Witsand Housing Project as the houses have appropriate overhangs (of a minimum of 150 mm), as previously stated.

CFL bulbs provide energy efficient lighting and are useful for reducing energy consumption (Hendler & Thompson-Smeddle, 2012:16). Sustainable Energy Africa (2007:31) and the

Smart Living Handbook (City of Cape Town, 2011:75) list the following advantages of CFLs:

- CFL bulbs use five times less energy than an equivalent incandescent bulb.
- They are expected to last 10 times longer than incandescent bulbs.
- CFL bulbs convert 80% of the energy they use into light and only 20% into heat, whereas traditional (incandescent) bulbs convert 20% of the electricity into light and 80% into heat.
- CFL reduces the amount of CO<sub>2</sub> released into the atmosphere.
- CFLs are 80% more efficient than an incandescent bulb.

The renewable energy applications that Hendler and Thompson-Smeddle mention are the solar water heater; sustainable water and sanitation systems; and waste minimisation and recycling. Hendler and Thompson-Smeddle (2010:17), argue that solar water heaters should become a stronger focus in the low-income sector. The City of Cape Town, however, did not provide solar water heaters to the Witsand community. They are available at a cost of approximately R3 000 for a small solar water heater. The water efficiency and sanitation system can include low-flow fixtures in showers and sinks, dual flush systems in toilets, rain harvesting and water recycling. Waste minimisation and recycling is a very good way of removing recyclable resources from landfill (Hendler & Thompson-Smeddle, 2010:17). This has more to do with sustainable living and the social responsibility of the people.

Taking into account the limited resources that the City of Cape Town has to work with, nearly implemented all the sustainable design criteria mentioned in the theory have been implemented. It is a move in the right direction.

### **6.3 Conclusions and Recommendations**

The investigation that resulted in this study was undertaken with the aim of contributing to existing environmental housing research, specifically in Cape Town. It can perhaps be looked at in terms of potential improvements in government housing in South Africa. It will conclude the findings of this study and also attempt to provide recommendations for future studies.

### 6.3.1 Conclusions

Chapter 2 summarises the importance of sustainable development within the housing context. This chapter also reflects on the uniqueness of the South African housing problem in the post-apartheid period. It also makes the point that sustainable development has many aspects and should be considered in development policies and thus in all housing projects. The relevant policies, legislation and housing theory that were used to inform the project are also discussed.

Chapter 3 acknowledges that South Africa has a huge housing backlog and many, many people are without houses, but this does not take away from the importance of developing sustainably. It is crucial to reach a balance between developing and protecting the environment.

In Chapter 3 it is shown how the view of the South African government is slowly changing, as it introduced the first large-scale integrated housing management project. PEER Africa, together with Eskom, initialised this project. The Witsand Housing Project was the result of the change and is the case investigated in this study. The chapter reviews the uniqueness of Witsand, Atlantis. Issues like the demographic situation, socio-economic background, details of the houses and how it came about that the inhabitants of Witsand were selected, are discussed.

In Chapter 4, the Witsand Housing Project is looked at, specifically from the point of view of the design, construction and the people's experience and awareness of the process. The field work for the study took place via interviews, a questionnaire and observations. Many deductions that could already be made from the information gathered are briefly discussed in the chapter.

This led to Chapter 5, in which the results of the findings in Chapter 4 are presented. In this chapter both the positive outcomes and the limitations of the project are discussed. One very positive outcome is that people are saving. They are saving on things such as electricity and health expenses. Another positive outcome deduced from the general claim of going to the doctor/clinic less frequently, is that the community as a whole is healthier. This can be linked to not having to burn coal and paraffin for heating and cooking purposes anymore.

The community's knowledge of the sustainable nature of their houses, however, is questionable. They claim to understand that their houses are "special", but what they regard as "special" concerns the availability of running water and electricity. It can be deduced that they have not been informed adequately, or that they do not completely understand the link between sustainable development and the nature of their houses. It should be stated, however, that they are aware of visible differences, such as the roof overhang, the large window, and that the house is north facing. They are also aware of the comfortable temperatures inside the houses during all seasons. It does not mean that they understand the link between the design of the house and the comfort they experience.

In this chapter (Chapter 5) the aim was to combine the findings reported in the previous chapters. What the theory states about sustainable development is clear. It is a very important realisation that sustainable development should be looked at holistically, so that all the people involved can become role - players and not just remain bystanders.

In Chapter 6, the extent to which the City of Cape Town followed the theory through in practice was measured. This was done by looking at the specific design criteria of sustainable housing theory, compared to the City of Cape Town's sustainable housing design theory, and then evaluating it or comparing it to the Witsand housing project. On the whole, the City of Cape Town was very successful, as almost all the criteria were met with limited resources. The only real concern is that of the knowledge of the community on the topic of sustainable living.

Witsand in Atlantis was a pilot study for the sustainable housing project in Cape Town. The results that reflect the responses to the questionnaires and the observation are both positive and limited. The positive results indicate decreased expenditure, better health and satisfaction in the community. The biggest limitation is the lack of knowledge concerning sustainability in the community of Witsand. This shows that they were not properly informed about the process and the importance of sustainable development. This is a big problem because sustainable living forms such a big part of development. It is very important that the community understands why saving energy, managing waste and protecting the environment is important.

Considering the study, it can be stated that there were no real problems with the City of Cape Town's design criteria. However, it is possible to improve on creating awareness of

sustainable housing design. Education in sustainable living is important in order to raise awareness about sustainable development and sustainable living.

### **6.3.2 Recommendations**

Language barriers can also lead to less effective knowledge transfer. A suggestion to this is that government should educate the people with regard to certain issues that affect their lives, especially when it comes to such a prominent issue in South Africa such as housing. If people are knowledgeable about the relevant topics, the language problem would not be as great, as the knowledge will serve as some sort of common language. Lots of meaning can be lost in translation as it often does when people do not fully comprehend each other's language. Knowledge transfer should thus be of key importance in the process of housing in South Africa.

The above recommendation can, however, only be realised if modern educational systems train engineers, planners, architects, social scientists and other workers together, so that they "are on the same page" when it comes to development. They all need to understand that they cannot work in isolation for development to take place sustainably. This is especially true for South Africa as not many planners, architects and engineers encourage communities to participate in building their own neighbourhoods (Thompson-Smeddle, 2007:3).

Cheap bulk infrastructure should not be the only focus. Housing is a huge problem in South Africa but bad quality will do none of the people any good if there are things such as leaking pipes and cracks in walls because the cheapest items were used to build the houses due to budget limitations. A suggestion could be to look to alternative, natural materials that could perhaps replace the current materials that are failing in some cases; examples of natural materials are stone, timber, clay and thatch (City of Cape Town, 2011:80).

Solar water heaters are a great way of heating water in a sustainable way. Financial constraints concerning housing, however, are a reality in South Africa because of the huge backlog and solar water heaters may cost more initially. It would be a good idea to introduce this to the low-income sector as it will be much cheaper in the long term. The way in which this could be possible would be for local government to get a subsidy scheme going to provide bridging finance (Winkler, in Hendler & Thompson-Smeddle, 2010:15). It will

however be very important for local government to administer the process (Hendler & Thompson-Smeddle, 2010:15).

Knowledge and awareness play a key role in achieving sustainable development. This is important for both the experts (planners, architects, social scientists, engineers) and the community. If the experts can start working on the housing issue holistically, they will be able to transfer the knowledge or information to the community. If the people have a better understanding of the purpose of a project and how it will benefit them, they could even be included in it.

All stakeholders should be involved as far as possible in decisions that are made. It is important to not just consult with the community but to enable them to be part of a participatory decision-making process. This will be very important for maintaining sustainable environment-friendly living within poorer communities.

To achieve true sustainable development within the housing context, it is imperative that sustainable consumption is practised. In the current draft City of Cape Town's IDP one of the objectives are dedicated to promoting a sustainable environment through the efficient utilisation of resources such as water and energy (City of Cape Town, 2013/2014: 51). This will be important in the construction and the design of the houses. Local production and consumption should be used and renewable energy should be utilised. When it comes to government housing, government's expenditure of public money should be measured. According to the government, what constitutes a sustainable system must be redefined (Burger, Burger, Rabie & Uys 2011:22).

Regarding this study, the houses seemed quite sustainably developed within the means provided by government, but the societal knowledge and participation did not seem to be very high. It is important for government to promote public access to information and also to promote public participation in decision making (Burger *et al.*, 2011:22). It is however acknowledged in the current draft IDP of City of Cape Town as it mentions that the mechanisms for future housing designs, production and delivery may need to be more participative, flexible and responsive to household needs (City of Cape, 2013/14: 71). According to Theron (Davids, I., Maphunye, L & Theron, F, 2005:106-107), the beneficiaries of development must also be the contributors. This will mean transferring the relevant



knowledge to the public, rethinking the planning and implementation of development, and also how social research is conducted.

The City of Cape Town was very successful on the whole, as almost all the criteria were met with limited resources. The only real concern is that of the knowledge of the community on the topic of sustainable living.

Besides looking at the indicators for sustainable construction, design and social responsibility of the housing project, it can be noted that there is definitely a need and responsibility for collaborative learning. It is important that people at both ends of the spectrum understand, and become educated and well informed about the holistic aspect of sustainable practices.

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## Annexure 1

### Primary Household Statistics

#### Gender statistics

Male	Female	Total
350	147	497

#### Statistics of unemployment

No of Unemployed Residents	No of Unemployed Females	No of unemployed Males
134	39	95

#### Marital statistics

Married	Single	Divorced	Cohabit	Widow
179	251	8	52	4

#### Dependants

People with dependents	People without dependents	Unknown
85	58	4

#### Nationality

South African	Other
497	none

### Secondary Household Statistics

#### Gender Statistics

Male	Female	Total
496	208	704

#### Statistics of unemployment

No of Unemployed Residents	No of Unemployed Females	No of unemployed Males
208	69	139

Marital statistics

Married	Single	Divorced	Cohabit	Widow
246	353	8	93	4

Dependants

People with dependents	People without dependents	Unknown
600	104	0

Nationality

South Africa	Other
704	none

Lodgers

Gender Statistics

Males	Females	Total
90	63	153